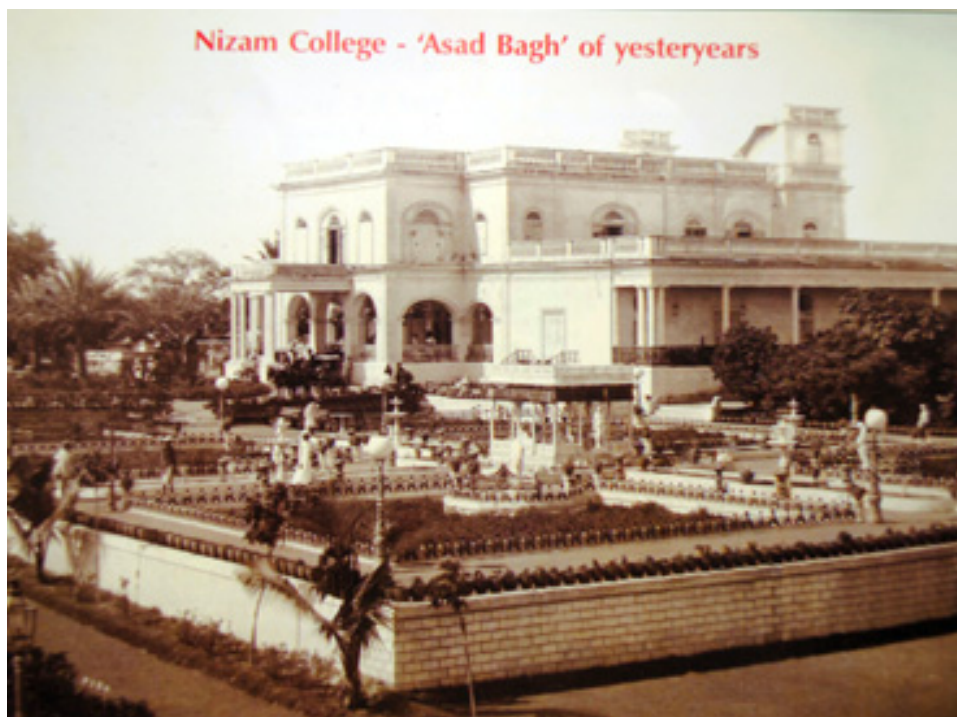


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Osmania University

Minorities Welfare Department, Govt. of Telangana

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Telangana State Integrated Common Entrance Test for MBA / MCA

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ICET

Integrated Common Entrance Test for MBA / MCA

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PREFACE

Taking competitive examinations has become the order of the day for any educated young man who is desirous of seeking any coveted job, a seat in any prestigious college. The approach required for such competitive examination is different from that of taking an academic examination.

It was observed that most of the minority candidates do not fare well at these competitive examinations not because they lack in talents but because they can neither afford to join the private coaching centres nor could purchase the required study material.

In order to improve the participation and performance of the candidates belonging to minorities in such competitive examinations, the Minorities Welfare Department, State Government sponsored a project to Osmania University. The University in turn established Centre for Educational Development of Minorities (CEDM) in 1994 in Nizam College. Since then, the Centre has been offering free coaching for the benefit of candidates belonging to minority communities appearing for various job seeking and admission seeking competitive examinations at Hyderabad and other minority concentrated districts of the state. In respect of job-seeking examinations, the Centre is providing free coaching and study material for TGTRT, TGTET etc. and for admission oriented examinations such as NEET, EAPCET, ICET, LAW CET, ECET, EdCET, DEECET and POLYCET etc. In addition to these coaching programmes, the Centre is also providing free coaching and study material to X class Urdu medium minority students in minority concentrated districts of the state to strengthen their educational foundation and to improve their performance in SSC Public Examination.

We wish to place on record the pains the compilers have taken to summarize and arrange the important questions. The Centre gratefully acknowledges their services.

If these study materials are of any help to the candidates, we feel immensely rewarded for the humble efforts we have put in.

Hyderabad
Apr 2026

Prof. S. A. Shukoor,
DIRECTOR

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Data Sufficiency:**(Marks : 20)**

Note: Each question is followed by data in the form of two statements labelled as I and II. You must decide whether the data given in the statements are sufficient to answer the questions. Using the data make an appropriate choice from (1) to (4) as per the following guidelines:

- (a) Mark choice (1) if the statement I alone is sufficient to answer the question.
- (b) Mark choice (2) if the statement II alone is sufficient to answer the question.
- (c) Mark choice (3) if both the statements I and II are sufficient to answer the question but neither statement alone is sufficient.
- (d) Mark choice (4) if both the statements I and II together are not sufficient to answer the question and additional data is required.

1. What is $\angle A$ in the triangle ABC?

I. $\angle A = 2\angle B$

II. $3\angle B = 2\angle C$

2. A and B are two sets. What are the elements of B?

I. $A \cap B = \{1, 2, 3, 4, 5\}$

II. $A - B = \{7, 8, 9, 10\}$

3. For integers a and b, is $a > b$?

I. $|a| > b$

II. $|a| = b$

4. What is the value of $\sin \theta$?

I. The matrix $\begin{pmatrix} \sin \theta & 0 & 0 \\ 2 & 2 & 0 \\ 3 & 4 & 1 \end{pmatrix}$ is not invertible. II. θ lies in the second quadrant.

5. Does the natural number n divide $15n^2 + 8n + 6$?

I. n divides 10

II. n divides 3!

6. If a and b are real numbers, what is the value of $a^3 + b^3$?

I. $a^2 + b^2 = 0$

II. $a + b = 4$

7. Is $x^2 < y^2$?

I. $x < y$

II. x and y are non-negative real numbers.

8. If a is an integer and $100 < a < 200$, what is the value of a?

I. When a is divided by 10, the remainder is 5.

II. When a is divided by 8, the remainder is 3.

9. What is the value of θ ?

I. $\sin^2 \theta - 1 = 0$

II. $0 < \theta < \pi$

10. What is the area of an equilateral triangle?

I. Each angle of the triangle is 60° .

II. The height of the triangle is 12cm.

11. Is the real number a , positive?
 I. $a^3 < 0$ II. $a^2 - 5a + 6 < 0$
12. Is it a Sunday?
 I. The same date in the previous year is Friday.
 II It is 1st January 2088.
13. What is the rate per metre length of the fencing of the rectangular field?
 I. The area of the field is 10,000 sq. metres.
 II. The total cost for fencing the field is Rs.1,00,000
14. What is the value of the non-negative integer a ?
 I. 3^a divides 33886 II. 7^a divides 2058
15. Is the set A contained in the set of prime numbers?
 I. Every element of A is a positive real number
 II. $A \subseteq \left\{ x \in \mathbb{R} \mid x < \frac{1}{n} \text{ for all positive integers } n \right\}$
16. Is n divisible by 720?
 I. n is divisible by 24 and 30
 II. $n = a(a+1)(a+2)(a+3)(a+4)(a+5)$ for some positive integer a .
17. What is $a : b : c$?
 I. $a : b = 2 : 3$ II. $b : c = 5 : 6$
18. The price of which of the mobile phones A and B is reduced more?
 I. The price of A is reduced by 10% II. The price of B is reduced by 12%
19. If a , b and c are distinct prime numbers, is a an even number?
 I. The product of a , b and c is even. II. The sum of b and c is odd.
20. Are a , b and c in arithmetic progression?
 I. $5a$, $5b$ and $5c$ are in arithmetic progression
 II. $2a$, $3b$ and $4c$ are in arithmetic progression.
21. What is the value of $\sin \theta$?
 I. $\tan \theta + \cot \theta = 3$ II. $(\operatorname{cosec} \theta + \cot \theta)(\operatorname{cosec} \theta - \cot \theta) = 1$
22. Is $x^2 < x$?
 I. x is a real number II. x is an integer.
23. How long will 200 men take to reap the harvest of a field of area 2.4 km²?

- I. 100 men will reap the harvest of a field of area 1 km^2 in 6 weeks.
 II. 200 women will reap the harvest of a field of area 1.2 km^2 in 6 weeks.
24. Is $ab = cd$?
 I. $a\%$ of c is equal to $b\%$ of d .
 II. $b\%$ of c is equal to $d\%$ of a .
25. Is $x = y$?
 I. $x\%$ of y is equal to $y\%$ of x .
 II. x is 20% of z .
26. Is the positive integer x odd?
 I. x^2 is even.
 II. $4x$ is even.
27. Is the set A equal to the set B ?
 I. $A \cap B \neq A$
 II. $n(A) = n(B)$
28. What is the slope of the straight line?
 I. The straight line passes through the origin and the point $(3, 2)$.
 II. The straight line passes through $(3, 3)$
29. What is the unit digit of the integer x ?
 I. The unit digit of x^4 is 1.
 II. The unit digit of x^3 is 2.
30. Which is the largest number among x, y and z ?
 I. $12x = z^2$
 II. $x : y : z = 3 : 7 : 6$
31. Is $(\log_{10} x)^2 = \log_{10} y^2$?
 I. $x = y = 10$
 II. $x^2 > y^2$
32. What are the values of the real numbers a and b ?
 I. 2 is a root of $x^a - b = 0$
 II. 2 is a root of $a^4 - \sqrt{2^x} = 0$
33. What are the values of the real numbers a and b ?
 I. $a : b = 7 : 3, b > 0$
 II. $2a : b = 6 : 11, a > 0$
34. Is the positive integer a divisible by 42?
 I. a is not divisible by 7.
 II. a is divisible by 21.
35. What is the volume of the cone?
 I. The height of the cone is 10 cm.
 II. The area of its base is 126 sq.cm.
36. What is the area of the triangle formed by joining the points A, B and C ?
 I. $A = (2, 5), B = (3, 2)$
 II. A, B and C lie on a straight line.
37. What is the value of $a + b + c + d$?

I. $3a + 5b + 7c - 6d = 24$

II. $a - b - 3c + 10d = 16$

38. If A is the matrix $\begin{bmatrix} 5 & 6 \\ x & 4 \end{bmatrix}$, then what is the value of x ?

I. A is not a symmetric matrix.

II. A is a singular matrix.

39. If x, y and n are positive integers, is $x^n + y^n$ divisible 2?

I. $x = 21$

II. $y = 1001$

40. What is the average mark of 10 students?

I. The average mark of 9 of them is 60.

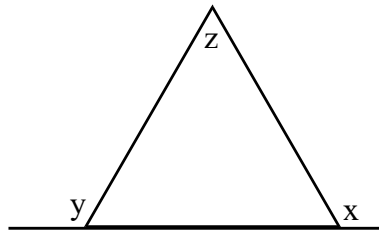
II. The marks obtained by one of them is 52.

41. If $a_0 + a_1 + a_2 + \dots + a_{10} = S$ and $a_0 = 3$, what is S ?

I. $a_n = 5a_{n-1}, n = 1, 2, \dots, 10$

II. $a_n > 0, n = 1, 2, \dots, 10$

42. How many degrees is the angle x ?



I. $y = 120^\circ$

II. $z = 87^\circ$

43. What are the values of the real numbers a, b, c in $f(x) = ax^2 + bx + c$?

I. $f(1) = 0$

II. $f(1 + i) = 0$

44. What is the cost of painting a room which is of the form of a cube?

I. The base area of the room is 144 sq.ft.

II. The room has one door of size $6' \times 4'$ and has no windows.

45. Is n divisible by 120?

I. n is the product of consecutive integers.

II. n is divisible by 6 and 20.

46. If x, y, z are distinct integers, is $(x - y)^2 > 0$?

I. $z = 2x$

II. $y > x$

47. What is the sum of the real numbers a, b, c ?

I. $a + c = 4$

II. a, b, c are in arithmetic progression.

48. Four circles of equal radius are inscribed in a square touching each other. What is the area covered by the four circles?

I. The perimeter of the square is 32cm.

- II. The ratio of the sum of the areas of the four circles to that of the square is $\pi/4$.
49. What is the equation of the straight line?
 I. It passes through (1, 1)
 II. Its perpendicular distance from the origin is 1.
50. If a, b, c are positive integers, is the product abc even?
 I. $a + b + c$ is odd. II. $a + c$ is odd.
51. Is the quadrilateral ABCD cyclic?
 I. $AC = BD$ II. $\angle BAD + \angle BCD = 180^\circ$
52. Is the triangle ABC right angled?
 I. $\angle A = 2\angle B$ II. $\angle B = \frac{2}{3}\angle C$
53. What is the equation?
 I. The coefficient of x^2 is 1. II. Both of its roots are real.
54. How many of A, B, C and D got selected into hockey team?
 I. The statement Atleast one of A and B got selected into the team is true.
 II. The statement C and D are selected into the team is false.
55. What is $A \cap B$?
 I. $A = \{3, 4, 5\}$ II. $B - A = \{1, 2\}$
56. Is x the largest among the positive real numbers x, y and z?
 I. $x - y > |z|$ II. $x + z > 2|y|$
57. If x and y are non-zero real numbers, is $x > y$?
 I. $(x - y) \left(\frac{1}{x} - \frac{1}{y} \right) = 0$ II. $(x - 5)^2 = (y - 5)^2$
58. Each student in a hostel speak Telugu or Kannada or both. What is the number of students who can speak Telugu only?
 I. The total number of students in the hostel is 500 and the number of students who can speak both Telugu and Kannada is 156.
 II. The number of students who can speak Kannada only is 124.
59. What is the minimum value of the real number y?
 I. $2y^2 \leq y^2 + y$ II. $y < 0$
60. If b, c are positive integers, is $b + c$, a prime number?

- I. b and c are odd. II. $c = 5b$.
61. Are the two triangles congruent?
I. They are both equilateral triangles. II. They have equal bases and equal heights.
62. What is the value of the non-negative integer x ?
I. 6^x is odd. II. 7^x is odd.
63. What is the value of $a + b$?
I. $a - 2b = 25$ II. $a^2 - 25 = 4ab - 4b^2$
64. What is the value of the integer a ?
I. $|a - 1| < 3$ II. $|a + 3| < 3$
65. What is the two-digit number?
I. The sum of the two digits is 6. II. The difference between the two digits.
66. A and B are standing on a sunny day. A's shadow is 10 feet long. B's shadow is 9 feet long. How tall is B?
I. A is standing 2 feet away from B. II. A is 6 feet tall.
67. If x and y are integers, is $x > y$?
I. $\frac{x}{3} = \frac{y}{3}$ II. x is a multiple of y .
68. Is $a > b$?
I. $|a - b| = 25$ II. $2a + b = 9$
69. What are the dimensions of a rectangle?
I. Its area is 12 sq. meters. II. It's diagonal is 5 meters.
70. What is the angle R in the triangle PQR ?
I. $\angle P + \angle R = 120^\circ$ II. $2\angle Q + \angle R = 110^\circ$
71. What is the value of $x + y$?
I. $x - y = x^2 - y^2$ II. $x - y = y - x$
72. Is $A = B = C = D$?
I. $A = 2B = C$ II. $D = 3B + C$
73. Is the integer ' a ' even?
I. $8a$ is even. II. $7a$ is odd.

74. Who is the heavier among four friends A, B, C and D.
I. B is heavier than A but lighter than D. II. C is lighter than B.
75. What is the value of the integer a ?
I. $\frac{1}{7} < \frac{1}{2+a} < \frac{1}{2}$ II. $a^2 + 24 = 10a$
76. What is the present age of A?
I. A was married in his 25th year.
II. A was a central government employee and retired in 1998 after completing 60 years.
77. Will it be a Wednesday tomorrow?
I. Coming Wednesday is a holiday. II. It is not Tuesday today.
78. In a class of 120 students, how many girls got distinction.
I. 20 boys in the class got distinction.
II. 25% of the students in the class got distinction.
79. How old is the son?
I. Mother was 22 years when the son was born.
II. Son retired in his 58th year and by then the mother was no more.
80. What is the value of x ?
I. $2x - 3y = 4$ II. $y^2 + 2y = -1$
81. What is the number of educated youth in the village?
I. In the village, $\frac{1}{4}$ th of the youth are educated.
II. In the village, $\frac{1}{5}$ th of the youth are employed.
82. What is the percentage of change in the area of the rectangle ABCD?
I. In measuring the sides, AB is taken 5% in excess.
II. In measuring the sides, AD is taken 4% in deficit.
83. Is $a > b$?
I. $a^2 > b^2$ II. $\frac{a}{b} = \frac{3}{5}$
84. What is the value of $a - b$?
I. $2(a - b) = 2b - 2a$ II. $a + b = 5$
85. What is the area of the rhombus?
I. Each of its sides is 120cm. II. Two of its opposite angles are 60°.

86. How old is each of the father and son?
 I. Four years ago the father was six times older than his son.
 II. After sixteen years, the father will be twice as old as his son.
87. What is the speed of the train?
 I. The train goes $2\frac{1}{2}$ times as fast as a goods train.
 II. The train leaves Hyderabad 3 hours after the goods train leaves and overtakes.
88. What is the equation for the straight line?
 I. The line makes a intercept of 5 units on Y-axis.
 II. The line passes through the point (0, 5).
89. What are the values of a and b in the polynomial $f(x) = 3x^5 - 11x^4 + 2x^3 - 5x^2 + ax + b$?
 I. $x^2 - 3x + 2$ divides $f(x)$.
 II. $f(x)$ is a multiple of $x + 5$.
90. If a, b, c, d are positive integers, what is the value of a ?
 I. The average of a, b, c is 15.
 II. The average of b, c, d is 20.
91. What was the age of the father, when his eldest son was born?
 I. Fathers present age is twice the sum of the ages of all of his three sons born at intervals of two years.
 II. Fathers present age is 42 years.
92. Does p divide $15x$?
 I. p divides $3x + 4y$.
 II. p divides both $x + 2y$ and $2x + y$.
93. What is the value of $(x + y + z)^4 - x^4 - y^4 - z^4$?
 I. $z = 8$
 II. $x = 6, y = -6$
94. What is value of $\frac{a}{b} - \frac{b}{a}$?
 I. $\frac{b^3}{a^3} - \frac{a^3}{b^3} = 36$
 II. $a + b = 10$
95. What are the dimensions of the room?
 I. The sum of all edges of the room is 68ft.
 II. The room is rectangular.
96. What is the value of $\frac{a^2 - b^2}{a^2 + ab}$?
 I. $\frac{a}{b} = 1$
 II. $a + b \neq 0$
97. What is the maximum value of x ?
 I. $5x^2 \leq 4x^2 + x$
 II. $\frac{1}{4x} + \frac{1}{5x} > 0$

98. What are the values of a and b ?
- I. $2.5a + 7b = 35$ II. $10a + 28b = 140$
99. Is $a < b$?
- I. $7a + 7b$ is positive. II. $-7a + 7b$ is negative.
100. If x is an integer, what is x ?
- I. $\frac{1}{4} < \frac{1}{x+2} < \frac{1}{2}$ II. $x^2 - 5x + 4 = 0$
101. What will be the age of x after 7 years from now?
- I. x is 21 years younger than his father. II. His father was 40 years old five years ago.
102. What is the value of the non-negative integer x ?
- I. 2^x is odd. II. 3^x is odd.
103. What is the area of the circle?
- I. The circle passes through $(0, 0)$ and $(0, 2)$.
 II. The circle is fully inscribed in a square of side 8 cm.
104. At what speed must the train x be travelling when it is overtaking the train y ?
- I. The length of the train x is 200 meters.
 II. The train y is travelling at a speed of 60 km/hr.
105. 5 men can complete a piece of work in 10 days. Some boys have joined the work 2 days later. In how many more days will the job be completed?
- I. One man can do as much as 2 boys.
 II. The boys who have joined can do the entire work in 20 days.
106. A and B are two positive real numbers. Which of them is greater than the other?
- I. $3A - 2B + C = 0$ II. $A + B = C$
107. What is the cost of 4 tables and 6 chairs?
- I. One table and one chair cost Rs. 250 II. Two tables and three chairs cost Rs. 800
108. What is the length of the train?
- I. It crosses a pole in 8 seconds.
 II. It crosses a bridge of length 100m in 12 seconds.
109. Does a divide b , where a , b and c are positive integers?
- I. a divides bc II. c is a -prime
110. What is the value of 3^{5n-3} , where n is a positive integer?
- I. $3^n = 243$ II. $3^7 = 2187$

111. What is the number of odd positive integers less, than x ?
 I. $x > 200$ II. Their sum of 10000
112. What is the total salary of A, B and C ?
 I. A and B have equal salaries each of which is twice the salary of C.
 II. The salary of C is Rs.4,000 less than that of B.
113. If a, b, c are integers is $a + b + c$ even.
 I. $a - b + c$ is even. II. a, b, c is even.
114. x is a positive integer. Is x divisible by 36 ?
 I. The digit in the units place of x is 2 and the digit in the tens place is odd.
 II. The sum of all digits in x is divisible by 9.
115. What the value of the expression $4a^2 - \frac{4a^2}{b}$?
 I. $a = 2$ II. $b^2 = 1$
116. The area of a rectangle is 12sq. meters. What is its perimeter ?
 I. The square of the diagonal of the rectangle is half of the sum of the squares of the sides.
 II. The length of a side of the rectangle is 4 meters.
117. What is the value of $x^2 + y^2$?
 I. $(x - 8)^2 + (y + 6)^2 = 0$ II. $(x + 7) + (y - 4) = 0$
118. Is an assistant's salary more than that of a manager ?
 I. A doctor's salary is 40% higher than that of an assistant.
 II. The doctor's salary is Rs. 159 higher than that of a manager.
119. m and n are positive integrs. Is m greater than n ?
 I. $m^2 = 81$ II. $n^2 = 36$
120. A boy can swim two miles per hour in still water. What is his speed relative to shore in a river ?
 I. The river's current flows at three miles per hour.
 II. The boy swims in the same direction as the current.
121. What is the area of the circle ?
 I. The center of the circle is (0 , 0).
 II. The point (2 , 3) lies within the circle.
122. What is the value of $2x + 3y$?
 I. $x + y = 2$ II. $3x - 2y = 1$
123. What is the value of $p^3 + q^3$?
 I. $p^2 + q^2 = 74$ II. $pq = 35$

124. After how much time will A meet B ?
 I. A and B are at a distance of 50 meters from each other.
 II. A and B are moving in the opposite directions with respective speeds of 10 kmph and 15kmph.
125. If $a > 0$ then is $a > b$?
 I. $a^2 > b^2$
 II. $\frac{a}{b} = \frac{2}{3}$.
126. Is $g : R \rightarrow R$ an even function?
 I. $g(x) = g(-x)$ for every $x \in R$
 II. $g(x)$ is a polynomial of even degree.
127. What is the cost price of the article?
 I. The selling price of the article is Rs.50
 II. The profit is 10%
128. What is the positive integer value of x ?
 I. $16 < 5x + 1 < 26$
 II. $4 < x^2 < 25$
129. What is the present age of the father ?
 I. The sum of the present ages of the father and his son is 46.
 II. 5 years ago the father's age was 5 times that of his son.
130. How many elements are there in the set A ?
 I. $A \cup B$ has 25 elements .
 II. $A - B$ has 25 elements .
131. How many brothers does A have ?
 I. A's father has four children.
 II. A is the only daughter of her parents.
132. In the right-angled $\triangle ABC$ what is $\angle A$?
 I. $\angle B = 30^\circ$
 II. $\angle A + \angle B > 90^\circ$.
133. What is the perimeter of the circular sector ?
 I. The angle of the sector is $\frac{\pi}{3}$.
 II. The area of the sector is 6π square units .
134. Is the product $a.b$ an irrational number ?
 I. a is an irrational number.
 II. b is an irrational number.
135. Is the value of x unique ?
 I. $x < 0$
 II. $x^2 = 16$.
136. Is $x > y$?
 I. $5^x = 25^y$
 II. $y = -2$

137. What is the area of $\triangle ABC$?
- I. $\angle ABC = 60^\circ$ II. $AB = BC = AC = 4$
138. What is the average of a, b, c and d ?
- I. a, b, c and d are primes. II. a, b, c and d lie in $\{10, 11, 12, \dots, 20\}$
139. Is $\triangle ABC$ right-angled?
- I. A lies on the circle with BC as a diameter. II. A, B, C lie on a circle.
140. What is the value of V ?
- I. V is the volume of a cylinder. II. The cylinder is of height h units.
141. What are the coordinates of the point M ?
- I. M is a point on the y -axis
II. M is a point such that MP is parallel to the x -axis, where P is $(3, -4)$
142. If a, b, c, d is a geometric progression what is the value of $\frac{b}{c}$?
- I. The product of a and d is 24
II. The common ratio of the geometric progression is 2
143. Does the point $P(x, y)$ lie on the first quadrant?
- I. $x + y \geq 4$ II. $xy < -4$
144. What are the values of a and b ?
- I. $a : b = 7 : 3, b > 0$ II. $2a : b = 6 : 11, a > 0$
145. How many elements are in the set $B = \{n \in \mathbb{Z} : f(n) \leq 5\}$?
- I. $f: \mathbb{Z} \rightarrow \mathbb{Z}$ is given by $f(n) = |2n - 1|$ for $n \in \mathbb{Z}$
II. $f: \mathbb{Z} \rightarrow \mathbb{Z}$ is onto
146. Is the product of the integers x, y and z equal to 1?
- I. $x + y + z = 3$ II. $x > 0, y > 0, z > 0$
147. What is the radius of the circle circumscribing the triangle ABC ?
- I. ABC is a right-angled triangle II. The largest side of the triangle is 12 cms.
148. Is $\triangle ABC$ equilateral?
- I. $AB = BC$ II. $\angle ABC = 60^\circ$
149. For the positive integer x is the greatest common divisor of 150 and x a prime number?
- I. x is a prime number II. $x < 4$
150. If x and y are integers then is z an even integer?

- I. $z = (x + y)^2$ II. $z = 2x + 8y$
151. Is the set E infinite?
 I. E contains natural numbers 1234567 II. E is the set of prime divisors of
152. Is $b > a$?
 I. $x + 3$ is a factor of $x^6 - 27^b$ II. $x - 2$ is a factor of $x^2 - 4a^b$
153. What is the value of $\sin^4 \theta + \operatorname{cosec}^4 \theta$?
 I. $\sin \theta + \operatorname{cosec} \theta = 2$ II. $\sec^2 \theta = 1 + \tan^2 \theta$
154. For integers a and b is $(a^3 + b^3)^{\frac{1}{3}}$ an integer?
 I. $a^3 + b^3$ is an even integer
 II. $a^3 + b^3$ is equal to the volume of a box with dimensions 12cm, 18cm and 125cms.
155. What is the cost price of the item?
 I. It is sold for Rs s at a loss of 10% II. If it is sold for Rs $(s + 50)$ the profit will be 5%
156. What is the area of the rhombus ABCD?
 I. The length of the side AB is 12cms II. One diagonal is of length 30cms
157. Is $a + b = d$?
 I. The averages of a, b and c is 6 II. The average of c and d is 9
158. Are the lines L_1 and L_2 parallel?
 I. L_1 and L_2 make equal angle with $y = 0$ II. L_1 and L_2 lie in a plane
159. What is the digit in the units place of the integer n ?
 I. n leaves remainder 17 when divided by 100 II. n is divisible by 17
160. What is the value of $\frac{1}{x + 48}$?
 I. $x + 96 = 0$ II. $x + 48 \neq 0$

Data Sufficiency: Answers

1. 3	2. 4	3. 1	4. 1	5. 4	6. 3	7. 3	8. 4	9. 3	10. 2	11. 2	12. 4
13. 4	14. 4	15. 4	16. 2	17. 3	18. 4	19. 1	20. 1	21. 4	22. 2	23. 1	24. 4
25. 4	26. 1	27. 4	28. 1	29. 2	30. 2	31. 1	32. 4	33. 4	34. 1	35. 3	36. 2
37. 3	38. 2	39. 3	40. 4	41. 1	42. 3	43. 3	44. 4	45. 1	46. 1	47. 3	48. 1
49. 4	50. 2	51. 2	52. 3	53. 4	54. 4	55. 4	56. 1	57. 1	58. 3	59. 1	60. 2

61. 3 62. 1 63. 4 64. 3 65. 4 66. 2 67. 1 68. 4 69. 3 70. 1 71. 4 72. 3
 73. 2 74. 3 75. 3 76. 4 77. 2 78. 3 79. 4 80. 3 81. 4 82. 3 83. 2 84. 1
 85. 3 86. 3 87. 4 88. 4 89. 1 90. 4 91. 3 92. 2 93. 3 94. 1 95. 4 96. 1
 97. 1 98. 4 99. 2 100. 1 101. 3 102. 1 103. 2 104. 4 105. 2 106. 3 107. 2 108. 3
 109. 4 110. 1 111. 2 112. 3 113. 1 114. 3 115. 2 116. 2 117. 1 118. 4 119. 4 120. 3
 121. 4 122. 3 123. 4 124. 3 125. 2 126. 1 127. 3 128. 1 129. 3 130. 3
 131. 3 132. 4 133. 3 134. 4 135. 3 136. 3 137. 2 138. 3 139. 1 140. 4
 141. 3 142. 2 143. 2 144. 4 145. 1 146. 3 147. 3 148. 3 149. 3 150. 2
 151. 2 152. 3 153. 1 154. 2 155. 3 156. 3 157. 3 158. 1 159. 1 160. 1

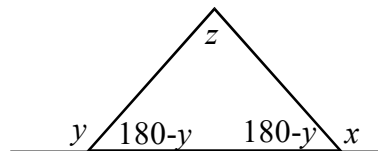
Data Sufficiency: Explanations

1. Let $\angle B = x$. So $\angle A = 2\angle B = 2x$. $\angle C = \frac{3}{2}x$. So $x + 2x + \frac{3}{2}x = 180$.
 Thus $x = 40$. So $\angle A = 80^\circ$. **Hence answer is 3.**
2. Data is not sufficient. Some more data needed. **Hence answer is 4.**
3. Statement (I) is sufficient. **Hence answer is 1.**
4. Statement (I) is sufficient. Det of matrix = 0. So we get $\sin \theta = 0$. **Hence answer is 1.**
5. Both the statements are not sufficient. Some more data needed. **Hence answer is 4.**
6. $a^3 + b^3 = (a + b)(a^2 + b^2 - ab)$. So $a^3 + b^3 = -4ab$. **Hence answer is 3.**
7. $x^2 < y^2$ is true for all non-negative integers x, y and $x < y$. **Hence answer is 3.**
8. 115, 135, 195 lies between 100 and 200 they give remainders 5 and 3 respectively when divided by 10 and 8. **Hence answer is 4.**
9. $\theta = \frac{\pi}{2}$. **Hence answer is 3.**
10. We can find the area of the equilateral triangle when height is known. **Hence answer is 2.**
 Here height = 12. So base = $8\sqrt{3}$. Area = $\frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 8\sqrt{3} \times 12 = 48\sqrt{3}$.
11. From statement (II) $(a - 2)(a - 3) < 0 \Rightarrow 2 < a < 3$. So a is positive. **Hence answer is 2.**
12. Data is not sufficient. Some more data needed. **Hence answer is 4.**
13. Area = length $\times$ breadth = $l \times b = 10,000$ sq. mts. Perimeter = $2(l + b)$. **Hence answer is 4.**

14. $3^9 = 19,683$; $3^{10} = 59,049$; $7^4 = 2,401$; $7^5 = 16,807$. **Hence answer is 4.**
15. Data is not sufficient. Some more data needed. **Hence answer is 4.**
16. Product of 6 consecutive integers is divisible by $6! = 720$. **Hence answer is 2.**
17. $a : b = 2 : 3 \Rightarrow a : b = 10 : 15$; $b : c = 5 : 6 \Rightarrow b : c = 15 : 18$. So $a : b : c = 10 : 15 : 18$. **Hence answer is 3.**
18. Without knowing the cost of mobile phones A and B we cannot conclude which phone price is reduced more. **Hence answer is 4.**
19. Statement (I) is sufficient. **Hence answer is 1.**
20. Statement (I) is sufficient. **Hence answer is 1.**
21. Data is not sufficient. Some more data needed. **Hence answer is 4.**
22. From statement (II) we know that x is an integer.
So x^2 is always greater (or) equal but not less than x . **Hence answer is 2.**
23. From statement (I) we know that 100 men can reap the harvest of a field of area 1 km^2 in 6 weeks. Using the relation $\frac{M_1 \times T_1}{W_1} = \frac{M_2 \times T_2}{W_2}$. **Hence answer is 1.**
24. Data is not sufficient. Some more data needed. **Hence answer is 4.**
25. Data is not sufficient. Some more data needed. **Hence answer is 4.**
26. From statement (I) x^2 is even then x should be even number. **Hence answer is 1.**
27. Data is not sufficient. Some more data needed. **Hence answer is 4.**
28. From statement (I) the points of straight lines becomes $(0, 0)$ & $(3, 2)$. we can find-slope of straight line. **Hence answer is 1.**
29. From statement (II) x^3 unit digit is '2'. It is only possible if any number unit place '8'.
Example: $8^3 = 512$. **Hence answer is 2.**
30. From statement (II) we can say y is the largest among x, y & z i.e. $x : y : z = 3 : 7 : 6$. **Hence answer is 2.**
31. Data (I) alone is sufficient. **Hence answer is 1.**

32. Data is not sufficient. Some more data needed. **Hence answer is 4.**
33. Data is not sufficient. Some more data needed. **Hence answer is 4.**
34. Any number divisible by 42 then it should be divisible by 6 & 7 also. From statement (I) we know that 'a' is not divisible by '7', then it is not divisible by 42. **Hence answer is 1.**
35. From statement (I) we know that height of cone is 10 cm. From statement (II) we know that base area is 126 sq.cm. By combining both statement (I) & (II) together we can find the volume of cone. **Hence answer is 3.**
36. From statement (II) we know that points on same straight line. Thus the points are collinear. The area of triangle is "zero". **Hence answer is 2.**
37. By adding given statement (I) & statement (II) equations we get $a + b + c + d = 10$. **Hence answer is 3.**
38. From statement (II) 'A' is singular. So $|A| = 0 \Rightarrow 20 - 6x = 0 \Rightarrow x = 10/3$. **Hence answer is 2.**
39. From statement (I), $x = 21$ is odd number. From statement (II), $y = 1001$ is odd number. We know that any (odd number)ⁿ is odd. Using both statements together we can say $x^n + y^n = \text{odd} + \text{odd} = \text{even}$. Hence $x^n + y^n$ is divisible by '2'. **Hence answer is 3.**
40. Data is not sufficient. Some more data needed. **Hence answer is 4.**
41. Given $a_0 + a_1 + a_2 + \dots + a_{10} = S$. $a_0 = 3$; From statement (I), $a_n = S$.
 $a_0 = 3$. From statement (I), $a_n = 5$, a_{n-1} , $n = 1, 2, \dots, 10 \Rightarrow a_1 = 5.a_0 \Rightarrow a_2 = 5.a_1$.
 Since we have $a_0 = 3$, we can find $a_1, a_2, a_3, \dots, a_n$. Then we can find S.
Hence answer is 1.

42. We have to find x.
 So, to find x, we need y, z
 We can get y, z from (I) and (II).
Hence answer is 3.



43. $f(x) = ax^2 + bx + c$. From statement (I), $f(1) = 0$. $a + b + c = 0$
 From statement (II), $f(1 + i) = 0$
 $\Rightarrow a(1 + i)^2 + b(1 + i) + c = 0 \Rightarrow a(1 + 1 + 2i) + b(1 + i) + c = 0$
 $\Rightarrow 2ia + b + ib + c = 0 \Rightarrow 2ia + ib + b + c = 0$. **Hence answer is 3.**
44. To find the cost of painting a room which is in the form of a cube, we need to find the area of 4 sides and the areas of ceiling and floor (or) atleast area of one side.

From statement (I) we can know the area of the floor i.e., 14 sq.ft.

So, area of the entire room is 6(144) sq.ft.

But the cost is not known from both statements. **Hence answer is 4.**

45. The product of three consecutive integers are divisible by 6. The product of 4 consecutive integers is divisible by 24 and the product of 5 consecutive integers is divisible by 120. So, statement (I) is enough. **Hence answer is 1.**

46. Let $(x - y) > 0$. From statement (I), $z = 2x$. $(x - y)^{2n} > 0 \Rightarrow [(x - y)^x]^2 > 0$.
This is true because the power is even and x, y, z are distinct integers. **Hence answer is 1.**

47. We need to find $a + b + c$. From statement (I), we have $a + c = 4$.
So, we can't find $a + b + c$ from $a + c = 4$. So, we can't find $a + b + c$ from this only.
From statement (II), we have $2b = a + c$, we can't find $a + b + c$, from here too.
But if we combine two statements, $a + c = 4$ and $2b = a + c \Rightarrow b = 2$.
Now $a + b + c = 4 + 2 = 6$. **Hence answer is 3.**

48. If the four equal circles are inscribed in a square, side of square is equal to 4 times the radius of the circle. So $r = 4r$. From statement (I), perimeter of square is 32cm.
 $\Rightarrow 4s = 32 \Rightarrow s = 8 \Rightarrow 4r = 8 \Rightarrow r = 2$.
Now, we can find the area covered by the covers. **Hence answer is 1.**

49. To find the equation of a straight line, we need two points, that the line pass through (or) one point and slope of the line. (or) intercepts of x and y axes. But even if we combine both statements, we get no information to find the equation. **Hence answer is 4.**

50. If the product of three integers is even, then at least one of those should be even. From statement (I), $a + b + c$ is odd means all three are odd (or) two are even and one is odd. In the first case, product is odd but in the second case, product is even. Both are possible, so, we can't answer. From statement (II) $a + c$ is odd, mean one is even and one is odd. Irrespective of b is either even or odd, one is even, the product is even. **Hence answer is 2.**

51. If a quadrilateral ABCD is to be cyclic we should be known that sum of opposite angles is 180° .
Thus is given in statement (II). **Hence answer is 2.**

52. From statement (I), $\angle A = 2\angle B$. From statement (II), $\angle B = \frac{2}{3} \angle C$.

Combining both, $\angle A = 2\angle B$ and $3\angle B = 2\angle C$. Since $\angle A + \angle B + \angle C = 180^\circ$.

$$\Rightarrow 2\angle B + \angle B + \angle B = 180^\circ \Rightarrow \frac{9\angle B}{2} = 180^\circ \Rightarrow \angle B = 40^\circ.$$

Now, $\angle A = 80^\circ$, $\angle C = 60^\circ$, So, ABC triangle is not right angled. **Hence answer is 3.**

53. To find a quadratic equation, we need sum of roots and product of roots.

But from both clues, we get nothing. **Hence answer is 4.**

54. We can't answer the question from either statements individually. But if we combine both, we can know that either C, D, A (or) C, D, B (or) C, D, B, A are selected into the team. So, the number can be c (or) d. **Hence answer is 4.**

55. What is $A \cap B$?

In the first statement A is given, its of no use individually.

In the second statement, B - A is given, its too of no use individually.

Combining both, $A = \{3, 4, 5\}$, $B - A = \{1, 2\}$.

If we combine these two, we get nothing. **Hence answer is 4.**

56. From statement (I), $x - y > |z| \Rightarrow x > |z| + y$. Here, z is positive real number. $\Rightarrow x > y + z$. So, it is clear that x is largest among three. **Hence answer is 1.**

57. From statement (I), $\Rightarrow (x - y) \left(\frac{1}{x} - \frac{1}{y} \right) = 0 \Rightarrow \frac{(x - y)^2}{xy} = 0 \Rightarrow (x - y)^2 = 0 [\because x, y \neq 0]$
 $\Rightarrow x - y = 0 \Rightarrow x = y$. So, it is clear that $x > y$ is not true. **Hence answer is 1.**

58. From statement (I), $n = 500$, i.e., $n(T \cup K) = 500$ and $n(T \cap K) = 156$.

We have to find the number of people who speak only Telugu i.e., $n(T \cap K')$.

From statement (II), $n(K \cap T') = 124$. From both statements. We know that $n(T \cup K) = 500$.

So, $n(T \cap K') = 500 - 156 - 124 = 500 - 280 = 220$. **Hence answer is 3.**

59. From statement (I), $2y^2 \leq y^2 + y \Rightarrow y \geq y^2 \Rightarrow y^2 - y \leq 0$
 $\Rightarrow y(y - 1) \leq 0 \Rightarrow 0 \leq y \leq 1$. So, the minimum value of y is 0. **Hence answer is 1.**

60. We have to check wheter $b + c$ is prime or not from statement (I), b, c are odd numbers. Then $b + c$ is even. Since 2 is a prime number and other even numbers are not from statement (II), $c = 5b$. Then $b + c = 5 + 5b = 6b$. Since $b + c$ is divisible by 6, it is not a prime. **Hence answer is 2.**

61. Both the statements are sufficient. **Hence answer is 3.**

62. Statement (I) satisfies when $x = 0$ only. **Hence answer is 1.**

63. Both the statements are not sufficient. **Hence answer is 4.**

64. From statement (I) ' a ' values are $\{-1, 0, 1, 2, 3\}$. From statement (II) ' a ' values are $\{-1, -2, -3, -4, -5\}$ from both the common value is -1. **Hence answer is 3.**

65. The given statements cannot give the uinique value to the numbers. Some more data needed. **Hence answer is 4.**

66. Statement (I) is irrelevant. Statement (II) gives height of B=5.4 feet. **Hence answer is 2.**
67. From statement (I) x and y must be equal so x is not greater than y . **Hence answer is 1.**
68. The given data is not sufficient. Some more data is needed. **Hence answer is 4.**
69. From statement (I) $l \times b = 1 \times 12 = 2 \times 6 = 3 \times 4$; From statement (II) $l^2 + b^2 = d^2$, the second condition satisfies by only the dimensions 4×3 . By using both we can solve the answer.
Hence answer is 3.
70. From statement (I) we get $\angle P + \angle Q = 120^\circ$ and $\angle P + \angle Q + \angle R = 180^\circ$ (sum of the angles in triangle is 180°). Thus $\angle R = 180^\circ - 120^\circ = 60^\circ$. **Hence answer is 1.**
71. The given data is not sufficient to find the value of $x + y$. Some more data is needed.
Hence answer is 4.
72. Statements (I) and (II) satisfies only when $A = B = C = D = 0$. **Hence answer is 3.**
73. From statement (II) $7a$ is odd, then ' a ' should be odd. **Hence answer is 2.**
74. From statement (I) we get $D > B > A$ and from statement (II) we get $C < B$. Combining these we get D is heavier among them. **Hence answer is 3.**
75. From (I), we get $0 < a < 5 \Rightarrow a \in \{1, 2, 3, 4\}$ but not unique.
From (II) $a^2 + 24 - 10a = 0 \Rightarrow (a - 6)(a - 4) = 0 \Rightarrow a = 6$ (or) $a = 4$.
Here also a is not unique. From (I) and (II) we get $a = 4$.
Only this value satisfies the condition $\frac{1}{7} < \frac{1}{2+a} < \frac{1}{2}$. **Hence answer is 3.**
76. The given statements are irrelevant to find age of A. **Hence answer is 4.**
77. Statement (I) is not sufficient. From statement (II) today is not Thursday $\Rightarrow$ tomorrow is not Wednesday. **Hence answer is 2.**
78. Statements (I) or (II) alone is not sufficient. Together, number of girls get distinction = 25% of $120 - 20 = 30 - 20 = 10$. **Hence answer is 3.**
79. The given data is not sufficient. Some more data needed. **Hence answer is 4.**
80. Statement (I) or (II) alone is not sufficient. By combining them we get $y = -1$ and $x = 1/2$.
Hence answer is 3.
81. The given data is not sufficient. Some more data needed. **Hence answer is 4.**
82. ~~Data (I) or (II) alone is not sufficient. From (I) and (II) together, we can find the percentage of~~
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change in area of rectangle. **Hence answer is 3.**

83. Statement (I) is not sufficient.

From statement (II) $\frac{a}{b} = \frac{3}{5}$ gives $a < b$. **Hence answer is 2.**

84. From statement (I) we get $4(a - b) = 0 \Rightarrow a - b = 0$. **Hence answer is 1.**

85. Data (I) or (II) alone is not sufficient. From (I) and (II) together, we can find side of rhombus = 120 cm. and the angle between the sides $\theta = 60^\circ$.

So area of rhombus = $a^2 \sin \theta = 120^2 \cdot \sin 60^\circ = 14400 \cdot \sqrt{3}$ sq. cm. **Hence answer is 3.**

86. Data (I) or (II) alone is not sufficient. From (I) and (II) together, we get sons age = 9 years, father age is 34 years. **Hence answer is 3.**

87. The given statements are in sufficient. Some more data needed. **Hence answer is 4.**

88. The given statements are in sufficient. Some more data needed. **Hence answer is 4.**

89. From statement (I) $x^2 - 3x + 2 = (x - 1)(x - 2)$ is factor of $f(x) \Rightarrow x = 1, 2$ are roots of $f(x)$.
 $\therefore a + b = 11$ and $2a + b = 84$. Solving these we get $a = 95, b = -84$. **Hence answer is 1.**

90. The given statements are in sufficient. Some more data needed. **Hence answer is 4.**

91. Data (I) or (II) alone is not sufficient. From (I) and (II) together, we get fathers age = 42 and his three children ages are 6, 7, 8. Thus the age of father, when the eldest son was born = 34 years.

Hence answer is 3.

92. Statement (I) is not sufficient. But from statement (II) we get $\frac{x + 2y}{p}$ and $\frac{2x + y}{p}$ are integers.

Adding them we get $\frac{3x + 3y}{p}$ is an integer. So p divides $15x$. **Hence answer is 2.**

93. Data (I) or (II) alone is not sufficient. From (I) and (II) together,
 $(x + y + z)^4 - x^4 - y^4 - z^4 = 8^4 - 6^4 - 6^4 - 8^4 = -2592$. **Hence answer is 3.**

94. From statement (I) $\frac{b^3}{a^3} - \frac{a^3}{b^3} = 36 \Rightarrow \left(\frac{b}{a} - \frac{a}{b}\right)^3 + 3\left(\frac{b}{a} + \frac{a}{b}\right) = 36 \Rightarrow \frac{b}{a} - \frac{a}{b} = 3$.

Hence answer is 1.

95. Both the statements are not sufficient. **Hence answer is 4.**

96. From statement (I) $\frac{a}{b} = 1 \Rightarrow a = b$. So $\frac{a^2 - b^2}{a^2 + ab} = 0$. **Hence answer is 1.**

97. From statement (I) $5x^2 \leq 4x^2 + x \Rightarrow x^2 - x \leq 0 \Rightarrow 0 \leq x \leq 1$. So maximum value of $x = 1$.
Hence answer is 1.
98. Statement (I) and (II) represents the same equation. So to find a and b some more data is needed. **Hence answer is 4.**
99. Statement (I) is not sufficient. From statement (II) $-7a + 7b < 0 \Rightarrow -a + b < 0 \Rightarrow b < a$.
Hence answer is 2.
100. From statement (I) $2 < x + 2 < 4 \Rightarrow 0 < x < 2$ and x an integer $\Rightarrow x = 1$. **Hence answer is 1.**
101. Data (I) or (II) alone is not sufficient. From (I) and (II) together.
Fathers age = 45 years and X's age = $45 - 21 = 24$ years
Age of X after 7 years = 31 years. **Hence answer is 3.**
102. From data (I) 2^x is add $\Rightarrow x = 0$. **Hence answer is 1.**
103. Data (I) is not sufficeint; From data (II) side of the square = 8 cms.
 $\Rightarrow$ Radius of the circle inscribed in square = $8\sqrt{2}$ cms.
 $\Rightarrow$ Area of circle = 128π sq.cms. **Hence answer is 2.**
104. Data is not sufficient. Some more data needed. **Hence answer is 4.**
105. Data (I) alone is not sufficient. From data (II), The boys
Who joined the entire work in 20 days.
They together finish the work = $\Rightarrow \frac{2 \times 10 \times 20}{30} = 13 \frac{1}{3}$ days. **Hence answer is 2.**
106. Data (I) or (II) alone is not sufficient. From (I) and (II) together $3A - 2B + C = 0$ and
 $A + B + C \Rightarrow B = 2A \Rightarrow B$ is greater than A . **Hence answer is 3.**
107. Data (I) alone is not sufficient. From data (II) two tables and three chairs cost = Rs. 800
 $\Rightarrow$ 4 tables and 6 chairs cost = 1600. **Hence answer is 2.**
108. Data (I) or (II) alone not sufficient. From (I) and (II) together, gives length of the train
= 200mts. **Hence answer is 3.**
109. Data is not sufficient. Some more data needed. **Hence answer is 4.**
110. From data (I) $3n = 243$, $n = 5$, $n^{5n-3} = 3^{22}$. **Hence answer is 1.**
111. Data (I) alone is not sufficient. From data (II). The sum of all positive integers less than x is
 $10000 = (100)^2 \Rightarrow$ The number of odd positive integers less than x is 100.
Hence answer is 2.

112. Data (I) or (II) alone is not sufficient. From (I) and (II) together, C salary = 4,000;
B salary = A salary = 8000 $\Rightarrow$ Sum of A, B, C salaries = Rs. 20,00. **Hence answer is 3.**
113. From (I) $a - b + c$ is even $\Rightarrow a + b + c = (a - b + c) + 2b$ is also even. **Hence answer is 1.**
114. Data (I) or (II) alone is not sufficient. But from data (I), we get x is divisible by 4 and from (II) x is divisible by 9. (I) and (II) together, we get x is divisible by 36. **Hence answer is 3.**
115. Data (I) alone is not sufficient. From data (II) $b = \pm 1$ gives $4a^2b - \frac{4a^2}{b} = 0$.
Hence answer is 2.
116. Data (I) alone is not sufficient. From data (II) Length of rectangle = 4 cms
 $\Rightarrow$ Its breadth = 3cms $\Rightarrow$ Perimeter = 14 cms. **Hence answer is (2)**
117. From data (I). We can get $x = 8, y = -6 \Rightarrow x^2 + y^2 = 100$. **Hence answer is 1.**
118. Data is not sufficient. Some more data needed. **Hence answer is 4.**
119. Data (I) and (II) doesn't determine m, n are either Positive or negative. Data is not sufficient. **Hence answer is 4.**
120. Data (I) or (II) alone is not sufficient. From (I) and (II) together, we get $x = 2$ kmph, $y = 3$ kmph and boy travels in down stream $\Rightarrow$ His speed = 4 kmph. **Hence answer is 3.**
121. Both the statements are not sufficient. Area = πr^2 , by using both the statements we cannot find r . **Hence answer is 4.**
122. From (I) and (II) together we can find x and y values. **Hence answer is 3.**
123. Both the statements are not sufficient. **Hence answer is 4.**
124. Both the statements are not sufficient. **Hence answer is 3 or 4.**
125. From (I) $a^2 > b^2 \Rightarrow a \neq b$. **Hence answer is 1.**
or From (II) $3a = 2b \Rightarrow a \neq b$. **Hence answer is 2.**
126. Statement (I) is definition of even function. **Hence answer is 1.**
127. By using both the statement we can find cost price. **Hence answer is 3.**
128. From statement (I) we get $x = 4$. **Hence answer is 1.**
129. Father age = x , son age = y ; by using both the statements we get $x = 35, y = 11$.

Hence answer is 3.

130. By using both the statements we get set A contains 10 elements. **Hence answer is 3.**

131. By using both the statements we get A has three brothers. **Hence answer is 3.**

132. Both the statements are not sufficient. **Hence answer is 4.**

133. By using both the statements we can find the perimeter of the circular sector.

$$\text{Area of sector} = \frac{1}{2} \times \text{Length of the arc} \times \text{radius. Hence ans. is 3.}$$

134. Both the statmenets are not sufficient. **Hence answer is 4.**

135. By using both the statements we get $x = -4$. **Hence answer is 3.**

136. $5^x = 25^y = (5^2)^y = 5^{2y} = 5^{-4}$; $x = -4$, $y = -2$. **Hence answer is 3.**

137. Statement $\Rightarrow$ ABC is an equilateral triangle. $\text{Area} = \frac{\sqrt{3}}{4} a^2 = \frac{\sqrt{3}}{4} 16 = 4(\sqrt{3})$ square units

$$\text{or Area} = \sqrt{s(s-a)(s-b)(s-c)}, \text{ where } s = \frac{a+b+c}{2}. \text{ Hence answer is 2.}$$

138. By using both statements primes between $\{10, 11, 12, 13, \dots, 20\}$ are 11, 13, 17, 19.

$$\text{Average} = \frac{11+13+17+19}{4} = \frac{60}{4} = 15. \text{ Hence answer is 3.}$$

139. Angle in a semi circle is 90° . From statement (I) BC - diameter. **Hence answer is 1.**

140. Both the statements are not sufficient. **Hence answer is 4.**

$$\text{Volume} = \pi r^2 h, \text{ curved surface area of cylinder} = 2\pi r h.$$

141. By using both the statements we can find the coordinates of the point M. **Hence answer is 3.**

142. By using (II) statement only we can find the value of b/c . **Hence answer is 2.**

143. By using (II) statement only we can say that the point P doesnot lie in first quadrant. **Hence answer is 2.**

144. By using both the statements we cannot find the value of a and b . **Hence answer is 4.**

145. By using statement (I) is only we can find B as $B = \{0, 1, 2, -1, -2, -3, 3\}$. **Hence answer is 1.**

146. By using both the statements we get $x = 1, y = 1, z = 1$. **Hence answer is 3.**

ICET - 2013**Data Sufficiency:****(Marks : 20)**

Note: Each question is followed by data in the form of two statements labelled as I and II. You must decide whether the data given in the statements are sufficient to answer the questions. Using the data make an appropriate choice from (1) to (4) as per the following guidelines:

- (a) Mark choice (1) if the statement I alone is sufficient to answer the question.
- (b) Mark choice (2) if the statement II alone is sufficient to answer the question.
- (c) Mark choice (3) if both the statements I and II are sufficient to answer the question but neither statement alone is sufficient.
- (d) Mark choice (4) if both the statements I and II together are not sufficient to answer the question and additional data is required.

1. Is $(x - a)$ a factor of the polynomial $f(x)$? **Answer is 1**

I. $f(a) \neq 0$

II. The sum of the coefficients of $f(x)$ is constant.

Answer is 3

2. What is the simple interest earned yearly on a deposit in a bank ?

I. The amount deposited is Rs.10,000.

II. The rate of interest is 8%.

3. What is the surface area of a sphere ?

I. The sphere is made of iron.

II. The radius of the sphere is given.

Answer is 2

4. What is the value of $x^4 + y^4$, if $xy = 1$?

I. $x + y = 5$

II. $x > 0, y > 0$

Answer is 1

5. What is the value of $8a^3 + b^3 - 27c^3$?

I. $abc = k$

II. $2a + b = 3c$

Answer is 3

6. What is the distance between two ships ?

I. Seen from the top of a mountain their angles of depression are 60° and 30° .

II. Height of the mountain is 60 metres.

Answer is 4

7. Do the two circles with their centres at A and B and having radii r_1 and r_2 intersect ?

I. Distance between A and B is ' a ' units.

II. $|r_1 - r_2| < a < r_1 + r_2$

Answer is 3

8. Are two triangles similar ?

I. They are equilateral.

II. Their areas are equal.

Answer is 1

9. What is the area of a regular hexagon ?

I. A circle of radius ' a ' units is inscribed in the hexagon.

II. Each side of the hexagon subtends an angle of 60° at the centre of the circle.

Answer is 1

10. What is the value of $\log_{10} x$?

I. $x > 3$

II. $\log_{10} x + \log_{10} (x-3) = 1$

Answer is 3

11. Is ABCD a cyclic quadrilateral ?

I. The lengths of the diagonals are given.

Answer is 2

- II. A circle with mid point of a diagonal as centre passes through the vertices.
12. What is the 100th term of a sequence ? **Answer is 4**
 I. The sequence is an Arithmetic Progression.
 II. The first term of the sequence is 5.
13. Can we find the quadratic equation $ax^2 + bx + c = 0$? **Answer is 3**
 I. The sum of the roots is given.
 II. The difference of the roots is given.
14. What is the percentage of profit on the sale of 50 books ? **Answer is 3**
 I. The cost price of each book is Rs.100 .
 II. The sale price of each book is Rs.125.
15. What is the value of n ? **Answer is 1**
 I. $1^3 + 2^3 + 3^3 + \dots + n^3 = 255$
 II. n is a positive integer.
16. What is the day of 31st December of an year ? **Answer is 1**
 I. In that year the first of March was Monday.
 II. That year was a leap year.
17. What is the Arithmetic Mean of the numbers x, y, z and t ? **Answer is 3**
 I. $x + 2y - z - 3t = K$ II. $2x + y + 4z + 6t = L$
18. What is the equation of a straight line ? **Answer is 4**
 I. The line is parallel to $2x + 3y = 5$.
 II. The line does not pass through the origin.
19. What is the angle subtended by the chord AB of a circle at a point P on the circumference? **Answer is 4**
 I. The radius of the circle is 5 cm.
 II. The length of the chord AB is 5 cm.
20. What is the value of $119x + 247y$? **Answer is 3**
 I. $118x + 246y = 482$ II. x is greater than y by 2.

ICET- 2014 Data Sufficiency:

(Marks : 20)

1. What is the positive integer n not exceeding 180 ? **Answer is 3**
 I. n is divisible by 7. II. n is divisible by 13.
2. If ABCD is a square and E is a point on BC, then what is the area (in square units) of AECD **Answer is 3**
 I. $BE = 6$
 II. $BE : EC = 1 : 2$
3. What is the shape of the play ground ? **Answer is 3**
 I. The perimeter of the play ground is 440 m.
 II. The area of the ground is 15400 sq. m.
4. What is the remainder when n is divided by 8 ? **Answer is 2**
 I. The digit in units place of n is 8.
 II. n is the product of eight consecutive positive integers.
5. What is the greatest common divisor of numbers a and b ? **Answer is 1**
 I. The least common multiple of a and b is ab . II. $a + b = 15$.
6. What is the average of a, b, c and 5 ? **Answer is 1**
 I. $5(a + b + c) + 4 = 45$. II. $a + b = c + d$.

7. What is the value of $\frac{x^2}{y^2} + \frac{y^2}{z^2}$? **Answer is 3**

$$\text{I. } \left(\frac{x}{y} + \frac{y}{z}\right)^2 = 100 \quad \text{II. } x = 2z$$

8. Is $xy < 0$? **Answer is 1**

$$\text{I. } 5|x| + 3|y| = 0 \quad \text{II. } 5|x| = 3|y|$$

9. How much time did A take to reach the destination? **Answer is 3**

- I. The ratio between the speeds of A and B is 3 : 4.
II. B takes 36 minutes to reach the same destination.

10. What is the slope of straight line? **Answer is 2**

- I. The straight line passes through the origin.
II. The straight line makes an angle 30° with the positive direction of the X-axis

11. In the matrix $A = \begin{bmatrix} -5 & 20 \\ 2 & -x \end{bmatrix}$, what is the value of x ? **Answer is 1**

- I. A is singular.
II. A is symmetric.

12. What is the value of $a + b$? **Answer is 3**

$$\text{I. } a \neq b \quad \text{II. } a^2 - b^2 = a - b$$

13. Is the quadrilateral a square? **Answer is 3**

- I. All the sides of the quadrilateral are of equal length.
II. The diagonals of the quadrilateral are of equal length.

14. For positive integers x , y and z , is the product xyz even? **Answer is 1**

- I. $x + y$ is odd.
II. $x + y + z$ is divisible by 7.

15. What is the monthly salary of A? **Answer is 3**

- I. A gets 15% more than B and B gets 10% less than C.
II. C's monthly salary is Rs.2,500.

16. Among the real numbers a and b , is b a rational number? **Answer is 3**

- I. $a + b$ is a rational number.
II. $a - b$ is a rational number.

17. How many persons are there in the library? **Answer is 3**

- I. If 3 persons leave the library, then the library has less than 8 persons.
II. If 3 persons enter the library, then it has more than 12 persons.

18. In the figure given below, what is the value of $\alpha + \beta + \gamma + \delta$? **Answer is 2**

$$\text{I. } \alpha + \beta = \gamma + \delta \quad \text{II. } \theta + \phi = 90^\circ$$

Triangle figure

19. How much is $(x + y) : (x - y)$? **Answer is 31**

$$\text{I. } x : y = 3 : 2 \quad \text{II. } x > 0, y > 0$$

20. If $p(x)$ is a polynomial, is $(x - 2)$ a factor of $p(2x^2 - 1)$? **Answer is 2**

- I. $x - 1$ is a factor of $p(x)$.
II. $x - 7$ is a factor of $p(x)$.

1. Is $\frac{n}{18}$ an integer ? **Answer is 3**
I. $6 \mid n$. II. 9 does not divide n .
2. Is $\triangle ABC$ scalene? **Answer is 4**
I. $AB \neq BC$ II. $\angle BAC \neq \angle BCA$
3. With how many zeroes does the number $a = 16!$ end? **Answer is 1**
I. $5^3 \mid a$, 5^4 does not divide a II. a is an even number
4. Is the quadrilateral ABCD a rectangle? **Answer is 3**
I. $AB = CD$, $AD = BC$. II. $AC = BD$.
5. If P, A, B are three points on a circle, what is $\angle APB$? **Answer is 1**
I. AB is the diameter of the circle. II. The sum of the angles of $\triangle APB$ is 180° .
6. Is the number n divisible by 2 ? **Answer is 2**
I. The sum of its digits is divisible by 2. II. The digits in the unit place is divisible by 2.
7. Are the roots of $ax^2 + bx + c = 0 (a \neq 0)$ real? **Answer is 3**
I. $4a + b = 0$ II. $c = 5a$
8. What is the area of the rectangle ABCD ? **Answer is 2**
I. E is the mid-point of AB. II. Area of $\triangle CDE = 50\text{cm}^2$.
9. What are the numbers a and b ? **Answer is 4**
I. a and b are relatively prime. II. L.C.M of a, b is 2500.
10. What is the rate of simple interest on a loan of Rs. 20,000 ? **Answer is 1**
I. Rs. 23,000 is to be paid at the end of first year.
II. There is a penal interest of 10% if the loan is not paid at the end of the first year.
11. Suppose $f(x)$ is a polynomial. Is $x - 1$ a factor of $f(x^2 + 7)$? **Answer is 2**
I. $(x - 7) \mid f(x)$. II. $(x - 11) \mid f(x - 3)$.
12. What is the value of xy ? **Answer is 2**
I. $x^2 = 9$ II. $y = 0$.
13. Is the quadrilateral a square ? **Answer is 3**

- I. All the sides of the quadrilateral are of equal length.
 II. The diagonals of the quadrilateral are of equal length.

14. If $0 \notin \{x, y\}$, then what is the value of $x + y$? **Answer is 4**

- I. $x \neq y$. II. $x^8 + y = y^8 + x$.

15. Is $525 \times k$ a perfect square? **Answer is 2**

- I. 21 divides k . II. $k = 21$.

16. If $n(A)$ denotes the number of elements in the set A , then $n(A \cup B)$? **Answer is 4**

- I. $n(A) = 35$. II. $n(B) = 28$.

17. What is the value of the integer $n \geq 0$? **Answer is 2**

- I. 25^n is odd II. 30^n is odd

18. For what integers a, b and c with $a = bc$, is $a > b$? **Answer is 4**

- I. $|a| = |b|$ II. $c^2 = 9$

19. What is $x_1 + x_2 + x_3 + x_4 + x_5$? **Answer is 3**

- I. $x_3 = 20$ II. x_1, x_2, x_3, x_4, x_5 are in arithmetic progression.

20. What is the average of $a - 3, b + 4, c - 5$ and 6 ? **Answer is 2**

- I. a, b, c are positive integers. II. $a + b + c = 100$.

A.P ICET- 2015

Data Sufficiency:

(Marks : 20)

1. Is $\triangle ABC$ equilateral? **Answer is 3**

- I. $AB = BC$. II. $\angle ABC = 60^\circ$.

2. Is $a + b \neq 0$, if a and b are real numbers? **Answer is 2**

- I. $ab = 0$ II. $a^2 + b^2 = 0$.

3. If x and y are real numbers, is $x > y$? **Answer is 3**

- I. x is the smaller of the roots of $x^2 - 1 = 0$ II. y is the real root of $y^3 - 1 = 0$.

4. If a and b are real numbers, is $ab > 0$? **Answer is 1**

- I. $2|a| + |b| = 0$ II. $2|a| = |b|$.

5. At how many points do the two circles intersect? **Answer is 4**

- I. The radii of the two circles are equal.
 II. The distance between their centres is 12 cms.

6. What is the share of A in a profit of Rs.1,500 in that year ? **Answer is 4**
 I. A's capital is Rs.5,000 more than B.
 II. A and B are the only partners in the business.
7. For two sets A and B , what is $n(A \cap B)$? **Answer is 2**
 I. $n(A) = 6$ and $(B - A) = 8$. II. $n(A - B) = 8 = n(B - A)$ and $n(A \cup B) = 24$.
8. If 'a' is a positive integer, is it a prime number? **Answer is 2**
 I. It is odd number. II. It is an even integer greater than 2.
9. If x and y are real numbers, what is the value of xy ? **Answer is 3**
 I. $x + y = 16$. II. $x^2 + y^2 = 160$.
10. What is the value of $\sin 2\theta$? **Answer is 1**
 I. $\tan \theta + \cot \theta = 3$. II. $(\operatorname{Cosec} \theta + \cot \theta)(\operatorname{Cosec} \theta - \cot \theta) = 1$.
11. What is the sum of the first 20 terms of the Arithmetic progression? **Answer is 1**
 I. The sum of the first term and 20th term of the AP is 120.
 II. The common difference of the AP is 5.
12. What is the surface area of the cuboid? **Answer is 4**
 I. Ratio of its length to its breadth is 2 : 5. II. Volume of the cuboid is 100 cu. units.
13. If 'a' is an integer, what is the value of a? **Answer is 3**
 I. $a^2 = 9$. II. $a^2 + a = 6$.
14. If a and b real numbers, is $a^2 > b^2$? **Answer is 4**
 I. $a > b$. II. $a > 0$.
15. Is 6 a factor of n ? **Answer is 1**
 I. n is even and divisible by 3. II. n is divisible by a prime number.
16. The product of two integers a and b is 270. What is the LCM of a and b ? **Answer is 1**
 I. The GCD of a and b is 9. II. a and b are divisible by 3.
17. What is the value of the positive integer n ? **Answer is 1**
 I. $1^2 + 2^2 + 3^2 + \dots + n^2 = 285$. II. $1 < n < 20$.
18. If a and b are positive integers such that the product is 30, then what is the value of $a + b$.
 I. $a > b$. II. $1 < \frac{a}{b} < 2$ **Answer is 2**
19. If a , b and c integers, is $a + b + c$ is divisible by 3? **Answer is 1**
 I. $a = 2b - 10$ and $c = 3b + 25$ II. $a + b + c$ is an odd integer.
20. If x is non-negative integer, is x even? **Answer is 4**
 I. 8^x is an even integer. II. 9^x is an odd integer.

Reasoning (sequence and series) Telangana ICET- 2015:

Note: In each of the questions numbered 1 to 10 a sequence of numbers or letters that follow a definite pattern is given. Each question has a blank space. This has to be filled by the correct answer from the four given options to complete the sequence without breaking the pattern.

1. 13, 28, 49, 76, ____, 148
 (1) 89 (2) 99 (3) 109 (4) 119 **Answer:3**

Reason: 13, 13 + 15 = 28; 28 + 21 = 49; 49 + 27 = 76; 76 + 33 = 109; 109 + 39 = 148

2. 2, 26, 242, ____ **Answer:4**
 (1) 546 (2) 956 (3) 1266 (4) 2186

Reason: 2 = 2x1; 26 = 2x13; 242 = 2x121 = 2x11x11; 2186 = 2x1093

3. $\frac{2}{3}, \frac{8}{9}, \frac{26}{27}, \frac{80}{81}, \text{---}, \frac{728}{729}$ **Answer:1**
 (1) $\frac{242}{243}$ (2) $\frac{322}{323}$ (3) $\frac{542}{543}$ (4) $\frac{722}{723}$

Reason: $2 = 3^1 - 1$; $8 = 3^2 - 1 = 9 - 1$; $26 = 3^3 - 1 = 27 - 1$; $80 = 3^4 - 1 = 81 - 1$;
 $242 = 3^5 - 1 = 243 - 1$; $728 = 3^6 - 1 = 729 - 1$. Observe the pattern. **Answer:1**

4. 3Z2A, 5X5C, 7V8E, ____ **Answer:4**
 (1) 9S10G (2) 10T12G (3) 10S12G (4) 9T11G

Reason: Observe the pattern 3, 5, 7, 9; Z, X, V, T; 2, 5, 8, 11; A, C, E, G

5. Z7A, Y6B, X5C, ____, U3E
 (1) V3C (2) V4C (3) V4D (4) V5D **Answer:3**

Reason: Z, Y, X, V, U; 7, 6, 5, 4, 3; A, B, C, D, E. Observe the pattern.

6. $\sqrt{1+\sqrt{15}}, \sqrt{3+\sqrt{13}}, \text{---}, \sqrt{10}$ **Answer:4**
 (1) $\sqrt{4+\sqrt{10}}$ (2) $\sqrt{4+\sqrt{11}}$ (3) $\sqrt{5+\sqrt{7}}$ (4) $\sqrt{5+\sqrt{11}}$

Reason: Observe the pattern 1, 3, 5, 7; $\sqrt{15}, \sqrt{13}, \sqrt{11}, \sqrt{9} = 3$;

$$\sqrt{1+\sqrt{15}}, \sqrt{3+\sqrt{13}}, \sqrt{5+\sqrt{11}}, \sqrt{7+\sqrt{9}} = \sqrt{7+3} = \sqrt{10}$$

7. UGX : AND :: QLN : ____
 (1) WRT (2) WST (3) WRS (4) VRT

Reason: A=1, G=7, U=21, Q=17, L=12, N=14, X=24, W=23, R=18, S=19, T=20, V=22.
 Observe the pattern. First letter is moved 6 places forward, First letter is moved 7 places forward, Third letter is moved 6 places forward,

U G X : A N D :: Q L N : W S T
 21 7 24 : 1 14 4 :: 17 12 14 : 23 19 20

Answer:2

8. _____ : HDGF :: FILM : ADGH **Answer:2**
 (1) LIKM (2) MILK (3) KLIM (4) IKLM

Reason: A=1, D=4, F=6, G=7, H=8, I=9, K=11, L=12, M=13.
 MILK=13,9,12,11; HDGF=8,4,7,6; FILM=6,9,12,13; ADGH=1,4,7,8

9. KEGV, JDFU, ICET, _____ **Answer:3**
 (1) HBDC (2) HBDF (3) HBDS (4) HBDU

Reason: K-J-I-H; E-D-C-B; G-F-E-D; V-U-T-S. Hence HBDS

10. DIVIDEND : CHUHCDCMC :: KEYBOARD: _____ **Answer:1**
 (1) JDXANZQC (2) JDXNZAQC (3) JDXANZRC (4) JDXANZPC

Reason: Observe the pattern .

Telangana ICET- 2015: Note: In each of the questions numbered 1 to 10 follow a definite pattern. Observe the same and fill in the blanks with the suitable answer.

1. $11\frac{1}{9}, 12\frac{1}{2}, 14\frac{2}{7}, 16\frac{2}{3}, \text{---}$
 (1) $18\frac{2}{3}$ (2) $18\frac{2}{7}$ (3) $17\frac{1}{6}$ (4) 20

Reason: $11\frac{1}{9} = \frac{100}{9}$, $12\frac{1}{2} = \frac{25}{2} = \frac{100}{8}$, $14\frac{2}{7} = \frac{100}{7}$, $16\frac{2}{3} = \frac{50}{3} = \frac{100}{6}$, $\frac{100}{5} = 20$.

So the missing term is $\frac{100}{5} = 20$; Answer:4

2. 4, 7, 12, 19, 28, ____, 52 **Answer:1**
 (1) 39 (2) 40 (3) 41 (4) 42

Reason: 4; 4+3=7; 7+5=12; 12+7=19; 19+9=28; 28+11=39; 39+13=52. Observe the pattern .

3. $\frac{15}{3}, \frac{24}{5}, \frac{35}{7}, \text{---}, \frac{63}{11}$ **Answer:1**
 (1) $\frac{48}{9}$ (2) $\frac{46}{9}$ (3) $\frac{44}{9}$ (4) $\frac{42}{9}$

$\frac{15}{3}, \frac{15+9}{3+2} = \frac{24}{5}, \frac{24+11}{5+2} = \frac{35}{7}, \frac{35+13}{7+2} = \frac{48}{9}$; Hence $\frac{48}{9}$.

4. 0010, 0011, 0101, _____, 1011 **Answer:2**
 (1) 0001 (2) 0111 (3) 1010 (4) 1111

Reason: In decimal system 0010=2, 0011=3, 0101=5, 0111=7, 1011=11.
 So 0111 is the missing term **Answer:2**

5. 9, 36, 100, 225, ____, 784 **Answer:2**

- (1) 365 (2) 441 (3) 498 (4) 526

Reason: $9=3^2$; $36=6^2$; $100=10^2$; $225=15^2$; $21^2=441$; $28^2=784$. Observe the pattern.

6. W4C, T9F, Q16I, ____, **Answer:2**

- (1) P25L (2) N25L (3) P27L (4) M25L

Reason: W, V, U, T, S, R, Q, P, O, N; 4, 4+5=9, 9+7=16, 16+9=25.
C, D, E, F, G, H, I, J, K, L Observe the pattern.

7. $(x+y)$, (x^2-y^2) , $(x+y)^2(x-y)$, $(x^2-y^2)^2$, $(x+y)^3(x-y)^2$, _____ **Answer:3**

- (1) $(x-y)^3(x+y)^2$ (2) (x^2-y^2) (3) $(x^2-y^2)^3$ (4) $(x^2-y^2)^2$

Reason: $(x^2-y^2) = (x+y)(x-y)$. Observe the pattern.

8. $\frac{5}{9}$, $\frac{10}{28}$, $\frac{17}{65}$, $\frac{26}{126}$, $\frac{37}{217}$, _____ **Answer:4**

- (1) $\frac{41}{344}$ (2) $\frac{45}{344}$ (3) $\frac{49}{344}$ (4) $\frac{50}{344}$

Reasoning (sequence and series) A.P ICET- 2015:

1. Train : Driver :: Class : _____ **Answer:3**

- (1) Benches (2) School (3) Teacher (4) Black Board

2. 5 : 3125 :: 6: _____ **Answer:4**

- (1) 36656 (2) 38656 (3) 46545 (4) 46656

Reason: $5^5=5 \times 5 \times 5 \times 5 \times 5=3125$. So $6^5=6 \times 6 \times 6 \times 6 \times 6=36 \times 36 \times 6=46656$

3. 6 : 210 :: ____ : 120 **Answer:4**

- (1) 3 (2) 4 (3) 5 (4) 7

Reason: $6^6 - 6=216 - 6=210$. In the same way $5^3 - 5= 125 - 5=120$.

4. BFJ : OSW :: DJR : _____ **Answer:4**

- (1) AGP (2) BIQ (3) CIR (4) QWE

5. 136 : 358 :: ____ : 489 **Answer:2**

- (1) 258 (2) 267 (3) 289 (4) 369

6. 1331 : 11 :: 1728 : _____ **Answer:4**

- (1) 24 (2) 22 (3) 14 (4) 12

7. 6FJ : 16PT :: 8HL : _____ **Answer:3**

- (1) 15PT (2) 18TX (3) 18RV (4) 16QV

8. 9 : 72 :: ____ : 64 **Answer:3**

- (1) 6 (2) 7 (3) 8 (4) 9

9. 64 : 100 :: 72 : _____ **Answer:4**

- (1) 144 (2) 121 (3) 112 (4) 81

Reasoning (sequence and series) ICET- 2014:

Note: In each of the questions numbered 1 to 10 a sequence of numbers or letters that follow a definite pattern is given. Each question has a blank space. This has to be filled by the correct answer from the four given options to complete the sequence without breaking the pattern.

1.If the letters D and E are removed from the English Alphabet, then the fourth letter is

- (1) F (2) C (3) G (4) H

Answer:1

2. $7 : 49 :: _ : 63$

- (1) 5 (2) 6 (3) 9 (4) 11

Reason: $7 \times 7 = 49$. $9 \times 7 = 63$ So the missing term is 9; **Answer:3**

3. HOSPITAL : PATIENTS :: SCHOOL : _____

- (1) TEACHERS (2) CLASS ROOMS (3) STUDENTS (4) BLACK BOARDS

Reason: Observe the pattern.**Answer:1**

4. $81 : 64 :: _ : 9$

- (1) 16 (2) 18 (3) 24 (4) 34

Answer:1

5. AEF : BIJ :: _____ : OUV

- (1) NOP (2) MPQ (3) NOQ (4) NQR

Reason: A=1, B=2, E=5, F=6, U=21, I=9, J=10, O=15, V=22. Observe the pattern .

A E F : B I J :: N O Q : O U V
1 5 6 : 2 9 10 :: 14 15 17 : 15 21 22

Answer:3

6. DRIVE : EIDRV :: BEGUM : _____

- (1) BGMEU (2) MGBEU (3) UEBGM (4) BGMUE

Reason: Observe the pattern .

Answer:2

7. $E \times I : 5 \times 9 :: _ : 15 \times 21$

- (1) L x K (2) K x L (3) O x U (4) U x O

Reason: E = 5, I = 9, O = 15, U = 21.

So the missing term is O x U ; Answer:3

8. ANT : CPV :: _____ : DQZ

- (1) BOX (2) BRB (3) FSB (4) FTB

Reason: A, C, B, D; N, P, O, Q; T, V, X, Z Observe the pattern .

Answer:1

9. K 11 M, _____, G 15 I, E 17 G

- (1) I 13 K (2) I 14 J (3) I 12 J (4) I 13 M

Reason: K = 11; M = 13; I = 9; G = 7; E = 5; 11-9-7-5; 11-13-15-17; 13-11-9-7
Observe the pattern . **Answer:1**

ICET-2014

Note: In each of the questions numbered 1 to 10 follow a definite pattern. Observe the same and fill in the blanks with the suitable answer.

1. $111\frac{1}{9}, 125, 142\frac{6}{7}, _, 200, 250$

(1) $166\frac{2}{3}$

(2) $178\frac{4}{7}$

(3) $181\frac{2}{5}$

(4) $192\frac{3}{7}$

Reason: $111\frac{1}{9} = \frac{1000}{9}$; $125 = \frac{1000}{8}$; $142\frac{6}{7} = \frac{1000}{7}$; $\frac{1000}{6} = \frac{500}{3} = 166\frac{2}{3}$; $\frac{1000}{5} = 200$;

$\frac{1000}{4} = 250$. So the missing term is $\frac{1000}{6} = \frac{500}{3} = 166\frac{2}{3}$; **Answer:1**

2. 0, 2, 3, 5, 8, 10, 15, __, 24, 26, 35.

(1) 10

(2) 18

(3) 17

(4) 16

Reason: In the given sequence $0 = 1^2 - 1$; $3 = 2^2 - 1$; $8 = 3^2 - 1$; $15 = 4^2 - 1$; $24 = 5^2 - 1$; $35 = 6^2 - 1$

$2 = 1^2 + 1$; $5 = 2^2 + 1$; $10 = 3^2 + 1$; $17 = 4^2 + 1$; $26 = 5^2 + 1$; $37 = 6^2 + 1$;

So the missing term is **17**; **Answer:3**

3. $\left\{\frac{1}{3}, \frac{1}{5}, \frac{1}{7}, \frac{1}{9}\right\}, \left\{\frac{1}{12}, \frac{1}{15}, \frac{1}{18}, \frac{1}{21}\right\}, \left\{\frac{1}{25}, \frac{1}{29}, \frac{1}{33}, \frac{1}{37}\right\}, \left\{\frac{1}{42}, \frac{1}{47}, _, \frac{1}{57}\right\}$

(1) $\frac{1}{50}$

(2) $\frac{1}{51}$

(3) $\frac{1}{52}$

(4) $\frac{1}{53}$

Reason: 3, 5, 7, 9 (2 is added); 12, 15, 18, 21 (3 is added); 25, 29, 33, 37 (4 is added);

42, 47, 52, 57 (5 is added). So the missing term is $\frac{1}{52}$; **Answer:3.**

4. 5, 11, 21, 43, 85, __

(1) 181

(2) 180

(3) 171

(4) 170

Reason: $5; 11 = (2)(5) + 1$; $21 = (2)(11) - 1$; $43 = (2)(21) + 1$; $85 = (2)(43) - 1$; $(2)(85) + 1 = 171$;

missing term is **171**; **Answer:3.**

5. 75, 105, 165, 195, __, 285

(1) 255

(2) 235

(3) 225

(4) 215

Reason: $75 = (15)(5)$; $105 = (15)(7)$; $165 = (15)(11)$; $195 = (15)(13)$; **255 = (15)(17)**; $285 = (15)(19)$;

missing term is **255**; **Answer:1**

6. $\frac{3}{5}, \frac{5}{9}, \frac{9}{13}, \frac{13}{17}, _, \frac{27}{33}$

(1) $\frac{11}{13}$

(2) $\frac{17}{27}$

(3) $\frac{15}{19}$

(4) $\frac{21}{23}$

Answer:2

7. (1,Z), (8,Y), (27,X), (125,W), _____
 (1) (243,U) (2) (243,V) (3) (343,V) (4) (343,U)

Reason: $1 = 1^3; 8 = 2^3; 27 = 3^3; 125 = 5^3; 343 = 7^3; Z=1; Y=2; X=3; W=4; V=5$

So missing term is (343,V) ; Answer:3

8. AEI, CGK, ____, GKO, IMQ
 (1) E J N (2) E N J (3) E I M (4) E M I

Reason: ABCDEFGHI; EFGHIJKLMNOPQ; IJKLMNOPQR

So missing term is EIM ; Answer:3

9. If $\{a_n\}_{n=1}^{\infty}$ is such that $a_1 = a_2 = 1$ and $a_k = a_1 + a_2 + a_3 + \dots + a_{k-1}$ for $k \geq 3$, then $a_7 =$
 (1) 16 (2) 32 (3) 64 (4) 128

Reason: $a_3 = 1 + 1 = 2$;

$a_4 = a_1 + a_2 + a_3 = 1 + 1 + 2 = 4$; $a_5 = a_1 + a_2 + a_3 + a_4 = 1 + 1 + 2 + 4 = 8$;

$a_6 = a_1 + a_2 + a_3 + a_4 + a_5 = 1 + 1 + 2 + 4 + 8 = 16$;

$a_7 = a_1 + a_2 + a_3 + a_4 + a_5 + a_6 = 1 + 1 + 2 + 4 + 8 + 16 = 32$. **Answer:2**

10. The n^{th} term in the sequence 1, -2, 3, -4, 5, -6, 7, -8, 9, is **Answer:4**
 (1) $(-1)^n n$ (2) $-n$ (3) n (4) $(-1)^{n-1} \cdot n$

Reasoning (sequence and series) ICET- 2013:

Note: In each of the questions numbered 1 to 10 follow a definite pattern. Observe the same and fill in the blanks with suitable answers.

1. $\frac{1}{2}, \frac{8}{5}, \frac{27}{10}, \text{---}, \frac{125}{26}, \frac{216}{37}$

(1) $\frac{36}{17}$ (2) $\frac{64}{17}$ (3) $\frac{32}{13}$ (4) $\frac{81}{25}$

Reason: In each term numerators are in the form n^3 and the denominators in the form $n^2 + 1$.

So the missing term is $\frac{64}{17}$; Answer:2

2. 4, 1, 9, 3, 16, 6, 25, 10, 36, ____

(1) 15 (2) 20 (3) 25 (4) 30

Reason: 4, 9, 16, 25, 36; 1, 1+2=3, 3+3=6, 6+4=10, 10+5=15 **So the missing term is 15; Answer:1**

3. 1, 4, 27, 256, ____

(1) 625 (2) 3152 (3) 1024 (4) 3125

Reason: $1 = 1; 2^2 = 4; 3^3 = 27; 4^4 = 256; 5^5 = 3125$. **Answer:4**

4. $1, \frac{1}{2}, \frac{1}{6}, \frac{1}{24}, \text{---}, \frac{1}{720}, \frac{1}{5040}$

Answer:2

(1) $\frac{1}{100}$ (2) $\frac{1}{120}$ (3) $\frac{1}{72}$ (4) $\frac{1}{240}$

Reason: $\frac{1}{2} = \frac{1}{1 \times 2}, \frac{1}{6} = \frac{1}{2 \times 3}, \frac{1}{24} = \frac{1}{4 \times 6}, \frac{1}{120} = \frac{1}{5 \times 24}, \frac{1}{720} = \frac{1}{6 \times 120}, \frac{1}{5040} = \frac{1}{7 \times 720}$.

5. 4, 7, 12, 19, 28, ____, 52

Answer:1

(1) 39 (2) 40 (3) 41 (4) 42

Reason: 4; 4+3=7; 7+5=12; 12+7=19; 19+9=28; 28+11=39; 39+13=52. Observe the pattern.

6. 1x 8, 3 v 6, 5 t 4, ____

(1) 7 r 3 (2) 7 r 2 (3) 7 v 2 (4) 7 v 3

Reason: 1 -, 3 - 5- 7; x - v - t - r; 8 - 6- 4- 2 Observe the pattern. **Answer:2**

7. 1, 2, 3, 5, 8, 13, 21, ____

(1) 24 (2) 26 (3) 29 (4) 34

Reason: 1, 2; 1+2=3; 2+3=5; 3+5=8; 5+8=13; 8+13=21; 13+21=34

So the missing term is 34 ; Answer:4

8. 5, 6, 10, 19, 35, 60, ____
 (1) 85 (2) 92 (3) 96 (4) 105

Reason: $5, 5 = 5 + 1^2 = 6$; $10 = 6 + 2^2$; $19 = 10 + 3^2$; $35 = 19 + 4^2$; $60 = 35 + 5^2$; $96 = 60 + 6^2$;
 Observe the pattern . **Answer:3**

9. $\frac{1}{5}, \frac{5}{10}, \frac{10}{17}, \frac{17}{26}, \text{---}, \frac{37}{50}$
 (1) $\frac{26}{37}$ (2) $\frac{36}{37}$ (3) $\frac{26}{50}$ (4) $\frac{36}{49}$

Reason: The series is in the form of $\frac{n^2 + 1}{(n+1)^2 + 1}$ **Answer:1**

10. 6, 12, 20, 30, __, 56 **Answer:4**
 (1) 50 (2) 48 (3) 44 (4) 42

Reason: $6; 6+6=12; 12+8=20; 20+10=30; 30+12=42; 42+14=56$. Observe the pattern .

ICET-2013

Note: In each of the questions numbered 1 to 15 a sequence of numbers or letters that follow a definite pattern is given. Each question has a blank space. This has to be filled by the correct answer from the four given options to complete the sequence without breaking the pattern.

1. ABCD : ZYXW :: _____ : VTUS
 (1) EFHG (2) EHGF (3) EGFH (4) EFGH

Reason: $A=1, Z=26; B=2, Y=25; C=3, X=24; D=4, W=23;$ **Answer:3**
 $E=5, V=22; G=7, T=20; F=6, U=21; H=8, S=19$.
 Sum of corresponding two letters is 27.

2. Tiger : Goat :: _____ : Herbivore
 (1) Carnivore (2) omnivore (3) parasite (4) insectivore **Answer:1**

3. Quadrilateral : Square :: Triangle : _____ **Answer:1**
 (1) Equilateral triangle (2) isosceles triangle (3) scalene triangle (4) Right-angled triangle

4. $122 : 145 :: 257 : \text{_____}$
 (1) 290 (2) 299 (3) 401 (4) 497 **Answer:1**

5. $1001 : 1332 :: \text{_____} : 2198$
 (1) 1728 (2) 1729 (3) 2413 (4) 2528 **Answer:2**

Reason: $1001=10^3+1; 1332=11^3+1; 1728=12^3+1; 2198=13^3+1$.

6. $\frac{n(n+1)}{2} : \sum n :: \text{_____} : \sum n^2$

(1) $\frac{n^2(n-1)^2}{4}$

(2) $\frac{n^2(n+1)^2}{4}$

(3) $\frac{n(n-1)(2n-1)}{6}$

(4) $\frac{n(n+1)(2n+1)}{6}$

Reason: $\sum n = \frac{n(n+1)}{2}$ and $\sum n^2 = \frac{n(n+1)(2n+1)}{6}$

Answer:4

7. ABCDEFG : STUVXYZ :: GECA : _____

(1) ZXUC

(2) ZXSU

(3) ZSXU

(4) ZSUX

Reason: A=1, Z=26; B=2, Y=25; C=3, X=24; D=4, W=23; E=5, V=22; G=7, T=20; F=6, U=21; H=8, S=19 .

8. Volume of a cylinder : Area of curved surface of the cylinder :: $\pi r^2 h$:

(1) πrh

(2) $2\pi rh$

(3) $\frac{2}{3}\pi rh$

(4) $\frac{1}{2}\pi r^2 h$

Answer:2

9. Wood : Chair :: _____ : Ornament

Answer:2

(1) Coal

(2) Gold

(3) Hammer

(4) Bauxite

Wood is used to make chair. Gold is used to make ornament.

10. Ice : Water :: _____ : Ghee

Answer:2

(1) Milk

(2) Curd

(3) Butter

(4) Oil

Ice on heating becomes water. Butter on heating becomes Ghee.

Reasoning (sequence and series) ICET- 2012:

Note: In each of the questions numbered 1 to 15 a sequence of numbers or letters that follow a definite pattern is given. Each question has a blank space. This has to be filled by the correct answer from the four given options to complete the sequence without breaking the pattern.

1. 10, 30, 150, _____, 11550, 150150

- (1) 1050 (2) 1500 (3) 1005 (4) 5100

Reason: Given sequence is in the form $10, 10 \times 3 = 30, 30 \times 5 = 150, \underline{150 \times 7 = 1050}, 1050 \times 11 = 11550, 11550 \times 13 = 150150$. So the missing term is **1050**; **Answer:1**

2. TUW, VWY, XYA, ZAC, _____

- (1) CDK (2) BDK (3) BCE (4) CDF

Reason: TUW, VWXY, XYZA, ZABC, BCE. So the missing term is **BCE**;
observe that underlined letter is deleted. **Answer:3**

3. KNIP:PINK:: _____ : _____

- (1) TCA: CAT (2) YOB: OBY (3) DAER: READ (4) TIGRE: TIREG

Reason: KNIP:PINK:: DAER: READ observe the pattern. **Answer:3**

4. 2, 10, 30, 68, _____, 222

- (1) 96 (2) 112 (3) 130 (4) 196

Reason: The given series is in the form $n^3 + n$; $2 = 1^3 + 1, 10 = 2^3 + 2,$
 $30 = 3^3 + 3, 68 = 4^3 + 4, \underline{130} = 5^3 + 5, 222 = 6^3 + 6$.

So the missing term is **130**; **Answer:3**

5. PRT : OPQ :: GIK : _____

- (1) EGH (2) FGI (3) FGH (4) FHH

Reason: M=13, N=14, O=15, P=16, Q=17, R=18, S=19, T=20 is the order. Observe the pattern.

P R T : O P Q :: G I K : F G H

16 18 20 : 15 16 17 7 9 11 6 7 8

Answer:3

6. 2, 6, 12, 20, _____, 42, 56, 72

- (1) 30 (2) 31 (3) 32 (4) 36

Reason: $2, 6 = (2+4), 12 = (6+6), 20 = (12+8), \underline{30 = (20+10)}, 42 = (30+12), 56 = (42+14),$

$72 = (56+16)$

OR $2 = 1^2 + 1, 6 = 2^2 + 2, 12 = 3^2 + 3, 20 = 4^2 + 4, 30 = 5^2 + 5, 42 = 6^2 + 6, 56 = 7^2 + 7, 72 = 8^2 + 8$

So the missing term is **30**; **Answer:1**

7. Reading : Knowledge :: _____ : _____

(1) Swimming : Exercise (2) Pleasure : Playing (3) Adventure : Touring (4) Working : Experience

Reason: Reading is for Knowledge ; Working is for Experience

So the missing term is Working : Experience ; **Answer:4**

8. 10, 100, 110, 111, 1000, _____

- (1) 1001 (1) 1101 (1) 1110 (1) 1111

9. April: 64 :: July : ____

- (1) 512 (2) 729 (3) 343 (4) 216

Reason: The given series is in the form n^3 ; April is 4th month. $64=4^3$, July is 7th month. $7^3=343$.

So the missing term is 343 ; Answer:3

10. 0, 15, 80, _____, 624

- (1) 95 (2) 110 (3) 205 (4) 255

Reason: $0=1^2-1$, $15=4^2-1$, $80=9^2-1$, $16^2-1=255$, $624=25^2-1$.

So the missing term is 255 ; Answer:4

11. YXDCPO, WVFENM, UTHGLK, _____

- (1) SRJINM (2) UTJIJI (3) SRJIJI (4) UTJINM

Reason: YX,WV,UT,SR=Y-X-W-V-U-T-S-R;

DC,FE,GH,JI=;

PO,NM,LK,JI=P-O-N-M-L-K-J-I

So the missing term is SRJIJI ; Answer:3

12. AEF : BIJ :: _____ : OUV

- (1) NOP (2) MPQ (3) NOQ (4) NQR

Reason: A=1, E=5, F=6, B=2, I=9, J=10,

N=14, Q=17, R=18 O=15, U=21, V=22

observe the $A^{+1}=B, E^{+4}=I, F^{+4}=J; N^{+1}=O, Q^{+4}=U, R^{+4}=V$; **So the missing term is NQR ;**

Answer:4

13. 120 : 60 :: 24 : _____

- (1) 3 (2) 4 (3) 5 (4) 6

Reason: $120 : 60 :: 24 : ____ \Rightarrow 10 \times 12 : 5 \times 12 :: 4 \times 6 : 2 \times 3$ **So the missing term is 6 ;**

Answer:4

14. 121, 112, _____, 97, 91, 86

- (1) 99 (2) 101 (3) 102 (4) 104

Reason: 121, 112=121-9, 112-8=104, 97=104-7, 91=97-6, 86=91-5

So the missing term is 104 ; Answer:4

15. 4, 8, 12, 24, 36, 72, _____

- (1) 108 (2) 106 (3) 98 (4) 96

Reason: 4, 8=4x2, 12=8x2-4,

24=12x2, 36=24x2-12,

72=36x2, 72x2-36=144-36=108

So the missing term is 108 ; Answer:1

Reasoning (sequence and series) ICET- 2011:

Note: In each of the questions numbered 16 to 30 a sequence of numbers or letters that follow a definite pattern is given. Each question has a blank space. This has to be filled by the correct answer from the four given options to complete the sequence without breaking the pattern.

16. 5, 10, 30, 150, 1050, _____,

- (1) 10550 (2) 11000 (3) 11525 (4) 115500

Reason: Given sequence is in the form $5, 5 \times 2 = 10, 10 \times 3 = 30, 30 \times 5 = 150, 150 \times 7 = 1050, 1050 \times 11 = 11550$. **So the missing term is 11550; Answer:4**

17. $1\frac{8}{9}, 2\frac{2}{9}, 2\frac{5}{9}, \text{---}, 3\frac{2}{9}$

- (1) $2\frac{3}{9}$ (2) $2\frac{5}{9}$ (3) $2\frac{7}{9}$ (4) $2\frac{8}{9}$

Reason: $1\frac{8}{9} = \frac{17}{9}, 2\frac{2}{9} = \frac{20}{9}, 2\frac{5}{9} = \frac{23}{9}, \frac{26}{9} = 2\frac{8}{9}, 3\frac{2}{9} = \frac{29}{9}$. **So the missing term is $2\frac{8}{9}$; Answer:4**

18. (2, 5, 9), (6, 8, 7), (10, 11, 5), _____

- (1)(14, 14, 4) (2)(14, 13, 4) (3) (12, 14, 3) (4) (12, 13, 4)

Reason: (2, 5, 9), (2+4, 5+3, 9-2) = (6, 8, 7), (6+4, 8+3, 7-2) = (10, 11, 5), (10+4, 11+3, 5-2) = (14, 14, 3). **So the missing term is (14,14,3); Answer:1.**

19. $\frac{1}{2}, \frac{8}{5}, \frac{27}{10}, \frac{64}{17}, \text{---}, \frac{216}{37}$

- (1) $\frac{35}{16}$ (2) $\frac{125}{26}$ (3) $\frac{75}{18}$ (4) $\frac{81}{19}$

Reason: Given sequence is in the form $\frac{n^3}{n^2+1}$.

$$\frac{1}{2} = \frac{1^3}{1^2+1}, \frac{8}{5} = \frac{2^3}{2^2+1}, \frac{27}{10} = \frac{3^3}{3^2+1}, \frac{64}{17} = \frac{4^3}{4^2+1}, \frac{125}{26} = \frac{5^3}{5^2+1}, \frac{216}{37} = \frac{6^3}{6^2+1}$$

So the missing term is $\frac{125}{26}$; Answer:2

20. The value of the 13th term in the sequence 1, 3, 6, 10, 15,.....,

- (1)97 (2)91 (3)89 (4)85

Reason: The given series is 1, 1+2, 1+2+3, 1+2+3+4, 1+2+3+4+5,.....
The 13th term in the series

$$= 1+2+3+4+5+6+7+8+9+10+11+12+13 = \frac{13 \times 14}{2} = 13 \times 7 = 91.$$

So the missing term is 91; Answer:2

22. DFIK, GILN, JLOQ, _____,

- (1) MPRO (2) MORP (3) MRPO (4) MORT

Reason: In each term each letter is forwarded by 3 steps ;i.e. first letter in each term $D^{+3}=G^{+3}=J^{+3}=\underline{M}$; second letter in each term $F^{+3}=I^{+3}=L^{+3}=\underline{O}$; third letter in each term $I^{+3}=L^{+3}=O^{+3}=R$; fourth letter in each term $K^{+3}=N^{+3}=Q^{+3}=T$; **So the missing term is MORT; Answer:4**

23. 2A4, 3E5, 4I6, _____, 6Q8

- (1) 5M7 (2) 5N7 (3) 5P7 (4) 5S7

Reason: In each term first digit is 2,3,4,5,6 second letter in each term $A^{+4}=E^{+4}=I^{+4}=\underline{M}^{+4}=Q$; third digit 4,5,6,7,8; **So the missing term is 5M7; Answer:1**

24. BDYZCA, CEXYDB, DFWXEC, _____

- (1) BDVWFC (2) EGVWFD (3) EGVWDF (4) BDVWCF

Reason: In each term first letter B,C,D,E; second letter in each term D,E,F,G; third letter in each term Y,X,W,V; fourth letter in each term Z,; **So the missing term is MORT; Answer:4**

25. ABDH, DEGK, GHJN, _____, MNPT

- (1) JKQM (2) JLNP (3) JKMQ (4) JLPN

Reason: In each term each letter is forwarded by 3 steps ;i.e. first letter $A^{+3}=D^{+3}=G^{+3}=\underline{J}^{+3}=M$; second letter $B^{+3}=E^{+3}=H^{+3}=\underline{K}^{+3}=N$; third letter $D^{+3}=G^{+3}=J^{+3}=\underline{M}^{+3}=P$; fourth letter $H^{+3}=K^{+3}=N^{+3}=\underline{Q}^{+3}=T$; **So the missing term is JKMQ; Answer:3**

26. 50:65::290: _____

- (1) 170 (2) 226 (3) 260 (4) 325

Reason: $50:65::290: _____\Rightarrow 7^2+1:8^2+1::17^2+1:18^2+1$; **So the missing term is $18^2+1=325$; Answer:4**

27. 289:324:: _____:64

- (1) 36 (2) 49 (3) 55 (4) 76

Reason: $289:324:: _____\Rightarrow 17^2:18^2::7^2:8^2$; **So the missing term is $7^2=49$; Answer:2**

28. L X M:12 X 13:: U X W: _____

- (1) 21 X 23 (2) 21 X 22 (3) 21 X 31 (4) 24 X 26

Reason: L X M:12 X 13:: U X W: 21X23; **So the missing term is 21 X 23; Answer:1**
In English alphabets L=12; M=13; U=21; W=23;

29. Foot:Inch::Year: _____

- (1) Day (2) Week (3) Month (4) Decade

Reason: 12 Inch makes one Foot.: 12 months makes one Year. **So month is answer; Answer:3**

In English alphabets L=12; M=13; U=21; W=23;

30. 441:961::21: _____

- (1) 11 (2) 31 (3) 61 (4) 41

Reasoning (sequence and series) ICET- 2010:

Note: In each of the questions numbered 31 to 45 a sequence of numbers or letters that follow a definite pattern is given. Each question has a blank space. This has to be filled by the correct answer from the four given options to complete the sequence without breaking the pattern.

31. ABD, EFH, _____, MNP, QRT

- (1) GHI (2) IJK (3) IJL (4) JKM

Reason: In each term each letter is forwarded by 4 steps ;i.e. first letter in each term $A^{+4}=E^{+4}=\underline{I}^{+4}=M^{+4}=Q$; second letter in each term $B^{+4}=F^{+4}=\underline{J}^{+4}=N^{+4}=R$; third letter in each term $D^{+4}=H^{+4}=\underline{L}^{+4}=P^{+4}=T$; **So the missing term is IJL; Answer:3**

32. 99:120::____:63

- (1)36 (2) 48 (3) 50 (4)52

Reason: In the given series is $(10^2-1):(11^2-1)::(7^2-1):(8^2-1)$; **So the missing term is 48 ;Answer:2** **OR** $99=9 \times 11$, $120=10 \times 12$; **6x8=48**, $63=7 \times 9$; **So the missing term is 48 ;Answer:2**

33. T, W, Z, C, __, I

- (1)D (2) E (3)F (4)H

Reason: The given sequence is T, W, Z, C, __, I. In the sequence each letter is forwarded by 3 steps to its previous letter. **So the missing term is F ;Answer:3** **OR**

$T=20$, $W=23$, $Z=26$, $C=3$, **F=6**, $I=9$. **So the missing term is F ;Answer:3**

34. 5, 10, 26, 50, 122, _____, 290, 362

- (1) 140 (2) 170 (3) 184 (4) 226

Reason: Given sequence is in the form of n^2+1 , n is a prime; $5=2^2+1$, $10=3^2+1$, $26=5^2+1$, $50=7^2+1$, $122=11^2+1$, $170=13^2+1$, $290=17^2+1$, $361=19^2+1$, **So the missing term is 170; Answer:2**

35. $22\frac{2}{9}$, 25, $28\frac{4}{7}$, _____, 40

- (1) $33\frac{1}{3}$ (2) $36\frac{2}{3}$ (3) $34\frac{2}{5}$ (4) $35\frac{4}{5}$

Reason: $22\frac{2}{9} = \frac{200}{9}$, $25 = \frac{200}{8}$, $28\frac{4}{7} = \frac{200}{7}$, $\frac{200}{6} = \frac{100}{3} = 33\frac{1}{3}$, $\frac{200}{5} = 40$.

So the missing term is $\frac{100}{3} = 33\frac{1}{3}$; Answer:1

36. (2, 0), (5, 3), (10, 8), _____

- (1)(13, 11) (2)(14, 12) (3) (15, 13) (4) (17, 15)

Reason: Given sequence is in the form of (n^2+1, n^2-1) n is an integer.

$(2, 0)=(1^2+1, 1^2-1)$, $(5, 3)=(2^2+1, 2^2-1)$, $(10, 8)=(3^2+1, 3^2-1)$, **(17,15)=(4^2+1, 4^2-1)**

So the missing term is (17,15); Answer:2

37. 4, 7, 19, 67, __, 1027

- (1) 108 (2) 148 (3) 259 (4) 617

38. $\frac{3}{5}, \frac{8}{10}, \text{---}, \frac{24}{26}, \frac{35}{37}$

- (1) $\frac{9}{11}$ (2) $\frac{11}{13}$ (3) $\frac{13}{15}$ (4) $\frac{15}{17}$

Reason: $\frac{3}{5} = \frac{2^2-1}{2^2+1}, \frac{8}{10} = \frac{3^2-1}{3^2+1}, \frac{15}{17} = \frac{4^2-1}{4^2+1}, \frac{24}{26} = \frac{5^2-1}{5^2+1}, \frac{35}{37} = \frac{6^2-1}{6^2+1}$;**Answer:4**

39. $2 + \sqrt{5}, 9 + 4\sqrt{5}, \text{---}, 161 + 72\sqrt{5}$

- (1) $18 + 16\sqrt{5}$ (2) $38 + 17\sqrt{5}$ (3) $64 + 32\sqrt{5}$ (4) $72 + 64\sqrt{5}$

Reason: $2 + \sqrt{5} = (2 + \sqrt{5})^1, 9 + 4\sqrt{5} = (2 + \sqrt{5})^2, (2 + \sqrt{5})^3 = 38 + 17\sqrt{5}, 161 + 72\sqrt{5} = (2 + \sqrt{5})^4$

So the missing term is $38 + 17\sqrt{5}$;Answer:2

40. 25, 49, 121, 225, ____

- (1) 361 (2) 256 (3) 529 (4) 676

Reason: The given series is in the form $(2n+1)^2$ where n is a prime.

$25 = (2 \times 2 + 1)^2, 49 = (2 \times 3 + 1)^2, 121 = (2 \times 5 + 1)^2, 225 = (2 \times 7 + 1)^2, 529 = (2 \times 11 + 1)^2$;**Answer:3**

41. 1800:1675::3600: ____

- (1) 3275 (2) 3450 (3) 3350 (4) 3375

Reason: $1800:1675::3600: \text{---} = 1800:1675::2(1800):2(1675)$;**Answer:3**

42. 2, -1, 5, -7, __, -31

- (1) 9 (2) 11 (3) 15 (4) 17

Reason: 2, -1, 5, -7, 17, -31.
-3 6 -12 24 -48

Double the value with alternate -ve and +ve signs.

So the missing term is 17;Answer:4

43. BAT, EDW, IHA, ____

- (1) NMG (2) MNF (3) NME (4) NMF

Reason: In each term first letter $B^{+3}=E^{+4}=I^{+5}=\underline{N}$; second letter $A^{+3}=D^{+4}=H^{+5}=\underline{M}$; third letter $T^{+3}=W^{+4}=A^{+5}=\underline{F}$; **So the missing term is NMF;Answer:4**

44. __, IHN, SRX, CBH

- (1) YXE (2) YXD (3) XYD (4) YXF

Reason: In each term first letter $\underline{Y}^{+10}=I^{+10}=S^{+10}=C$; second letter $\underline{X}^{+10}=H^{+10}=R^{+10}=B$; third letter $\underline{D}^{+10}=N^{+10}=X^{+10}=H$; **So the missing term is YXD;Answer:4** **Note: 10 letter cycle.**

45. ABC:ZYX::EFG: ____

- (1) ECB (2) DCB (3) DCA (4) FCB

Reason: A B C:Z Y X::E F G: ____ =
1 2 3 :26 25 24::5 6 7 :

Reasoning (sequence and series) ICET- 2009:

Note: In each of the questions numbered 46 to 60 a sequence of numbers or letters that follow a definite pattern is given. Each question has a blank space. This has to be filled by the correct answer from the four given options to complete the sequence without breaking the pattern.

46. 50, 65, __, 290, 325

- (1) 75 (2) 95 (3) 176 (4) 145

Reason: Given sequence is in the form $50=7^2+1$, $64=8^2+1$, **145** $=12^2+1$, $290=17^2+1$, $325=18^2+1$.

So the missing term is 145; Answer:3

47. (25, 1), (23, 2), (20, 4), __, (11, 16)

- (1) (16, 4) (2) (16, 6) (3) (16, 8) (4) (16, 10)

Reason: In the given sequence $25, 25-2=23, 23-3=20, \underline{16=20-4}, 11=16-5; 1=2^0, 2=2^1, 4=2^2, \underline{8=2^3}, 16=2^4$. **So the missing term is (16, 8); Answer:3**

48. $11\frac{1}{9}, 12\frac{1}{2}, 14\frac{2}{7}, 16\frac{2}{3}, \underline{\hspace{1cm}}$

- (1) $18\frac{1}{3}$ (2) 20 (3) $17\frac{1}{3}$ (4) 24

Reason: $11\frac{1}{9} = \frac{100}{9}, 12\frac{1}{2} = \frac{25}{2} = \frac{100}{8}, 14\frac{2}{7} = \frac{100}{7}, 16\frac{2}{3} = \frac{50}{3} = \frac{100}{6}, \frac{100}{5} = 20$.

So the missing term is $\frac{100}{5} = 20$; Answer:2

49. The value of the 13th term in the series 1, 1+2, 1+2+3, 1+2+3+4,

- (1) 97 (2) 91 (3) 89 (4) 85

Reason: The 13th term in the series

$$\text{series} = 1+2+3+4+5+6+7+8+9+10+11+12+13 = \frac{13 \times 14}{2} = 13 \times 7 = 91.$$

So the missing term is 91; Answer:2

50. A, D, I, P, __

- (1) X (2) Y (3) Z (4) U

Reason: $1^2=1=A, 2^2=4=D, 3^2=9=I, 4^2=16=P, 5^2=25=Y$. **So the missing term is Y; Answer:2**

51. DFIK, GILN, JLOQ, ____

- (1) MORP (2) MPRO (3) MORT (4) MROP

Reason: In each term each letter is forwarded by 3 steps ;i.e. first letter in each term $D^{+3}=G^{+3}=J^{+3}=\underline{M}$; second letter in each term $F^{+3}=I^{+3}=L^{+3}=\underline{O}$; third letter in each term $I^{+3}=L^{+3}=O^{+3}=R$; fourth letter in each term $K^{+3}=N^{+3}=Q^{+3}=T$; **So the missing term is MORT; Answer:3**

53. $625 : 5 :: 1296 : \underline{\hspace{1cm}}$

- (1) 9 (2) 7 (3) 6 (4) 8

Reason: In the given analogy $625(=5^4):5::1296(=6^4):6$;

$5^4:5::6^4:6$ So the missing term is 6 ;Answer:3

54. PALE : LEAP :: $\underline{\hspace{1cm}}$: SHOP

- (1) SOAP (2)PSOH (3)POSH (4) SAOP

Reason:PALE : LEAP :: $\underline{\hspace{1cm}}$: SHOP

PALE : LEAP :: **POSH**: SHOP

$5^4:5::6^4:6$ So the missing term is POSH ;Answer:3

55. Professor : Lecture::Doctor :

- (1) Hospital (2) Disease (3) Treatment (4) Patient

Reason:Profressor gives Lecture.

Doctor gives Treatment. **Answer:3**

56. 6, 15, 35, 77, $\underline{\hspace{1cm}}$

- (1) 141 (2) 142 (3) 143 (4) 144

Reason:Given sequence is in the form of product of consecutive primes; $6=2 \times 3$, $15=3 \times 5$,

$35=5 \times 7$, $77=7 \times 11$, **$143=11 \times 13$** , . So the missing term is **143**;Answer:3

57. CEGK, EGKM, $\underline{\hspace{1cm}}$, KMQS

- (1) GJKM (2) GKMQ (3) GLMQ (4)GMQS

Reason:CEGK, 2nd term=last three letters of the first term and fourth letter is forwarded by 2 steps=EGKM(here $K^{+2}=M$. So 3rd term=last three letters of the second term and fourth letter is third letter of the given fourth term=GKMQ.

So the missing term is GKMQ; Answer:2

58. 15, 24, 35, 48, 63, $\underline{\hspace{1cm}}$, 99

- (1) 72 (2) 80 (3) 84 (4) 90

Reason: $15=4^2-1$, $24=5^2-1$, $35=6^2-1$, $48=7^2-1$, $63=8^2-1$, **$9^2-1=81-1=80$** , $99=10^2-1$

So the missing term is 80; Answer:2

59. 18, 50, 98, $\underline{\hspace{1cm}}$, 338

- (1) 121 (2) 169 (3) 189 (4) 242

Reason: $18=3^2 \times 2$, $50=5^2 \times 2$, $98=7^2 \times 2$, **$242=11^2 \times 2$** , $338=13^2 \times 2$

So the missing term is 242; Answer:4

60. 2, 10, 30, $\underline{\hspace{1cm}}$, 130

- (1) 40 (2) 50 (3) 68 (4)90

Reason:The given series is in the form n^3+n ; $2=1^3+1$, $10=2^3+2$, $30=3^3+3$,

$68=4^3+4$, $130=5^3+5$. So the missing term is **120** ;Answer:1

Reasoning (sequence and series) ICET- 2008:

Note: In each of the questions numbered 61 to 75 a sequence of numbers or letters that follow a definite pattern is given. Each question has a blank space. This has to be filled by the correct answer from the four given options to complete the sequence without breaking the pattern.

61. 6, 27, 128, ____, 3130

- (1) 209 (2) 369 (3) 629 (4) 1031

Reason: Given sequence is in the form $6=5^1+1$, $27=5^2+2$, $128=5^3+3$, $629=5^4+4$, $3130=5^5+5$.

So the missing term is 629; Answer:3

62. 7, 19, 37, 61, ____, 127

- (1) 91 (2) 101 (3) 111 (4) 121

Reason: Given sequence is in the form 7 , $7+12=19$, $19+18=37$, $37+24=61$, $61+30=91$, $91+36=127$

So the missing term is 91; Answer:1

63. 99, 9999, 999999, ____, 9999999999

- (1) 9999999 (2) 99999999 (3) 999999999 (4) 99999999999

Reason: The first term has 2 nines, second term has 4 nines, third term has 6 nines, so fourth term should have 8 nines, fifth term has 10 nines. **So the missing term is 99999999; Answer:2**

64. $\frac{3}{4}$, $\frac{15}{16}$, $\frac{63}{64}$, ____, $\frac{1023}{1024}$

- (1) $\frac{127}{128}$ (2) $\frac{255}{256}$ (3) $\frac{511}{512}$ (4) $\frac{711}{712}$

Reason: $\frac{3}{4} = \frac{4^1-1}{4^1}$, $\frac{15}{16} = \frac{4^2-1}{4^2}$, $\frac{63}{64} = \frac{4^3-1}{4^3}$, $\frac{4^4-1}{4^4} = \frac{256-1}{256} = \frac{255}{256}$, $\frac{1023}{1024} = \frac{4^5-1}{4^5}$

So the missing term is $\frac{4^4-1}{4^4} = \frac{256-1}{256} = \frac{255}{256}$; Answer:2

65. 2, -1, 5, -7, ____, -31

- (1) 9 (2) 11 (3) 15 (4) 17

Reason: 2, -1, 5, -7, 17, -31.

-3 6 -12 24 -48

Double the value with alternate -ve and +ve signs. **So the missing term is 17; Answer:4**

66. DFI, EGJ, FHK, ____, HJM

- (1) GIM (2) GIL (3) HJN (4) HIM

Reason: In each term each letter forwarded by 1 steps ;i.e. first letters D,E,F,G,H; second letters in each term F,G,H,I,J; third letters in each term I,J,K,L,M; **So the missing term is GIL; Answer:2**

67. $4+\sqrt{13}$, $9+\sqrt{10}$, ____, $25+\sqrt{4}$

- (1) $14+\sqrt{7}$ (2) $15+\sqrt{7}$ (3) $16+\sqrt{7}$ (4) $19+\sqrt{7}$

68. A9Z, B7Y, C5X, ___, E1V

- (1) D2W (2) D4W (3) D3U (4) D3W

Reason: In each term each letter forwarded by 1 steps; i.e. first letters A, B, C, D, E; second letters in each term 9, 7, 5, 3, 1; third letters in each term Z, Y, X, W, V; **So the missing term is D3W** ;**Answer:4**

69. 8 : 81 :: 6 : ____

- (1) 25 (2) 36 (3) 49 (4) 64

Reason: In the given analogy $8:(8+1)^2::6:(6+1)^2$; **So the missing term is 49** ;**Answer:3**

70. 99:120 :: ____ :63

- (1) 48 (2) 42 (3) 36 (4) 24

Reason: In the given series is $(10^2-1):(11^2-1)::(7^2-1):(8^2-1)$; **So the missing term is 48** ;**Answer:1** **OR** $99=9 \times 11$, $120=10 \times 12$; $6 \times 8=48$, $63=7 \times 9$; **So the missing term is 48** ;**Answer:1**

71. 22 : 2222 :: 222 : ____

- (1) 22222 (2) 2222 (3) 222222 (4) 2222222

Reason: In the given analogy there are 2 twos in the first term and 4 twos in the second. Similarly there are 3 twos in the next half, so 222222(6 times) is the second term. **So the missing term is 222222** ;**Answer:3**

72. LFHW, KEGV, JDFU, _____

- (1) ITCE (2) ICET (3) IECT (4) ETCI

Reason: In each term each letter backwarded by 1 steps; i.e. first letters L, K, J, I; second letters in each term F, E, D, C; third letters in each term H, G, F, E; fourth letters in each term W, V, U, T

So the missing term is ICET ;**Answer:2**

73. 11, 101, 1001, _____, 100001, 1000001

- (1) 1001 (2) 10001 (3) 10000001 (4) 100000

Reason: $11=10+1$, $101=10^2+1$, $1001=10^3+1$, $10001=10^4+1$, $100001=10^5+1$, $1000001=10^6+1$, **So the missing term is 10001** ;**Answer:2**

74. 2, 3, 5, 11, 13, ___, 19, 23

- (1) 14 (2) 15 (3) 16 (4) 17

Reason: The given series is series of prime numbers. **So the missing prime is 17** ;**Answer:4**

75. T, W, Z, C, ___, I

- (1) D (2) E (3) F (4) H

Reason: The given sequence is T, W, Z, C, ___, I. In the sequence each letter is forwarded by 3 steps to its previous letter. **So the missing term is F** ;**Answer:3** **OR**

T=20, W=23, Z=26, C=3, F=6, I=9. **So the missing term is F** ;**Answer:3**

Reasoning (sequence and series) ICET- 2007:

Note: In each of the questions numbered 76 to 90 a sequence of numbers or letters that follow a definite pattern is given. Each question has a blank space. This has to be filled by the correct answer from the four given options to complete the sequence without breaking the pattern.

76. 2, 8, 18, 32, __, 72, 98

- (1) 46 (2) 52 (3) 42 (4) 50

Reason: 2, 8=(2+6), 18=(8+10), 32=(18+14), 50=(32+18), 72=(50+22),
98=(72+26) **So the missing term is 50 ; Answer:4**

77. 4, 13, 28, 49, __, 109, 148

- (1) 76 (2) 70 (3) 72 (4) 74

Reason: 4, 13=(4+9), 28=(13+15), 49=(28+21), 76=(49+27), 109=(76+33),
148=(109+39) **So the missing term is 76 ; Answer:1**

78. $0010_2, 0011_2, _, 0111_2, 1011_2$

- (1) 1010_2 (2) 1000_2 (3) 0101_2 (4) 0110_2

Reason: In decimal system $0010_2=2$, $0011_2=3$, $0101_2=5$, $0111_2=7$, $1011_2=11$.
So 0101_2 is the missing term **Answer:3**

79. 0, 7, 26, 63, __, 215, 343

- (1) 126 (2) 124 (3) 125 (4) 127

Reason: The given series is in the form n^3-1 ; $0=1^3-1$, $7=2^3-1$, $26=3^3-1$, $63=4^3-1$,
 $124=5^3-1$, $212=6^3-1$, $343=7^3-1$. **So the missing term is 124 ; Answer:2**

80. ACEG, IKMO, ____, YACE

- (1) QSUW (2) PRTV (3) QSUV (4) QSVX

Reason: In each term each letter forwarded by 8 steps ; i.e. $A^{+8}=I^{+8}=\underline{Q}^{+3}=Y$;
 $C^{+8}=K^{+8}=\underline{S}^{+8}=A$; $E^{+8}=M^{+8}=\underline{U}^{+8}=C$; $G^{+8}=O^{+8}=\underline{V}^{+8}=E$;
So the missing term is QSUV; Answer:3

81. 6, 15, 35, __, 143, 221

- (1) 81 (2) 93 (3) 78 (4) 77

Reason: Given sequence is in the form of product of consecutive primes; $6=2 \times 3$, $15=3 \times 5$,
 $35=5 \times 7$, $77=7 \times 11$, $143=11 \times 13$, $221=13 \times 17$. **So the missing term is 77; Answer:4**

82. 5, 10, 26, __, 122, 170

- (1) 48 (2) 50 (3) 49 (4) 53

Reason: Given sequence is in the form of n^2+1 , n is a prime; $5=2^2+1$, $10=3^2+1$, $26=5^2+1$,
 $50=7^2+1$, $122=11^2+1$, $170=13^2+1$. **So the missing term is 50; Answer:2**

83. ABC, DEF, IJK, ____, YZA

- (1) MNO (2) LMN (3) NOP (4) PQR

Reason: Observe the increments given for each term and each term has three consecutive alphabets.
 ABC_{+1} , DEF_{+3} , IJK_{+5} , PQR_{+7} , YZA . **So the missing term is PQR; Answer:4**

84. 6:35::77:_____

- (1) 135 (2) 221 (3) 225 (4) 321

Reason: Given are in the form of product of primes; $6=2 \times 3$, $35=5 \times 7$, $77=7 \times 11$, $221=13 \times 17$.

So the missing term is 221; Answer: 2

85. 8:16::125:_____

- (1) 426 (2) 138 (3) 625 (4) 526

Reason: Given are in the form $2^3:2^4::5^3:5^4$; **So the missing term is $5^4=625$; Answer: 3**

86. AEI, CGK, _____, GKO, IMQ

- (1) EIM (2) EIN (3) DHL (4) EJM

Reason: Each term is forwarded 2 steps to its previous term.

$AEI_{+2} = CGK_{+2} = \underline{EIM}_{+2} = GKO_{+2} = IMQ$; $A_{+2} = C_{+2} = E_{+2} = G_{+2} = I$, Similarly the other two.

So the missing term is EIM; Answer: 1

87. A, H, A, L, _____, H, E

- (1) S (2) T (3) V (4) U

Reason: In the series 1st, 3rd, 7th terms are vowels. So the 5th term is also a vowel.

So the missing term is U; Answer: 4 OR

88. 216, 343, _____, 729

- (1) 470 (2) 512 (3) 570 (4) 626

Reason: The given series is in the form n^3 ; $216=6^3$, $343=7^3$, $512=8^3$, $729=9^3$

So the missing term is 512; Answer: 2

89. BDF, DHL, HPX, _____, FLR

- (1) JFV (2) PGV (3) PFV (4) PFU

Reason: B D F, D H L, H P X, P F V, F L R

2 4 6, 4 8 12, 8 16 24, 16 32 48, 32 64 96 because $32=32-26=6=F$,

$64=64-52=12=L$,

$48=48-27=21=V$, $96=96-78=18=R$, here we are using the cycling technique.

So the missing term is PFV; Answer: 3 OR

$B \times 2 = D \times 2 = H \times 2 = \underline{P} \times 2 = F$, because $B=2$, $D=4$, $H=8$, $P=16$. Similarly

$D \times 2 = H \times 2 = P \times 2 = \underline{F} \times 2 = L$; $F \times 2 = L \times 2 = X \times 2 = \underline{V} \times 2 = R$

So the missing term is PFV; Answer: 3

90. 05-01-1996, 27-01-1996, 18-02-1996, _____, 02-04-1996

- (1) 08-03-1996 (2) 28-02-1996 (3) 12-03-1996 (4) 11-03-1996

Reason: There is a difference of 22 days between any two consecutive dates of the given series

$22+05-01-1996=27-01-1996$; $22+27-01-1996=18-02-1996$,

$22+18-02-1996=\underline{11-03-1996}$ [because 1996 is a leap year and hence in February there will be 29 days] $22+11-03-1996=02-04-1996$ **So the missing term is 11-03-1996; Answer: 4**

Reasoning (sequence and series) ICET- 2006:

Note: In each of the questions numbered 91 to 105 a sequence of numbers or letters that follow a definite pattern is given. Each question has a blank space. This has to be filled by the correct answer from the four given options to complete the sequence without breaking the pattern.

91. V2I, W3G, X5E, Y7C, ____, A13Y

- (1) Z11B (2) Z9B (3) Z9A (4) Z11A

Reason: In each term 1st letter forwarded by 1 steps and 2nd is a prime number and 3rd letter backward by 2 steps; i.e. $V^{+1}=W^{+1}=X^{+1}=Y^{+1}=\underline{Z}^{+1}=A$; 2, 3, 5, 7, 11, 13; $I^{-2}=G^{-2}=E^{-2}=C^{-2}=\underline{A}$; $2=Y$; So the missing term is **Z11A**; Answer:4

92. ACZY, CEYX, EGXW, ____, IKVU

- (1) GIZY (2) GIWV (3) GIVU (4) GIWU

Reason: AC, CE, EG, GI, IK (the first two letters); ZY, YX, XW, WV, VU (the last two letters); So the missing term is **GIWV**; Answer:2

93. Z0A, Y3C, ____, W15G, V24I

- (1) X9E (2) X8F (3) X8E (4) X9F

Reason: Z, Y, X, W, V (the first letter); $0=1^2-1$, $3=2^2-1$, **8** = 3^2-1 , $15=4^2-1$, $24=5^2-1$. A, C, E, G, I (the last letter); So the missing term is **X8E**; Answer:3

94. DFIK, GILN, JLOQ, _____

- (1) MORT (2) MOQS (3) MNRT (4) MNOT

Reason: In each term each letter is forwarded by 3 steps; i.e. $D^{+3}=G^{+3}=J^{+3}=M$; $F^{+3}=I^{+3}=L^{+3}=O$; $I^{+3}=L^{+3}=O^{+3}=R$; $K^{+3}=N^{+3}=Q^{+3}=T$; So the missing term is **MORT**; Answer:1

95. ZYX, WVU, ____, QPO, NML, KJI

- (1) SRT (2) TSR (3) TRS (4) RST

Reason: In letter forwarded by 3 steps; i.e. $Z^{-3}=W^{-3}=\underline{T}^{-3}=Q^{-3}=N^{-3}=K$; $Y^{-3}=V^{-3}=\underline{S}^{-3}=P^{-3}=M^{-3}=J$; $X^{-3}=U^{-3}=\underline{R}^{-3}=O^{-3}=L^{-3}=I$; So the missing term is **TSR**; Answer:2

96. 3, 5, 7, 11, 13, 17, 19, ____, 29

- (1) 21 (2) 25 (3) 23 (4) 27

Reason: The series is prime number series. So the missing term is **23**; Answer:3

97. 5, 7, 12, 19, 31, ____, 81, 131

- (1) 36 (2) 40 (3) 48 (4) 50

Reason: Every term of the sequence is sum of its previous two terms.

5, 7, $(5+7)=12$, $(7+12)=19$, $(12+19)=31$, $(19+31)=50$, $(31+50)=81$, $(50+81)=131$
So the missing term is **50**; Answer:4

98. 15, 32, 66, ____, 270

- (1) 136 (2) 134 (3) 140 (4) 138

Reason: Every term of the sequence is in the for $2(\text{previous term})+2$.

99. (0,1), (1, 2), (2, 5), (3,10),____,(5, 26)

1) (4, 17) (2) (4, 15) (3) (4, 19) (4) (4, 21)

Reason: $(0,1)=(0,0^2+1)$; $(1, 2)=(1, 1^2+1)$; $(2, 5)=(2, 2^2+1)$; $(3,10)=(3, 3^2+1)$; **$(4, 4^2+1)=(4, 17)$; $(5, 26)=(5, 5^2+1)$; So the missing term is (4, 17)**

;Answer:1

100. 2, 6, 12, 20, 30,____,56

(1) 38 (2) 40 (3) 42 (4) 44

Reason: $2, 6=(2+4), 12=(6+6), 20=(12+8), 30=(20+10), 42=(30+12), 56=(42+14)$ **OR** $2=1^2+1, 6=2^2+2, 12=3^2+3, 20=4^2+4, 30=5^2+5, 42=6^2+6, 56=7^2+7.$ **So the missing term is 42 ; Answer:1**

101. EJO, DHL, CFI, BDF, ____

(1)ABC (2)ACE (3)ABD (4)ABE

Reason: In each term 1st letter backwarded by 1 steps and 2nd is letter backwarded by 2 steps and 3rd letter backwarded by 3 steps; i.e. $E^{-1}=D^{-1}=C^{-1}=B^{-1}=\underline{A}$; $J^{-2}=H^{-2}=F^{-2}=D^{-2}=\underline{B}$; $O^{-3}=L^{-3}=I^{-3}=F^{-3}=\underline{C}$ **So the missing term is ABC; Answer:1**

102. HLTX, JMSV, LNRT, NOQR,____

(1)PPQR (2)RPPP (3)QPPQ (4)PPPP

Reason: In each term 1st letter forwarded by 2 steps ; 2nd is letter forwarded by 1 step ; 3rd letter backwarded by 1 step and the 4th letter backwarded by 2 step ; i.e. $H^{+2}=J^{+2}=L^{+2}=N^{+2}=\underline{P}$; $L^{+1}=M^{+1}=N^{+1}=O^{+1}=\underline{P}$; $T^{-1}=S^{-1}=R^{-1}=Q^{-1}=\underline{P}$; $X^{-2}=V^{-2}=T^{-2}=R^{-2}=\underline{P}.$ **So the missing term is PPPP; Answer:4**

103. 0,6, 24, 60,____,210

(1)120 (2) 126 (3) 164 (4) 172

Reason: The given series is in the form n^3-n ; $0=1^3-1, 6=2^3-2, 24=3^3-3, 60=4^3-4, 120=5^3-5, 210=6^3-6.$ **So the missing term is 120 ;Answer:1**

104. 3, 5, 9, 17, 33,____

(1) 67 (2) 65 (3) 57 (4) 87

Reason: Each term of the sequence $=2(\text{previous term}) - 1$; $3, 5=2(3) - 1, 9=2(5) - 1, 17=2(9) - 1, 33=2(17) - 1, \underline{65=2(33) - 1}.$ **So the missing term is 65 ; Answer:2**

105. $\frac{1}{2}, \frac{8}{3}, \frac{27}{5}, \text{---}, \frac{125}{11}, \frac{216}{13}$

(1) $\frac{81}{7}$ (2) $\frac{64}{7}$ (3) $\frac{81}{9}$ (4) $\frac{64}{9}$

Reason: In each term numerarors are in the form n^3 and the denominators are prime numbers.

$\frac{1}{2} = \frac{1^3}{2}, \frac{8}{3} = \frac{2^3}{3}, \frac{27}{5} = \frac{3^3}{5}, \frac{64}{7} = \frac{4^3}{7}, \frac{125}{11} = \frac{5^3}{11}, \frac{216}{13} = \frac{6^3}{13}$

Reasoning (sequence and series) ICET- 2005:

Note: In each of the questions numbered 106 to 120 a sequence of numbers or letters that follow a definite pattern is given. Each question has a blank space. This has to be filled by the correct answer from the four given options to complete the sequence without breaking the pattern.

106. 0010, 0011, 0101, _____, 1011

- (1) 0001 (2) 0111 (3) 1010 (4) 1111

Reason: In decimal system $0010=2$, $0011=3$, $0101=5$, $0111=7$, $1011=11$.

So 0111 is the missing term **Answer:2**

107. 1, 2, 3, 5, _____, 10, 15, 30

- (1) 6 (2) 11 (3) 7 (4) 8

Reason: The sequence represents the factors of 30 in ascending order. So the missing term is 6;
Answer:1

108. AZBY, CXDW, _____, GTHS

- (1) EXUV (2) EVFU (3) EVRU (4) EVSU

Reason: In each term 1st and 3rd letters forwarded by 2 steps and 2nd and 4th letters backwarded by 2 steps; $A^{+2}=C^{+2}=E^{+2}=G$; $Z^{-2}=X^{-2}=V^{-2}=T$; $B^{+2}=D^{+2}=F^{+2}=H$; $Y^{-2}=W^{-2}=U^{-2}=S$; **Answer:2**

109. 9, 19, 40, _____, 146

- (1) 70 (2) 59 (3) 69 (4) 64

Reason: The sequence represents ; **Answer:3**

110. 7:13::21:_____

- (1) 31 (2) 27 (3) 23 (4) 17

Reason: $7^{+6}=13$; $21^{+6}=27$. So the missing term is 27; **Answer:2**

111. 8:27::_____ :343

- (1) 125 (2) 216 (3) 124 (4) 163

Reason: $8=2^3$; $27=3^3$; $343=7^3$. So the missing term is $5^3=125$; **Answer:1**

112. $11\frac{1}{9}$, $12\frac{1}{2}$, $14\frac{2}{7}$, $16\frac{2}{3}$, _____

- (1) $18\frac{2}{3}$ (2) $18\frac{2}{7}$ (3) $17\frac{1}{6}$ (4) 20

Reason: $11\frac{1}{9} = \frac{100}{9}$, $12\frac{1}{2} = \frac{25}{2} = \frac{100}{8}$, $14\frac{2}{7} = \frac{100}{7}$, $16\frac{2}{3} = \frac{50}{3} = \frac{100}{6}$, $\frac{100}{5} = 20$.

So the missing term is $\frac{100}{5} = 20$; **Answer:4**

113. 165, 195, _____, 285, 345

- (1) 235 (2) 245 (3) 275 (4) 255

Reason: $165, 195 = (165+30), [195+40=235], [235+50=285], [285+60=345]$.

So the missing term is 235; Answer:1

114. 09:25::49:___

- (1) 64 (2) 81 (3) 36 (4) 68

Reason: $9=3^2; 25=5^2; 49=7^2$. So the missing term is $9^2=81$; **Answer:2**

115. 13, 29, ___, 125, 253

- (1) 49 (2) 59 (3) 61 (4) 72

Reason: Each term of the sequence $= 2(\text{previous term}) + 3$.

So the missing term is $2(29)+3=58+3=61$; **Answer:3**

116. 583:283::488:___

- (1) 387 (2) 378 (3) 478 (4) 368

Reason: $583+283=866$; So $488+\underline{378}=866$. **Answer:2**

117. CAT, FDW, IGZ, _____,

- (1) LIC (2) MJC (3) LJBH (4) LJC

Reason: In each term 1st, 2nd and 3rd letters forwarded by 3 steps. $C^{+3}=F^{+2}=I^{+3}=L$; $A^{+3}=D^{+3}=G^{+3}=J$; $T^{+3}=W^{+3}=Z^{+3}=C$; So the missing term is LJC; **Answer:4,**

118. 82:122::___:226

- (1) 154 (2) 145 (3) 185 (4) 170

Reason: Each term is in form $(\text{odd})^2+1$. $82=81+1=9^2+1$; $122=121+1=11^2+1$; $226=225+1=15^2+1$;

So the missing term is $13^2+1=169+1=170$; Answer:4

119. GHD, JEG, MBI, _____

- (1) QZM (2) PYM (3) PZM (4) PYN

Reason: In each term 1st and 3rd letters forwarded by 3 steps and 2nd letter was backwarded by 3 steps; $G^{+3}=J^{+3}=M^{+3}=P$; $H^{-3}=E^{-3}=B^{-3}=Y$; $D^{+3}=G^{+3}=J^{+3}=M$; **So the missing term is PYM;**

Answer:2

120. D4V, F6T, ___, J10P

- (1) K7P (2) L8P (3) H8R (4) H9S

Reason: D, F, H, J : 4, 6, 8, 10 ; V, T, R, P : 22, 20, 18, 16. **So the missing term is H8R;**

Answer:3

Number Analogy

1. 11529 : 72135 :: 152943 : ?
A. 213549 B. 203448 C. 163044 D. 62034
2. 42 : 56 :: 110 : ?
A. 18 B. 126 C. 132 D. 140
3. 26 : 5 : 65 : ?
A. 6 B. 7 C. 8 D. 9
4. 20 : 11 :: 102 : ?
A. 49 B. 52 C. 61 D. 98
5. Given set : (12, 20, 28)
A. (5, 10, 5) B. (13, 21, 29) C. (17, 27, 5) D. (20, 15, 25)
6. Given set : (18, 9, 2)
A. (3, 7, 1) B. (11, 12, 10) C. (17, 9, 3) D. (24, 12, 2)
7. Given set : (63, 48, 35)
A. (72, 40, 24) B. (72, 48, 24) C. (64, 40, 28) D. (80, 63, 48)
8. 6542 : 5431 :: 4673 : ?
A. 2367 B. 3562 C. 2531 D. None of these
9. 125 : 217 :: 343 : ?
A. 730 B. 346 C. 512 D. 513
10. 9 : 90 :: 12 : ?
A. 124 B. 148 C. 156 D. 172
11. 7 : 56 :: 9 : ?
A. 48 B. 60 C. 64 D. 72

12. $49 : 81 :: 100 : ?$
 A. 64 B. 144 C. 169 D. 199
13. $2 : 8 :: 5 : ?$
 A. 5 B. 125 C. 50 D. 125
14. $4 : 8 :: 9 : ?$
 A. 17 B. 19 C. 21 D. 27
15. $5 : 130 :: 6 : ?$
 A. 220 B. 216 C. 222 D. 36
16. $3 : 11 :: 7 : ?$
 A. 11 B. 18 C. 20 D. 51

KEY

1. Ans is A
 First number + 60606 is the second number
 $11529 + 60606 = 72135$
 Same as $152943 + 60606 = 72135$
2. Ans is C
 $6^2 + 6 : 7^2 + 7 :: 10^2 + 10 : 11^2 + 11$
3. Ans C
 $\sqrt{26-1} = 5$ Same as $\sqrt{65-1} = 8$
4. Ans B
 $\frac{20}{2} + 1 = 11$ Same as $\frac{102}{2} + 1 = 52$
5. Ans B
 $12 + 8 = 20; 20 + 8 = 28$ Same as $13 + 8 = 21; 21 + 8 = 29$
6. Ans D
 The product of 2nd and 3rd numbers is 1st number
7. Ans D
 $8^2 - 1, 7^2 - 1, 6^2 - 1$ same as $9^2 - 1, 8^2 - 1, 7^2 - 1$
8. Ans B
 First number - 1111 is the second number
9. Ans D
 $5^3 : 6^3 + 1$ same as $7^3 : 8^3 + 1$

10. Ans C
 $9 : 9^2 + 9 :: 12 : 12^2 + 12$
11. Ans D
 First number multiply with 8 is second number
12. Ans B
 $7^2 : 9^2 :: 10^2 : 12^2$
13. Ans B
 $2 : 2^3 :: 5 : 5^3$
14. Ans D
 $2^2 : 2^3 :: 3^2 : 3^3$
15. Ans C
 $5 : 5^3 + 5 :: 6 : 6^3 + 6$
16. Ans D
 $3 : 3^2 + 2 : 7 : 7^2 + 2$

WORD ANALOGY

- As 'Wheel' is related to 'Vehicle' similarly 'Clock' is related to what?
 (A) Needle (B) Nail (C) Stick (D) Pin
 (E) None of these
- As 'Plateau' is related a 'Mountain', similarly 'Bush' is related to what?
 (A) Plants (B) Field (C) Forest (D) Trees
 (E) Stem
- As 'Astronomy' is related to 'Planets', similarly 'Astrology' is related to what?
 (A) Satellites (B) Disease (C) Animals (D) Coins
 (E) None of these
- As 'Earthquake' is related to 'Earth', similarly 'Thundering' is related to what?
 (A) Earth (B) Sea (C) Fair (D) Sky
 (E) None of these
- As 'Author' is related to 'Writing', similarly 'Thief' is related to what?
 (A) To night (B) To feel (C) To steal

- (D) To wander (E) None of these
6. As 'Magazine' is related to 'Editor' in the same way 'Drama' is related to what?
(A) Hero (B) Heroine (C) Co-actor (D) Villain
(E) None of these
7. As 'Steal' is related to 'Factory' in the same way 'Wheat' is related to what?
(A) Field (B) Sky (C) Godown (D) Market
(E) None of these
8. As 'Cricket' is related to 'Bat' in the same way, 'Tennis' is related to what?
(A) Game (B) Stick (C) Court (D) Hand
(E) None of these
9. As 'Football' is related to 'Field' in the same way, 'Tennis' is related to what?
(A) Court (B) Net (C) Fieldq (D) Racket
(E) None of these
10. As 'Tennis' is related to 'Racket' in the same way 'Hockey' is related to what?
(A) Ball (B) Stick (C) Field (D) Player
(E) None of these
11. As 'Mosque' is related to 'Islam' in the same way 'Church' is related to what?
(A) Hinduism (B) Sikhism (C) Christianity (D) Buddhism
(E) None of these
12. As 'Hindu worshiper' is related to 'Temple' in the same way 'Maulvi' is related to what?
(A) Monastery (B) Church (C) Mosque (D) Sikh temple
(E) None of these
13. As 'Hungry' is related to 'Food' in the same way 'Thirsty' is related to what?
(A) Drink (B) Tea (C) Coffee (D) Juice
(E) Waler
14. As 'Fly' is related to 'Parrot' in the same way 'Creep' is related to what?
(A) Snake (B) Rabbit (C) Fish (D) Crocodile

- (E) Sparrow
15. As 'Needle' is related to 'Thread' in the same way 'Pen' is related to what?
(A) Word (B) To write (C) Cap (D) Ink
(E) Paper
16. As 'Circle' is related to 'Circumference' in the same way 'Square' is related to what?
(A) Diagonal (B) Perimeter (C) Circumference (D) Area
(E) Angle
17. As 'Bell' is related to 'Sound' in the same way 'Lamp' is related to what?
(A) Flame (B) Light (C) Wick (D) Oil
(E) Gong
18. As 'Oil' is related to an 'Oilman', in the same way 'Milk' is related to what?
(A) Water (B) Blacksmith (C) Shoemaker (D) Milkman
(E) None of these
19. As 'Furniture' is related to 'Bench' in the same way 'Stationary' is related to what?
(A) Godown (B) Room (C) Pen (D) Chair
(E) Office
20. CTPN: DSQM :: MUSK: ?
(A) NVTL (B) NITJ (C) NTTL (D) LTRJ
(E) None of these

KEY

1.A 2.C 3.E 4.D 5.C 6.E 7.A 8.E 9.A 10.B
11.C 12.C 13.E 14.A 15.D 16.B 17.B 18.D 19.C 20.B

In the following questions pick the odd thing out.

1.(1)Fish (2) Frog (3) Crocodile (4) Turtle

Ans:(1) Fish is odd, because the remaining all can live both in water and on land.

2.(1) $x^2 - 1 = 0$ (2) $x^2 - 4 = 0$ (3) $x^2 - 9 = 0$ (4) $x^2 - 12 = 0$

Ans:(4); $x^2 - 12 = 0$ is odd, because the remaining are of the form $x^2 - a^2 = (x + a)(x - a)$ type.

3.(1) Parallelogram (2) Rectangle (3) Rhombus (4) Square

Ans:(1); Parallelogram is odd, because the remaining all have 90° angles.

4. (1) 43 (2) 63 (3) 33 (4) 93

Ans: (1); 43 is odd and 43 is prime and the remaining are all not primes. $63 = 7 \times 9$; $33 = 3 \times 11$; $93 = 3 \times 31$

5. (1) 16 (2) 25 (3) 36 (4) 48

Ans: (4); 48 is odd, because the remaining are all squares. $16 = 4 \times 4$; $25 = 5 \times 5$; $36 = 6 \times 6$;

6. (1) 13 (2) 21 (3) 48 (4) 232

Ans: (1); 13 is prime and the remaining are all not primes

7. (1) 0.01 (2) 0.001 (3) 0.0001 (4) 0.000001

Ans: (2); 0.001 is odd, because the remaining all have odd number of zeros.

8. (1) $\frac{3}{7}$ (2) $\frac{11}{13}$ (3) $\frac{17}{19}$ (4) $\frac{21}{23}$

Ans: (1); $\frac{3}{7}$ is odd, because in the remaining fractions the difference between numerator and denominator is 2.

9.(1) $\frac{15}{19}$ (2) $\frac{18}{19}$ (3) $\frac{21}{19}$ (4) $\frac{11}{19}$

Ans: (4); $\frac{11}{19}$ is odd, because in the remaining fractions the numerator is not a prime number.

10. (1) 24 (2) 121 (3) 720 (4) 5040

Ans: (2); 121 is a perfect square; $121 = 11 \times 11$. The remaining are all not perfect squares.

11. (1) 35 (2) 77 (3) 117 (4) 143

Ans: (3); $35 = 5 \times 7$; $77 = 7 \times 11$; $117 = 9 \times 13$; $143 = 11 \times 13$. 117 is not product of primes.

12. (1) 14 (2) 34 (3) 62 (4) 96

Ans: (4); $14 = 2 \times 7$; $34 = 2 \times 17$; $62 = 2 \times 31$; $96 = 2 \times 3 \times 4 \times 4$. 96 is not product of primes.

13. (1) (2,3,13) (2) (3,4,25) (3) (4,5,41) (4) (5,6,71)

Ans: (4); $2^2+3^2=13$; $3^2+4^2=25$; $4^2+5^2=41$; $5^2+6^2=61$ but it was given as 71 and hence it is odd.

14. (1) July (2) August (3) September (4) October

Ans: (3); September is odd because the remaining all has 31 days in a month.

15. (1) 11 (2) 111 (3) 11111 (4) 11111111

Ans: (1); 11 because the remaining all has odd number of 1's.

16. (1) $\frac{19}{15}$ (2) $\frac{13}{11}$ (3) $\frac{7}{5}$ (4) $\frac{3}{2}$

Ans: (1); $\frac{19}{15}$ denominator 15 is not prime. $\frac{3}{2}=1.5$; $\frac{19}{15}=1.26666...$; $\frac{13}{11}=1.181818...$; $\frac{7}{5}=1.4$

17. (1) $(0111)_2$ (2) $(1101)_2$ (3) $(1111)_2$ (4) $(10001)_2$

Ans: (3); $(1111)_2$ is odd because the remaining all has atleast one zero. OR

$(0111)_2 = 0+4+2+1=7$, a prime; $(1101)_2 = 8+4+0+1=13$, a prime;

$(1111)_2 = 8+4+2+1=15$, not a prime; $(10001)_2 = 16+0+0+0+1=17$, a prime;

18. (1) 2W3 (2) 1Q7 (3) 1M3 (4) 1R9

Ans: (4); In English alphabets W=23; Q=17; M=13; And R=18 but not 19.

19. (1) $x^2+4x+5 = 0$ (2) $x^2+4x+4 = 0$ (3) $x^2-4x+4 = 0$ (4) $x^2+2x+1 = 0$

Ans: (1); $x^2+4x+4 = (x+2)^2$; $x^2-4x+4 = (x-2)^2$; $x^2+2x+1 = (x+1)^2$; x^2+4x+5 cannot be written as a square.

20. (1) 37 (2) 47 (3) 57 (4) 67

Ans: (3); $57=3 \times 19$ is not a prime, the remaining are all primes.

21. (1) 80 (2) 99 (3) 120 (4) 163

Ans: (4); $80=8 \times 10$; $99=9 \times 11$; $120=10 \times 12$; 163 is a prime, the remaining are all not primes.

22. (1) Bus complex (2) Cinema hall (3) Railway station (4) Aerodrome

Ans: (2); Cinema hall is odd, because the remaining all are useful for travelling.

23. (1) 2T1 (2) 2V2 (3) 2X4 (4) 2Z6

Ans: (1); In English alphabets T=20 but not 21; V=22; Z=26; X=24.

24. (1) Hand (2) Eye (3) Ear (4) Mouth

Ans: (1); Hand is foldable the remaining are not.

25. (1) $x^2+1 = 0$ (2) $x^2+3x+6 = 0$ (3) $x^2+2x+5 = 0$ (4) $x^2-x-12 = 0$

Ans: (1); $x^2+1=0$ has real factors, the remaining all have real factors.

26.(1) K (2) C (3)G (4) T

Ans: (4);In English alphabets $K=11$; $C=3$; $G=7$, these there are primes. But $T=20$ not a prime

27.(1)Violin (2) Veena (3)Mandolin (4)Flute

Ans: (4);Flute is played with the help of mouth and hands is odd,because the remining all are played with only hands.

28.(1)35 (2)46 (3)72 (4)91

Ans: (3);72 is odd,because $72=2 \times 2 \times 2 \times 3 \times 3$,cannot be expressed as product of two primes;
 $35=5 \times 7$; $46=2 \times 23$; $91=7 \times 13$.

29.(1)28 (2)65 (3)126 (4)216

Ans: (2);65 is odd number,the remaining are all even numbers.

30.(1)FIHG (2)KNML (3)RTUS (4)VYXW

Ans: (3);RTUS is not in the same manner as the remaining. FGHI;KLMN;VWXY

31.(1)River (2)Lake (3)Dam (4)Pond

Ans: (1);Except river all other bodies contain still water.

32.(1) E (2)G (3)K (4)P

Ans: (1 OR 4);In English alphabets $K=11$; $E=5$; $G=7$, these there are primes. But $P=16$ not a prime OR E is the vowel the remining are all consonents.

33.(1) Cap (2) Turban (3)Helmet (4) Veil

Ans: (4);Except Veil all other are Head wears.

34.(1) JLNQ (2) FHKU (3)CEHL (4) NPSW

Ans: (1);In English alphabets J L N Q=10 12 14 17; F H K U=6 8 11 15;
C E H L = 3 5 8 12; N P S W = 14 16 19 23 observe the diference and increase.

35.(1) 576 (2) 225 (3)672 (4)961

Ans: (3); $576=24 \times 24$; $225=15 \times 15$; $961=31 \times 31$ We cannot write 672 as a square.

36. (1) (14,3,4) (2) (26,4,6) (3)(37,5,7) (4) (70,8,9)

Ans: (4); $(14=3 \times 4+2,3,4)$; $(26=4 \times 6+2,4,6)$; $(37=5 \times 7+2,5,7)$; We cannot 70 as the earlier.
 $(70=-X+2,8,9)$;

37.(1)17 (2)13 (3)11 (4)2

Ans: (4);Except 2 all other are odd primes and have two place values.

38.(1)LUNG (2)EYE (3)HEART (4)EAR

Ans: (3);Except HEART are all pairs.

39.(1)31 (2)41 (3)51 (4)61

Ans: (3); $51=3 \times 17$ is odd number,the remaining are all prime numbers.

41. (1)57 (2)67 (3)77 (4)87

Ans: (2);Except 67 all are not primes. $57=3 \times 19$; $77=7 \times 11$; $87=3 \times 29$

42. (1)25 (2)49 (3)64 (4)81

Ans: (3);Except 64 all are squares of odd primes. $25=5 \times 5$; $49=7 \times 7$; $81=9 \times 9$

43. (1)30 (2)12 (3)20 (4)8

Ans: (1 OR 4);Except 30 all are divisible by 4.

$$30=5^2+5; \quad 12=3^2+3; \quad 20=4^2+4; \quad 8=2^3$$

44. (1)10 (2)28 (3)80 (4)244

Ans: (3);Except 80 all are in the form 3^n+1 ; $10=3^2+1$; $28=3^3+1$; $244=3^5+1$

45. (1)0.01 (2)0.001 (3) 0.0001 (4) 0.000001

Ans: (2);0.001 is odd, because the remaining all have odd number of zeros.

$$0.01=10^{-2}; \quad 0.001=10^{-3}; \quad 0.0001=10^{-4}; \quad 0.000001=10^{-6}$$

46. (1) FG (2) HI (3) KL (4) OQ

Ans: (4);In English alphabets except OQ, the remaining letters are consecutive.

47. (1) AZ (2) CX (3) DV (4) FU

Ans: (3);In English alphabets except DV, the remaining are opposite pairs.

A	B	C	D	E	F	G	H	I	J	K	L	M
Z	Y	X	W	V	U	T	S	R	Q	P	O	N

48. (1) BAT (2) CAT (3) RAT (4) MAT

Ans: (4);Except MAT, the remaining are living.

49. (1) 289 (2) 361 (3) 529 (4) 441

Ans: (4); $441=21^2$, not a prime square; $289=17^2$; $361=19^2$; $529=23^2$;

50. (1) 15 (2) 77 (3) 117 (4) 221

Ans: (3);Except $117=9 \times 13$, the remaining $15=3 \times 5$; $77=7 \times 11$; $221=13 \times 17$ are all products of consecutive primes.

51. (1) 2 (2) 3 (3) 5 (4) 7

Ans: (1);Except 2, the remaining are all odd primes.

52. (1) 46 (2) 58 (3) 69 (4) 34

Ans: (3);Except $69=3 \times 23$, the remaining are all even numbers.

53. (1) 35 (2) 77 (3) 91 (4) 63

Ans: (4);Except $63=9 \times 7$, the remaining $35=7 \times 5$; $77=7 \times 11$; $91=13 \times 7$ are all products of consecutive primes.

54. (1) 180 (2) 247 (3) 246 (4) 147

Ans: (3);Except $247=19 \times 13$, the remaining are all divisible by 3.

55.(1) 29 (2) 47 (3) 51 (4) 67

Ans: (4); Except $51=3 \times 17$, the remaining all are primes.

56.(1) 95 (2) 91 (3) 92 (4) 97

Ans: (3 OR 4); 92 is even the remaining are all odd OR 97 is prime, the remaining are all not primes.

57.(1) B (2) D (3) I (4) P

Ans: (3); In English alphabets B=2; D=4; I=9, P=16.

I is the vowel the remaining are all consonants.

58.(1) BAT (2) CAT (3) DOT (4) PAT

Ans: (3); Except DOT, the remaining have A in the middle.

59.(1) 5 (2) 50 (3) 122 (4) 169

Ans: (4); Except $169=13^2$, $5=2^2+1$; $50=7^2+1$; $122=11^2+1$

169 is a perfect square the remaining are not.

60.(1) 961 (2) 531 (3) 169 (4) 841

Ans: (2); Except 531, the remaining are perfect squares. $961=31^2$; $169=13^2$; $841=29^2$

61.(1) AXZT (2) XZTA (3) ZTAX (4) TAZX

Ans: (4); Places between A, X, Z, T are cyclic except TAZX.

62.(1) 67 (2) 57 (3) 47 (4) 37

Ans: (2); Except 57, the remaining are all prime numbers. $57=3 \times 19$.

63.(1) 11 (2) 111 (3) 1111 (4) 111111

Ans: (2); Except 111, the remaining are all multiples of 11. $111111=11 \times 10101$. $111111 = 11 \times 10101$;

64.(1) $\frac{15}{14}$ (2) $\frac{2}{3}$ (3) $\frac{23}{24}$ (4) $\frac{31}{35}$

Ans: (4); Except $\frac{31}{35}$, the remaining fractions have consecutive numbers.

65.(1) Fish (2) Frog (3) Crocodile (4) Turtle

Ans: (1); Except Fish, all the remaining can live in both water and on earth.

66.(1) August (2) July (3) May (4) June

Ans: (4); Except June all the remaining months has 31 days.

67.(1) 216 (2) 343 (3) 516 (4) 729

Ans: (3); $216=6^3$; $343=7^3$; 516 is not a cube ; $729=9^3$

71.(1)65 (2)126 (3)217 (4)343

Ans: (4);Except 343,the remaining are in the form n^3+1 . $65=4^3+1$; $126=5^3+1$; $216=6^3+1$

72.(1) $\frac{15}{19}$ (2) $\frac{11}{13}$ (3) $\frac{3}{7}$ (4) $\frac{2}{5}$

Ans: (1);Except $\frac{15}{19}$,the remaining fractions both numerator and denominator is prime.

73.(1)345 (2)143 (3)567 (4)789

Ans: (2);Except 143,in the remaining the middle is the average of the extremes.

74.(1)169 (2)961 (3)132 (4)625

Ans: (3);Except 132,the remaining are squares. $169=13^2$; $961=31^2$; $625=25^2$

75.(1)DELM (2)BDIJ (3)GHRS (4)PQAB

Ans: (2);Except BDIJ,the remaining the first two and the last two are consecutive.

76.(1)BFH (2)MQS (3)GJL (4)NRT

Ans: (3);Except GJL,in the remaining there is 3 letters between first two letters.

B F H=2 6 8;M Q S=13 17 19;G J L=7 10 12;N R T=14 18 20. Observe the difference.

1	2	3	4	5	6	7	8	9	10	11	12	13
A	B	C	D	E	F	G	H	I	J	K	L	M
14	15	16	17	18	19	20	21	22	23	24	25	26
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

77.(1)Planet (2)Satellite (3)Sky (4)Star

Ans: (3);Except Sky,the remaining lies in the sky.

78.(1)Bat (2)Fat (3)Eat (4)Pot

Ans: (4);Except Pot,the remaining have A as the middle letter.

79.(1)697 (2)957 (3)894 (4)876

Ans: (1);Except 697,the remaining sum of the digits is 21.

80.(1)96 (2)64 (3)48 (4)78

Ans: (2);Except 64, the remaining are divisible by 3.

In the following questions pick the odd thing out.

ICET-2013

1. (1)ABYZ (2)CDWX (3)EFUV (4)GHTS

Ans:(4) A=1, B=2, Y=25, Z=26; C=3, D=4, W=23, X=24; E=5, F=6, U=21, V=22;
G=7, H=8, T=20, S=19. It should be GHST

2. (1) $x^3 - 4 = 0$ (2) $x^3 - 3 = 0$ (3) $x^3 - 2 = 0$ (4) $x^3 - 1 = 0$

Ans:(4); $x^3 - 1 = 0$ can be resolved into real factors.

3. (1)(5,6,11) (2)(6,7,13) (3)(7,8,15) (4)(8,9,19)

Ans: (4); 5+6+11; 6+7=13; 7+8=15; 8+9=17 but it was given as 19 and hence it is odd.

4. (1) $\sin^2 x + \cos^2 x$ (2) $\sec^2 x - \tan^2 x$ (3) $\tan^2 x + \cot^2 x$ (4) $\operatorname{cosec}^2 x - \cot^2 x$

Ans: (3); $\sin^2 x + \cos^2 x = 1$; $\sec^2 x - \tan^2 x = 1$; $\operatorname{cosec}^2 x - \cot^2 x = 1$;
 $\tan^2 x + \cot^2 x \neq 1$

5. (1)Eagle (2)vulture (3)owl (4)crow

Ans: (3); owl is odd, because it will fly during night only.

ICET-2014

1. (1) 147 (2)125 (3) 103 (4) 84

Ans: (3); 103 is prime and the remaining are all not primes

2. (1) (3,4,5) (2) (5,12,13) (3)(6,8,10) (4) (10,12,15)

Ans: (3); 6,8,10 are all the three are even.

3. (1)April (2)May (3) November (4)September

Ans: (1); May is odd, because the remaining have 30 days in a month, but May has 31 days.

4. (1) $\frac{19}{15}$ (2) $\frac{13}{11}$ (3) $\frac{7}{5}$ (4) $\frac{3}{2}$

Ans: (1); $\frac{19}{15}$ is odd, because in the remaining fractions numerator and denominator are consecutive primes.

5. (1) C 4 E (2) G 8 I (3)L 15 N (4) T 21 V

Ans: (3); C=3, 4 E=5; G=7, 8, I=9; L=12 15 N=14; T=20, 21, V=21

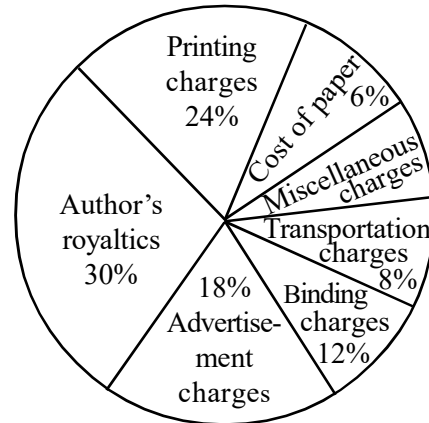
Telangana ICET-2015

1. (1) 36 (2) 28 (3) 126 (4) 343
Ans: (4) $36 = 2^2 \times 3^2$; $28 = 2^2 \times 7$; $126 = 2 \times 3^2 \times 7$; $343 = 7^3$. Hence 343 is odd.
2. (1) 87 (2) 77 (3) 67 (4) 57
Ans: (3) $87 = 3 \times 29$; $77 = 11 \times 7$; 67 is a prime; $57 = 3 \times 19$. Hence 67 is odd.
3. (1) $x^2 + 4x + 4$ (2) $x^2 - 2x + 1$ (3) $x^2 + 2x + 1$ (4) $x^2 + 2x + 2$
Ans: (4); $x^2 + 4x + 4 = (x + 2)^2$; $x^2 - 2x + 1 = (x - 1)^2$; $x^2 + 2x + 1 = (x + 1)^2$; $x^2 + 4x + 2$ cannot be written as a square. Hence $x^2 + 2x + 2$ is odd.
4. (1) 1993 AD (2) 1994 AD (3) 1995 AD (4) 1996 AD
Ans: (4) 1996 AD is odd because it is a Leap year and the remaining are non-leap years.
5. (1) Standard deviation (2) Variance (3) range (4) Mode
Ans: (4) Mode is odd because it is a measure of central tendency and the remaining are measures of dispersion.

A.P. ICET-2015

1. (1) Goat (2) Cow (3) Cat (4) Camel
Ans: (3) Cat. The remaining are Herbivore i.e they eat grass only.
2. (1) Chlorine (2) Bromine (3) Iodine (4) Methane
Ans: (4) Methane is used as cooking gas.
3. (1) 15 (2) 35 (3) 77 (4) 99
Ans: (3 OR 4); $15 = 3 \times 5$; $35 = 5 \times 7$; $77 = 7 \times 11$; $99 = 3 \times 3 \times 11$
4. (1) (2, 3, 7) (2) (3, 5, 8) (3) (5, 7, 12) (4) (7, 11, 16)
Ans: (1) In each triple there is one non-prime. But 2, 3, 5 are primes.
5. (1) 25 (2) 81 (3) 121 (4) 289
Ans: (2); $25 = 5 \times 5$; $81 = 3 \times 3 \times 3 \times 3$; $121 = 11 \times 11$; $289 = 17 \times 17$.

Data Analysis: Study the following Pie diagram and answer the questions.



1. The miscellaneous charges amount Rs. 10,000 and a total of 13,000 copies of the book are printed. What is the cost of each copy at which the book must be priced, if the publisher desires a profit of 4% ?

1. Rs.40 2. Rs.36 3. Rs.52 4. Rs.48

Solution: 2% = Rs.10,000. So 100% = 5,00,000. Profit = 4% = 20,000.

So cost of each book = $\frac{5,20,000}{13,000}$ = Rs.40. **So the answer is 1.**

2. If the transportation charges are reduced by half, then how much is the saving if the binding charges amount to Rs. 60,000?

1. Rs.15,000 2. Rs.30,000 3. Rs. 25,000 4. Rs. 20,000

Solution: Binding charges = 12%, which is equal to Rs. 60,000.

So saving = $\frac{4}{12}$ x 60,000 = Rs. 20,000. **So the answer is 4.**

3. If the author's royalties amount to Rs. 30,000/- more than the printing charges, how much will be the amount for advertisement charges ?

1. Rs.60,000 2. Rs.45,000 3. Rs.75,000 4. Rs.90,000

Solution: Author's royalties - printing charges = 6%. So 6% = 30,000.

The amount for advertisement charges = $\frac{18}{6}$ X 30,000 = 90,000. **So the answer is 4.**

4. What is the angle of the sector for miscellaneous charges ?

1. 6°36' 2. 7°24' 3. 7°12' 4. 6°12'

Solution: 100% = 360°. So miscellaneous charges = 2%,

which is = $\frac{2}{100}$ x 360 = 7.2° = 7°12'. **So answer is 3.**

5. If the cost of the paper and the transportation put together amounts of Rs.70,000, then the total expenditure incurred in bringing out the book is (in rupees)

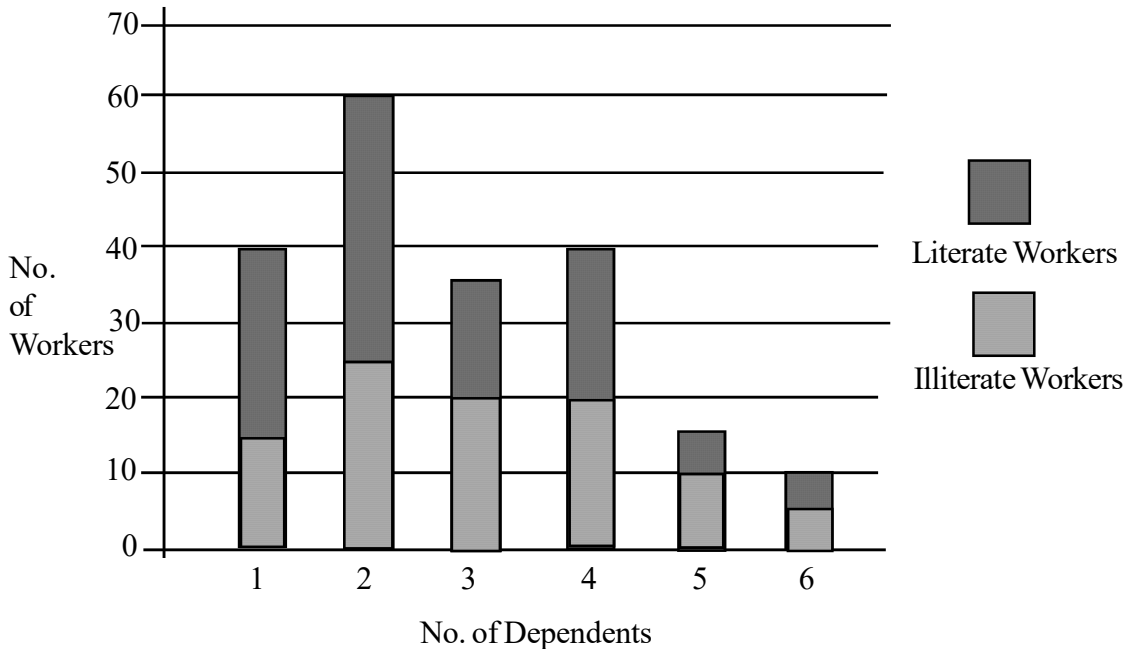
1. 6,00,000 2. 5,00,000 3. 5,40,000 4. 4,50,000

Solution: Cost of paper + transport = 14%. Which was given as 70,000.

So total expenditure incurred in bringing out the book = $\frac{100}{14}$ x 70,000 = 5,00,000

So the answer is 2.

In the bar diagram given below, the frequency distribution of workers in a factory is given according to the number of dependents they have. Answer the questions.



- The total number of dependent that all the workers have
 1. 560 2. 650 3. 580 4. 540

Solution: $40(1) + 60(2) + 35(3) + 40(4) + 15(5) + 10(6)$
 $= 40 + 120 + 105 + 160 + 75 + 60 = 560$. **So the answer is 1.**

- What is the percentage of illiterate workers among the total workers ?
 1. 48 2. 47.5 3. 48.5 4. 52.5

Solution: Total workers = $40 + 60 + 35 + 40 + 15 + 10 = 200$.

Number of illiterate workers = $15 + 25 + 20 + 20 + 10 + 5 = 95$.

So percentage of illiterate workers among the total workers = $\frac{95}{200} \times 100 = 47.5$.

So the answer is 2.

- The total number of workers in the organization is
 1. 150 2. 200 3. 250 4. 300

Solution: Total number of workers = $40 + 60 + 35 + 40 + 15 + 10 = 200$.

So the answer is 2.

- The ratio of literate workers to illiterate workers is
 1. 21:20 2. 20:21 3. 21:19 4. 19:21

Solution: Total number of workers = 200. Total number of illiterate workers = 95.

Total number of literate workers = 105. So required ratio = $105 : 95 = 21 : 19$.

So the answer is 3.

- The number of literate workers with atleast 3 dependents is
 1. 50 2. 55 3. 65 4. 45

Solution: $15 + 20 + 5 + 5 = 45$. **So the answer is 4.**

Data Analysis: Study the following table and Pie chart and answer the questions.

A : Salaries

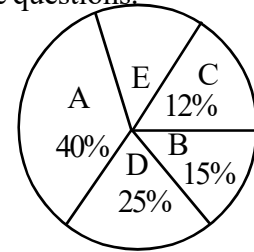
B : Canteen

C : Medical Expenses

D : Insurance and Social Security

E : Miscellaneous

The above diagram shows the heads of expenditure under various categories in percentages in a budget of Rs. 2,880 lakhs of an industry?



1. From the total budget, if the canteen and insurance and social security heads are reduced by 5% and 10% respectively, then what saving could be achieved, in lakhs of rupees?

1. 93.6 2. 28.8 3. 57.6 4. 43.2

Solution: Savings in canteen budget = $\frac{15}{100} \times 2800 \times \frac{5}{100} = 21.6$ lakhs.

Savings in insurance and social security = $\frac{25}{100} \times 2800 \times \frac{10}{100} = 72$ lakhs.

So total savings = $21.6 + 72.0 = 93.6$. **So the answer is 1.**

2. If the total budget is Rs. 8640 lakhs instead of Rs. 2,880 lakhs, then how much amount will be increased on canteen budget, in lakhs of rupees?

1. 764 2. 1152 3. 1296 4. 864

Solution: Canteen budget = 15% of total amount.

If the total amount = 8640, then canteen budget = $\frac{15}{100} \times 8640 = 1296$

If the total amount = 2880, then canteen budget = $\frac{15}{100} \times 2880 = 432$

So increase = $1296 - 432 = 864$. **So the answer is 4.**

3. How much money, in lakhs of rupees, is ear-marked towards the salaries for the employees?

1. 1152 2. 1252 3. 1100 4. 1052

Solution: Salaries = $40\% = \frac{40}{100} \times 2880 = 1152$. **So the answer is 1.**

4. If the insurance premiums during the year amount to 15% of the insurance and social security budget, then how much money, in lakhs of rupees, is left for spending on social security?

1. 108 2. 720 3. 612 4. 288

Solution: Insurance and social security budget = 25% of 2880 = $\frac{25}{100} \times 2880 = 720$

Out of the 720 lakhs 85% of it is for spending on social security = $\frac{85}{100} \times 720 = 612$.

So answer is 3.

5. How much amount, in lakhs of rupees, is saved if miscellaneous allocation is not utilised and 10% of the canteen budget is over spent?

1. 197.2 2. 187.2 3. 273.6 4. 207.6

Solution: Not utilized miscellaneous allocation = 8%. 10% of canteen budget over spent = ~~10% of 15 = 1.5%. So saved = 8% - 1.5% = 6.5% of 2880 = 187.2. So the answer is 2.~~

Study the following table carefully and answer the questions.

Year	1970	1975	1980	1985	1990	1995
Party						
X	20	60	50	40	35	26
Y	200	160	180	220	224	140
Z	80	70	60	40	31	138
A	35	50	40	20	25	36
B	15	10	20	30	35	10

This table shows the number of elected members from various parties in a State Assembly.

- In the year 1975, what percentage of seats did the party B get with respect to party Y?
 - 6.5
 - 5.25
 - 6
 - 6.25

Solution: In 1975 party B get 10, party Y get 160, so required percentage = $\frac{10}{160} \times 100 = 6.25$.
So the answer is 4.

- Which of the two parties could join to form a government in 1995 if Y and Z are opposed to each other?
 - Y and X
 - Z and A
 - Z and X
 - Y and A

Solution: In 1995 Y and X got $26 + 140 = 166$, in 1995 Z and A got $138 + 36 = 174$, in 1995 Z and X got $138 + 26 = 164$, in 1995 Y and A got $140 + 36 = 176$.

In 1995 total members = $26 + 140 + 138 + 36 + 10 = 350$. To form a government minimum required = 176. **So the answer is 4.**

- How many more seats did the party A get over the party B in all the elections put together?
 - 76
 - 86
 - 40
 - 65

Solution: In all elections party A get $35 + 50 + 40 + 20 + 25 + 36 = 206$.

In all elections party B get = $15 + 10 + 20 + 30 + 35 + 10 = 120$.

So party A get 86 seats more than party B. **So the answer is 2.**

- What percentage of growth did the party A gain in 1995 over the previous election?
 - 40
 - 42
 - 44
 - 46

Solution: In 1990 party A get 25 seats and in 1996 it get 36 seats. So growth percentage by

party A in 1995 = $\frac{36 - 25}{25} \times 100 = 44$. **So the answer is 3.**

- What percentage of seats did party Y get in 1990?
 - 70
 - 64
 - 68
 - 62

Solution: In 1990 total number of seats = $35 + 224 + 31 + 25 + 35 = 350$.

Seats secured by party Y in 1990 = 224. So the required percentage = $\frac{224}{350} \times 100 = 64\%$.

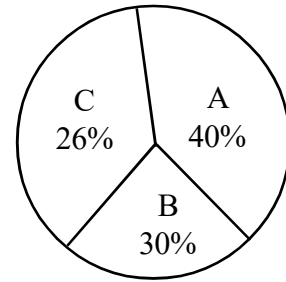
So the answer is 2.

Data Analysis:

Study the following table and Pie chart and answer the questions.

Number of Students in the School

Level	Percentage of Total students	Out of which	
		Boys	Girls
Primary	30%	40%	60%
Middle	40%	60%	40%
High	30%	55%	45%



Division of students into three groups

The above percentage are applicable for all groups. The total number of students in the school is

$$5000. \text{ Primary students} = \frac{30}{100} \times 5000 = 1500, \text{ Primary boys} = \frac{40}{100} \times 1500 = 600, \text{ Primary}$$

$$\text{girls} = 900, \text{ Middle school students} = \frac{40}{100} \times 5000 = 2000, \text{ Middle boys} = \frac{60}{100} \times 2000 =$$

$$1200, \text{ Middle girls} = 800, \text{ Highschool students} = \frac{30}{100} \times 5000 = 1500, \text{ Highschool boys} =$$

$$\frac{55}{100} \times 1500 = 825, \text{ Girls} = 675. \text{ A group students} = \frac{40}{100} \times 5000 = 2000, \text{ B group students}$$

$$= \frac{30}{100} \times 5000 = 1500, \text{ C group} = 1500$$

1. What is the difference between the number of students belonging to group A and B?

1. 400 2. 450 3. 350 4. 500

Solution: $2000 - 1500 = 500$. **So the answer is 4.**

2. Which number of the following is the highest?

1. Boys in the high school 2. Girls in the primary school
3. Girls in the middle school 4. Boys in the middle school

Solution: Boys in the high school = 825, Girls in the primary school = 900,

Girls in the middle school = 800, Boys in the middle school = 2000. **So the answer is 4.**

3. What is the percentage excess of the number of boys in the primary school to those in the middle school...

1. 85% 2. 100% 3. 90% 4. 80%

Solution: The number of boys in primary school = 600, number of boys in middle school =

$$1200. \text{ So percentage excess} = \frac{600}{600} \times 100 = 100\%. \text{ So the answer is 2.}$$

4. What is the total number of girl students in the middle school

1. 850 2. 1000 3. 800 4. 940

Solution: Girl students in the middle school = $\frac{40}{100} \times \frac{40}{100} \times 5000 = 800$. **So the answer is 3.**

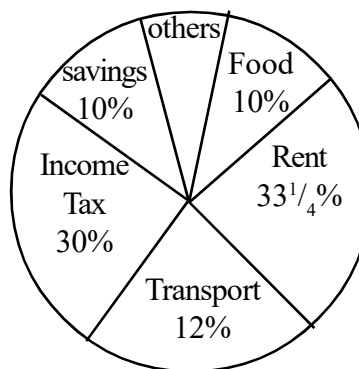
5. What is the number of girls belonging to group A and the High School?

1. 270 2. 380 3. 460 4. 480

Study the following pie chart and answer the questions.

Expenditure pattern of Mr. Jaideep.

Monthly salary of Mr. Jaideep is Rs.24,000 in 2006



- If Mr. Jaideep's salary increases by 10% and income tax also increases by 10% over its existing rate then what will be his new savings, given that all other components have the same percentage as in 2006.

1. Rs.1940 2. Rs.2080 3. Rs.2240 4. Rs.1848

Solution: After 10% increase salary = $\frac{110}{100} \times 24000 = 26,400$.

Income tax increase by 10%. So the new rate of income tax = $\frac{110}{100} \times 30 = 33\%$.

So new savings = 7% of 26400 = $\frac{7}{100} \times 26400 = 1848$. **So the answer is 4.**

- What is the ratio of the amount meant for others to that of food?

1. 7 : 15 2. 17 : 30 3. 15 : 7 4. 3 : 4

Solution: $4\frac{2}{3} : 10 \Rightarrow \frac{14}{3} : 10 \Rightarrow 14 : 30 \Rightarrow 7 : 15$. **So the answer is 1.**

- What is the amount of rent paid by the Mr.Jaideep per month?

1. Rs.7500 2. Rs. 8000 3. Rs.8500 4. Rs.9000

Solution: $\frac{24000}{100} \times \frac{100}{3} = 8000$ (because $33\frac{1}{3} = \frac{100}{3}$). **So the answer is 2.**

- Mr. Jaideep could not go to work for six days in June 2006 due to ill health and it was a loss of pay during that period. At the end of that month, what was his net salary after payment of income tax?

1. Rs.14,800 2. Rs.13,440 3. Rs.12,880 4. Rs.13,220

Solution: In June 2006, he was absent for 6 days. He worked for 24 days.

So his 24 days salary = $24000 \times \frac{24}{30} = 19,200$. Income tax = $30\% = \frac{30}{100} \times 19,200 = 5,760$.

His net salary after payment of income tax = $19,200 - 5,760 = 13,440$. **So the answer is 2.**

- What is the angle made by the sector representing the transport expenditure?

1. 41.8° 2. 42.2° 3. 43.2° 4. 38.2°

Solution: 100% means 360°. Transport expenditure = 12%. So the angle made by the

sector representing the transport expenditure = $\frac{12}{100} \times 360 = 43.2^\circ$. **So the answer is 3.**

Study the following table carefully & answer the questions. Performance of students of a college

Year	2000	2001	2002	2003	2004	2005	2006
No. of students Appeared	750	780	840	960	1040	1200	1430
No. of students passed with distinction	150	130	142	127	308	246	397
No. of students passed	300	390	278	483	472	354	323

1. In which year the distinction percentage is maximum?

1. 2004 2. 2006 3. 2001 4. 2000

Solution: In 2004, $\frac{308}{1040} \times 100 = 29.6\%$; In 2006, $\frac{397}{1430} \times 100 = 27.8\%$;

In 2001, $\frac{130}{780} \times 100 = 16.7\%$; In 2000, $\frac{150}{750} \times 100 = 20\%$. **So answer is 1.**

2. If the policy of the college is to give Rs. 1,000 as prize to each of the students passed with distinction, then in which year the college has spent maximum on this account?

1. 2003 2. 2004 3. 2005 4. 2006

Solution: In 2003, 127 students; In 2004, 308 students; In 2005, 246 students; In 2006, 397 students. **So answer is 4.**

3. In which year the failure percentage is least

1. 2003 2. 2001 3. 2000 4. 2004

Solution: In 2003, $\frac{350}{960} \times 100 = 38.9\%$ {Because total failed in 2003 = $960 - 127 - 483 = 350$ }.

In 2001, $\frac{360}{780} \times 100 = 46.2\%$ {Because total failed in 2001 = $780 - 130 - 390 = 360$ }.

In 2000, $\frac{300}{750} \times 100 = 40\%$ {Because total failed in 2000 = $750 - 150 - 300 = 300$ }.

In 2004, $\frac{260}{1040} \times 100 = 25\%$ {Because total failed in 2004 = $1040 - 308 - 472 = 260$ }.

So answer is 4.

4. The percentage of students who have passed with distinction in the year 2006 is

1. 26.76% 2. 28.64% 3. 27.76% 4. 28%

Solution: $\frac{397}{1430} \times 100 = 27.76\%$. **So answer is 3.**

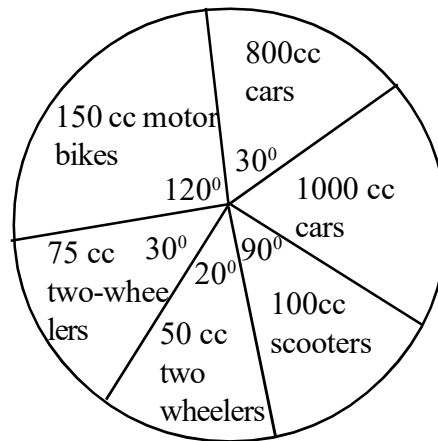
5. The percentage of students who have passed or with distinction in the year 2004

1. 74% 2. 75% 3. 76% 4. 77%

Solution: Students who have passed or with distinction in the year 2004 = $308 + 472 = 780$.

So the percentage = $\frac{780}{1040} \times 100 = 75\%$. **So answer is 2.**

An automobile company manufactures vehicles as given in the following Pie diagram study this carefully and answer questions 51 to 55.



1. In a period, if the total number of vehicles manufactured by the company is 7200, then the number of 1000 cc cars among them is

1. 1200 2. 1400 3. 1000 4. 1500

Solution: $360^\circ = 7200$ vehicles.

$$1000 \text{ cc cars} = 360^\circ - 120^\circ - 30^\circ - 90^\circ - 30^\circ - 20^\circ = 70^\circ = \frac{70}{360} \times 7200 = 1400.$$

So answer is 2.

2. The ratio of the 4-wheelers and 2-wheelers produced by the company is

1. 13 : 5 2. 4 : 9 3. 9 : 4 4. 5 : 13

Solution: Ratio of the 4-wheelers = 100° ; Ratio of 2-wheelers = 260° .

So $100 : 260 \Rightarrow 5 : 13$. **So answer is 4.**

3. The ratio of the 75cc 2-wheelers and 50cc 2-wheelers is

1. 2 : 1 2. 1 : 2 3. 3 : 2 4. 2 : 3

Solution: Ratio of 75cc 2-wheelers = 30° ; Ratio of 50cc 2-wheelers = 20° .

So $30 : 20 \Rightarrow 3 : 2$. **So answer is 3.**

4. The percentage of 150cc motor bikes in the total production by the company is

1. 30% 2. $33\frac{1}{3}\%$ 3. $32\frac{1}{3}\%$ 4. 32%

Solution: Ratio of 150cc motor bikes = 120° .

$$\text{So the percentage of 150cc motor bikes in total production} = \frac{120}{360} \times 100 = 33\frac{1}{3}\%$$

So answer is 2.

5. If the number of 75cc 2-wheeler manufactured in a month is 2700, then the total number of vehicles manufactured by the company in the month is

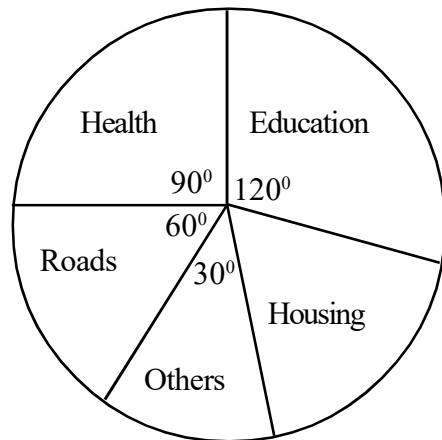
1. 32400 2. 30860 3. 32600 4. 33800

Solution: Ratio of 75cc 2-wheelers is $30^\circ = 2700$ vehicles.

$$\text{The total number of vehicles manufactures that month} = \frac{360}{30} \times 2700 = 32400$$

So the answer is 1.

The following pie chart shows how the municipal funds are spend under different heads in a year. Study the chart carefully and answer equations.



1. Which single head uses 25% of the funds?

1. Health 2. Education 3. Housing 4. Roads

Solution: The percentage of expenditure on health = $\frac{90}{360} \times 100 = 25\%$. **So the answer is 1.**

2. What percentage is spent on housing?

1. $19\frac{2}{3}$ 2. $16\frac{1}{3}$ 3. 15 4. $16\frac{2}{3}$

Solution: The percentage of expenditure on housing = $\frac{60}{360} \times 100 = 16\frac{2}{3}\%$.

So the answer is 4.

3. What is the ratio of the expenditure on Education to that on health?

1. 3 : 2 2. 2 : 3 3. 3 : 4 4. 4 : 3

Solution: The ratio of the expenditure on Education to that on Health $120 : 90 = 4 : 3$.

So the answer is 4.

4. Which heads has the maximum expenditure?

1. Health 2. Education 3. Roads 4. Housing

Solution: The expenditure on Education is maximum (because it is representing 120°).

So the answer is 2.

5. Which heads have the same amount of expenditure?

1. Housing and Education 2. Health and Housing
3. Roads and Housing 4. Housing and Others

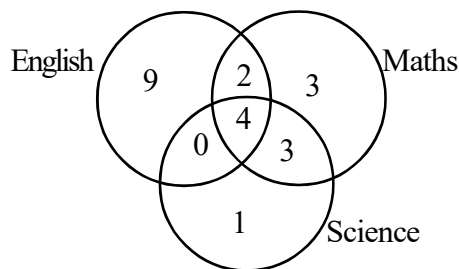
Solution: Roads and Housing have the same amount of the expenditure.

(Because both represents 60°)

So the answer is 3.

(Note: Housing = $360^\circ - 120^\circ - 90^\circ - 60^\circ - 30^\circ = 60^\circ$)

The following figure has three intersecting circles, each representing a group of students who got first class marks in the subject shown against it. Study the figure carefully and answer the questions.



1. The number of students who got first class marks in more than one subject?

1. 8 2. 12 3. 9 4. 10

Solution: $2 + 4 + 3 + 0 = 9$ (intersection part of the circles).

So the answer is 3.

2. How many students got first class marks in Science?

1. 6 2. 8 3. 7 4. 4

Solution: $0 + 4 + 3 + 1 = 8$ (numbers in Science circle)

So the answer is 2.

3. How many students got first class marks in all the three?

1. 1 2. 2 3. 3 4. 4

Solution: 4 (the intersection part of all the 3 circles).

So the answer is 4.

4. How many students got first class marks only in Mathematics?

1. 1 2. 2 3. 3 4. 4

Solution: 3 (the number in Mathematics circle which out of the intersecting part).

So the answer is 3.

5. The percentage of students who got first class marks in English among students who got first class marks in atleast one of the three subjects?

1. $68\frac{2}{11}$ 2. $48\frac{2}{11}$ 3. $58\frac{2}{11}$ 4. 62

Solution: Total students = $9 + 2 + 3 + 0 + 4 + 3 + 1 = 22$.

The number of students who got first class marks in English = $9 + 2 + 4 + 0 = 15$

So the required percentage = $\frac{15}{22} \times 100 = 68\frac{2}{11}$.

So the answer is 1.

Study the following table carefully and answer the questions. The following table gives the number of cars of different models A, B, C, D, E, manufactured by a company in the years 1996 to 2001.

Type Year	A	B	C	D	E	Total
1996	18	23	21	12	40	114
1997	20	18	24	14	35	111
1998	18	21	20	18	42	119
1999	22	26	19	21	44	132
2000	25	30	22	25	48	150
2001	28	34	26	30	52	170

1. In what type of cars the percentage of increase is more from 1998 to 1999?

1. B 2. D 3. E 4. C

Solution: B type cars percentage of increase = $\frac{26-21}{21} \times 100 = 23.80$

Similarly D type cars percentage of increase = 16.66

and E type cars percentage of increase = 4.76

C type cars percentage of increase = negative increase. **So the answer is 1.**

2. In 1999, which type of cars constitute approximately 20% of the total number of cars produced in that year?

1. E 2. B 3. C 4. D

Solution: Total cars produced in 1999 = 132.

20% of 132 = $\frac{20}{100} \times 132 = 26.4$. **So the answer is 2.** (because B type cars produced = 26)

3. In the years 1996 and 2000 put together, which type of cars constitute approximately 20% of the total number of cars produced in the two years?

1. E 2. C 3. B 4. D

Solution: Total number of cars produced in 1996 and 2000 = 114 + 150 = 164.

20% of 164 = $\frac{20}{100} \times 164 = 32.8$. **So the answer is 3.**

(because E type cars produced = 40 + 48 = 88; C type cars produced = 21 + 22 = 43; B type cars produced = 23 + 30 = 53; D type of cars produced = 12 + 25 = 37)

4. The approximate percentage of increase in the total production of cars in the year 2001 over the year 1996 is

1. 40% 2. 45% 3. 50% 4. 55%

Solution: $\frac{170-114}{114} \times 100 = 49.1\%$ approximate. **So the answer is 3.**

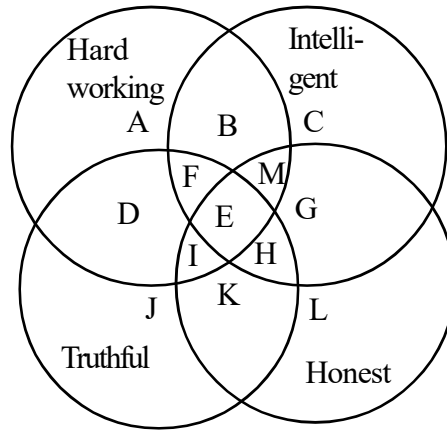
5. In which year the percentage increase of total number of cars manufactured is more?

1. 1998 2. 1999 3. 2000 4. 2001

Solution: In 1998, $\frac{119-111}{111} \times 100 = 7.2\%$; In 1999, $\frac{132-119}{119} \times 100 = 10.9\%$;

In 2000, $\frac{150-132}{132} \times 100 = 13.6\%$, In 2001, $\frac{170-150}{150} \times 100 = 13.3\%$. **So the answer is 3.**

Directions: Below is given a figure with four intersecting circles, each representing a group of persons having the quality written against it. Study the figure carefully and answer the questions.



A = Only Hardworking; C = Only Intelligent; J = Only Truthful; L = Only Honest;
 B = Hardworking and Intelligent; D = Hardworking and Truthful; K = Truthful and Honest;
 G = Intelligent and Honest; M = Hardworking and Intelligent and Honest;
 F = Hardworking and Intelligent and Truthful; I = Hardworking and Truthful and Honest;
 H = Honest and Truthful and Intelligent; E = All four qualities.

1. The region which represents people who are not honest but possess all other three qualities, is denoted by

1. B 2. F 3. D 4. M

Answer is 2.

2. The region which represents the people who are neither honest nor truthful but are intelligence and hard working, is denoted by

1. A 2. C 3. D 4. B

Answer is 4.

3. The people possessing all the four qualities are represented by

1. E 2. F 3. I 4. H

Answer is 1.

4. The honest people who are not possessing any of the other three qualities are represented by

1. K 2. H 3. G 4. L

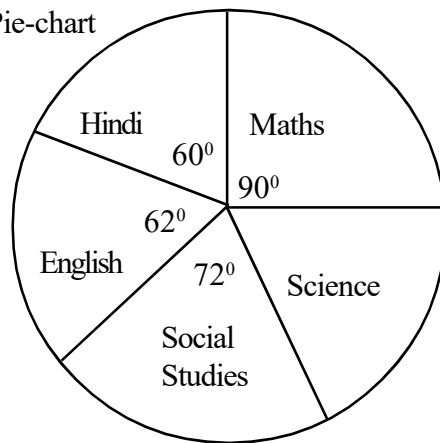
Answer is 4.

5. The region which represents the people who are intelligent, honest and truthful but not hard working is denoted by

1. F 2. E 3. H 4. I

Answer is 3.

Directions: The following Pie diagram shows the marks secured by a student in different subjects in an examination. If the student scored 135 marks in Mathematics, answer the following questions after studying the Pie-chart



- What is the total number of marks secured by the student in all the subjects put together ?
 (1) 360 (2) 450 (3) 540 (4) 720
Solution: $90^\circ \Rightarrow 135$ marks. So $360^\circ \Rightarrow 135 \times 4 = 540$ marks. **Answer is 3.**
- How many marks did he score in Science ?
 (1) 108 (2) 114 (3) 120 (4) 136
Solution: $90^\circ \Rightarrow 135$ marks. So $76^\circ \Rightarrow 114$ marks. **Answer is 2.**
- How many more, marks did the student score in Science and English put together than he scored in Social Studies and Hindi put together ?
 (1) 9 (2) 18 (3) 27 (4) 45
Solution: Science + English = $76^\circ + 62^\circ = 138^\circ$.
 Hindi + Social studies = $60^\circ + 72^\circ = 132^\circ$.
 Therefore difference = 6° .
 $90^\circ \Rightarrow 135$ marks.
 So $1^\circ \Rightarrow 1.5$ marks.
 Therefore $6^\circ = 1.5 \times 6 = 9$ marks. **Answer is 1.**
- The ratio of the marks scored by him in Hindi to the marks scored in Social Studies, is
 (1) 2 : 3 (2) 3 : 4 (3) 4 : 5 (4) 5 : 6
Solution: Hindi : Social studies = $60^\circ : 72^\circ = 5 : 6$ (dividing with 12). **Answer is 4.**
- Out of the total marks scored by him in the examination, the percentage of marks scored in Social Studies is C
 (1) 15 (2) 20 (3) 25 (4) 30
Solution: $90^\circ \Rightarrow 135$ marks.
 Social studies = 72° .

The percentage of marks scored in Social studies = $\frac{72^\circ}{360^\circ} \times 100 = 20$. **Answer is 2.**

ICET - 2011

Notes for the following five Questions : Each of the integers from 1 to 16 are to be placed on the Venn diagram given below in the appropriate regions A to H. Take

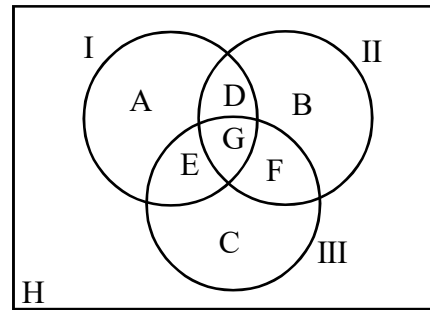
$S = \{\text{the set of Integers from 1 to 16}\}$

$I = \{\text{The set of odd integers from 1 to 16}\}$

$II = \{\text{The set of perfect square integers from 1 to 16}\}$

$III = \{\text{The set of prime integers from 1 to 16}\}$

$H = S - \{I \cup II \cup III\}$



Answer the following five questions based on this data.

1. Which regions in the diagram are empty (not represented) ? **Answer is 4.**
 (1) G only (2) C and G only (3) A and F only (4) G and F only

2. Which regions contain a single integer ? **Answer is 3.**
 (1) B and D only (2) G and D only (3) A and C only (4) E and B only

3. Which regions contain five integers ? **Answer is 1.**
 (1) E and H only (2) D and B only (3) B only (4) A and C only

4. Which regions contain two integers ? **Answer is 2.**
 (1) E and F only (2) B and D only (3) A and E only (4) C only

5. The number of elements contained in the regions E and D put together is **Answer is 3.**
 (1) 5 (2) 6 (3) 7 (4) 8

$S = \{\text{the set of Integers from 1 to 16}\} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16\}$

$I = \{\text{The set of odd integers from 1 to 16}\} = \{1, 3, 5, 7, 9, 11, 13, 15\}$

$II = \{\text{The set of perfect square integers from 1 to 16}\} = \{1, 4, 9, 16\}$

$III = \{\text{The set of prime integers from 1 to 16}\} = \{2, 3, 5, 7, 11, 13\}$

$H = S - \{I \cup II \cup III\} = \{6, 8, 10, 12, 14\} \Rightarrow H$ contains five elements

$D = I \cap II = \{1, 9\} \Rightarrow D$ contains two elements

$E = I \cap III = \{3, 5, 7, 11, 13\} \Rightarrow E$ contains five elements

$G = I \cap II \cap III = \{\} = \text{Null or empty.}$

$F = II \cap III = \{\} = \text{Null or empty.}$

$A = I - (D \cup E \cup G) = \{15\} \Rightarrow A$ contain one element

$B = II - (D \cup F \cup G) = \{4, 6\} \Rightarrow B$ contains two elements

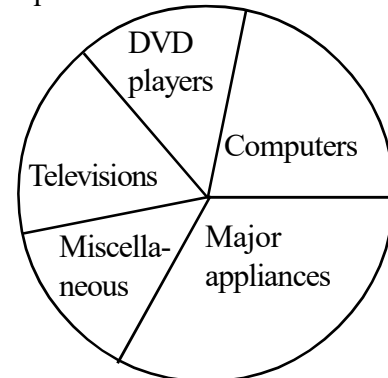
$C = III - (D \cup E \cup F) = \{2\} \Rightarrow C$ contain one element

$D \cup E = \{1, 3, 5, 7, 9, 11, 13\} \Rightarrow$ number of elements in the regions E and D put together is 7.

ICET-2012

The following Pie-chart gives the percentages of various items manufactured by an electronic company in a particular year. Based on this diagram, answer the questions from 1 to 5.

Major appliances	: 40%
Computers	: 25%
Televisions	: 17%
DVD Players	: 10%
Miscellaneous	: 8%



1. If 50% of the miscellaneous amount is Rs 180 lakhs, then the total investment in that year (in crores of rupees) is

1. 35 2. 40 3. 45 4. 48

Solution: Miscellaneous = 8%, 50% of this is 4%. Given that 4% is Rs. 180 lakhs.

So total investment = 100% = $25 \times 4\% = 25 \times 180 \text{ lakhs} = 4500 \text{ lakhs} = 45 \text{ crores}$. **Ans. is 3.**

2. The ratio of the number of computers produced to the number of DVDs produced in that year is

1. 25 : 17 2. 8 : 5 3. 5 : 2 4. 5 : 4

Solution: Computers : DVD $\Rightarrow 25 : 10 \Rightarrow 5 : 2$. **Answer is 3.**

3. If 10% of the major appliances cost is towards manufacturing the accessories and if the total investment in that year is Rs. 32 crores, the cost of producing the accessories (in crores of rupees) is

1. 2.56 2. 1.28 3. 0.64 4. 0.32

Solution: Given the total investment = Rs. 32 crores. i.e. 100% is 32 crores.

Major appliances = 40%. So 10% of 40% = 4%

So the cost of producing the accessories = $\frac{4}{100} \times 32 = \frac{32}{25} = 1.28 \text{ crores}$. **Answer is 2.**

4. If the company produced 12000 computers in that year, how many televisions it has manufactured during that year.

1. 8160 2. 7260 3. 6360 4. 5460

Solution: Computers produced = 12,000. i.e. 25% means 12,000.

No. of Televisions manufactured = $\frac{17}{25} \times 12,000 = 8160$. **Answer is 1.**

5. If the company manufactured 3400 televisions and the manufacturing cost of a DVD player is Rs.3400, then money invested (in Lakhs of Rupees) for DVD players by the company is

1. 60 2. 62 3. 64 4. 68

Solution: Television manufactured = 3,400. i.e. 17% means 3,400.

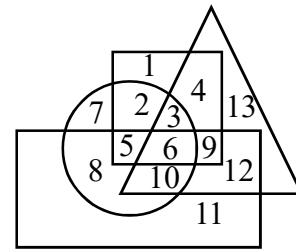
So 10% = 2,000. Cost of one DVD Player = Rs. 3,400.

So Cost of 2,000 DVD Players = $2,000 \times 3,400 = 68,00,000 = 68 \text{ lakhs}$. **Answer is 4.**

ICET-2012

In the diagram given below, the square represents women, the triangle represents government service employees, the circle represents educated persons and the rectangle represents persons working in private sector. Each section of the diagram is numbered.

Read the diagram and answer the questions from 1 to 5.



1. The region numbered 10 represents
 1. Educated women working in private sector
 2. Uneducated men in government service
 3. Educated men working in private sector
 4. Educated men working in private sector and in government service

Solution: 10 = circle + triangle + rectangle - square. **Answer is 4.**

2. Region 2 represents
 1. Educated women without job
 2. Uneducated women without job
 3. Educated men working in government service
 4. Uneducated men working in government service

Solution: 2 = circle + square. **Answer is 1.**

3. The number of region that represents uneducated women who are in government service and in the private sector is
 1. 4
 2. 6
 3. 9
 4. 12

Solution: 4 = triangle + square; 6 = triangle + square + circle + rectangle.
 9 = triangle + square + circle; 12 = triangle + rectangle. **Answer is 3.**

4. The region representing the educated persons without job is
 1. 7
 2. 2
 3. 7 and 2
 4. 8 and 9

Solution: 7 = circle; 2 = circle + square.
 8 = circle + rectangle; 9 = triangle + square + rectangle. **Answer is 3.**

5. The number of the region representing educated women in government service, is
 1. 2
 2. 3 and 6
 3. 4
 4. 6 and 9

Solution: 2 = square + circle; 3 = triangle + square + circle.
 6 = triangle + square + circle + rectangle.
 9 = triangle + square + rectangle. **Answer is 2.**

Note: Square = Women Triangle = Government service employees i.e.(Government service Men + Government service Women)

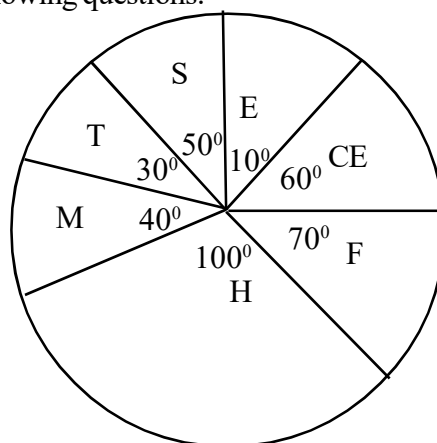
Circle = Educated persons i.e. (Educated men + Educated Women)

Rectangle = Persons working private sector i.e. (Private service Men + Private service Women)

ICET-2013

The amounts spent by a person under various heads in a month is given in the following Pie Chart. Based on this information answer the following questions.

S - Savings
E - Entertainment
CE - Children Education
F - Food
H - House Rent
M - Miscellaneous
T - Travel



- The amount spent on children education is equal to the amounts spent on which of the following two heads ? [4]
1. Entertainment and miscellaneous 2. Travel and miscellaneous
3. Savings and travel 4. Savings and entertainment
- If the amount spent on house rent in a month is Rs. 5,000 more than the amount spent on travel and savings put together, then the monthly income in (Rs.) of the person is [2]
1. 25,000 2. 90,000 3. 1,00,000 4. 45,000
- Monthly savings percentage is [1]
1. $13\frac{8}{9}\%$ 2. $13\frac{2}{9}\%$ 3. $13\frac{1}{9}\%$ 4. 14%
- If the monthly income of the person is Rs. 54,000, then the difference between the amounts spent on travel and food per month (in Rs.) is [3]
1. 21,600 2. 16,200 3. 6,000 4. 12,000
- If the amounts spent on savings and children education put together is Rs. 22,000, then the monthly income of the person (in Rs.) is [3]
1. 7,000 2. 66,000 3. 72,000 4. 36,000

ICET-2013

In a group of 75 students 28 students study Mathematics (M), 32 study Physics (P), 30 study Chemistry (C) and 15 students study none of these; 13 study both M and P, 12 study P and C and 10 study C and M. Based on this information answer the following ***TWO*** questions

1. The number of students who study only Chemistry is [1]
1.13 2.14 3.15 4.16
2. The number of students who study Physics alone is [3]
1.10 2.13 3.12 4.15

NOTE: The following table gives the details of the 5 commodities A, B, C, D, E required, with their costs, for a family in a month. Study the table and answer the following 3 questions.

Commodity	Quantity required/month (in kg)	Rate/kg in Rs.	
		Year 1990	Year 1995
A	10	70	100
B	15	40	45
C	8	35	40
D	25	50	60
E	5	58	62

1. The amount (in Rs.) spent extra on commodities B and C in the year 1995 than in the year 1990 is [1]
1.115 2.230 3.260 4.180
2. The total amount (in Rs.) spent on all the 5 commodities by the family in 1990 is [add score]
1.253 2.315 3.302 4.312
3. The percentage of increase (per kg) in the rate of the commodity E from 1990 to 1995 is [2]
1.20.3% 2.6.89% 3.34.5% 4.17.8 %

ICET-2014**Data Analysis****(Marks : 10)**

Note : An automobile company produces four types of vehicles (Cars, Motor bikes; Scooters and Mopeds) at different branches in the country. The production at these units from 2007 to 2012 are given in the table below. Answer the questions 1 to 3 using the table.

	2007	2008	2009	2010	2011	2012
Cars	3600	6300	8100	10800	16200	19800
Motor bikes	7000	12250	15750	21000	31500	38500
Scooters	8000	14000	18000	24000	36000	44000
Mopeds	9000	15750	20250	27000	40500	19500

1. The ratio of the number of Cars produced in 2008 to the number of Scooters produced in 2011 is
 (1) 37:40 (2) 27:40 (3) 17:40 (4) 7:40 **Answer 4**

2. In which year the total number of the four types of vehicles produced was 62100 ?
 (1) 2007 (2) 2008 (3) 2009 (4) 2010 **Answer 3**

3. If $k : 1$ is the ratio of the number of Scooters produced in the year 2011 to the number of Scooters produced in 2007, then $k =$ **Answer 3**
 (1) 3 (2) 4 (3) $9/2$ (4) $2/9$

Note: Given that

$$A = \{n : n \text{ prime}, 1 \leq n \leq 20\};$$

$$B = \{n : n \text{ odd}, 1 \leq n \leq 20\}$$

$$\text{and } C = \{n : n \text{ square}, 1 \leq n \leq 20\}.$$

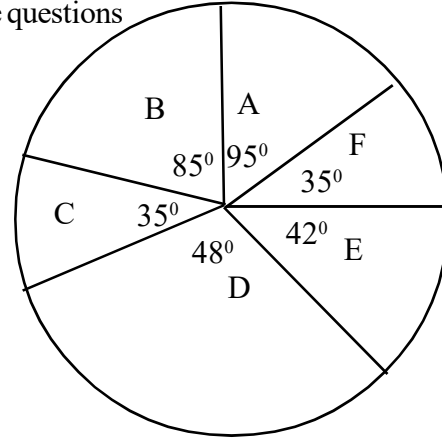
Using this answer the questions 4 and 5.

4. $B \cap C =$ **Answer 4**
 (1) $\{1, 4, 9, 16\}$ (2) $\{1, 3, 5, 7, 9, 11, 13, 15, 17, 19\}$ (3) Φ (4) $\{1, 9\}$

5. The number of integers between 1 and 20 which do not lie in $A \cup B \cup C$ is
 (1) 8 (2) 7 (3) 6 (4) 5 **Answer 2.**

ICET-2014

Note: The expenditure under six heads A, B, C, D, E and F in an year are as given in the following Pie diagram. Answer the questions 1-5 using the diagram.



1. If the total expenditure in an year is Rs.54,00,000, then the expenditure (in rupees) under the head E in that year is

Answer 3

- (1) Rs.3,60,000 (2) Rs.4,20,000 (3) Rs.6,30,000 (4) Rs.7,20,000

2. If the expenditure under the heads A and B together is Rs.18,00,000 in an year, then the expenditure under the head D in that year is

Answer 2

- (1)Rs.4,20,000 (2)Rs.4 80,000 (3)Rs.5,50,000 (4)Rs.8,50,000

3. If the difference in the expenditure under the heads A and B in an year is Rs.2.5 lakhs, then the total expenditure (in lakhs of rupees) in that year is

Answer 1

- (1) 90 (2) 81 (3) 72 (4) 63

4. If the expenditure under the head E in an year is Rs.3.5 lakhs, then the expenditure (in lakhs of rupees) under the head D in that year is

Answer 1

- (1)3 (2) 3.5 (3)4 (4) 4.5

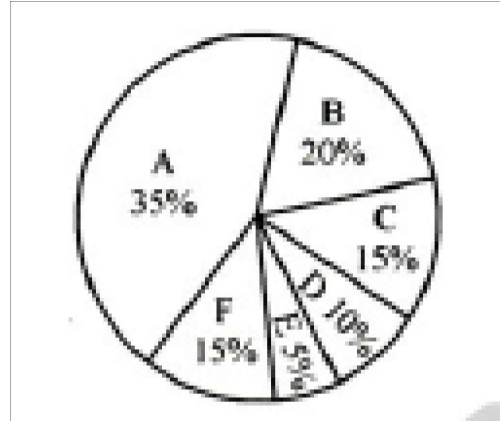
5. In any year the expenditure under the heads C and F together is equal to

Answer 3

- (1) half of the expenditure on B and F together.
(2) double the expenditure on C.
(3) the expenditure on D and E.
(4) the expenditure on A.

Telangana ICET-2015

Note: The following Pie diagram illustrate the yearly expenditure of an educational institution towards six heads: A-Staff salaries, B-Maintenance, C-Laboratories, D- Learner activities, E-Examinations and F-Miscellaneous. Using the data given answer the five questions .



1. In a year total expenditure incurred towards E is 20 lacs of rupees. Then the expenditure towards D (in lacs) is **Answer 4**
(1) 30 (2) 35 (3) 45 (4) 40
2. The sectorial angle corresponding to A is **Answer 3**
(1) 105° (2) 120° (3) 126° (4) 145°
3. The total sectorial angle corresponding to the heads C, D and E is **Answer 2**
(1) 125° (2) 108° (3) 120° (4) 90°
4. If in a year the expenditure under B is 30 lac more than the expenditure under E, then the total expenditure (in Lacs) for that year is **Answer 1**
(1) 200 (2) 185 (3) 175 (4) 150
5. If the annual expenditure is 200 lacs, then the expenditure towards F (in lacs) is **Answer 2**
(1) 25 (2) 30 (3) 32 (4) 35

Coding and Decoding ICET- 2014:

The letters A, B, C, ..., Z of the English alphabet are NUMBERED AS 1, 2, 3, ..., 26 respectively. A code is designed by shifting r^{th} letter to $(14 - r)^{\text{th}}$ letter if $1 \leq r \leq 13$ and s^{th} letter to $(40 - s)^{\text{th}}$ letter if $14 \leq r \leq 26$. The reverse process is used for decoding. Based on this coding and decoding system answer the following 10 questions.

1. The code word for 'HYDERABAD' is -----**ANSWER:1**
(1) FOJIVMLMJ (2) FJOIVMJML (3) FIJOVMLMJ (4) FIOJMVLMJ
2. The code word for 'WARANGAL' is -----**ANSWER:2**
(1) QMUMZBGM (2) QMVMZGMB (3) QVMZMBGM (4) QVMZMGBM
3. Which word is coded as 'IPKFMZGI'? -----**ANSWER:3**
(1) ENTRANCE (2) ELEGANCE (3) EXCHANGE (4) EMPATHIE
4. Which word is coded as 'UIBIKTEYZ'? -----**ANSWER:2**
(1) SEDUCTION (2) SELECTION (3) SUGGESTED (4) SHOCKINGS
5. The word for 'TIRUPATI' is -----**ANSWER:4**
(1) TEMXVSTE (2) TESVXMTE (3) TESVMXTE (4) TVSXMTE
6. If 'TEACHER' is coded as 'UFBDIFS' then the code word for 'PARENT' is -----**ANSWER:2**
(1) QSB OFU (2) QBSFOU (3) RBSENU (4) QRAESU
7. If 'BOMBAY' is coded as 'OBZONL', then the code for 'DELHI' is -----**ANSWER:3**
(1) QRYVU (2) QYRUV (3) QRYUV (4) RQYUV
8. If COMMERCE is coded as DONNESDE, then the code for BIOLOGY is -----**ANSWER:2**
(1) CJPM PHZ (2) CIOMOHZ (3) CIOOMHZ (4) CIOMOZH
9. If FILURE is coded as EZHKTQD, then the code for SUCCESS is -----**ANSWER:3**
(1) RSDDFRR (2) RTDDFRR (3) RTBBDRR (4) RTCBRDR
10. If TRIANGLE is coded as USJBOHMF, then the code word for SQUARE is ---**ANSWER:4**
(1) TRUBSF (2) TRVSBF (3) TRUSBF (4) TRVBSF

Coding and Decoding ICET- 2013:

The letters of the English alphabets are arranged cyclically. Then the letters are coded as follows: (i) a vowel is to be coded as the second vowel after it in the clockwise direction. and (ii) a consonent is to be coded as the second consonent after it in the clockwise direction. For decoding, the inverse process is to be followed. Based on this coding and decoding system answer the following 5 questions.

1.The code word for 'LEAVE' is -----**ANSWER:1**
 (1) NOIXO (2) NOIXU (3) JUOTO (4) JUOTU

2.The word that is coded as 'RNIVO' is -----**ANSWER:3**
 (1) TLATE (2) PLATA (3) PLASE (4) TQUXA

3.The word that is coded as 'QUEUE' is -----**ANSWER:3**
 (1) NIOIO (2) SEOEO (3) NIUIU (4) SIOIO

4. Code word for 'HAND' is-----**ANSWER:4**
 (1) KIQH (2) KIQF (3) KIPG (4) KIQG

5. The word that is coded as 'RIUT' is-----**ANSWER:1**
 (1) PAIR (2) PAIW (3) PAAR (4) PUIR

1	2	3	4	5	6	7	8	9	10	11	12	13
A	B	C	D	E	F	G	H	I	J	K	L	M
L	S	Z	G	N	U	B	I	P	W	D	K	R
14	15	16	17	18	19	20	21	22	23	24	25	26
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
Y	F	M	T	A	H	O	V	C	J	Q	X	E

6. If the word 'CENTRAL' is coded as 'LARTNEC', then the code word for 'SEMINAR' is
 (1) RINAMES (2) RANMIES (3) RAMNIES (4) RANIMES **ANSWER:4**

7. If the word 'FLUTE' is coded as 'EJRPZ', then the code word of 'PLANE' is **ANSWER:1**
 (1) OJXIZ (2) OJXKZ (3) OJXLZ (4) OJXLA

8. If the code word for 'VICTORY' is 'XKVQTA' then the code word for 'SUCCESS' IS
 (1) UWEEGUU (2) VXFFHV V (3) UWEEGVV (4) UWEEHUU **ANSWER:1**

9.If the word COMPUTER is coded as RFUVQNPC, the code word for MEDICINE is
 (1) EOJDJEFM (2) EMIDIFEM (3) EOKDKFEM (4) EOLDLFEM **ANSWER:3**

10.If the word DWUKPGUU is coded as BUSINESS, the word MANAGEMENT is coded as
 (1) KZLZECKCLR (2) KXLXECKCLR (3) KYLYECKCLR (4) KYLEDKDLR **ANSWER:3**

Coding and Decoding ICET- 2012:

In a certain code the m^{th} letter of the English alphabet is coded as the n^{th} letter where n is the remainder obtained when $7m + 5$ is divided by 26, $1 \leq n \leq 26$. For example, the third letter C becomes $(7 \times 3 + 5) = 26^{\text{th}}$ letter Z in the coded language. For decoding, the reverse process is followed. Based on this information, answer the following five questions.

- The code word for 'BUST' is-----**ANSWER:2**
(1) SUGP (2) SVHO (3) SWIQ (4) TJHO
- The word that is coded as 'BLPY' is -----**ANSWER:2**
(1) GAIL (2) GAIN (3) RAIN (4) GARE
- Which word is coded as 'RNLKH'? -----**ANSWER:1**
(1) MEALS (2) TRIMS (3) MEATS (4) TRAIN
- The number of letters that are invariant in this code is-----**ANSWER:4**
(1) 3 (2) 2 (3) 1 (4) 0
- The code word for 'FRAME' is-----**ANSWER:3**
(1) UAMSO (2) TZKQM (3) UALRN (4) TZMSO

1	2	3	4	5	6	7	8	9	10	11	12	13
A	B	C	D	E	F	G	H	I	J	K	L	M
L	S	Z	G	N	U	B	I	P	W	D	K	R
14	15	16	17	18	19	20	21	22	23	24	25	26
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
Y	F	M	T	A	H	O	V	C	J	Q	X	E

Note: Based upon the following coding system and the conditions (i), (ii), (iii), given below answer the following five questions.

Number/Symbol: 7 3 & 6 % 2 # 8 4 @ 1 + 5 \$
Code : S H P W L D K J X Z Q T N F

Conditions:

- If the first element is a symbol and the last element is a number, then the codes for both elements are to be interchanged
- If both the first and the last elements are symbols, then the last elements code is to be taken as the code for the first element.
- If the group of elements contain only one symbol, then that symbol is to be coded as A.

- What is the code word for '4563l#'? **ANSWER:3** (by applying condition-iii)
(1) ANWHQX (2) XNWHQX (3) XNWHQA (4) XNHWQA
- What is the code word for '3+5641'? **ANSWER:1** (by applying condition-iii)
(1) HANWXQ (2) QANWXH (3) HANXWQ (4) HANWXW
- What is the code word for '@4153+'? **ANSWER:1** (by applying condition-ii)
(1) TXQNHT (2) ZQXNHZ (3) TQXNHT (4) ZXQNHZ
- What is the code word for '2@7\$4&'? **ANSWER:2** (No condition)DIRECT
(1) DASFXP (2) DZSFXP (3) PZSAXD (4) DZSXFP
- What is the code word for '%82 & 47'? **ANSWER:3** (by applying condition-i)
(1) LDJPXS (2) SJDXP L (3) LSJD PXL (4) LJDPXS

Coding and Decoding ICET- 2011: In a code, the n^{th} letter in English alphabet is coded to k^{th} letter, where $k \equiv 3n + 2 \pmod{26}$, $1 \leq k \leq 26$. For example, the 5th letter E is coded as Q since $3 \times 5 + 2 = 17 \equiv 17 \pmod{26}$ and Q is the 17th letter. The reverse of this process is used for decoding. Based on this coding and decoding processes, answer the following five questions :

11. The code word for STATE is-----**ANSWER:4**

- (1) GJEJG (2) GJEJF (3) GJEJP (4) GJEJQ

12. The code word for MOUSE is-----**ANSWER:2**

- (1) OUMQG (2) OUMGQ (3) OUGMQ (4) OUGQM

13. The code word for JOLLY is-----**ANSWER:3**

- (1) PASSY (2) FUPPI (3) FULLY (4) FOLLY

14. The word coded as XED1 is-----**ANSWER:3**

- (1) POLE (2) PALE (3) PARK (4) PERK

15. The number of letters that are invariant in this code is-----**ANSWER:2; They are L,Y**

- (1) 1 (2) 2 (3) 3 (4)

1	2	3	4	5	6	7	8	9	10	11	12	13
A	B	C	D	E	F	G	H	I	J	K	L	M
E	H	K	N	Q	T	W	Z	C	F	I	L	O
14	15	16	17	18	19	20	21	22	23	24	25	26
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
R	U	X	A	D	G	J	M	P	S	V	Y	B

In a code, the n -th letter of an English alphabet is coded to $f(n)^{\text{th}}$ letter, where $f(n)$ is

defined by
$$f(n) = \begin{cases} n+17, & \text{if } 1 \leq n \leq 9 \\ n-1, & \text{if } 10 \leq n \leq 18 \\ n-18, & \text{if } 19 \leq n \leq 26 \end{cases}$$
 . **For decoding, the reverse process is**

used. Based on this coding and decoding process, answer the following five questions :

16. The code word for MANGO is-----**ANSWER:2**

- (1) LSOYN (2) LRMXN (3) KRLXN (4) KTPFN

17. The code word for RHYME is -----**ANSWER:4**

- (1) QZGNV (2) PYGMU (3) QYILV (4) QYGLV

18. The word that is coded as ROME is-----**ANSWER:1**

- (1) APNW (2) ANPW (3) AOMW (4) AMNU

19. The code word for ICET is -----**ANSWER:3**

- (1) ZUWC (2) ZVTD (3) ZTVB (4) ZUTD

20. Which letter is coded as X? -----**ANSWER:2**

- (1) F (2) G (3) W (4) C

1	2	3	4	5	6	7	8	9	10	11	12	13
A	B	C	D	E	F	G	H	I	J	K	L	M
E	H	K	N	Q	T	W	Z	C	F	I	L	O
14	15	16	17	18	19	20	21	22	23	24	25	26
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
R	U	X	A	D	G	J	M	P	S	V	Y	B

Coding and Decoding - ICET-2010: In a code, the n^{th} letter in English alphabet is coded to K^{th} letter, where $K \equiv 3n+2 \pmod{26}$, $1 \leq K \leq 26$. For example, the 9^{th} letter I is coded as C, since $3 \times 9 + 2 = 29 \equiv 3 \pmod{26}$ and C is the third letter. The reverse of this process is used for decoding. Based on these coding and decoding processes, answer the five questions .

21. The word coded as DENCU is -----**ANSWER:1**

- (1) RADIO (2) DANCE (3) RADIC (4) DELHI

22. The word coded as KUOXMJQD is-----**ANSWER:2**

- (1) COMPLEXS (2) COMPUTER (3) COMMENCE (4) COMPLETE

23. The code word for ICET is-----**ANSWER:4**

- (1) CKPJ (2) CKQI (3) CKQK (4) CKQJ

24. The code word for JOLLY is -----**ANSWER:3**

- (1) SILLY (2) SORRY (3) FULLY (4) PETTY

25. The word coded as GJEJQ is-----**ANSWER:2**

- (1) STATD (2) STATE (3) STBTE (4) STATF

1	2	3	4	5	6	7	8	9	10	11	12	13
A	B	C	D	E	F	G	H	I	J	K	L	M
E	H	K	N	Q	T	W	Z	C	F	I	L	O
14	15	16	17	18	19	20	21	22	23	24	25	26
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
R	U	X	A	D	G	J	M	P	S	V	Y	B

The vowels of the English alphabet are arranged alphabetically and among these vowels, the r^{th} vowel is coded as $(r + 1)^{\text{th}}$ vowel and the last as the first. The consonants of the English alphabet are arranged alphabetically and among these consonants, the r^{th} consonant is coded as $(r - 1)^{\text{th}}$ consonant and the first as the last. For decoding, the inverse process is followed. Basing on these coding and decoding processes, answer the following five questions.

26. The code word for ENERGY is -----**ANSWER:4**

- (1) IMIQHZ (2) IMIQHX (3) IMISFX (4) IMIQFX

27. Which word is coded as QEMFIQ ? -----**ANSWER:2**

- (1) RANGES (2) RANGER (3) PILGOP (4) SANGES

28. The code word for CRICKET is -----**ANSWER:3**

- (1) BQOJBAS (2) BQOJB AU (3) BQOJBIS (4) BQOJBAY

29. Which word is coded as CORBUTIQ ? -----**ANSWER:4**

- (1) DISCLOSE (2) DISPLACE (3) DISPLAYS (4) DISCOVER

30. The code word for EVEREST is -----**ANSWER:1**

- (1) ITIQIRS (2) ITIQIRV (3) ITIQERS (4) ITIQITS

1	2	3	4	5	6	7	8	9	10	11	12	13
A	B	C	D	E	F	G	H	I	J	K	L	M
E	Z	B	C	I	D	F	G	O	H	J	K	L
14	15	16	17	18	19	20	21	22	23	24	25	26
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
M	U	N	P	Q	R	S	A	T	V	W	X	Y

Coding and Decoding - ICET-2009: The following TEN questions are to be answered using the coding and decoding of the letters in the English Alphabet as given below :

The r^{th} letter is coded as $(r+1)^{\text{th}}$ letter if r is odd and as $(r-1)^{\text{th}}$ letter if r is even. In decoding, the inverse process is followed.

31. What is the code letter for T ?-----**ANSWER:1**

- (1)S (2)U (3)V (4)R

32. Which letter is coded as J ?-----**ANSWER:2**

- (1)H (2)I (3)K (4)L

33. What is the coded word for QUALITY ?-----**ANSWER:3**

- (1)RVBKJUX (2)RVBKJUZ (3)RVBKJSZ (4)RVBKIUZ

34. Which word is coded as FWOKBMS ? -----**ANSWER:4**

- (1)EXPLOIT (2)EXPLORE (3)EXPLODE (4)EXPLANT

35. Which word is coded as CPNJMP ? -----**ANSWER:1**

- (1)DOMINO (2)DOLINO (3)DOMAIN (4)DOLMEN

36. What is the code word for HOMOGENEOUS ? -----**ANSWER:2**

- (1)GPNPFMFVPT (2)GPNPHFMFPVT (3)GPNPHFNFPVT
(4)GPNPHFMFPVT

37. What is the code word for GREGORY ? -----**ANSWER:3**

- (1)HQFHPSZ (2)HPFHQPZ (3)HQFHPQZ (4)HQFHPQX

38. Which word is coded as OQPCJHZ ?-----**ANSWER:4**

- (1)PROVERB (2)PRODUCT (3)PROCUCE (4)PRODIGY

39. What is the code word for ENIGMA ?-----**ANSWER:2**

- (1)FMJGNB (2)FMJHNB (3)FMJHIB (4)FMHGNC

40. Which word is coded as JNOPTF ? -----**ANSWER:4**

- (1)IMPURE (2)IMMUNE (3)IMPORT (4)IMPOSE

1	2	3	4	5	6	7	8	9	10	11	12	13
A	B	C	D	E	F	G	H	I	J	K	L	M
B	A	D	C	F	E	H	G	J	I	L	K	N
14	15	16	17	18	19	20	21	22	23	24	25	26
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
M	P	O	R	Q	T	S	V	U	X	W	Z	Y

Coding and Decoding - ICET-2008:

For the following questions in a code an English word of n letters is coded as follows.

(i) If n is even, each of the first $\frac{n}{2}$ letters of the word are shifted forward by 3 places,

the last $\frac{n}{2}$ letters are shifted backward by 3 places.

(ii) If n is odd, each of the first $\frac{n-1}{2}$ letters of word are shifted forward by 3 places, the

last $\frac{n-1}{2}$ letters are shifted backward by 3 and the middle letter is fixed. For example

POISON is coded as SRLPLK and EAMCET is coded as HPCBQ. Decoding is the inverse process of this coding.

41. The code word for TEMPLE is-----**ANSWER:4**

- (1) WHPPIB (2) WHPMIC (3) WHPMJB (4) WHPMIB

42. Which word is coded as ZENITH?-----**ANSWER:4**

- (1) WAKLWK (2) WALLWK (3) WBKKWK d) WBKLWK

43. The code word for CHIMNEY is-----**ANSWER:1**

- (1) FKLPKBV (2) FKLMKBV (3) FKLMLBV (4) FKLPKBV

44. Which word is coded as CURIOUS?-----**ANSWER:3**

- (1) ZROLRXV (2) ZRPIRXV (3) ZROIRXV (4) ZRPLRXV

45. The code word for LOUSY is-----**ANSWER:4**

- (1) ORUQV (2) ORXPY (3) ORRPV (4) ORUPV

46. Which word is coded as HOUSE? -----**ANSWER:2**

- (1) ELXUH (2) ELUVH (3) ELUUh (4) ELXVH

47. The code word for POTATO is-----**ANSWER:1**

- (1) SRWXQL (2) SRXXQL (3) SRWYQL (4) SRXXWL

48. Which word is coded as MAXIMA?-----**ANSWER:3**

- (1) JXUMPD (2) LXUMPD (3) JXULPD (4) JXVLPD

49. The code word for BANARAS is-----**ANSWER:3**

- (1) DEQDOXP (2) EDQAMXP (3) EDQAOXP (4) EDQAMWP

50. Which word is coded as LAZY? -----**ANSWER:1**

- (1) IXCB (2) OACB (3) IXZY (4) IXCA

Coding and Decoding - ICET-2007:

In a certain code the words HONEST, EXAMINATION, BOY, RIGHT and WRONG are respectively written as UBARFG, RKNZVANGVBA, OBL, EVIUG and JEBAT, find the process of coding, answer the following ten questions .

51. The code word for FIGHT is -----**ANSWER:4**
 (1)TVTUG (2)SVTUH (3)SWTUG (4)SVTUG
52. The code for ICET is-----**ANSWER:2**
 (1)UPRG (2)VPRG (3)VQRG (4)VPSG
53. The code for ARMY is-----**ANSWER:3**
 (1)NEZM (2)MEZI (3)NEZL (4)NFZL
54. The code for SOLDIER is-----**ANSWER:1**
 (1)FBYQVRE (2)FBYQVSE (3)FBZQVRE (4)FBYQURE
55. The code for SEVEN is -----**ANSWER:4**
 (1)FRIRZ (2)FRJRA (3)FRIRB (4)FRIRA
56. Which word is coded as MINISTER-----**ANSWER:1**
 (1)ZVAVFGRE (2)ZVAVFHRE (3)ZVAVFGSE (4)ZVAVFGRF
57. Which word is coded as KING -----**ANSWER:2**
 (1)XVAS (2)XVAT (3)XVAU (4)XUAT
58. Which word is coded as HISTORY ?-----**ANSWER:3**
 (1)UVFGBEM (2)UVFGAEL (3)UVFGBEI (4)UVFGBEK
59. Which word is coded as PLAN ?-----**ANSWER:3**
 (1)CYNZ (2)CYNB (3)CYNA (4)CYND
60. Which word is coded as QUESTION? -----**ANSWER:1**
 (1)DHRFGVBA (2)DHRFGUBA (3)DHRFGVCA (4)DHRFGVDA

From the given examples the alphabet is coded as follows:

1	2	3	4	5	6	7	8	9	10	11	12	13
A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
14	15	16	17	18	19	20	21	22	23	24	25	26

code for the word FIGHT = S V T U G

code for the word ICET = V P R G

code for the word ARMY = N E Z L

code for the word SOLDIER = F B Y Q V R E

code for the word SEVEN = F R I R A

decode for the word MINISTER = Z V A V F G R E

decode for the word KING = X V A T

decode for the word HISTORY = U V F G B E I

decode for the word PLAN = C Y N A

decode for the word QUESTION = D H R F G V B A

Coding and Decoding - ICET-2006:

Note : In a code, the r^{th} letter is shifted to $(27 - 2r)^{\text{th}}$ letter for $r = 1, 2, \dots, 13$, the fourteenth letter is shifted to 26th letter and, for $r = 15, 16, \dots, 26$, the r^{th} letter is shifted to $(2r - 28)^{\text{th}}$ letter. For decoding the inverse process of the above is followed. Using this coding and decoding, answer the following ten questions .

61. Which word is coded as ITALY ?-----**ANSWER:3**

- (1) IXTMA (2) IXMTY (3) IXMTA (4) IMXTY

62. Which letter is coded as Y ?-----**ANSWER:1**

- (1) A (2) N (3) B (4) M

63. What is the code letter for P?-----**ANSWER:2**

- (1) J (2) D (3) L (4) W

64. What is the code word for SENDER ? -----**ANSWER:4**

- (1) JQSZQH (2) JRSZRH (3) JPZSPH (4) JQZSQH

65. What is the code word for POTA ? -----**ANSWER:3**

- (1) DLBY (2) DBYJ (3) DBLY (4) DLYB

66. Which word is decoded as LMVIXMT ?-----**ANSWER:2**

- (1) CAPSTAN (2) CAPITAL (3) CAPTAIN (4) CAPTION

67. What is the code for IUPILM ?-----**ANSWER:4**

- (1) INDIAN (2) INDIRA (3) INDUCE (4) INDICA

68. What is the code word for MAGNET -----**ANSWER:3**

- (1) AYMZQL (2) AYZMQL (3) AYMZQL (4) AYQMZL

69. What is the code for HIXVTA ?-----**ANSWER:2**

- (1) KITKAT (2) KITPLY (3) KINLEY (4) KINDLE

70. Which word is decoded as XIDLF ? -----**ANSWER:3**

- (1) THINK (2) TIGER (3) TISCO (4) THICK

1	2	3	4	5	6	7	8	9	10	11	12	13
A	B	C	D	E	F	G	H	I	J	K	L	M
Y	W	U	S	Q	O	M	K	I	G	E	C	A
14	15	16	17	18	19	20	21	22	23	24	25	26
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
Z	B	D	F	H	J	L	N	P	R	T	V	X

Coding and Decoding - ICET-2005:

In a code TANK is written as SZOL and FRIEND is written as EQHFOE. Find the process of coding and answer the following TEN questions.

71. The code for RING is-----**ANSWER:2**

1. QHOG 2. QHOH 3. QHME 4. PHOH

72. The code for FROG is -----**ANSWER:1**

1. EQPH 2. GAPH 3. EQNF 4. GSNF

73. The code for ZENITH is -----**ANSWER:1**

1. YDMJUI 2. ADMJUI 3. YFMJUI 4. ADMJUG

74. The code for PARADE is -----**ANSWER:3**

1. OZQZEF 2. OZPBEJG 3. OZQBEF 4. OZQBFE

75. The code for PIPE is-----**ANSWER:3**

1. QJOD 2. OHOD 3. OHQF 4. QJQF

76. Which word is coded as BATS ? -----**ANSWER:4**

1. CBTR 2. CZSR 3. CBST 4. CBSR

77. Which word is coded as COURSE? -----**ANSWER:3**

1. DPVPRD 2. DPUPRD 3. DPVQRD 4. DPVORD

78. Which word is coded as DEMAND? -----**ANSWER:2**

1. EFNBM C 2. EFNZMC 3. DENZMC 4. EFNZLC

79. Which word is coded as NUMBER? -----**ANSWER:4**

1. OVBES 2. OVADQN 3. OVNZDQ 4. OVNADQ

80. Which word is coded as RATE?-----**ANSWER:2**

1. SBUF 2. SBSD 3. SBRD 4. SZSD

NOTE:As per the given directions the first half part of the given word backwarded 1 step and the second half part forwarded by 1 step. For decoding the inverse process followed.

Code for R I N G = Q H O H;

-1 -1 +1 +1

Code for Z E N I T H = Y D M J U I;

-1 -1 -1 +1 +1 +1

Code for P I P E = O H Q F;

-1 -1 +1 +1

Decode for C O U R S E = D P V Q R D;

+1 +1 +1 -1 -1 -1

Decode for N U M B E R = O V N A D Q;

+1 +1 +1 -1 -1 -1

Code for F R O G = E Q P H;

-1 -1 +1 +1

Code for P A R A D E = O Z Q B E F

-1 -1 -1 +1 +1 +1

Decode for B A T S = C B S R

+1 +1 -1 -1

Decode for D E M A N D = B F N Z M C

+1 +1 +1 -1 -1 -1

Decode for R A T E = S B S D

+1 +1 -1 -1

CALENDER

Calender helps us in finding the day of the week for a particular date. In order to find the day of the week, we calculate the number of odd days during that particular period.

Odd Days: The number of odd days are the days which are more than the complete weeks in a particular period.

Leap Year: Every year which is divisible by 4 such as 1964 is called a leap year. Every century such as 300, 600, 900 etc. is not a leap year where as every fourth century such as 800, 1200, 1600 etc. is a leap year.

Hints:

1. An ordinary year consists of 365 days, i.e., 52 weeks + 1 day.
Hence, an ordinary year contains one odd day.
2. A leap year consists of 366 days, i.e. 52 weeks + 2 days.
Hence, a leap year contains 2 odd days.
3. 100 years = 76 ordinary years + 24 leap years. 100 years have 76 odd days + 24 x 2 odd days
 $= (76 + 48) \text{ odd days} = 124 \text{ odd days} = 17 \text{ weeks} + 5 \text{ odd days}.$
100 years contains 5 odd days.
4. 200 years contains $5 \times 2 = 10$ odd days, i.e. 0 odd days.
5. 300 years contains $5 \times 3 = 15$ odd days, i.e. 1 odd day.
6. 400 years contains $5 \times 4 + 1 = 21$ odd days, i.e. 0 odd days.
Since there are 5 odd days in hundred years, there should be 20 odd days in 400 hundred years. But every 4th century is a leap year. Therefore 400 years contain 21 odd days. i.e. 0 odd days.
7. Last day of a century cannot be either Tuesday, Thursday or Saturday.
8. The first of a century must be either Monday, Tuesday, Thursday or Saturday.
9. 1st January 1 A.D. was Monday. We must count days from Sunday.
Sunday for 0 odd day, Monday for 1 odd day, Tuesday for 2 odd days ... and Saturday for 6 odd days.

CLOCKS

A clock is an instrument which indicates time at a moment. The dial of a clock is a circle which is divided into 60 equal parts which are called minute spaces.

The clock has two hands, the smaller one is called hour hand, the bigger one is a minute hand. The hours are denoted from 1 to 12 and the minute have markings from 1 to 60. In between every two successive hour markings, there are 5 minute markings.

Hints: The clock is divided into 60 equal minute spaces.

2. One minute space = $\frac{360^0}{60} = 6^0$.
3. In one hour the minute hand goes 60 minute spaces.
4. In one hour the hour hand goes 5 minutes spaces.
5. In one hour the minute hand gains 55 minute spaces over the hour hand.
6. In one minute, the minute hand moves 6^0 .
7. In one minute, the hour hand gains $\frac{1}{2^0}$.
8. In one minute, the minute hand gains $5\frac{1}{2^0}$.
9. In every hour, the hands coincide once.
10. When the hands are in opposite direction they are 30 minute spaces apart. This happens once in every hour.
11. When the two hands are at right angles they are 15 minute space apart. This happens twice in every hour.
12. The hands are in the same straight line when they are coincident (or) opposite to each other.
13. The hands coincide 11 times in every 12 hours (because between 11 and 12 0'clock, there is a common position, 12 0'clock when the hands coincide), hence 22 times in 24 hours.
14. The hands point towards each other 11 times in 12 hours (because between 5 and 6 0'clock there is a common position 6 0'clock when the hands straight), hence 22 times 24 hours.
15. The hands of clock are at right angle 22 times in 12 hours.
16. The hands of a clock are straight (coincide and are in opposite direction) 22 times in 12 hours. Hence 44 times in 24 hours.
17. In a correct clock, both the hands coincide at an interval of $65\frac{5}{11}$ minutes.
18. In a clock, the angle between the hours hand and minutes hand is $\theta = 30h - \frac{11m}{2}$ degrees.

DIRECTIONS

The test is meant to judge the candidate's ability to trace, follow and sense the direction correctly. This questions describe the motion of some one in some given direction for some given directions. Mostly you will be asked to state the correct position of a moving body area a moving person with respect to the starting point.

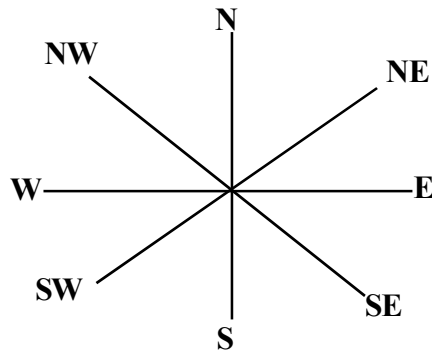
There are four main directions

1. North 2. South 3. East 4. West

and there are four regions

1. North East Region (NE) 2. North West Region (NW)
3. South West Region (SW) 4. South East Region (SE)

The given figure shows the four main directions and four regions.



First have careful look of given figure and read the mentioned points.

North	
North-West Region IInd quadrant (Upper left)	North-East Region Ist quadrant (Upper right)
West	East
South-West Region III quadrant (Lower left)	South-East Region IV quadrant (Lower right)
South	

A diagonal direction in Ist quadrant means North East direction.

A diagonal direction in IInd quadrant means North West region.

A diagonal direction in IIIrd quadrant means South West region.

A diagonal direction in IVth quadrant means South East region.

BLOOD RELATIONS

Problems of this type involve analysis of certain blood relations and then inferring on the basis of the given informations.

Chart of useful Blood Relations:

The following chart is very useful to solve Blood relation problems.

1. Mother's or Father's Son = Brother
2. Mother's or Father's Daughter = Sister
3. Mother's or Father's Sister = Aunt
4. Mother's or Father's Brother = Uncle
5. Mother's Brother = Maternal Uncle
6. Mother's or Father's Mother = Grand Mother
7. Mother's or Father's Father = Grand Father
8. Son's Wife = Daughter-in-law
9. Daughter's Husband = Son-in-law
10. Husband's or Wife's Sister = Brother-in-law
11. Brother's Son = Nephew
12. Brother's Daughter = Niece
13. Uncle or Aunt's Son or Daughter = Cousin
14. Sister's Husband = Brother-in-law
15. Brother's Wife = Sister-in-law
16. Grand Father's only Son = Father
17. Grand Mother's only Son = Father
18. Grand Father's Son = Father or Uncle
19. Grand Mother's Son = Father or Uncle
20. Grand Father's only Daughter-in-law = Mother
21. Grand Mother's only Daughter-in-law = Mother

In blood relations, we should know the relation between two persons by using the information given to you.

Some important relations

Brother or Sister	: Only siblings
Uncle	: Mother or Father's brother
Aunt	: Mother or Father's sister
Cousin	: Aunt or Uncle's children or Mother or Father's brother or sister's Children
Brother in law	: Wife or Husband's brother or Sister's husband
Sister in law	: Wife or Husband's sister or Brother's wife
Mother in law	: Wife or Husband's mother
Father in law	: Wife or Husband's father
Son in law	: Daughter's husband
Daughter in law	: Son's wife
Nephew	: Brother or Sister's son
Niece	: Brother or Sister's daughter
Grand Father	: Mother or Father's father
Grand Daughter	: Mother or Father's mother

Some more important relations

1. A male person's father or mother's only son- Him self
2. A male person's father or mother's only daughter –His sister
3. A female person's father or mother's only daughter –Her self
4. A female person's father or mother's only son –Her brother
5. A male person's father or mother's only daughter in law - His wife
6. A female person's father or mother's only son in law - Her husband
7. Maternal – Mother side
8. Paternal - Father side

EXERCISE – 1

1. Pointing a person, a man said to a lady, "His mother is the only daughter of your Father."
How is the lady related to the person?
a. Sister b. Mother c. Wife d. Daughter
2. Pointing to a lady in the photograph, Shaloo said, "Her son's Father is the Son-in-law of my mother. How is shaloo related to the lady?
a. Aunt b. Sister c. Mother d. Cousin

3. Pointing to a photograph, a woman says, "This man's son's sister is my mother-in-law." How is the woman's husband related to the man in the photograph?
 a. Grandson b. Son c. Son-in-law d. Nephew
4. Arun Said, "This girl is the wife of the only grandson of my mother". Who is Arun to the girl?
 a. Father b. Grand Father c. Husband d. Father-in-law
5. Pointing to a photograph, a lady tells Murali, "I am the only daughter of this lady and her son is your maternal uncle." How is the speaker related to Murali's Father?
 a. Sister-in-law b. Wife c. Either (a) or (b) d. Neither (a) nor (b)
6. R's brother is Q, Q's son is P, S's brother is T, R's daughter is 'S'. Who are the cousins of 'P'?
 a. R and Q b. R and T c. S and T d. S and Q
7. A is the father of B, But 'B' is not the son of 'A'. What is B to A?
 a. Son b. Sister c. Daughter d. Brother
8. 'X' and 'Y' are two brothers. 'B' is 'A's brother and A is the mother of 'X'. What is B to Y?
 a. Brother b. Father c. Mother d. Uncle
9. 'X' is the sister of 'Y', Y is the daughter of K, K is the husband of L. What is L to Y?
 a. Father b. Mother c. Brother d. Sister
10. 'X' is the brother of Y, Y is the wife of Z, Z is the son of W and W is the wife of V. What is V to Y?
 a. Father-in-law b. Son-in-law c. Mother-in-law d. Brother-in-law
11. X is brother of Y. Y is the wife of Z. Z is the brother of W. What is W to X?
 a. Son b. Daughter c. Sister-in-law d. Brother-in-law
12. Pointing to a gentleman, Vamshi said, "His only brother is the father of my daughter's father." How is the gentleman related to vamshi?
 a. Grand Father b. Father c. Uncle d. Brother-in-law
13. Pointing to the woman in the picture, Madhu said, "Her mother has only one grandchild, whose mother is my wife". How is the woman in the picture related to Madhu?
 a. Cousin b. wife c. Sister d. Data inadequate

14. If Surrender says, "Venkat's mother is the only daughter of my mother! How is Surrender related to Venkat? Grand Father"
- a. Father b. Brother c. Maternal Uncle d. None of these
15. Pointing to a photograph, Raju said, "She is the mother of my son's wife's daughter. How is Raju related to the lady?"
- a. Uncle b. Cousin c. Father-in-law d. None of these

Directions (16-19) They are six children playing Cricket, namely A, B, C, D, E and F. A and F are brothers. E is the sister of F. C is the only son of A's Maternal Uncle. B and D are the daughters of the brother of C's Father.

16. How is 'C' related to 'F'?
- a. Cousin b. Brother c. Son d. Uncle
17. How many male players are there?
- a. One b. Three c. Four d. Six
18. How many Female players are there?
- a. Three b. Two c. One d. Five
19. How is 'D' related to 'A'?
- a. Uncle b. Sister c. Niece d. Cousin
20. In a joint family, there are father, mother, three married sons and one unmarried daughter.... of the sons, two have 2 daughters each, and one has a son. How many female members are there in the family?
- a. 2 b. 3 c. 8 d. 9
21. In a family, there are wife and husband. They have three sons, each son has two sisters. Then how many male and female members are there in the family?
- a. M-4, F-3 b. M-4, F- 7 c. M-7, F-4 d. None of these
22. In a family, there are wife and husband. They have three sons, each son has two wives. Then how many male and female members are there in the family?
- a. M-4, F-3 b. M-4, F- 7 c. M-7, F-4 d. None of these

Directions (23-27)

i) 'A\$B' means 'A is mother of B';

ii) 'A#B' means A is father of B;

- iii) 'A@B' means A is husband of B;
- iv) 'A%B' means A is daughter of B. Then
23. P@Q\$M#T indicates what relationship of 'P with T'?
- a. Paternal Grandfather b. Maternal Grandfather
c. Paternal Grandmother d. Maternal Grandmother
24. Which of the following expressions indicates 'R is the sister of H'?
- a. H\$D@F#R b. R%D@F\$H c. R\$D@F#H d. H%D@F\$R
25. If 'F@D%K#H', then how is F related to H?
- a. Brother-in-law b. Sister
c. Sister-in-law d. cannot be determined
26. Which of the following expressions indicates 'H is the brother of N'?
- a. H#R\$D\$N b. N%F@D\$H#R c. N%F@D\$H d. N%F@D%H
27. If G\$M2K, how is 'K related to G'?
- a. Daughter-in-law b. Mother-in-law c. Daughter d. Aunt
28. A man pointing to a photograph says, "The lady in the photograph is my nephew's maternal grandmother." How is the lady in the photograph related to the man's sister who has no other sister?
- a. Mother b. Cousin c. Mother-in-law d. Sister-in-law
29. A woman introduces a man as the son of the brother of her mother. How is the man related to the woman?
- a. Son b. Nephew c. Grandson d. Cousin
30. Kiran said, "This girl is the wife of the grandson of my mother." Who is Kiran to the girl?
- a. Husband b. Father c. Father-in-law d. Grandfather

KEY

- | | | | | | |
|-------|-------|-------|-------|-------|-------|
| 1) b | 2) b | 3) a | 4) d | 5) b | 6) c |
| 7) c | 8) d | 9) b | 10) a | 11) d | 12) c |
| 13) b | 14) c | 15) c | 16) a | 17) b | 18) a |
| 19) d | 20) d | 21) a | 22) b | 23) a | 24) b |
| 25) a | 26) b | 27) a | 28) a | 29) d | 30) c |

Date, Time, Clock, Calender , Blood Relations and Arrangement Problems
ICET - 2010

1. The number of ways of arranging 4 men 5 women alternately in a row so that the row begins and ends with a woman is,

1. 280 2. 720 3. 2880 4. 3600

Solution: $5! \times 4! = 120 \times 24 = 2880$

Answer is 3.

W M W M W M W M W

2. Five persons A, B, C, D are sitting around a table such that D is in-between A and E, C is in-between A and B. Then the person sitting between B and D is,

1. A 2. C 3. D 4. E

Solution: **Answer is 4.**

3. If the first date of a month is a Sunday, then the date of the Monday that comes after the second Saturday of that month, is

1. 8 2. 9 3. 15 4. 16

Solution: **Answer is 4.**

4. In a leap year, if January first is a Tuesday, then March second of that year falls on

1. Sunday 2. Monday 3. Tuesday 4. Saturday

Solution: January (30) + February (29) + March (2) = 61 = 5 odd days .

So 5th day after Tuesday is Sunday. **So answer is 1.**

5. Fifteen years ago the ages of a mother and her daughter were in the ratio 6 : 1. If the present age of the daughter is 20 years, then the mother age in years after 5 years from now is

1. 40 2. 45 3. 50 4. 55

Solution: $x - 15 : 5 = 6 : 1 \Rightarrow \frac{x-15}{5} = \frac{6}{1} \Rightarrow x - 15 = 30 \Rightarrow x = 15 + 30 = 45.$

So present age of mother = 45. After 5 years mother age = 45 + 5 = 50. **Answer is 3.**

6. The operator * is defined by the equation $x * y = 2x + y$ for all real x and y. If $2 * a = a * 3$, then the value of a =

1. -1 2. 0 3. 1 4. 4

Solution: $2 * a = a * 3 \Rightarrow 2(2) + a = 2(a) + 3 \Rightarrow 4 + a = 2a + 3 \Rightarrow 4 - 3 = 2a - a \Rightarrow a = 1.$

Answer is 3.

7. The number of 3 digit positive integers that leave the remainder 5 when divided by 7 is

1. 142 2. 141 3. 129 4. 128

Solution: 103 is the least 3 digit positive integer that leave remainder 5 when divided by 7.

999 is the highest 3 digit positive integer that leave remainder 5 when divided by 7.

So the number of 3 digit positive integers that leave the remainder 5 when

divided by 7 is = $\frac{999-103}{7} + 1 = \frac{896}{7} + 1 = 128 + 1 = 129$. **Answer is 3.**

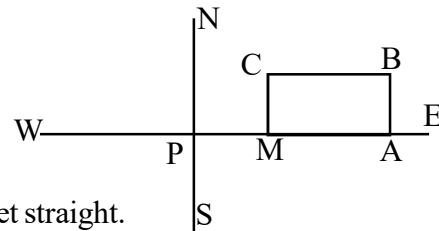
8. The number of times that the hours hand and minutes hand of a clock coincide in a day, is

1. 22 2. 23 3. 24 4. 26

Solution: Coincide once in every one hour. 24 times the hours hand and minutes hand of a clock coincide. **So the answer is 3.**

9. A person M starts walking from a point P straight towards East. After walking 100 feet he turns left and walks 45 feet straight. He again turns left and walks 45 feet straight. He again turns left and walks a distance of 60 feet straight. Then he turns to the left and walks a distance of 45 feet. The distance between M and P in feet, is

1. 60 2. 55 3. 45 4. 40



Solution: Person M started from P.

From P he walked 100 feet. So he reached A.

So PA = 100 feet. From A he turn left and walks 45 feet straight.

So he reached B. So AB = 45 feet. He again turns left and walks 60 feet straight.

Now he reached C. So BC = 60 feet. Now from C he turns left and walks 45 feet.

So now he is at M. Now distance between P and M = AP - BC = 100 - 60 = 40 feet. **Ans.is 4.**

10. Pointing to woman, a man said “The son of her only brother is the brother of my wife”. How is the woman related to the man?

1. Grand mother 2. Sister 3. Mother-in-law 4. Sister of father-in-law.

Solution: Answer is 4.

ICET - 2009

1. The director came to the office to attend a meeting at 15 minutes past 12 and he came 25 minutes before his steno who in turn was late by 30 minutes to the meting. At what time was the meeting supposed to start?

1. 12.00 2. 12.15 3. 12.10 4. 12.20

Solution: Director at 12 - 15; Steno came at 12-40; Steno late by 30 minutes to meeting Meeting is 12-10. **So the answer is 3.**

2. Which will be the first leap year after 2096?

1. 2100 2. 2104 3. 2102 4. 2108

Solution: The leap year after 2096 is $2096 + 8 = 2104$.

So the answer is 2.

3. In a clock, the angle between the hours hand and minutes hand at 5 hour 10 minutes is

1. 60° 2. 95° 3. 120° 4. 90°

Solution: $\theta = 30h - \frac{11m}{2} = 30 \times 5 - \frac{11 \times 10}{2} = 150 - 55 = 95^\circ$. **Answer is 2.** (here $h = 5$; $m = 10$)

4. The number of ways of arranging 4 boys and 3 girls in a row so that the row begins with a boy and ends with a girl

1. 360 2. 480 3. 720 4. 1440

Solution: $5! \times 4 \times 3 = 120 \times 12 = 1440$. **Answer is 4.**

5. If two circles of diameters 10 cms. and 6 cms. touch externally, then the distance between their centres is

1. 16cms. 2. 2cms. 3. 4cms. 4. 8cms.

Solution: The distance between their centres = sum of their radii = $5 + 3 = 8$ cms. **Answer is 4.**

6. B is the brother of A. S is the sister of B. E is the brother of D. D is the daughter of A. F is the father of S. Then the uncle of E is

1. A 2. B 3. F 4. D

Solution: A, B, S are Brothers and Sisters. D is Daughter of A. E is Brother of D. The uncle of E is B. **Answer is 2.**

7. If 9th May was Friday, then what day was February 14th of the same year?

(Note: Given year is normal year)

1. Thursday 2. Monday 3. Friday 4. Wednesday

Solution: If given year is normal year then number of odd days from Feb 14th to 9th May is Feb - 14; March - 31; April - 30; May - 9
9th May is Friday then February 14th is Friday. **Answer is 3.**

8. If a month in an year starts with Monday, then the date of fourth day after the second Saturday in that month, will be

1. 16 2. 17 3. 18 4. 19

Solution: 1st Month is Monday $\Rightarrow$ 6th month is first Saturday $\Rightarrow$ 13th month is second Saturday $\Rightarrow$ 17th is the fourth day after second Saturday. **Answer is 2.**

9. The ages of a son and his father were in the ratio 2 : 5 respectively 17 years ago. If the present age of son is 35, then the present age of father in years is

1. 66 2. 65 3. 64 4. 62

Solution: Present age of son = 35. 17 years ago son age = $35 - 17 = 18$.

So $2x = 18 \Rightarrow x = 9$. 17 years ago father age = $5x = 5 \times 9 = 45$.

So present age of father is $45 + 17 = 62$. **Answer is 4.**

10. If $5 @ 6 = 61$ and $8 @ 10 = 164$, then $7 @ 9 =$

1. 124 2. 120 3. 32 4. 130

Solution: $5 @ 6 = 5^2 + 6^2 = 61$, $8 @ 10 = 8^2 + 10^2 = 164$

$7 @ 9 = 7^2 + 9^2 = 130$. **Answer is 4.**

ICET - 2008

1. Four persons A, B, C and D are sitting around a square table and discussing their trades. A sits opposite to the Carpenter and B sits right to the Electrician. The Painter is on the left of Mason and D opposite to C. What are the trades of C and D?

1. Electrician and Mason 2. Painter and Maon
3. Painter and Carpenter 4. Painter and Electrician.

Solution: As per the given directions. In C, D one of them is Painter and another is Electrician.

So the answer is 4.

2. B is twice as old as A, but twice younger than F, C is half the age of A but twice older than D. Who are the oldest and youngest?

1. F, C 2. B, D 3. F, D 4. F, A

Solution: $B = 2A \Rightarrow B = 8D$; $F = 2B \Rightarrow F = 16D$; $A = 2C \Rightarrow A = 4D$ and $C = 2D \Rightarrow C = 2D$.

So the oldest is F and youngest is D. **Answer is 3.**

3. Two circles C_1 and C_2 are such that a square S is inscribed in C_1 and C_2 is inscribed in S. Then the ratio of the areas of C_1 and C_2 is

1. $\sqrt{2} : 1$ 2. $2 : 1$ 3. $2 : \sqrt{2}$ 4. $3 : 2$

Solution: Let a be the side of square and r_1 and r_2 be the radius of C_1 and C_2 of and respectively.

From the data and by using Pythagours theorem $2r_1 = \sqrt{a^2 + a^2} = \sqrt{2}a$. So $r_1 = \frac{a}{\sqrt{2}}$.

From the data $2r_2 = 2a$. So $r_2 = \frac{a}{2}$.

Ratio of areas of C_1 and $C_2 = \pi r_1^2 : \pi r_2^2 = r_1^2 : r_2^2 = \frac{a^2}{2} : \frac{a^2}{4} = \frac{1}{2} : \frac{1}{4} = 2 : 1$. **Answer is**

2.

4. A square sheet of paper is cut along the diagonal into two equal triangles. What is the minimum number of pieces into which one of the two triangles shall have to cut so that these pieces together with other triangle could be arranged as a rectangle.

1. 2 2. 3 3. 4 4. 5

Solution: Answer is 1.

5. If fourth day after January 6 is a Saturday, which day of the week was on December 1 of the previous year?

1. Saturday 2. Monday 3. Sunday 4. Thursday

Solution: January 10th of the month = Saturday

The number of odd days from December 1st to January 10th = 40 days (i.e.) 5 odd days.

December 1st is Monday. **Answer is 2.**

6. The angle between the hands of a clock when the time shown is 12 minutes past 5 O'clock is

1. 78° 2. 80° 3. 84° 4. 86°

Solution: In a clock, the angle between the hours hand and minutes hand is

$\theta = 30h - \frac{11m}{2}$ degrees. The angle between the hands of a clock when the clock shows 12

minutes past 5 $= 30 \times 5 - \frac{11}{2} \times 12 = 150 - 66 = 84^\circ$. **Answer is 3.**

7. In a village $\frac{1}{4}$ th of the youth are educated and $\frac{1}{5}$ th of the youth are employed. If the number of unemployed youth is 128, how many educated youth are there in that village?

1. 50 2. 55 3. 65 4. 40

Solution: $\frac{1}{4}$ th of youth - educated; $\frac{1}{5}$ th of the youth - employee.

So unemployed youth $= \frac{1}{4} - \frac{1}{5} = \frac{4}{5}$. So $\frac{4}{5}$ of youth = 128.

Therefore youth $= 128 \times \frac{5}{4} = 160$. Therefore educated youth $= \frac{1}{4} \times 160 = 40$. **Answer is 4.**

8. $a * b = a^2 + b^2 - 2ab \Rightarrow ((a * a) * (b * b)) * (c * c) = ?$

1. 0 2. 1 3. 2 4. $a + b + c$

Solution: $a * b = a^2 + b^2 - 2ab = (a - b)^2 \Rightarrow a * a = 0, b * b = 0, c * c = 0$.

$(a * a) * (b * b) * (c * c) = 0$. **Answer is 1.**

9. If N is the set of positive integers, then $\{n \in N \mid |n - 2| < 3\} =$

1. $\{1, 2, 3, 4, 5\}$ 2. $\{1, 2, 3, 4\}$ 3. $\{2, 3, 4, 5\}$ 4. $\{2, 3\}$

Solution: $|n - 2| < 3 \Rightarrow -3 < n - 2 < 3 \Rightarrow -1 < n < 5$ and $n \in N \Rightarrow n \in \{1, 2, 3, 4\}$.

Answer is 2.

10. Twenty years back, the ratio of the ages of a father and his son was 11 : 3. If the ratio of their present ages is 2 : 1, then the age of the son is

1. 30 2. 35 3. 34 4. 32

Solution: Son presented age = x , father presented age = $2x$.

20 years ago their ages are $2x - 20$ and $x - 20$. From the data we have $\frac{2x-20}{x-20} = \frac{11}{3} \Rightarrow$

$6x - 60 = 11x - 220 \Rightarrow 11x - 6x = 220 - 60 \Rightarrow 5x = 160 \Rightarrow x = 32$. **Answer is 4.**

ICET - 2007

1. The time on the clock is 3.00p.m. If the hours hand is pointing towards West, then the direction of the minutes hand is

1. North 2. South 3. South-West 4. East

Solution: In a clock, the angle between the hours hand and minutes hand is $\theta = 30h -$

$\frac{11m}{2}$ degrees. $30 \times 3 = 90^\circ$. The hour hand pointing towards West.

The minute hand points towards South. **Answer is 2.**

2. If the first day of June is a Saturday, then the date on which the last Saturday of that month falls is

1. 22 2. 28 3. 29 4. 30

Solution: 1st June is Saturday. The Saturday falls on 1, 8, 15, 22, 29.

The last Saturday falls on 29th. **So the answer is 3.**

3. If 9th March of 1995 is a Saturday, then the 9th March of 1996 is a

1. Wednesday 2. Tuesday 3. Sunday 4. Monday

Solution: The given period represents a Leap year (ie) Number of days = 2

9th March 1996 = 2 days after Saturday = Monday. **So the answer is 4.**

4. The ratio of the present age of a father and his son is 2 : 1. If the ratio 10 years ago is 5 : 2, then the present age of the son is

1. 30 2. 25 3. 24 4. 32

Solution: Son presented age = x , father presented age = $2x$.

10 years ago their ages are $2x - 10$ and $x - 10$. From the data we have $\frac{2x-10}{x-10} = \frac{5}{2} \Rightarrow$

$4x - 20 = 5x - 50 \Rightarrow 5x - 4x = 50 - 20 \Rightarrow x = 30$. **Answer is 1.**

5. A is the father of B and C, E is the mother of C and D is the wife of F. If F is the brother of E,

then how D is related to B?

1. Maternal grand-mother
2. Maternal aunt
3. Paternal grand-mother
4. Paternal aunt

Solution: From the given data D is wife of the Brother of B's Mother $\Rightarrow$ D is maternal Aunt of B.

So the answer is 2.

6. $a \Delta b = a^2 - ab + b^2 \Rightarrow (a \Delta a) \Delta (a \Delta a) = ?$
1. a^6
 2. a^3
 3. a^4
 4. a^8

Solution: $a \Delta a = a^2 - a^2 + a^2 = a^2 \Rightarrow (a \Delta a) \Delta (a \Delta a) = (a^2)^2 = a^4$. **So the answer is 3.**

7. If $a * b = (a + b - 3)^3 + a - b \Rightarrow 1 * 2 =$
1. $3 * 2$
 2. $-(2 * 3)$
 3. $2 * 1$
 4. $-(2 * 1)$

Solution: $1 * 2 = (1 + 2 - 3)^3 + 1 - 2 = -1$ and $2 * 1 = (2 + 1 - 3)^3 + 2 - 1 = 1 \Rightarrow 1 * 2 = -(2 * 1)$.

So the answer is 4.

8. The number of 3's that are preceded by 5 but not followed by 2 in the following sequence of digits is 3147531245321887538162537531675324
1. 7
 2. 5
 3. 4
 4. 6

Solution: 314 7531 24532 18875381 62537 531675324

There is four times occurs 3 preceded by 5 but not followed by 2. **Answer is 3.**

9. If N is the set of positive integers, then $\{n \in N \mid |n - 4| \leq 2\} =$
1. $\{3, 4, 5\}$
 2. $\{2, 3, 4, 5, 6\}$
 3. $\{2, 3, 4, 5\}$
 4. $\{3, 4, 5, 6\}$

Solution: $|n - 4| \leq 2 \Rightarrow -2 \leq n - 4 \leq 2 \Rightarrow 4 - 2 \leq n - 4 \leq 4 + 2$

$\Rightarrow 2 \leq n \leq 6$ and $n \in N \Rightarrow n \in \{2, 3, 4, 5, 6\}$. **Answer is 2.**

10. If January 1st falls on Saturday in a year, then the number of Saturdays in that year is

1. 52
2. 51
3. 54
4. 53

Solution: January 1st is Saturday $\Rightarrow$ December 30 or 31st is also Saturday $\Rightarrow$ There is 53 Saturdays in that year. **So the answer is 4.**

Previous ICET Questions

1. In a clock, what is the angle between the two hands at 5 hours 10 minutes?
1. 60°
 2. 95°
 3. 90°
 4. 100°

Solution: In a clock, the angle between the hours hand and minutes hand is $\theta = 30h -$

$$\frac{11m}{2} \text{ degrees.}$$

The angle between the hands of a clock when it shows 5 : 10 = $5 \times 30 - 10 \times \frac{11}{2} = 95^\circ$.

Answer is 2.

2. The time on the watch is 9-15 and the hour -hand points towards west. The direction of the minutes hand is

1. North 2. South 3. East 4. West

Solution: The hour hand points towards West. The minute hand points to wards South.

Answer is 2.

3. A clock is set right at 5 am. The clock loses 16 min. in 24 hours. What will be the true time when the lock indicates 10 p.m. on the fourth 1-day?

1. 10:30 pm 2. 11pm 3. 11:30pm 4. 10:45pm

Solution: 1440 min. of the correct clock = 1424 min. of this clock.

The time period from 5am to 10pm of fourth day = $3\frac{1}{2}$ days + 5 hours = 89 hours.

89 hours of this clcok = $\frac{89}{1424} \times 1440 = 90$ hours.

The correct clock shows 5am + 90 hours = 11pm. **Answer is 2.**

4. If 8th March falls three days after Sunday on what day will the last day of that month fall?

1. Wednesday 2. Thursday 3. Friday 4. Saturday

Solution: 8th March falls on Wednesday. The number of odd days from March 8th March 31 = 2

March 31 is Friday. **Answer is 3.**

5. The last day of February 2006 was a

1. Monday 2. Tuesday 3. Wednesday 4. Thursday

Solution: Number odd days is 2005 years = $0 + 6 = 6$

In 2006, January -3 odd days; February - 0 odd days.

The total odd days = $6 \div 7 = 6$. The last day of February 2006 was Tuesday. **Answer is 2.**

6. On July 2, 1985, it was Wednesday. The day of the B-week on July 2, 1984 was

1. Monday 2. Tuesday 3. Wednesday 4. Saturday

Solution: The number of odd days from 2nd July 1985 to 2nd July 1984 = 1 and 2nd July 1985 - Wednesday $\Rightarrow$ 2nd July 1984 is Tuesday. **Answer is 2.**

7. Which of the following is true if $a = \frac{3}{4}$, $b = \frac{4}{5}$ and $c = \frac{5}{6}$?

1. $a < c < b$ 2. $a < b < c$ 3. $c < a < b$ 4. $b < a < c$

Solution: $a = \frac{3}{4} = 0.75$; $b = \frac{4}{5} = 0.8$; $c = \frac{5}{6} = 0.83$. $a < b < c$. **Answer is 2.**

8. In the array 48392874362754869364, the number of instances where an even number is followed by two odd number is

1. 1 2. 2 3. 3 4. 4

Solution: 4 8 3 9 2 8 7 4 3 6 2 7 5 4 8 6 9 3 6 4

In 3 instances an even number is followed by two odd numbers. **Answer is 3.**

9. How many integers from 1 to 100 exist such that each is divisible by 5 and also has 5 as a digit?

1. 10 2. 11 3. 12 4. 20

Solution: The numbers from 1 to 100 such that each divisible by 5 and 5 as a digit = {5, 15, 25, 35, 45, 50, 55, 65, 75, 85, 95}. **Answer is 2.**

10. $a*b = a^2 - ab + 2 \Rightarrow 2*(3*4) = ?$

1. 24 2. 16 3. 9 4. 8

Solution: $2*(3*4) = 2*(3^2 - 12 + 2) = 2*(9 - 10) = 2*(-1) = 2^2 - 2(-1) + 2 = 8$. **Answer is 4.**

11. Sekhar was A years old P years ago. How old was he T years ago?

1. A - P + T 2. P - A + T 3. A + P - T 4. A - P - T

Solution: Sekhar's present age = A + P. T years ago his age = A + P - T. **Answer is 3.**

12. $\frac{2}{3}$ of the members of a committee are women, $\frac{1}{4}$ male members of the committee are married. If there are 9 unmarried male members in the committee, how many members are there in the committee?

1. 32 2. 36 3. 28 4. 42

Solution: Let the total members of committee = x. Male members of committee = $x - \frac{2x}{3} =$

$$\frac{x}{3}.$$

$\frac{1}{4}$ th male are married $\Rightarrow$ unmarried male = $\frac{3}{4} \cdot \frac{x}{3} = 9x = 36$. **Answer is 2.**

13. While climbing a 40 feet tall pole, a monkey ascends 4 feet in a single jump, but slips down 2 feet immediately. How many jumps does it require to reach the top of the pole?

1. 10 2. 2 3. 20 4. 19

Solution: The number of Jumps required to reach the top = $\frac{40+2}{2} + 1 = 19$. **Answer is 4.**

14. If $a*b = (a + b - 5)$ and $a \Delta b = ab$, then $(3*4) A(4*5) = ?$

1. 64 2. 0 3. 16 4. 32

Solution: $a*b = (a + b - 5)^2 \Rightarrow (3 + 4) = (3 + 4 - 5)^2 = 4$.

$4*5 = (4 + 5 - 5)^2 = 16$. Now $(3*4) B(4*5) = \frac{4 \times 16}{4} = 16$. **Answer is 3.**

15. A starts from his home and goes two kilometers straight. Then he turns towards his right and goes one kilometer. He turns again towards his right and goes one kilometer. If he is North-

West from his house, then in which direction did he go in the beginning?

1. East 2. West 3. South 4. North

Solution: Direction of AD in North - West. At first he moves West. **Answer is 2.**

16. In a row of six persons D and C are immediate neighbours of E. B is a neighbour of A only. A is the fourth from F. Who are on the two end points?

1. F, B 2. F, C 3. B, D 4. C, A

Solution: As persons given direction, the arrangement may be as follows

B A C E D F or B A D E C F. Hence B and F are on two ends. **Answer is 2.**

17. Five books are lying in a pile. E is lying on A and C is lying under B. A is lying above B and D is lying under C. Which book is lying at the bottom?

1. A 2. C 3. D 4. B

Solution: As per the given directions the arrangement is Hence D lies at the bottom.

Answer is 3.

ICET - 2011 Date, Time and Arrangement Problems

1. B is the brother of A, S is the sister of B, E is the brother of D, D is the daughter of A and F is the Father of S. Then the uncle of E is

1. A 2. B 3. E 4. F

Solution: The uncle of E is B. **Answer is 2.**

2. A person X is facing north. He turns 165° in the anti-clockwise direction, then 30° in the clock-wise direction and thereafter 90° in the anti-clockwise direction. Then X is facing

1. North-West 2. North-East 3. South-West 4. South-East

Solution: Answer is 4.

3. The ages of a son and his father was in the ratio 2 : 5 seventeen years ago. If the present age of the son is 35 years, the age of the father 5 years hence, is

1. 62 years 2. 65 years 3. 67 years 4. 68 years

Solution: $y - 17 : x - 17 = 2 : 5$

$$\frac{18}{x-17} = \frac{2}{5} \Rightarrow 90 = 2x - 3y \Rightarrow 2x = 34 + 90 = 124 \Rightarrow x = 62.$$

After 5 years $\Rightarrow 62 + 5 = 67$ years. **Answer is 3.**

4. A leap year starts with Sunday. On what day will be the second of March in that year

1. Wednesday 2. Thursday 3. Friday 4. Saturday

Solution: 1 - Sunday $\Rightarrow 30(J) + 29(F) + 2(M) = 2 + 1 + 5 = 8.$

Five days after Sunday - Friday. **Answer is 3.**

5. If $a * b = a^3 + b^3 - 3ab$, then $\frac{(2*1)*(2*1)}{(2*1)} =$
1. 1 2. 3 3. 9 4. 27

Solution: $\frac{(2*1)*(2*1)}{(2*1)} = \frac{3*3}{3} = \frac{27+27-27}{3} = 9$. **Answer is 3.**

6. If A, M, D and S denote the usual addition, multiplication, division and subtraction respectively, then $\{10 \text{ S } (3 \text{ M } 4) \text{ D } 2\} \text{ A } 3$, is equal to

1. 3 2. 7 3. 18 4. 75

Solution: $\{10 - (3 \times 4) \div 2\} + 3 = \{10 - 12/2\} + 3 = \{10 - 6\} + 3 = 4 + 3 = 7$. **Answer is 2.**

7. If $a * b = a + b - \frac{ab}{2}$ for all $a, b \in R$ and e is a non-zero real number, then the value of a for which $a * e = a$ is

1. 0 2. 1 3. 2 4. 3

Solution: $a * e = a$; $a + e - \frac{ae}{2} = a \Rightarrow e = \frac{ae}{2} \Rightarrow a = 2$. **Answer is 3.**

8. B is the father of A, C is the wife of B, D is the mother of C and E is the husband of D. Then how is E related to A?

1. Grandfather 2. Mother 3. Brother-in-law 4. Father

Solution: B is male. C is Mother of A. D is Grandmother of A. E is Grandfather of A. E is Husband of D. **Answer is 1.**

9. In a row of six persons, D and C are immediate neighbours of E, B is the only neighbour of A and C is the neighbour of F. The possible persons occupying the two end points of the row are

1. F and B 2. A and F 3. F and C 4. C and A

Solution: F C E D B A. **Answer is 2.**

10. If a clock shows 12 minutes past 5, then the angle between its two hands is

1. 86° 2. 84° 3. 80° 4. 78°

Solution: In a clock, the angle between the hours hand and minutes hand is $\theta = 30h - \frac{11m}{2}$ degrees.

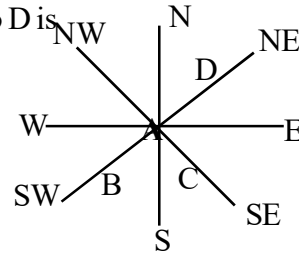
The angle between the hands of a clock when the clock shows 12 minutes past 5

$$= 30 \times 5 - \frac{11}{2} \times 12 = 150 - 66 = 84^\circ. \text{ Answer is 2.}$$

1. B is to the South-West of A; C is to the East of B and is also South-East of A while D is to the North of C in line with B and A. The direction of A relative to D is

1. North
2. East
3. South-West
4. North-East

Solution: If we represent them on the line they will be as shown in the figure. **Answer is 4.**



2. Five persons A, B, C, D and E are in a row such that
- (i) B is not at any extreme end,
 - (ii) C is an between B and E,
 - (iii) A is on the left of B
 - (iv) D is on the right of E

Then the persons at the extreme ends are

1. C, D
2. A, E
3. C, E
4. A, D

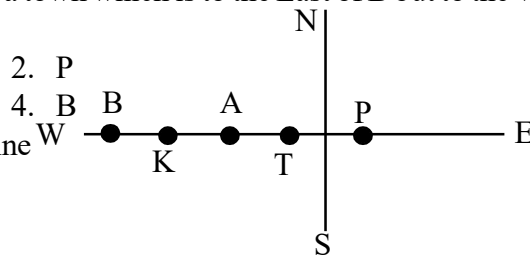
Solution: A B C E D. **Answer is 4.**

3. The town P is located on the bank of a river. Another town A is to the West of P and a town T is to the East of A but West of P. K is a town which is to the East of B but to the West of T and A. The town on farthest West is

1. T
2. P
3. K
4. B

Solution: If we represent them on the line they will be as shown in the figure.

Answer is 4.



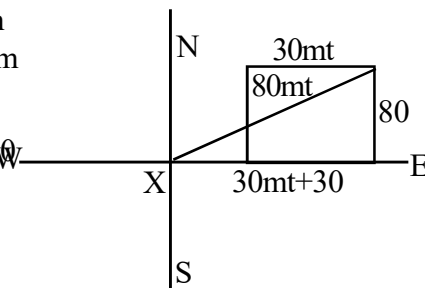
4. A person facing East moves 30 meters towards East and then moves a distance of 80 meters North and later moves 30 meters towards East again. How far is he from the initial point?

1. 80m
2. 90m
3. 100m
4. 110m

Solution: By pythagorous theorem he is

$$\sqrt{80^2 + 60^2} = \sqrt{6400 + 3600} = \sqrt{10000} = 100$$

distance from the initial point.



5. After 1990, which year has the same calendar as that of 1990?

1. 1994
2. 1995
3. 1996
4. 1997

Solution: Add score to all.

6. Five years back the ratio of son's age to that of his father is 2:5. The present age of the father is 50 years. Then the present age of the son (in years) is

1. 18
2. 21
3. 23
4. 25

Solution: Let the present age of the son be x

$$\frac{x-5}{50-5} = \frac{2}{5}, \quad 5x - 25 = 90 \Rightarrow 5x = 115 \Rightarrow x = \frac{115}{5} = 23. \text{ Answer is 3.}$$

7. 15th August of a year falls on Wednesday. Then what day is 2nd October of that year?

1. Wednesday 2. Tuesday 3. Monday 4. Sunday

Solution: W - 0; T - 1; F - 2; S - 3; Sun - 4; Mon - 5; Tues - 6,

Aug - 16 days; September - 30 days; October - 2 days. Total = 48 days = 6 odd days.

So Tues day. **Answer is 2.**

8. If $a * b = a \left(1 + \frac{1}{b} + \frac{1}{b^2} + \dots \right)$ for $a, b \in N, b > 1$ then $2 * 3 =$

1. 1 2. 3 3. 6 4. 8

Solution: $2 * 3 = 2 \left(1 + \frac{1}{3} + \frac{1}{3^2} + \dots \right) = 2 \times \frac{1}{1 - \frac{1}{3}} = 2 \times \frac{3}{2} = 3. \text{ Answer is 3.}$

Note: $\left(1 + \frac{1}{3} + \frac{1}{3^2} + \dots \right) = \text{Infinte geometric progression} = \frac{a}{1-r} = \frac{1}{1 - \frac{1}{3}} = \frac{3}{2}$

9. At 15 minutes past 5, the angle between both the hands of a clock is

1. $72\frac{1}{2}^0$ 2. $67\frac{1}{2}^0$ 3. 64^0 4. $58\frac{1}{2}^0$

Solution: In a clock, the angle between the hours hand and minutes hand is $\theta = 30h -$

$\frac{11m}{2}$ degrees.

$$\left| 30h - \frac{11m}{2} \right| = \left| \frac{11 \times 5}{2} - 30(8) \right| = \left| \frac{165 - 300}{2} \right| = \left| \frac{135}{2} \right| = 67\frac{1}{2}^0. \text{ Answer is 2.}$$

10. The denominator of a fraction is one more than twice the numerator. If one is added to both the numerator and denominator the fraction becomes

1. $\frac{3}{4}$ 2. $\frac{2}{3}$ 3. $\frac{1}{2}$ 4. $\frac{4}{5}$

Solution: The fraction is $\frac{x}{2x+1}$. Adding 1 to the numerator and denominator the fraction becomes

$$\frac{x+1}{2x+1+1} = \frac{x+1}{2(x+1)} = \frac{1}{2}. \text{ Answer is 3.}$$

1. If the minutes hand of a clock is facing south, then the direction of the minutes hand after 210 minutes is
 1. North 2. East 3. West 4. South-West [1]
2. A is the mother of B and C. Dis the husbend of C. Then A is related to D as [3]
 1. Mother 2. Sister 3. Mother-in-law 4. Daughter-in-law.
3. If the first day of March in a year happens to be Friday, then the day on which Indian Independence day falls in the year is [3]
 1. Monday 2. Tuesday 3. Thursday 4. Saturday
4. If a clock shows 15 minutes past 3'o clock then the angle between the hours and minutes hand is
 1. 20^0 2. 30^0 3. 40^0 4. 7.5^0 [4]
5. If $a * b = a + b - \frac{ab}{2}$ for all $a, b \in R$ and e is a non-zero real number, then the value of a for which $a * e = a$ is [3]
 1. 0 2. 1 3. 2 4. 3
6. $a * b = \frac{1}{ab} + 1 \Rightarrow \sum_{n=1}^{2013} n * (n+1) =$ [2]
 1. $2013 - \frac{1}{2013}$ 2. $2014 - \frac{1}{2014}$ 3. $-\frac{1}{2014}$ 4. $2013 - \frac{1}{2014}$
7. In a queue Anitha is the 10th from the front while Meena is 25th from the last and Mohan is just in the middle of the two. If there are 50 persons in the queue, the position of Mohan from the front is
 1. 20th 2. 19th 3. 18th 4. 17th [3]
8. If $a * b = a + b + ab$ for all $a, b \in R$, then the value of x satisfying $(1 * 2) * x = -13$ is [2]
 1. 1 2. -3 3. 2 4. -2
9. The denominator of a fraction is one more than twice the numerator. If one is added to both the numerator and denominator the fraction becomes [3]
 1. $\frac{3}{4}$ 2. $\frac{2}{3}$ 3. $\frac{1}{2}$ 4. $\frac{4}{5}$
10. In a row of six persons, D and C are immediate neighbours of E, B is the only neighbour of A and C is the neighbour of F. The possible persons occupying the two end points of the row are [2]
 1. F and B 2. A and F 3. F and C 4. C and A

1. HCF AND LCM

Factors and Multiples: If a number 'a' divides 'b' exactly, we say that 'a' is factor of 'b', In this case, 'b' is called a multiple of 'a'.

Highest Common Factor (or) Greatest Common Measure G.C.M. (or) Greatest Common Divisor G.C.D: The H.C.F of two or more numbers is the greatest number that divides each of them exactly. There are two methods of finding the H.C.F. of a given set of numbers.

Factorization Method: Express each one of the given number as the product of prime factors. The product of least powers of common prime factors gives H.C.F.

Division Method: Divide the larger number by the smaller one. Now, divide the divisor by the remainder. Repeat the process of dividing, till zero is obtained as remainder. The last divisor is the required H.C.F.

Least Common Multiple (L.C.M.): The least number which is exactly divisible by each one of the given numbers is called their L.C.M.

Co-primes: Two numbers are said to be co-primes if their H.C.F. is one.

Note: For any two positive numbers, product of two numbers = Product of their H.C.F and L.C.M.

$$\text{L.C.M of fractions} = \frac{\text{L.C.M.of the numerator numbers}}{\text{H.C.F.of the denominator numbers}}$$

$$\text{H.C.F, of fractions} = \frac{\text{H.C.F.of the numerator numbers}}{\text{L.C.M. of the denominator numbers}}$$

Provided that the given fractions are first converted into their basic form. A basic form means, there should be no common factor in the numerator and denominator of a given fraction. Thus, a

fraction say $\frac{15}{20}$, when expressed in its basic form yields $\frac{3}{4}$.

PROBLEMS

1. If HCF (1152, 1664) = 128, then LCM (1152, 1664) =
1. 1152 2. 1154 3. 14976 4. 16872

Solution: HCF x LCM = product of the numbers.

$$\text{So LCM} = \frac{\text{product of the numbers}}{\text{HCF} \times \text{LCM}} = \frac{1152 \times 1664}{128} = 1152 \times 13 = 14976.$$

So the answer is 3.

2. The least positive integer that leaves remainders 25, 37 and 53 respectively when divided by 36, 48 and 64 is
1. 576 2. 574 3. 567 4. 565
Solution: Divisors = 36, 48 and 64; Remainders = 25, 37 and 53; Difference = 11, 11 and 11.

Difference of divisors and remainders is same, in all the cases.

So required number = (LCM of 36, 48 and 64) - (11) = 576 - 11 = 565.

So the answer 4.

3. The l.c.m. and g.c.d. of two numbers are 240 and 16 respectively. If the two numbers are in the ratio 3 : 5, the numbers are,

1. 24, 40 2. 21, 35 3. 36, 60 4. 80, 48

Solution: Let the numbers be $3x, 5x$.

Product of the numbers = g.c.d $\times$ l.c.m $\Rightarrow 3x.5x = 240 \times 16 \Rightarrow 15x^2 = 240 \times 16 \Rightarrow x^2 = 16 \times 16$

$\Rightarrow x = 16$. So the numbers are 48, 80. **So the answer is 4.**

4. The g.c.d. and l.c.m. of two numbers are 66 and 384 respectively. If the first number is divided by 2, the resulting answer is 66. The second number is

1. 192 2. 196 3. 384 4. 576

Solution: Let first number be ' a ' and second number be ' b '.

Given that $\frac{a}{2} = 66 \Rightarrow a = 132$. Now $132 b = 66 \times 384 \Rightarrow b = \frac{66 \times 384}{132} = \frac{384}{2} = 192$.

So the answer is 1.

5. The ascending order of the numbers $\frac{7}{8}, \frac{9}{11}, \frac{5}{7}$ is

1. $\frac{7}{8}, \frac{9}{11}, \frac{5}{7}$ 2. $\frac{9}{11}, \frac{7}{8}, \frac{5}{7}$ 3. $\frac{5}{7}, \frac{9}{11}, \frac{7}{8}$ 4. $\frac{5}{7}, \frac{7}{8}, \frac{9}{11}$

Solution: LCM of denominators 8, 11, 7 is 616.

So the fractions can be written as $\frac{7}{8} = \frac{7 \times 77}{8 \times 77} = \frac{539}{616}$, $\frac{9}{11} = \frac{9 \times 56}{11 \times 56} = \frac{504}{616}$,

$\frac{5}{7} = \frac{7 \times 88}{7 \times 88} = \frac{440}{616}$.

So ascending order = $\frac{440}{616}, \frac{504}{616}, \frac{539}{616}$. So ascending order of fractions = $\frac{5}{7}, \frac{9}{11}, \frac{7}{8}$.

So the answer is 3.

6. The least positive integer which leaves a remainder 2, when divided by each of the numbers 4, 6, 8, 12 and 16

1. 46 2. 48 3. 50 4. 52

Solution: The LCM of 4, 6, 8, 12 and 16 = 48.

So the required number = $48 + 2 = 50$. **So the answer is 3.**

7. The least perfect square which is divisible by each of the numbers 12, 15, 20, 24 is
 1. 3600 2. 4600 3. 6400 4. 8100
Solution: The least number which is exactly divisible by 12, 15, 20, 24 is their LCM.
 $LCM = 2 \times 2 \times 2 \times 3 \times 5 = 120$. 120 is not a perfect square.
 To make this a perfect square we have to multiply with $3 \times 2 \times 5 = 30$.
 So the required number is $120 \times 30 = 3600$. **So the answer is 1.**
8. The least number of five digits exactly divisible by 456 is
 1. 10000 2. 10012 3. 10032 4. 10056
Solution: The least 5 digit number is 10000.
 When 10000 divided by 456, then we get remainder as 424.
 So the least 5 digit number which is divisible by 456 is $10000 + (456 - 424) = 10032$.
So the answer is 3.
9. If three natural numbers, whose LCM is 360, are in the ratio 2 : 3 : 4, then the largest of them is
 1. 60 2. 90 3. 120 4. 180
Solution: Let the numbers be $2x$, $3x$, $4x$. Their $LCM = 12x$.
 So $12x = 360 \Rightarrow x = 30$. So the numbers are 30, 90, 120.
 The largest among them is 120. **So the answer is 3.**
10. The greatest possible length of a scale which can be used to measure exactly the lengths 1m 20cm, 9m, 1m 5cm. and 1m 65cm. is
 1. 35cm 2. 25cm. 3. 5cm. 4. 15cm.
Solution: The greatest possible length of a scale which can be used to measure exactly the lengths 1m 20cm, 9m, 1m 5cm. and 1m 65cm. is the GCD of 120, 900, 105 and 165.
 Their GCD = 15cm. **So the answer is 4.**
11. The least number which is exactly divisible by 3, 4, 5, 6 and 8 is
 1. 60 2. 90 3. 120 4. 180
Solution: The least number which is exactly divisible by 3, 4, 5, 6 and 8 is their LCM.
 $LCM = 2 \times 3 \times 4 \times 5 = 120$. **So the answer is 3.**
12. The LCM of 36, 48, 72 and 24 is
 1. 120 2. 144 3. 288 4. 240
Solution: $36 = 2^2 \times 3^2$; $48 = 2^4 \times 3^1$; $72 = 2^3 \times 3^2$; $24 = 2^3 \times 3^1$.
 So $LCM = 2^4 \times 3^2 = 16 \times 9 = 144$. **So the answer is 2.**
13. The GCD of 36, 48, 72 and 24 is
 1. 24 2. 12 3. 8 4. 6
Solution: $36 = 2^2 \times 3^2$; $48 = 2^4 \times 3^1$; $72 = 2^3 \times 3^2$; $24 = 2^3 \times 3^1$.
 So $GCD = 2^2 \times 3^1 = 4 \times 3 = 12$. **So the answer is 2.**

14. The LCM of $1\frac{1}{2}$, $2\frac{3}{4}$ and $1\frac{1}{8}$.

1. 49 2. $49\frac{1}{2}$ 3. $\frac{97}{2}$ 4. 48

Solution: Converting into improper fractions we get $\frac{3}{2}$, $\frac{11}{4}$ and $\frac{9}{8}$.

So L.C.M of fractions = $\frac{\text{L.C.M. of the numerator numbers}}{\text{H.C.F. of the denominator numbers}}$

$$= \frac{\text{LCM of } 3, 11, 9}{\text{GCD of } 2, 4, 8} = \frac{99}{2} = 49\frac{1}{2}. \text{ So the answer is 2}$$

ICET-2011

15. The smallest positive integer which leaves a remainder 3 when divided by 5 and leaves a remainder 5 when divided by 7, is

1. 68 2. 23 3. 33 4. 12

Solution: Divisors = 5, and 7; Remainders = 3 and 5; Difference = $5-3=2$ and $7-5=2$.

Difference of divisors and remainders is same, in all the cases.

So required number = (LCM of 5 and 7) - (2) = $35 - 2 = 33$. **Answer is 3.**

16. When the following fractions are arranged in ascending order of magnitude, the

middle one is $\frac{2}{3}$, $\frac{5}{7}$, $\frac{9}{13}$, $\frac{9}{14}$, $\frac{7}{9}$

1. $\frac{2}{3}$ 2. $\frac{5}{7}$ 3. $\frac{9}{13}$ 4. $\frac{7}{9}$

Solution: $\frac{2}{3}=0.66..$, $\frac{5}{7}=0.71..$, $\frac{9}{13}=0.69..$, $\frac{9}{14}=0.642..$, $\frac{7}{9}=0.777..$

Ascending order is $\frac{2}{3}$, $\frac{9}{14}$, $\frac{9}{13}$, $\frac{5}{7}$, $\frac{7}{9}$. The middle one is $\frac{9}{13}$. **Answer is 3.**

17. The least value of k such that $735 \times k$ is a perfect square is

1. 3 2. 5 3. 7 4. 15

Solution: $735 \times k = 3 \times 7^2 \times 5$

So the least value $k = 3 \times 5 = 15$. **Answer is 4.**

ICET-2012

18. If $x > x^2 > x^3$, then a possible value of x among the following is

1. -2 2. $-\frac{1}{2}$ 3. $\frac{3}{4}$ 4. 1

Solution: $x = -2 \Rightarrow -2 > 4 > -8$ wrong; $x = -\frac{1}{2} \Rightarrow -\frac{1}{2} > \frac{1}{4} > \frac{-1}{8}$ wrong;

$x = \frac{3}{4} \Rightarrow \frac{3}{4} > \frac{9}{16} > \frac{27}{64}$ Correct; $x = 1 \Rightarrow 1 > 1 > 1$ wrong. **Answer is 3.**

19. If the fractions $\frac{1}{2}$, $\frac{2}{9}$ and $\frac{7}{13}$ are expressed with a common denomination, then the least

numerator is

1. 117 2. 91 3. 136 4. 52

Solution: LCM of 2, 9, 13 is 234. $\frac{1}{2} = \frac{117}{234}$, $\frac{2}{9} = \frac{52}{234}$, $\frac{7}{13} = \frac{126}{234}$

The least numerator is 52.

Answer is 4.

20. H C F of two numbers is 15 and their sum is 150. If both the numbers are greater than 15, then those numbers are

1. 45, 105 2. 60, 90 3. 55, 95 4. 30, 120

Solution: The HCF of 45, 105 is 15.

The HCF of 60, 90 is 30.

The HCF of 55, 95 is 5.

The HCF of 30, 120 is 30. **Answer is 1.**

21. If $n = 847 \times K$ is a perfect square then the least possible positive value of K is:

1. 3 2. 5 3. 7 4. 11

Solution: $847 = 11^2 \times 7$. So the least possible positive value of K is 7; **Answer is 3.**

2. NUMBERS AND DIVISIBILITY

1. If a number is divisible by another number, it must be divisible by each of the factors of that number.

Example: 36 is divisible by 6.

The factor of 6 are 2, 3 $\Rightarrow$ 36 is divisible by 2 and 3 also (i.e.,) the factors of 6.

2. If a number is divisible by each of the two or more co-prime numbers, it must be divisible by their product.

Example: 120 is divisible by 3, 4 and 5 which are co-primes $\Rightarrow$ 120 is divisible by $3 \times 4 \times 5 = 60$.

3. If a number is a factor of each the two given numbers it must be a factor of their sum.

Example: 6 is divisible by 3 and 15 is divisible by 3 $\Rightarrow 6 + 15 = 21$ is divisible by 3.

4. If a number is a factor of each of the two given numbers then it must be a factor of their difference.

Example: 324 and 264 are divisible by 4 $\Rightarrow 324 - 264 = 60$ is also divisible by 4.

Rules for Testing Divisibility of a Number

A number is Divisible by 2 if the last digit or units place is 0, 2, 4, 6 or 8.

A number is Divisible by 3 if the sum of its digits is divisible by 3.

A number is Divisible by 4 if the last two digits from a number divisible by 4 or 00.

A number is Divisible by 5 if the last digit is either 0 or 5.

A number is Divisible by 6 if it is divisible by both 2 and 3.

A number is Divisible by 8 if the last three digits from a number divisible by 8 or 000.

A number is Divisible by 9 if the sum of all digits is divisible by 9.

A number is Divisible by 10 if the last digit is 0.

A number is Divisible by 11 if the difference between the sum of digits at odd and even places is either 0 or in multiples of 11.

A number is Divisible by 12 if it is divisible by both 3 and 4.

A number is Divisible by 14 if it is divisible by both 2 and 7.

A number is Divisible by 15 if it is divisible by both 3 and 5.

A number is Divisible by 16 if the number formed by the last four digits is divisible by 16.

PROBLEMS

1. If the ten-digit number $116342a32b$ is divisible by 9 and $a - b = 2$ then the ordered pair (a, b) is

1. (6, 4) 2. (8, 6) 3. (5, 3) 4. (3, 1)

Solution: The number is divisible by 9 if the sum of the digits is divisibly by 9.

Here, if $116342a32b$ is divisible by 9

then $1 + 1 + 6 + 3 + 4 + 2 + a + 3 + 2 + b = 22 + a + b$ is divisible by 9.

Also given that $a - b = 2$, then go through options.

If $(a, b) = (6, 4)$, here $a - b = 2$ is true, but $22 + 6 + 4 = 32$ is not divisible by 9.

So answer is not (1).

If $(a, b) = (8, 6)$, here $a - b = 2$ is true. Also $22 + 8 + 6 = 36$ is divisible by 9. **So the answer is 2.**

2. If the numbers: 169, 248, 416, 974, 517, 612 and 325 are arranged in descending order based on the sum of the digits of each of these numbers, the middle number will be

1. 248 2. 517 3. 612 4. 974

Solution: Sum of the digits of 169 = 16; Sum of the digits of 248 = 14; Sum of the digits of 416 = 11;

Sum of the digits of 974 = 20; Sum of the digits of 517 = 13; Sum of the digits of 612 = 9;

Sum of the digits of 325 = 10;

Descending order based on the sum of the digits of each of these numbers is

612, 325, 416, 517, 248, 169, 974. So the middle number is 517. **So the answer is 2.**

3. The number of divisors excluding 1 and itself of the number 8625 is

1. 15 2. 14 3. 12 4. 13

Solution: $8625 = 5^3 \times 3^1 \times 23^1$.

The number of factors = $(3 + 1)(1 + 1)(1 + 1) = (4)(2)(2) = 16$.

The number of divisors excluding 1 and it self = $16 - 2 = 14$. **So the answer is 2.**

4. The number of integers between 200 and 600, that the divisible by 2, 3 and 7 is

1. 14 2. 9 3. 11 4. 10

Solution: The integer which is divisible by 2, 3 and 7 is LCM of 2, 3 and 7.

LCM of 2, 3 and 7 is 42.

The number of integers divisible by 2, 3 and 7 between 200 and 600

= number of integers divisibly by 2, 3 and 7 up to 600 - number of integers divisibly by 2, 3 and

7 up to 200 = $\frac{600}{42} - \frac{200}{42} = 14 - 4 = 10$. **So the answer is 4.**

5. The number of 3 digit positive integers that leave the remainder 5 when divided by 7, is

1. 142 2. 141 3. 129 4. 128

Solution: The least 3 digit number = 100, the greatest 3 digit number = 999.

$100 = 7(14) + 2$, so the remainder is 2. $999 = 7(142) + 5$, so the remainder is 5.

$103 = 7(14) + 5$, so the remainder is 5.

So the number of 3 digit numbers that leave remainder 5 when divided by 7 is $\frac{999 - 103}{7} + 1 =$

129

So the answer is 3.

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6. The number of distinct prime factors of $8!$ is:

1. 3 2. 4 3. 5 4. 8

Solution: $8! = 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$. 7, 5, 3, 2, are prime factors. **Answer is 2.**

7. The number of elements in the set $E = \{n : n \text{ integer}, 500 \leq n \leq 700 \text{ and } n \text{ is divisible by } 11\}$ is

1. 63 2. 45 3. 108 4. 18

Solution: $11 \times 50 = 550$; $11 \times 60 = 660$; $660 - 550 = 110$; $\frac{110}{11} = 10$; $10 + 4 + 4 = 18$.

Answer is 4.

3. PERCENTAGES

Percent means per 100.

To Express $x\%$ as a Fraction: $x\% = \frac{x}{100}$

Important Formulae: If the price of commodity increases by $x\%$, then the reduction in consumption, so as not to increase the expenditure is $\left(\frac{x}{100+x} \times 100\right)\%$

If the price of a commodity decreases by $x\%$, then the increase in consumption, so as not to decrease the expenditure is $\left(\frac{x}{100-x} \times 100\right)\%$

PROBLEMS

1. If A gets 50% more than B, how much does B get less than A?

1. 25% 2. $33\frac{1}{3}\%$ 3. 50% 4. $66\frac{2}{3}\%$

Solution: $A = B + 50\%B \Rightarrow \frac{A}{B} = \frac{150}{100}$.

So B get less than 'A'. $\frac{50}{150} \times 100 = 33\frac{1}{3}\%$. **So the answer is 2.**

2. In an examination, A got 10% marks less than B and B got 10% marks less than C. If A get 810 marks, then how many marks did C get?

1. 900 2. 970 3. 920 4. 1000

Solution: Let C = 100 part. B = 90% of 100 parts = 90 parts.

A = 90% of 90 parts = 81 parts. A = 81 parts = 810 $\Rightarrow$ 1 part = 10.

So C = 100 parts = 100 x 10 = 1000. **So the answer is 4.**

3. If 7% of 800 is equal to 20% of x , then $x =$

1. 300 2. 280 3. 240 4. 200

Solution: 7% of 800 = 20% of $x \Rightarrow \frac{7}{100} \times 800 = \frac{20}{100} \times x \Rightarrow x = \frac{7 \times 800}{20} = 280$.

4. If 20% of $a = 25\%$ of $b = 30\%$ of $c = 10\%$ of $d = k > 1$ then the largest of $2a, 3b, 6c$ and d is

1. $2a$ 2. $3b$ 3. $6c$ 4. d

Solution: 20% of $a = 25\%$ of $b = 30\%$ of $c = 10\%$ of $d = k$

$$\Rightarrow \frac{a}{5} = \frac{b}{4} = \frac{3c}{10} = \frac{d}{10} = k \Rightarrow a = 5k; b = 4k; c = \frac{10k}{3}; d = 10k$$

$$\Rightarrow 2a = 10k; 3b = 12k; 6c = 20k; d = 10k.$$

So maximum among these is $6c$. **So the answer is 3.**

5. A student has to secure 45% of marks to pass. If a boy getting 285 marks fails by 30 marks the maximum marks for the examination is

1. 600 2. 650 3. 700 4. 750

Solution: A student has to get 45% to pass. He got 285 and fails by 30 marks.

So, pass marks are $285 + 30 = 315 \Rightarrow 45\%$ of maximum marks = 315.

$$\Rightarrow 45\% \text{ of } x = 315 \Rightarrow \frac{45}{100} \times x = 315 \Rightarrow x = 700. \text{ So the answer is 3.}$$

6. If 25% of a number is added to another number then the second number increases by 10%. The ratio of the first number to the second is

1. 1 : 2 2. 2 : 1 3. 5 : 2 4. 2 : 5

Solution: Let the two numbers be x and y .

$$25\% \text{ of } x + y = 110\% \text{ of } y \Rightarrow \frac{x}{4} = \frac{110y}{100} - y \Rightarrow \frac{x}{4} = \frac{y}{10} \Rightarrow \frac{x}{y} = \frac{4}{10} = \frac{2}{5}. \text{ So the answer is 4.}$$

7. After successive discounts of $x\%$ and $y\%$ an article worth Rs.250 is available for Rs.170. If $y = 15$ then $x =$

1. 25 2. 20 3. 15 4. 10

$$\text{Solution: } (100 - x)\% \text{ of } (100 - 15)\% \text{ of } 250 = 170 \Rightarrow \frac{100 - x}{100} \times \frac{85}{100} \times 250 = 170$$

$$\Rightarrow 100 - x = 80 \Rightarrow x = 20. \text{ So the answer is 2.}$$

8. A has a share of 75% in a property and sold two-third of his share for Rs.3 lakhs. The value of the entire property (in lakhs of rupees) is

1. 7 lakhs 2. 6 lakhs 3. 5 lakhs 4. 4 lakhs

Solution: Let the entire property is x rupees, then from the given problem,

$$\frac{2}{3} (75\%(x)) = 3,00,000 \Rightarrow \frac{2}{3} \times \frac{3}{4} \times x = 3,00,000 \Rightarrow x = 6,00,000 = 6 \text{ lakhs.}$$

So the answer is 2.

9. If the income tax is reduced from 15% to $12\frac{1}{2}\%$, what difference does it make to a person

whose taxable income is Rs.9,800?

1. 245 2. 250 3. 205 4. 650

Solution: The difference = 15% of 9,800 - $12\frac{1}{2}\%$ of 9,800 = $2\frac{1}{2}\%$ of 9,800

$$= \frac{5}{200} \times 9,800 = \text{Rs. 245. So the answer is 1.}$$

10. Two numbers are respectively 20% and 25% more than a third number. What percent is the first number of the second?

1. 86 2. 90 3. 92 4. 96

Solution: First number = 20% more than third number.

Second number = 25% more than third number.

Let third number = 100; First number = 120; Second number = 125.

The first number as the percentage of the second = $\frac{120}{125} \times 100 = 96\%$. **So the answer is 4.**

11. If the salary of A is 20% more than the salary of B, then the salary of B is less than that of A by

1. $16\frac{2}{3}\%$ 2. 20% 3. 18% 4. 15%

Solution: Let B's salary 100, then A's salary is 120.

B's salary is less than A = $\frac{120-100}{120} \times 100 = \frac{100}{6} = \frac{50}{3} = 16\frac{2}{3}\%$. **So the answer is 1.**

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12. If 7% of 900 is equal to $x\%$ of 200, then $x =$

1. 14 2. $31\frac{1}{2}$ 3. $32\frac{1}{2}$ 4. $21\frac{1}{2}$

Solution: $\frac{7}{100} \times 900 = \frac{x}{100} \times 200 \Rightarrow \frac{63}{2} = 31\frac{1}{2}$. **Answer is 2.**

ICET-2012

13. If $\frac{3}{4}$ of 15% of an amount is Rs.72, then that amount (in rupees) is

1. 1400 2. 540 3. 360 4. 640

Solution: $\frac{3}{4} \times \frac{15}{100} \times x = 72 \Rightarrow x = 32 \times 20 = 640$. **Answer is 4.**

4. PROFIT AND LOSS

The shopkeepers buy the goods directly from a factory or from a wholesale merchant. The amount paid by the shopkeeper to buy goods from the wholesale dealer or the manufacturer is called the Cost Price (C.P.). The amount at which the shopkeeper sells the goods to his customer is called the Selling Price (S.P.)

Cost Price: The price at which an article is purchased is called its cost price abbreviated as C.P.

Selling Price: The price at which an article is sold is called its selling price abbreviated as S.P.

Profit or Gain: If $S.P. > C.P.$ the seller is said to have a profit or gain. $Profit = S.P. - C.P.$

Loss: If $S.P. < C.P.$, the seller is said to have incurred a loss. $Loss = C.P. - S.P.$

$$1. \text{ Gain}\% = \frac{\text{Gain}}{\text{C.P.}} \times 100$$

$$2. \text{ Loss}\% = \frac{\text{Loss}}{\text{C.P.}} \times 100$$

$$3. \text{ S.P.} = \frac{100 + \text{Gain}\%}{100} \times \text{C.P.}$$

$$4. \text{ S.P.} = \frac{100 - \text{Loss}\%}{100} \times \text{C.P.}$$

$$4. \text{ C.P.} = \frac{100}{100 + \text{Gain}\%} \times \text{S.P.}$$

$$6. \text{ C.P.} = \frac{100}{100 - \text{Loss}\%} \times \text{S.P.}$$

7. If a trader sells his goods at cost price, but uses false weights, then,

$$\text{Gain}\% = \left[\frac{\text{true weight} - \text{false weight}}{\text{false weight}} \times 100 \right] \%$$

8. When a person sells two similar items, one at a gain of $x\%$ and the other at a loss of $x\%$, then

$$\text{the seller always incurs a loss given by } \left[\frac{\text{Common loss and gain}\%}{10} \right]^2 = \left(\frac{x}{10} \right)^2$$

Note: a) If an article is sold at a gain of 10% then $S.P. = 110\%$ of C.P.

b) If an article is sold at a loss of 10% then $S.P. = 90\%$ of C.P.

9. When there are two successive profits of $x\%$ and $y\%$ then the resultant

$$\text{Profit}\% = \left[x + y + \frac{xy}{100} \right]$$

10. When there is a profit of $x\%$ and loss of $y\%$ in a transaction then the resultant profit % (or)

$$\text{Loss}\% = \left[x - y - \frac{xy}{100} \right] \text{ according to the sign.}$$

11. If cost price of x articles is equal to the selling price of y articles then the profit $\% = \frac{x - y}{y} 100\%$.

12. If a trader marks his goods at $x\%$ above his cost price and allows purchasers a discount of $y\%$ for cash then there is $\left[x - y - \frac{xy}{100} \right] \%$ profit or loss according to the sign.

PROBLEMS

1. An article is sold at a profit of 20%. Had it been sold at a profit of 25%, it would have fetched Rs. 35 more. The cost price of the article (in rupees) is
 1. 650 2. 700 3. 750 4. 800

Solution: Let cost price be x .

$$\text{For 20\% profit} = \frac{x}{100}(100 + 20) = \frac{120x}{100} = \frac{6x}{5}.$$

$$\text{For 25\% profit} = \frac{x}{100}(100 + 25) = \frac{125x}{100} = \frac{5x}{4}.$$

$$\text{So } \frac{5x}{4} - \frac{6x}{5} = 35 \Rightarrow \frac{25x - 24x}{20} = 35 \Rightarrow x = 35(20) = 700. \text{ So the answer is 2.}$$

2. A trader allows a discount of 15% on the marked price of an article. How much percent above the cost price is to be marked to make a profit of 19% ?
 1. 40% 2. 39% 3. 33% 4. 29%

Solution: LET CP = 100 parts; SP = 119 parts; Discount = 15%

$$\text{SP} = \text{MP} \times \left(\frac{100 - 15}{100} \right) = 119\text{P}; \text{MP} = 119\text{P} \times \frac{100}{85} = 140\text{P}; \text{CP} = 100\text{P}; \text{MP} 40\text{P}.$$

$$\text{Percentage above the cost price} = \frac{40\text{P}}{100\text{P}} \times 100 = 40\%. \text{ So the answer is 1.}$$

3. By selling an article for Rs.990 a trader makes a profit of $12\frac{1}{2}\%$. The cost price of the article in rupees is
 1. 920 2. 900 3. 800 4. 880

$$\text{Solution: Let cp} = 100\text{p; profit} = 12\frac{1}{2}\%; \text{sp} = 112\frac{1}{2}\%; \frac{225}{2}\text{p} = 990.$$

$$\text{p} = \frac{990}{225} \times 2; \text{cp} = 100\text{p} = 100 \times \frac{990}{225} \times 2 = 880\text{p}. \text{ So the answer is 4.}$$

4. A man sells 320 mangoes at the cost price of 400 mangoes. Then the percentage of his gain is
 1. 10 2. 15 3. 20 4. 25

Solution: Cost price of 400 Mangoes = Selling price of 320 Mangoes

$$\Rightarrow \text{The sellers gain percentage} = \frac{400 - 320}{320} \times 100 = 25\%.$$

So the answer is 4.

5. A trader marks his good at 20% above the cost price and allows a discount of 10%. Then the percentage of his gain is

1. 8 2. 10 3. 12 4. 15

Solution: Let CP = 100 Rs, marks up is 20%, marked price = $100 + 20 = 120$

$$\text{Discount} = 10\%, \text{ selling price} = 120 \times \frac{90}{100} = 108 \text{ Rs.}$$

Gain percentage 8%. **So the answer is 1.**

6. An article sold for Rs. y yields $x\%$ profit. Then the cost price of the article (in Rupees) is

1. $\frac{100+x}{100y}$ 2. $\frac{100y}{100+x}$ 3. $\frac{100x}{100+y}$ 4. $\frac{100+y}{100x}$

Solution: $(100 + x)\%$ of cost price = $y \Rightarrow \text{cost price} = \frac{100y}{100+x}$. **So the answer is 2.**

7. A and B invest in a business in the ratio 3 : 2. If 10% of the total profit goes for donations and if A's share is Rs.810, then the total profit (in Rupees) is

1. 1550 2. 1500 3. 1460 4. 1400

Solution: The ratio of the investment of A, B = 3 : 2. Let the total profit = x .

$$\text{Donated amount} = \frac{x}{100}. \text{ The remaining distribution amount} = \frac{9x}{10}.$$

$$\text{The share of A} = \frac{9x}{10} \times \frac{3}{5} = 810 \Rightarrow x = 1500. \text{ So the answer is 2.}$$

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8. A merchant prepares the market price of the article at a profit of 40% and sells them giving a discount of 10%. If an article is sold for Rs.630, then its cost price (in rupees) is

1. 600 2. 500 3. 450 4. 400

Solution: Let C.P. = 100;

$$\text{M.P.} = 100 + 40 = 140;$$

$$\text{S.P.} = 140 - 14 = 126$$

If C.P.=100 then S.P.=126.

$$\text{If an article is sold for Rs.630, then its cost price is} = \frac{630}{126} \times 100 = 500. \text{ Answer is 2.}$$

9. An item costing Rs.200 is being sold out at 10% loss. If the price is further reduced by 5%, the selling price will be

1. Rs.170 2. Rs.171 3. Rs.175 4. Rs.179

Solution: C.P. = 200;

S.P. = 200 - 20 = 180; loss 10% $\Rightarrow$ loss = Rs.20

Further reduce by 5% i.e 5% of 180 $\Rightarrow$ Rs.9.

Therefore S.P. = 180-9 = Rs. 171. **Answer is 2.**

10. A man sold an article for Rs. 187 and gained 10%. The article was bought for

1. Rs.150 2. Rs.160 3. Rs.170 4. Rs.180

Solution: C.P.=170;

Gain %= 10%; So profit = 17; S.P. = 170 + 17 = 187. **Answer is 3.**

11. By selling 15 mangoes, a fruit seller recovers the cost price of 20 mangoes. What is the profit percentage?

1. 25% 2. $\frac{200}{3}\%$ 3. $\frac{100}{3}\%$ 4. 50%

Solution: S.P. of 15 = C.P. of 20.

Profit = 5 Mangoes.

$$\text{profit \%} = \text{Gain\%} = \frac{\text{Gain}}{\text{C.P}} \times 100 = \frac{5}{15} \times 100 = \frac{100}{3} \%. \text{ Answer is 3.}$$

ICET-2012

12. A person buys an article with 15% discount on its marked price. He makes a profit of 15% by selling it at Rs.3910. Then the marked price of the article (in rupees) is

1. 3,500 2. 4,500 3. 4,000 4. 4,200

Solution: M.P. = $\frac{100}{85} \times 3910 \times \frac{100}{115} = 4000$. **Answer is 3.**

13. If the cost price of 20 books is equal to the selling price of 16 books, then the percentage of profit is

1. 16 2. 20 3. 25 4. 32

Solution: 20 C.P. = 16 S.P.; Profit = 4;

$$\text{profit \%} = \text{Gain\%} = \frac{\text{Gain}}{\text{C.P}} \times 100 = \frac{4}{16} \times 100 = 25\%. \text{ Answer is 3.}$$

5. RATIO AND PROPORTION

Introduction: The ratio between two quantities is the quotient obtained by dividing the first quantity by the second. The colon : is used between the quantities to indicate the ratio. The units of measurement of the quantities being compared should always be the same. While proportion is the equality of ratio, which can be obtained by multiplying the terms of the ratio by the same number. A detailed discussion is given below.

Ratio: The ratio of two quantities of the same kind and in the same unit is a comparison by division of the measures of two quantities. Thus the ratio of a to b is the fraction a/b and is generally expressed as $a : b$. For the ratio $a : b$, the quantities a and b are called the terms of the ratio.

Antecedent: The term is called the first term or antecedent.

Consequent: The term b is called the second term or consequent.

Comparison of Ratios: Let $a : b$ and $c : d$ be two ratios, then

$$\text{i) } a : b > c : d \text{ if, } ab > bc \quad \text{(ii) } a : b < c : d, \text{ and } ab < bc$$

Compounded Ratio: Ratios are compounded by taking the product of the antecedents for a new antecedent and the product of the consequents for a new consequent. For example, the compounded ratio of $a : b, c : d, e : f$ is $ace : bdf$.

Componendo and Dividendo Rule: If $\frac{a}{b} = \frac{c}{d}$ then $\frac{a+b}{a-b} = \frac{c+d}{c-d}$

This rule is called Componendo and Dividendo rule.

Duplicate Ratio: It is the compounded ratio of two equal ratios. Duplicate ratio of $a : b$ is $a^2 : b^2$.

Triplicate Ratio: It is the compounded ratio of three equal ratios. Triplicate ratio of $a : b$ is $a^3 : b^3$.

Sub-duplicate Ratio: The sub-duplicate ratio of $a : b$ is $\sqrt{a} : \sqrt{b}$

Sub-triplicate Ratio: The sub-triplicate ratio of $a : b$ is $\sqrt[3]{a} : \sqrt[3]{b}$

Inverse Ratio: If $a \neq 0, b \neq 0$, then the reciprocal ratio of $a : b$ is $\frac{1}{a} : \frac{1}{b}$. Clearly $\frac{1}{a} : \frac{1}{b} = b : a$.

Proportion: Four quantities a, b, c, d are said to be in proportion if, $\frac{a}{b} = \frac{c}{d}$. Symbolically it is written as $a : b :: c : d$. The terms a and b are known as extremes and b, c are known as means. The term d is called the fourth proportion to a, b and c .

Thirs Proportional: If $a : b = b : c$. Then c is called the third proportional to a and b .

Mean Proportional: Mean proportional between a and b is $\sqrt{ab}$.

Variation: If ' a ' is directly proportional to ' b ', we say $a = kb$ for some constant k , and we write, $a \propto b$. If ' a ' is inversely proportional to ' b ', we say $ab = k$ for some constant k , and we

PROBLEMS

1. In a class of 70 students consisting of boys and girls, a sum of Rs. 2,350 is distributed. If each boy gets Rs.30 and each girl gets Rs.35, then the number of boys in the class is

1. 40 2. 30 3. 25 4. 20

Solution: Let the boys x . So girls = $70 - x$.

Each boy get Rs. 30 and each girls get 35. So $30x + (70 - x)35 = 2350$.

$$\Rightarrow 30x + 2450 - 35x = 2350 \Rightarrow 2450 - 5x = 2350$$

$$\Rightarrow 2450 - 2350 = 5x \Rightarrow 100 = 5x \Rightarrow 20 = x.$$

So the number of boys in the class = 20. **So the answer is 4.**

2. If $\frac{3q}{5p} = \frac{7}{10}$, then $p : q$

1. 6 : 7 2. 7 : 6 3. 5 : 9 4. 9 : 5

Solution: $\frac{3q}{5p} = \frac{7}{10} \Rightarrow \frac{q}{p} = \frac{7 \times 5}{10 \times 3} = \frac{7 \times 1}{2 \times 3} = \frac{7}{6}$

$$\Rightarrow \frac{p}{q} = \frac{6}{7} \Rightarrow p : q = 6 : 7. \text{ So the answer is 1.}$$

3. The incomes of A and B are in the ratio 6 : 7. Their savings are in the ratio 8 : 7. Then what is the ratio of their expenditure if B save one-third of his income?

1. 4 : 5 2. 5 : 7 3. 5 : 6 4. 3 : 4

Solution: Given income ratio of A and B are 6I : 7I.

Given savings ratio of A and B are 8S : 7S.

$$\text{B's saving : } \frac{1}{3} \text{ of B's income; B's } \times 7S = \frac{1}{3} \text{ of } 7S; \frac{S}{I} = \frac{1}{3}.$$

$$\text{Savings ratio is } 6I - 8S : 7I - 7S. \text{ So } 6(3) - 8(1) : 7(3) - 7(1) = 10 : 14 = 5 : 7.$$

So the answer is 2.

4. If $a : b$ is 1 : 2, $b : c$ is 3 : 5, $c : d$ is 5 : 4 and $e : d$ is 5 : 6, then $a : b : c : d : e =$

1. 3 : 6 : 10 : 8 : 7 2. 15 : 30 : 50 : 40 : 48
3. 1 : 2 : 3 : 4 : 5 4. 9 : 18 : 30 : 24 : 20

Solution: $a : b = 1 : 2$; $b : c = 3 : 5$; $c : d = 5 : 4$; $e : d = 5 : 6$; $d : e = 6 : 5$.

$$\text{So } a : b : c : d : e \Rightarrow 1 \times 3 \times 5 \times 6 : 2 \times 3 \times 5 \times 6 : 2 \times 5 \times 5 \times 6 : 2 \times 5 \times 4 \times 6$$

$$\Rightarrow 90 : 180 : 300 : 240 : 200 \Rightarrow 9 : 18 : 30 : 24 : 20.$$

So the answer is 4.

5. If $\frac{2y}{3x} = \frac{5}{6}$, then $x : y =$

1. 5 : 3 2. 3 : 5 3. 5 : 4 4. 4 : 5

Solution: $\frac{2y}{3x} = \frac{5}{6} \Rightarrow \frac{x}{y} = \frac{12}{15} = \frac{4}{5}$. So $x : y = 4 : 5$. **So the answer is 4.**

6. If $x : y = 2 : 3$ and $x + y = 10$, then what is the value of $y - x$?

1. 4 2. 7 3. 5 4. 2

Solution: $x : y = 2 : 3$. So $x = 2p$ and $y = 3p$. So $x + y = 10 \Rightarrow 2p + 3p = 10 \Rightarrow p = ?$
So $y - x = 3p - 2p = 1p = 2$. **So the answer is 4.**

7. If a, b, c are positive integers such that $a^2 + b^2 + c^2 = 1197$, $a : b = 3 : 2$ and $b : c = 3 : 2$ then $b =$

1. 9 2. 18 3. 27 4. 36

Solution: Given that a, b, c are positive integers.

Also $a : b = 3 : 2$ and $b : c = 3 : 2$, then $a : b : c = 9 : 6 : 4$ -----(1)

Also given that $a^2 + b^2 + c^2 = 1197$, according to (1), take $a = 9k, b = 6k, c = 4k$

So, $(9k)^2 + (6k)^2 + (4k)^2 = 1197 \Rightarrow 81k^2 + 36k^2 + 16k^2 = 1197 \Rightarrow 133k^2 = 1197$

$\Rightarrow k^2 = 9 \Rightarrow k = 3$. And since $b = 6k, b = 18$. **So the answer is 2.**

8. If $x = \frac{4y}{5}$ then $\frac{2y}{3x} =$

1. $\frac{15}{8}$ 2. $\frac{6}{5}$ 3. $\frac{3}{4}$ 4. $\frac{5}{6}$

Solution: Given that $x = \frac{4y}{5}$, then $\frac{2y}{3x} = \frac{2y}{3\left(\frac{4y}{5}\right)} = \frac{2y}{\frac{12y}{5}} = \frac{10y}{12y} = \frac{10}{12} = \frac{5}{6}$. **Answer is 4.**

9. If the ratio of speeds of three trains is $3 : 4 : 5$, then the ratio of the times taken by them to travel the same distance is

1. $5 : 4 : 3$ 2. $12 : 15 : 20$ 3. $3 : 4 : 5$ 4. $20 : 15 : 12$

Solution: The ratio of speeds is $3 : 4 : 5$, then the ratio of the times is

$(4 \times 5) : (3 \times 5) : (3 \times 4) = 20 : 15 : 12$. **So the answer is 4.**

10. The numerator and denominator of a rational number are in the ratio $7 : 8$. If 10 is subtracted from numerator and denominator the resulting rational number is $\frac{2}{3}$. The numerator of the original number is

1. 12 2. 14 3. 16 4. 18

Solution: Numerator : Denominator = $7 : 8$.

$$\frac{7p-10}{8p-10} = \frac{2}{3}; 21p - 30 = 16p - 20; 5p = 10 \Rightarrow p = 2$$

Numerator = $7 \times 2 = 14$. **So the answer is 2.**

11. 2 tables and 3 chairs cost Rs.3,500 while 3 tables and 2 chairs cost Rs.4,000. The cost of a table (in rupees) is

1. 500 2. 1000 3. 1200 4. 1500

Solution: 2 tables + 3 chairs = 3,500 $\Rightarrow 2(2 \text{ tables} + 3 \text{ chairs}) = 7,000$ -----(1)

3 tables + 2 chairs = 4,000 $\Rightarrow 3(3 \text{ tables} + 2 \text{ chairs}) = 12,000$ -----(2)

(2) - (1) 5 tables = 5000. So table = 1000. **So the answer is 2.**

12. The incomes of A and B are in the ratio 3 : 4 and their expenditure are in the ratio 4 : 5. If B saves one third of his income, then the ratio of their savings is,

1. 13 : 21 2. 13 : 20 3. 14 : 23 4. 12 : 19

Solution: Income ratio of A and B are 3 : 4. So $3I : 4I$

Expenditures ratio of A and B are 4 : 5. So $4E : 5E$.

A's saving = $3I - 4E$; B's saving = $4I - 5E$.

Given that $4I - 5E : 4I \Rightarrow 12I : 15E = 4I \Rightarrow 8I = 15E \Rightarrow \frac{I}{E} = \frac{15}{8}$.

A and B's saving ratio $3 \times (15) - 4 \times (8) : 4 \times (15) - 5 \times (8)$

= $45 - 32 : 60 - 40 = 13 : 20$. **So the answer is 2.**

13. Two numbers are in the ratio 4 : 7. If 14 is added to each, they are in the ratio 5 : 7, then the numbers are

1. 20 and 35 2. 15 and 18 3. 12 and 21 4. 16 and 28

Solution: Numbers ratio = 4 : 7, two numbers are $4x$ and $7x$.

$$\frac{4x+14}{7x+14} = \frac{5}{7} = \frac{5}{7} \Rightarrow 7(4x+14) = 5(7x+14) \Rightarrow 7x = 2 \times 14 \Rightarrow x = 4$$

The numbers are 16 and 28. **So the answer is 4.**

14. Fifteen years ago the ages of mother and her daughter were in the ratio 6 : 1. If the present age of the daughter is 20 years, then the mother's age, in years, after 5 years from now, is

1. 40 2. 45 3. 50 4. 55

Solution: Let the present age of mother be m and present age of daughter = 20 = d (let)

Now $m - 15 : d - 15 = 6 : 1 \Rightarrow m - 15 = 6(20 - 15) \Rightarrow m - 15 = 6(5) \Rightarrow m = 30 + 15 = 45$.

So the mother's present age is 45. So the mother's age after 5 years from now = $45 + 5 = 50$

So the answer is 3.

15. The ages of son and his father were in the ratio 2 : 5 seventeen years ago. If the present age of the son is 35, then the present age of the father in years, is

1. 66 2. 65 3. 64 4. 62

Solution: Let the ages of son and father are $2x$ and $5x$ '17' years ago present son's age

$$\Rightarrow 2x + 17 = 35 \Rightarrow x = \frac{18}{2} = 9. \text{ Father present age} = 5x + 17 = 5(9) + 17 = 45 + 17 = 62.$$

So the answer is 2.

16. B is twice as old as A, but twice younger than F, C is half the age of A but is twice older than D. Who are the oldest and youngest

1. F, C 2. B, D 3. F, D 4. F, A

Solution: As per the given direction

$$B = 2A; F = 2B; A = 2C; \text{ and } C = 2D \Rightarrow F = 2B \quad 4A = 8C = 16D.$$

The oldest among them = F. The youngest among them = D. **So the answer is 3.**

17. In a village $\frac{1}{4}$ th of the youth are educated and $\frac{1}{5}$ th of the youth are employed. If the number unemployed youth is 128, how many educated youth are there in that village?

1. 50 2. 55 3. 65 4. 40

Solution: Let the total number of youth = x .

$$\text{The number of unemployed youth} = x - \frac{x}{5} = 128 \Rightarrow x = 160.$$

$$\text{The number of educated youth} = \frac{160}{4} = 40. \text{ So the answer is 4.}$$

18. Twenty years back, the ratio of the ages of a father and his son was 11 : 3. If the ration on their pre ages is 2 : 1, then the age of the son is

1. 30 2. 35 3. 34 4. 32

Solution: Let the present ages of a father and his son = $2x, x$.

$$20 \text{ years ago the ratio} = \frac{2x - 20}{x - 20} = \frac{11}{3} \Rightarrow 6x - 60 = 11x - 220$$

$$5x = 160 \Rightarrow x = 32 \text{ years. So the answer is 4.}$$

19. The ratio of the present ages of a father and his son is 2 : 1. If the ratio 10 years ago is 5 : 2, then the present age of the son is

1. 30 2. 25 3. 24 3. 32

Solution: Let the present ages of a father and his son = $2x$.

$$\frac{2x - 10}{x - 10} = \frac{5}{2} \Rightarrow x = 30. \text{ So the answer is 1.}$$

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20. If $a : b = 4 : 5$ and $b : c = 7 : 9$, then $a : b : c =$

1. 4 : 5 : 9 2. 4 : 7 : 9 3. 4 : 5 : 7 4. 28 : 35 : 45

Solution: $a : b = 4 : 5; \quad b : c = 7 : 9;$

$$\Rightarrow a : b = 28 : 35; \quad b : c = 35 : 45. \quad \text{Therefore } a : b : c = 28 : 35 : 45. \text{ Answer is 4.}$$

21. If $\frac{x+y}{4x+y} = \frac{7}{10}$, then $x : y =$

1. 7 : 10 2. 6 : 1 3. 1 : 6 4. 10 : 7

Solution: $10x + 10y = 28x + 7y \Rightarrow 18x = 3y \Rightarrow \frac{x}{y} = \frac{3}{18} = \frac{1}{6} \Rightarrow x : y = 1 : 6$. **Answer is 3.**

22. The monthly incomes of two persons P and Q are in the ratio 4 : 3 and their monthly expenditures are in the ratio 3 : 2. If each of them save Rs.750 per month, then Q's monthly income is

1. Rs.3,000 2. Rs.1,500 3. Rs.2,250 4. Rs.3,750

Solution: Income 4 : 3;

Expenditure 3 : 2; So Savings $3x - 2x = \text{Rs.750} \Rightarrow x = \text{Rs.750}$

So income of Q = $3 \times 750 = 2250$. **Answer is 3.**

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23. If the angles of a triangle are in the ratio 3:4:5, then the least angle is

1. 36° 2. 45° 3. 60° 4. 72°

Solution: Sum of the ratios = $3+4+5=12$. The least angle = $\frac{3}{12} \times 180 = 45^\circ$. **Answer is 2.**

24. If $16x^2 - 24xy + 9y^2 = 0$, then $x : y =$

1. 3 : 4 2. 4 : 3 3. 2 : 3 4. 3 : 2

Solution: $16x^2 - 24xy + 9y^2 = 0 \Rightarrow (4x - 3y)^2 = 0 \Rightarrow 4x = 3y \Rightarrow \frac{x}{y} = \frac{3}{4}$. **Answer is 1.**

25. If $\frac{b}{a-c} = \frac{a+b}{c} = \frac{a}{b}$ then $a : b : c =$

1. 1 : -1 : 1 2. 3 : 1 : 2 3. 4 : 2 : 3 4. 3 : 2 : 4

Solution: $\frac{b}{a-c} = \frac{a+b}{c} \Rightarrow bc = a^2 + ab - ac - bc \Rightarrow 2bc = a^2 + ab - ac$;

$\frac{b}{a-c} = \frac{a}{b} \Rightarrow b^2 = a^2 - ac$; ---(2) $\frac{a+b}{c} = \frac{a}{b} \Rightarrow ab + b^2 = ac$

We have $2bc = a^2 + ab - ac = b^2 + ab$ from (2) . $\Rightarrow 2c = b + a$ ---(3)

We have $\frac{a+b}{c} = \frac{a}{b}$; $\frac{2c}{c} = \frac{a}{b} = \frac{2}{1}$ by using (3). $\Rightarrow a : b = 2 : 1 = 4 : 2$

$\frac{a+b}{c} = \frac{a}{b} \Rightarrow \frac{2b+b}{c} = \frac{2b}{b} \Rightarrow \frac{b}{c} : \frac{2}{3} \Rightarrow b : c = 2 : 3$

Therefore $a : b : c = 4 : 2 : 3$. **Answer is 3.**

6. PIPES AND CISTERNS

Suppose a pipe can fill a cistern in ' n ' hrs then in one hour the pipe will fill $\frac{1}{n}$ th of the cistern.

If a pipe can empty a cistern in ' m ' hrs then in one hour the pipe will empty $\frac{1}{m}$ th of the cistern.

If a pipe can fill a cistern in ' n ' hours and another can empty the full cistern in ' m ' hours, then the net

per filled in hour = $\frac{1}{n} - \frac{1}{m}$.

PROBLEMS

1. If a pump takes 6 hours to fill $\frac{3}{7}$ th of a cistern, the total time required to completely fill the cistern (in hours) is

1. 14

2. 13

3. 12

4. 11

Solution: to fill $\frac{3}{7}$ th ----- time 6 hours; to fill 1----- x hours. $x = \frac{\frac{1}{3}}{\frac{3}{7}} \times 6 = \frac{7}{3} \times 6 = 14$.

So the answer is 1.

2. A tank can be filled by one tap in 20 minutes and by another in 25 minutes. If both the taps are opened for 5 minutes and then the second tap is turned off, in how many more minutes the tank is completely filled?

1. 12

2. 11

3. 9

4. 6

Solution: $T_1 = 20$ minutes $\Rightarrow 1$ minute $\Rightarrow \frac{1}{20}$; $T_2 = 25$ minutes $\Rightarrow 1$ minute $\Rightarrow \frac{1}{25}$.

$$T_1 + T_2 \text{ in 1 minute} = \frac{1}{20} + \frac{1}{25} = \frac{5+4}{100} = \frac{9}{100}.$$

$$T_1 + T_2 \text{ in 5 minutes} = \frac{9 \times 5}{100} = \frac{9}{20}. \text{ Remaining} = 1 - \frac{9}{20} = \frac{11}{20}.$$

So time required to fill the remaining by $T_1 = \frac{\frac{11}{20}}{\frac{1}{20}} = 11$. **So the answer is 2.**

3. Two taps A and B can fill a tank in 12 and 18 minutes each respectively. Both are kept open for 2 minutes and then the tap A is closed. In how many more minutes will the tank be filled?

1. 15

2. 13

3. 18

4. 16

Solution: Two taps A + B complete work in '2' minutes = $\frac{2}{12} + \frac{2}{18} = \frac{1}{6} + \frac{1}{9}$

Remaining work $1 - \frac{5}{18} = \frac{13}{18}$.

So time taken to fill tank remaining part by B = $\frac{13}{18} \times 18 = 13\text{min}$. **So the answer is 2.**

4. Pipe A full a tank in 3 hours while pipe B empties it in 5 hours. If both the taps are opened portion of the tank filled in 80 minutes is

1. $\frac{8}{45}$ 2. $\frac{17}{45}$ 3. $\frac{16}{45}$ 4. $\frac{13}{45}$

Solution: Pipe 'A' takes 3 hours to fill the tank. Pipe 'B' takes 5 hours to fill the tank. The portion of the tank that can be filled by pipe 'A' in hour is $\frac{1}{3}$. Similarly in 10 minutes is $\frac{1}{18}$.

The portion of the tank that can be emptied by pipe 'B' in 1 hour is $\frac{1}{5}$.

Similarly in 10 minutes is $\frac{1}{30}$. If both the taps are opened the portion of the tank filled in 10 minutes is $\frac{1}{8} - \frac{1}{30} = \frac{5-3}{90} = \frac{2}{90} = \frac{1}{45}$ and in 80 minutes, $8 \times \frac{1}{45} = \frac{8}{45}$. **So the answer is 1.**

5. Two taps A and B can fill a tank in 10 and 15 minutes respectively while C can empty it in 20 minutes. If all the three are opened for 1 minutes. If all the three are opened for 1 minutes and then the tap C is closed, the extra time (in minutes) required to fill the tank is

1. $8\frac{3}{10}$ 2. $6\frac{3}{10}$ 3. $5\frac{3}{10}$ 4. 5

Solution: Part of tank filled in the first minute = $\frac{1}{10} + \frac{1}{15} - \frac{1}{20} = \frac{6+4-3}{60} = \frac{7}{60}$.

So remaining part to be filled = $\frac{53}{60}$

Part of the tank filled by A and B in one minute = $\frac{1}{10} + \frac{1}{15} = \frac{5}{30} = \frac{1}{6}$.

So time taken = $\frac{\frac{53}{60}}{\frac{1}{6}} = \frac{53}{10}$ i.e., $5\frac{3}{10}$ minutes. **So the answer is 3.**

6. Two pipes A and B can fill a tank in 6 hrs and 8 hrs respectively. If they are opened in alternate hours starting in A the number of hours needed to fill the tank is

1. $3\frac{3}{7}$ 2. 6 3. $6\frac{1}{2}$ 4. $6\frac{3}{4}$

Solution: Pipe A can fill in 6 hrs. Pipe B can fill in 8 hrs.

In 1 hour A's working part $\frac{1}{6}$, In 1 hour B's working part $\frac{1}{8}$.

(A + B)'s 1 hour = $\frac{1}{6} + \frac{1}{8} = \frac{7}{24}$. So (A + B) can complete in $3\frac{3}{7}$.

So the answer is 1.

7. A tank is normally filled in 8 hrs, but takes 2 hrs longer to fill because of leakage. If the tank is full, the time taken by the leak to empty it is

1. 36 hrs 2. 38 hrs 3. 40 hrs 4. 44 hrs

Solution: Filling pipe can fill in 8 hrs. In 1 hour it fills $\frac{1}{8}$ th ps.

Fill pipe and leakage pipe in 10 hr. In 1 hour both together fills $\frac{1}{10}$.

So leakage can empty in 1 hr = $\frac{1}{8} - \frac{1}{10} = \frac{5-4}{40} = \frac{1}{40}$.

So leakage can empty the tank in 40 hours. **So the answer is 3.**

8. Two taps can fill a tub in 5 minutes and 7 minutes respectively. Another pipe can empty it in 3 minutes. If all the three are kept open simultaneously, then the time (in minutes) to fill the tub is

1. 105 2. 115 3. 120 4. 135

Solution: Work done part of first and second filling taps in 1 minute = $\frac{1}{5} + \frac{1}{7} = \frac{12}{35}$

Workdone part of third empty tap = $\frac{1}{3}$

So total work done by three taps in 1 minute = $\frac{12}{35} - \frac{1}{3} = \frac{36-35}{105} = \frac{1}{105}$

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10. If $\left(\frac{4}{5}\right)^{th}$ of a bucket is filled in one minute, the rest of it will be filled in

1. $9/4$ minutes 2. 1 minute 3. $1/4$ minute 4. $1\frac{1}{2}$ minutes

Solution: In 1 Minute $\left(\frac{4}{5}\right)^{th}$ of a bucket is filled. Rest = $1 - \frac{4}{5} = \frac{1}{5}$

So $\frac{1}{5}$ part of the bucket in $\frac{1}{5} \times \frac{5}{4}$ minute = $\frac{1}{4}$ minute. **Answer is 3.**

11. Taps A and B can fill a tank in 10 hours and 15 hours respectively. The time taken (in hours) for both the taps together to fill the tank is

1. $12\frac{1}{2}$ 2. 5 3. 6 4. 10

Solution: Tap A fill in 10 hours. So Tap A fill in 1 hour = $\frac{1}{10}$;

Tap B fill in 15 hours. So Tap B fill in 1 hour = $\frac{1}{15}$,

Taps A + B fill in 1 hour = $\frac{1}{10} + \frac{1}{15} = \frac{3+2}{30} = \frac{5}{30} = \frac{1}{6}$

$\therefore$ A + B can fill the tank in 6 hours. **Answer is 3.**

12. Two taps A and B can fill a tank in 12 and 18 minutes respectively. Both are kept open for 2 minutes and then the tap A is closed. In how many minutes will the tank be filled?

1. 18 2. 16 3. 15 4. 13

Solution: Taps A and B fill in 1 Minute = $\frac{1}{12} + \frac{1}{18} = \frac{3+2}{36} = \frac{5}{36}$.

Taps A and B fill in 2 Minutes = $\frac{10}{36} = \frac{5}{18}$;

If Tap A is closed after 2 minutes, then Tap B fill the rest in

$$\frac{1 - \frac{10}{36}}{\frac{1}{18}} = \frac{36-10}{36} \times \frac{18}{1} = \frac{26}{2} = 13 \text{ minutes. Answer is 4.}$$

ICET-2012

13. Two pipes A and B can fill an empty tank in 6 hours and 8 hours respectively. After opening both of them for t hours the pipe B is closed and the pipe A filled the rest of the tank in 4 hours. Then $t =$

1. $\frac{8}{7}$ 2. $\frac{8}{3}$ 3. $\frac{4}{3}$ 4. $\frac{2}{3}$

Solution: Pipe A fill in 6 hours. So A fill in 1 hour is $\frac{1}{6}$.

Pipe B fill in 8 hours. So B fill in 1 hour is $\frac{1}{8}$.

Pipes A and B fill in 1 hour is $\frac{1}{6} + \frac{1}{8} = \frac{7}{24}$. So Pipes A and B fill in t hour = $\frac{7t}{24}$;

A fill in 4 hour = $\frac{4}{6}$; From the given data $1 - \frac{7}{24}t = \frac{4}{6}$

Therefore $\frac{7t}{24} + \frac{4}{6} = 1$; $7t + 16 = 24$; $7t = 8$; $t = \frac{8}{7}$. **Answer is 1.**

14. Two pipes can fill an empty tank in 36 minutes and 45 minutes respectively. If both pipes are opened simultaneously, the how much time is needed in minutes to fill the tank?

1. 10 2. 15 3. 20 4. 25

Solution: Pipes A and B fill in 1 hour is $\frac{1}{36} + \frac{1}{45} = \frac{45+36}{36 \times 45} = \frac{81}{36 \times 45} = \frac{1}{20}$.

There fore 20 minutes. **Answer is 3.**

7. PARTNERSHIP

Introduction: Partnership is a business when two or more partners invest a certain amount (capital) for a specified period to carry out business. At the end of the period the business may generate profit or loss. This profit or loss needs to be distributed between the partners. The proportion in which the profit (or loss) would be distributed among the partners is given by the ratio of the joint product of the capital invested and the period of investment for each partner.

Working and Sleeping Partners: A partner who manages the business is known as a working partner and the one who simply invests the money is a sleeping partner.

Ratio of Division of Gains:

1. When investments of all the partners are for the same time, the gain or loss is distributed among the partners in the ratio of their investments.
Suppose A and B invests Rs. x and y respectively then at the end of the year A's profit: B's profit = $x : y$.
2. When investments are of different time periods, then equivalent capitals are calculated for a unit of time by taking capital x number of units of time. Suppose A invests Rs. x for p months and B invests Rs. y for q months, then
A's share of profit: B's share of profit = $xp : yq$

Note:

1. If a partner retires during one year period, then in such cases, only the period for which his capital was utilised is taken into consideration.
2. If a partner joins during one year period, then in such case, only the period for which his capital was utilised is taken into consideration.

PROBLEMS

1. The details of investment of three persons X, Y, Z in a common business are given below. Out of a profit of Rs.900, the share of X in rupees is

	X	Y	Z
amount in Rs.	6,000	7,000	6,400
time in months	2	4	5

1. 110 2. 150 3. 350 4. 400

Solution: $6000(2) : 7000(4) : 6400(5) \Rightarrow 60(2) : 70(4) : 64(5)$

$\Rightarrow 6(2) : 7(4) : 32 \Rightarrow 3 : 7 : 8$

$3x + 7x + 8x = 900; 18x = 900 \Rightarrow x = 50.$

The share of x is $3(50) = 150$. **So the answer is 2.**

2. In a partnership A invested $\frac{1}{6}$ of the capital for $\frac{1}{6}$ of the time; B invested $\frac{1}{3}$ of the capital for

$\frac{1}{3}$ of the time and C invested the rest of the capital for the whole time. If the total profit of the business is Rs.46,000/- then the share of B in it (in rupees) is

1. 2000 2. 6000 3. 8000 4. 36000

Solution: The part investment of $c = 1 - \frac{1}{6} - \frac{1}{3} = \frac{1}{2}$.

The ratio of their shares = $\frac{1}{6} \times \frac{1}{6} : \frac{1}{3} \times \frac{1}{3} : \frac{1}{2} \times 1 = 1 : 4 : 18$.

The share of B in the profit Rs. 46,000.

$$46000 \times \frac{4}{23} = \text{Rs.}8000/- \text{ So the answer is 3}$$

3. In a business, A invested 3 times as much of B invested and B invested $\frac{2}{3}$ of what C invested. If the annual profit is Rs.55,000. The share of B in thousands of rupees is

1. 12 2. 10 3. 15 4. 30

Solution: $A : B = 3 : 1$ and $B : C = 2 : 3$

The ratio between investment of A, B, C = $6 : 2 : 3$

The share of B in the total profit Rs.55, 000 = $55000 \times \frac{2}{11} = 10,000$.

So the answer is 2.

4. Four transport companies A, B, C, D rented a parking place. A kept 18 cars for 4 months; B kept 24 cars for 2 months; C kept 28 cars for 6 months and D kept 28 cars for 3 months in the parking place. If A's share of rent is Rs.3,600, the total rent of the parking place in rupees is

1. 18,000 2. 18,600 3. 21,000 4. 24,000

Solution: The ratio between the shares of A, B, C, D = $18 \times 4 : 24 \times 2 : 28 \times 6 : 28 \times 3$
 $6 : 4 : 14 : 7$

The share of A in the total rent = Rs.3,600. The total rent = $3600 \times \frac{31}{6} = 18,600$.

So the answer is 2.

5. A, B and C enter into a partnership with a capital in which A's contribution is Rs.10,000. Out of total profit of Rs.1,000, if A gets Rs.500 and B gets Rs.300, then C's capital (in Rupees) is

1. 9000 2. 6000 3. 4000 4. 3500

Solution: The capital of A = Rs.10,000/-

The ratio between the shared of A, B, C = $500 : 300 : 200 = 5 : 3 : 2$

The capital of C = $\frac{2}{5} \times 10000 = 4000/-$ **So the answer is 3.**

7. A and B started a business investing Rs. 10,00,000 and Rs.15,00,000 respectively and C joined them after 6 months with an investment of Rs. 20,00,000. The ratio of the share of their profits at the end of the year is

1. 3 : 2 : 3 2. 2 : 3 : 2 3. 1 : 3 : 1 4. 2 : 3 : 4

Solution: The ratio of the share of their profits at the end of the year is

$$12 \times 10,00,000 : 12 \times 15,00,000 : 6 \times 20,00,000$$

$$120 : 180 : 120 = 2 : 3 : 2. \text{ Answer is 2.}$$

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8. A, B and C started a business investing a sum of money in the ratio of 8:9:10. After three months B contributed another $\frac{1}{3}$ rd of his capital towards business while C withdrew $\frac{1}{5}$ th of his capital after 6 months. If they get an annual profit of Rs.2,37,000 then C's share of profit in rupees is.

1. 94,200 2. 83,700 3. 75,600 4. 67,200

Solution: $8 \times 12 + (9 \times 12 + 3 \times 9) + (10 \times 12 - 2 \times 6)$
 $= 96 + (108 + 27) + (120 - 12) = 96 + 135 + 108 = 339.$

C's share = $2,37,000 \times \frac{108}{339} = 75,600.$ **Answer is 3.**

9. A, B and C started a business with some investment. At the end of the year, in the profit, the share of B is Rs.5000 more than that of A and C's share is Rs.2000 more than B. If the total profit is Rs.1,11,000, then the share of C, in the profit in rupees is

1. 39,000 2. 37,000 3. 38,000 4. 40,000

Solution: Let A's share = x ; B's share = $x + 5,000$; C's share = $x + 7,000$

Sum of shares = $3x + 12,000 = 1,11,000$ (given) $\Rightarrow 3x = 99,000 \Rightarrow x = 33,000$

C's share = $33,000 + 7,000 = 40,000.$ **Answer is 4.**

10. A and B started business together. B's capital is Rs.700 more than that of A. But B invested his capital for 9 months and A invested for 10 months. If A and B share the profit in the ratio 8:9, then the capital of B (in rupees) is

1. 3,500 2. 4,200 3. 4,000 4. 2,100

Solution: Let A's capital = x . So B's capital = $x + 700$;

We have $10x : 9(x + 700) = 8 : 9 \Rightarrow \frac{10x}{9x + 6300} = \frac{8}{9} \Rightarrow 90x = 72x + 8 \times 6300 \Rightarrow 18x = 8 \times 6300$

$\Rightarrow x = 2800.$ Hence B capital = $2800 + 700 = 3500.$ **Answer is 1.**

11. A started a business with a capital of Rs.6400. Later B joined the business with a capital of Rs.8000. At the end of the year shared the profit in the ratio 6 : 5. After how many months B has joined the business?

1. 8 2. 6 3. 4 4. 3

Solution: $\frac{6400 \times 12}{8000(12 - x)} = \frac{6}{5} \Rightarrow 8 = 12 - x \Rightarrow x = 12 - 8 = 4.$

After 4 months B has joined the business. **Answer is 3.**

8. AVERAGE

Introduction: We might have come across terms such as average height, average speed, average weight, average marks, etc. What do we mean by the word average? Average is a number indicating the representative or central value of a group of observations or data. Averages are of different types. In this chapter, we shall learn about the simplest type of average, commonly known as the arithmetic mean or simply the mean.

Important Formulae

1. $\text{Average} = \frac{\text{sum of observations}}{\text{Total number of observations}}$
2. $\text{Sum of all items} = \text{Average} \times \text{Total no. of items.}$

Note: The quantities whose average is to be determined, should be in the same unit.

PROBLEMS

1. The average age of 3 females is 15 years and their ages are in the ratio 1 : 2 : 6. Then what is the age of the eldest female in years?

1. 30 2. 20 3. 25 4. 40

Solution: Let the ages be x , $2x$ and $6x$. So average = $\frac{x + 2x + 6x}{3} = 15$.

$$\frac{9x}{3} = 15 \Rightarrow 9x = 45 \Rightarrow x = 5. \text{ So eldest female age} = 6(5) = 30. \text{ So the answer is 1.}$$

2. A sum of Rs.410 is distributed among 50 students in a class. If each boy gets Rs.9 and each girl gets Rs.6.50, then the number of boys in the class is

1. 17 2. 34 3. 16 4. 25

Solution: Number of boys = x , so girls = $50 - x$. So $9(x) + 6.50(50 - x) = 410$

$$\Rightarrow 2.5x = 410 - 325 \Rightarrow 2.5x = 85 \Rightarrow x = \frac{85}{2.5} = 34. \text{ So the answer is 2.}$$

3. A purse contains some two-rupee coins, one-rupee coins and 50 paise coins in the ratio of their denomination (that is, $2 : 1 : \frac{1}{2}$). If the total money in the purse is Rs.210 then the number of one-rupee coins in the purse is

1. 100 2. 60 3. 50 4. 40

Solution: The ratio of two rupees, one rupees and 50 paise coins = $2 : 1 : \frac{1}{2} = 4 : 2 : 1$

Let the number of coins is $4x, 2x, x$ respective.

Sum of their values = $4x.2 + 2x.1 + x.\frac{1}{2} = \frac{21}{2}x = 210 \Rightarrow x = 20$. **So the answer is 4.**

4. The average age of 5 children is 8 years. If the age of the father of the children is included the average becomes 13, then the age of the father (in years) is
1. 30 2. 34 3. 37 4. 38

Solution: The sum of the age of 5 childrens = $5 \times 8 = 40$ years.

The sum of the ages of 5 childrens and his father = $6 \times 13 = 78$ years.

The age of father = 38 years. **So the answer is 4.**

5. Three years ago, the average age of A and B was 20 years. Now C has joined them and their average age became 25 years. What is the present age of C in years?
1. 30 2. 31 3. 29 4. 32

Solution: At present, the average age of A and B = 23 years.

The average age of A, B and C = 25 years.

The age of C = $3 \times 25 - 2 \times 23 = 75 - 46 = 29$. **So the answer is 3.**

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6. The average of all the prime numbers less than 20 is
1. 9 2. 9.15 3. 9.55 4. 9.625

Solution: $\frac{2+3+5+7+11+13+17+19}{8} = \frac{77}{8} = 9.625$. **Answer is 4.**

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9. SIMPLE INTEREST AND COMPOUND INTEREST

Introduction: When a person is need of money, he borrows it from a bank, a financial institution or from another person. He has to pay a charge on the sum of money he borrows. This charge is called the Interest. The sum that is borrowed is the principal. In this chapter, we shall discuss the concepts of Simple Interest and Compound Interest and the methods of calculating them.

Notations used

P - Principal

A - Amount

N - No. of years

R - Rate of interest

SI - Simple interest

CI - Compound interest

Important Formulae

$$1. \quad SI = \frac{PNR}{100} \quad 2. \quad P = \frac{100 \times SI}{N \times R} \quad 3. \quad N = \frac{100 \times SI}{P \times R} \quad 4. \quad R = \frac{100 \times SI}{P \times N}$$

$$5. \quad A = P + SI \quad 6. \quad CI = P \left(1 + \frac{R}{100} \right)^N - P$$

Where $P \left(1 + \frac{R}{100} \right)^N$ is the amount on CI, where interest is compounded annually.

Note:

a) When interest is compounded half yearly Amount = $P \left(1 + \frac{(R/2)}{100} \right)^{2n}$

b) When interest is compounded quarterly Amount = $P \left(1 + \frac{(R/4)}{100} \right)^{4n}$

PROBLEMS

1. A certain amount of money deposited for compount interest becomes 4 times in 4 years. In how many years will that amount be 64 times the deposited amount if it is given for the same rate of interest?

1. 18

2. 16

3. 15

4. 12

Solution: x becomes $4x$ in 4 years $\Rightarrow 4x$ becomes $16x$ in 4 years $\Rightarrow 16x$ becomes $32x$ in 4 years

$\Rightarrow 32x$ becomes $64x$ in 4 years. So x becomes $64x$ in 16 years. **So the answer is 2.**

2. An amount given for compound interest becomes 3 times itself in 3 years. In how many years will that amount be 9 times itself?

1. 9 2. 6 3. 5 4. 8

Solution: x becomes $3x$ in 3 years, $3x$ becomes $9x$ in 3 years.

So x becomes $9x$ in total 6 years. **So the answer is 2.**

3. A invests two equal amounts earning 10% and 12% of interest annually. If the interest on them earned is Rs.1650 in an year then the sum invested in each (in rupees) is

1. 17000 2. 15000 3. 8500 4. 7500

Solution: Let the each investment of $A = x$.

10% of x + 12% of $x = 1650/-$

$$\Rightarrow x \times \frac{22}{100} = 1650 \Rightarrow x = \text{Rs.}7,500/- \text{ So the answer is 4.}$$

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4. The difference between compound interest and simple interest on a sum for 2 years at the same 6% interest per annual is Rs.36. Then that sum (in rupees) is

1. 10,000 2. 20,000 3. 15,000 4. 18,000

$$\text{Solution: sum} = P, T = 2; R = 6\%, \text{ simple interest} = I = \frac{PTR}{100} = \frac{P \cdot 2 \cdot 6}{100} = \frac{2PR}{25}$$

$$\text{compound interest } I = P \left(1 + \frac{R}{100} \right)^2 - P = \frac{2PR}{100} + \frac{PR^2}{10,000} \Rightarrow$$

$$\text{Difference between compound interest and simple interest } \frac{2PR}{100} + \frac{PR^2}{10,000} - \frac{2PR}{25} = 36$$

$$\Rightarrow \frac{PR^2}{10,000} = 36 \Rightarrow P = \frac{36 \times 10,000}{6 \times 6} = 10,000. \text{ Answer is 1.}$$

10. TIME AND WORK

Introduction: In most work problems, a complete job is broken into several parts, each representing a fraction part of the entire job. For each fractional part, which represents the portion completed by one man, one machine, one pipe and so on, the numerator should represent the time actually spent on working. While the denominator should represent the total needed to do the entire job alone. The sum of all the individual fractions should be one. In this chapter, we shall use some basic concepts to solve some practical problems involving time and work.

Basic Concepts:

1. If A can do a piece of work in x days, then A's 1 day work = $\frac{1}{x}$.
2. If A's 1 daywork = $\frac{1}{x} \rightarrow$ A can finish the work in x days.
3. If A is x times faster than B, then the ratio of work done by A and B is $x : 1$ and ratio of time taken by A and B = $1 : x$.

Variation: When two quantities are compared, the increase or decrease in one of the quantities results in a corresponding change in the other quantity, then we say there is a variation between the two quantities. The two types of variation are discussed below.

Direct Variation ($\uparrow$): When one quantity increases, the other also increases or when one quantity decreases the other also decreases. Then the variation is said to be direct and is denoted by upper arrow head $\uparrow$.

Indirect Variation ($\downarrow$): The increase or decrease in one quantity results in a corresponding decrease or increase in other quantity is called indirect variation and is denoted by down arrow head $\downarrow$.

Note:

1. These two variations are called simple variations since it involves the variation between two quantities only.
2. When three or more quantities are compared, then the variation in any two results in a change in the third quantity, the three quantities are said to be in compound variation.

PROBLEMS

1. A and B can do a work in 12 days; B and C in 15 days; C and A days. The number of days required for all the three together to complete the work is
 1. 30
 2. 20
 3. 16
 4. 10

Solution: A + B's one day work = $\frac{1}{12}$; B + C's one day work = $\frac{1}{15}$; C + A's one day work = $\frac{1}{20}$

Adding these (A + B + C)'s two day's work = $\frac{1}{12} + \frac{1}{15} + \frac{1}{20} = \frac{5+4+3}{60} = \frac{12}{60} = \frac{1}{5}$.

So A + B + C's are day work = $\frac{1}{5 \times 2} = \frac{1}{10}$.

So they can together complete to the work in 10 days. **So the answer is 4.**

2. A job can be completed in 12 days by one man or two women. In how many days can one man and one woman complete the same job?

1. 4 2. 6 3. 9 4. 8

Solution: 1 man = 2 woman can complete in 12 days.

Man's one day work = $\frac{1}{12}$; Woman's one day work $\frac{2}{12} = \frac{1}{6}$;

One man + one woman one day work = $\frac{1}{12} + \frac{1}{6} = \frac{1+2}{12} = \frac{3}{12} = \frac{1}{4}$.

So one man and one woman can complete in 4 days. **So the answer is 1.**

3. A works 3 times as fast as B. If B completes a work in 60 days, then in how many days can A and B together complete the same work ?

1. 12 2. 15 3. 18 4. 20

Solution:

4. A and B can do a piece of work in 8 days respectively. A started the work and after 3 days B joined him to finish the work. The number of days B worked is

1. 1 2. $1\frac{1}{2}$ 3. 2 4. 3

Solution: A's 1 day work = $\frac{1}{8}$ th of total work, B's 1 day work = $\frac{1}{12}$ th of the total work.

A-(x + 3) days work + B - x days work = 1 $\Rightarrow \frac{x+3}{8} + \frac{x}{12} = 1 \Rightarrow \frac{5x}{24} = \frac{5}{8} \Rightarrow x = 3$.

So the answer is 4.

5. A can complete a piece of work in 18 days. B is 20% more efficient than A. The number of days B takes to complete the same piece of work is

1. 15 2. 12 3. 10 4. 9

Solution: The number of days taken by A finish the work = 18.
B is 20% more efficient than A.

The number of days taken by B to finish the tank = $\frac{100}{120} \times 18 = 15$ days.

So the answer is 1.

6. One man or two women or 3 part-timers can complete a piece work in 48 days. How many days will it take for 2 men, 3 women and 3 part-timers to complete the same piece of work?

1. 12 2. 18 3. 20 4. None

Solution: 1 man one day work = $\frac{1}{48}$; 2 man one day work = $\frac{1}{48}$;

3 part timers one day work = $\frac{1}{48}$; 2 man, 2 women, 3 part timers 1 day work

$$= \frac{2}{48} + \frac{1}{48} + \frac{1}{48} = \frac{1}{12}.$$

2 man, 2 women, 2 part timers finish the work in 12 days. **So the answer is 1.**

7. A can do $\frac{1}{5}$ th of the work in 2 days and B can do $\frac{1}{3}$ rd of it in 5 days. Then the number of days that both A and B can do the work is

1. 10 2. 8 3. 6 4. 4

Solution: A 1 day work = $\frac{1}{10}$; B 1 day work = $\frac{1}{15}$.

A and B together 1 day work = $\frac{1}{10} + \frac{1}{15} = \frac{1}{6}$.

A and B together can finish the work in 6 days. **So the answer is 3.**

8. A, B and C can do a piece of work in 4, 5 and 7 days respectively. If they get Rs.415 for working together to complete the job, then A's share is (in rupees)

1. 170 2. 185 3. 175 4. 180

Solution: The ratio between the efficiencies of A, B and C = $\frac{1}{4} : \frac{1}{5} : \frac{1}{7} = 35 : 28 : 20$

The share of A in Rs 415 = $415 \times \frac{35}{83} = 175$. **So the answer is 3.**

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9. 4 men and 6 women finish a job in 8 days, while 3 men and 7 women finish it in 10 days. 10 women working alone will finish it in

1. 24 days 2. 32 days 3. 36 days 4. 40 days

Solution: $(4\text{men} + 6\text{women})8 = 1 \text{ job} \Rightarrow 4\text{men} + 6\text{women} = \frac{1}{8} \Rightarrow 12\text{men} + 18 \text{ women} = \frac{3}{8}$

And $(3\text{men} + 7\text{women})10 = 1 \text{ job} \Rightarrow 3\text{men} + 7\text{women} = \frac{1}{10} \Rightarrow 12\text{men} + 28 \text{ women} = \frac{4}{10}$

Subtracting the above two relations we get, $10 \text{ women} = \frac{4}{10} - \frac{3}{8} = \frac{16-15}{40} = \frac{1}{40}$.

10 women alone will finish it is 40 days. **Answer is 4.**

10. Two persons A and B together can do a work in 30 days. After A and B worked for 5 days, C joined them and they together finished the work in another 20 days. Then the number of days in which C alone can complete the total work is

1. 60 2. 75 3. 90 4. 120

Solution: $A + B \text{ one day} = \frac{1}{30}$; $(A + B) \text{ five day} = \frac{5}{30} = \frac{1}{6}$. Remaining work $= 1 - \frac{1}{6} = \frac{5}{6}$

$A + B + C \text{ one day} = \frac{1}{20}$; $\frac{5}{6} \text{ work of } (A+B+C) \text{ in } 20 \text{ days.}$

$A+B+C \text{ work of one day} = \frac{5}{120}$; $(A+B) \text{ one day work} = \frac{1}{30}$

$\therefore C \text{ one day work} = \frac{5}{120} - \frac{1}{30} = \frac{5-4}{120} = \frac{1}{120}$.

$\therefore C \text{ alone can finish the work is } 120 \text{ days. Answer is 4.}$

11. Three persons A, B and C can do a work individually in 10 days, 12 days and 15 days respectively. If all the three persons work together, the number of days needed to complete the same work is

1. 8 2. 6 3. 4 4. 5

Solution: $\frac{1}{10} + \frac{1}{12} + \frac{1}{15} = \frac{6+5+4}{60} = \frac{15}{60} = \frac{1}{4}$.

4 days is required. **Answer is 3.**

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12. Three persons can complete a work individually in 6 days, 8 days and 12 days respectively. If all the three persons work together the number of days required to complete the same work is

1. 3 2. $\frac{10}{3}$ 3. $\frac{8}{3}$ 4. $4\frac{1}{3}$

Solution: $\frac{1}{6} + \frac{1}{8} + \frac{1}{12} = \frac{4+3+2}{24} = \frac{9}{24} = \frac{3}{8}$.

Three persons work together require $\frac{8}{3}$ days to complete the same work. **Answer is 3.**

13. A, B and C can do a work individually in 20 days, 15 days and 25 days respectively. To complete the work fast, which of the two are to be assigned the work?

1. A, B 2. B, C 3. C, B 4. B alone

Solution: A and B one day work = $\frac{1}{20} + \frac{1}{15} = \frac{3+4}{60} = \frac{7}{60}$. So A and B can complete in $\frac{20}{7}$ days.

B and C one day work = $\frac{1}{25} + \frac{1}{15} = \frac{3+5}{75} = \frac{8}{75}$. So B and C can complete in $\frac{75}{8}$ days.

To complete the work fast, A and B are to be assigned. **Answer is 3.**

11. TIME AND DISTANCE

Introduction: A particle is said to be in motion if it changes its position with respect to its surroundings. If the particle does not change its position, then it is said to be at rest.

Speed: The speed of a moving body is the distance travelled by it in unit time.

$$\text{Speed} = \frac{\text{Distance travelled}}{\text{Time taken}}$$

$$\text{Distance} = \text{Speed} \times \text{Time}$$

Conversion of kmph to metre per second

$$\text{km/hr} = \frac{5}{18} \text{ /sec}; \quad \text{m/sec} = \frac{18}{5} \text{ km/hr}$$

Relative Speed: If two bodies move in the same direction, the relative speed of one with respect to the other is the difference of their speeds.

If two bodies move in opposite direction, relative speed of one with respect to the other body is the sum of their speeds.

Important Formulae

1. If the ratio of the speeds of A and B is $a : b$, then the ratio of time taken by them to cover the

$$\text{same distance is } \frac{1}{a} : \frac{1}{b} = b : a$$

2. Suppose a man covers a certain distance at x km/hr and an equal distance at y km/hr. Then

$$\text{the average speed during the whole journey is } \left(\frac{2xy}{x+y} \right) \text{ km/hr.}$$

Stoppage time per hour for a train: For the same distance of travel, if a train runs at an average speed V_1 km/hr without stopping and an average speed of V_2 km/hr with stoppage then stoppage

$$\text{time per hour} = \frac{V_1 - V_2}{V_1} \text{ hour} = \frac{\text{Difference in speed}}{\text{Faster speed}} \text{ (hour)}$$

Time and distance between two moving bodies:

Let there be two persons A and B

Speed of A = V_1 km/hr

Speed of B = V_2 km/hr

If they walk in the same direction, A and B will be $(V_1 - V_2)$ km apart in 1 hour.

Similarly, if they walk in opposite direction, A and B will be $(V_1 + V_2)$ km apart in 1 hour.

12. TRAINS AND MOVING OBJECTS

Introduction: A train is said to have crossed an object (stationary or moving) only when the last coach (end) of the train, crossed the said object completely. It implies that the total length of the train had crossed the total length of the object.

Basic Formulas

For Non moving objects

1. The time taken by the train to cross a stationary object (examples) is (lamp post, pole, standing man) which is of negligible length is given by

$$t = \frac{\text{Length of the train}}{\text{Speed of the train}}$$

Note: If the object is of some length (example, bridge, a tunnel, platform, another train) then,

$$t = \frac{\text{Length of (Train + Object)}}{\text{Speed of the train}}$$

For moving objects

2. If the object is moving and is of negligible length (example, a train crosses a running man) is given by

$$t = \frac{\text{Length of the train}}{\text{Speed of (Train - Object)}}$$

3. If the object is moving and has some length then,

$$t = \frac{\text{Length of (Train + Object)}}{\text{Speed of (Train - Object)}}$$

Note: If the object is moving in opposite direction put -ve sign before v.

4. Two trains crossing each other in both directions,

length of 1st train = L_1

length of 2nd train = L_2

They are crossing each other in opposite directions, in t_1 seconds.

They are crossing each other in same direction in t_2 seconds then,

$$\text{Speed of faster train} = \frac{L_1 + L_2}{2} \left(\frac{1}{t_1} + \frac{1}{t_2} \right)$$

$$\text{Speed of slower train} = \left(\frac{L_1 + L_2}{2} \right) \left(\frac{1}{t_1} - \frac{1}{t_2} \right)$$

5. If two trains start at the same time from points A and B towards each other and after crossing

they take a and b seconds in reaching B and A respectively, then

$$A's \text{ speed} : B's \text{ speed} = \sqrt{b} : \sqrt{a}.$$

PROBLEMS

1. A train running at a speed of 90 kmph takes 20 seconds to cross a bridge of length 150m. The length of the train in metres is

1. 350 2. 100 3. 50 4. 45

Solution: Let the length of train = x metres.

$$\text{Speed} = 90 \text{ kmph} = 90 \times \frac{5}{18} \text{ m/sec} = 25 \text{ m/sec.}; \text{ time} = 20 \text{ sec.}$$

$$\text{Speed} = \frac{\text{distance}}{\text{time}} \Rightarrow 25 = \frac{x + 150}{20} \Rightarrow 25(20) = x + 150 \Rightarrow 500 - 150 = x \Rightarrow 350 = x.$$

So the length of the train = 350 metres. **So the answer is 1.**

2. A train takes 8 secs to pass a person standing on the platform. If the speed of the train is 36 kmph, its length in meters is

1. 80 2. 90 3. 110 4. 115

Solution: gsr, 100, 4, 2007

3. A car starts at 8 A.M. With a speed of 65 kmph. Another car follows it at 9 A.M. with a speed of 70 kmph. The two cars will meet in the evening at time.

1. 4 2. 6 3. 8 4. 10

Solution: The time taken the second car meet the first = $\frac{65}{70 - 65} = 13$ hours.

The two cars meet at $9 + 13 \text{ hr} = 10 \text{ PM}$. **So the answer is 4.**

4. A car covers a certain distance going at a speed of 60 kmph and returns to the starting point at a speed of 40 kmph. Then the average speed of the car (in kmph) for the whole journey is

1. 56 2. 60 3. 48 4. 52

Solution: The average speed of the total journey = $\frac{2xy}{x + y} = \frac{2 \times 40 \times 60}{100} = 48 \text{ krph}$.

So the answer is 3.

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5. If the speed of a train is 92.4 kmph, how many metres would it cover in 20 minutes?

1. 30,800 2. 3,080 3. 4,028 4. 4,280

Solution: speed = 92.4 kmph = $92.4 \times \frac{5}{18}$ meter per second

1 hour = 92.4 km; 20 minutes = $\frac{92.4}{60} \times 20 = 30.8$ km = $30.8 \times 1000 = 30,800$ metres. **Ans.**

is 1.

6. A train runs from station A to station B in 1 hr.20 min. If the train is running at a speed of 18 kmph, then the distance between A and B is

1. 24 kms 27 kms 3. 20 kms 4. 30 kms.

Solution: Time = $t = 1$ hour 20 minutes = $1\frac{1}{3} = \frac{4}{3}$ hours.

Speed = $s = 18$ km;

Distance = speed $\times$ time = $18 \times \frac{4}{3} = 24$ kms. **Answer is 1.**

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107. Three trains A, B and C moving at speeds s_1, s_2 and s_3 respectively take times t_1, t_2 and t_3 respectively to cover a distance of x kms. If $t_1 : t_2 : t_3 = 20 : 15 : 12$, then $s_1 : s_2 : s_3 =$
(1) 2:3:4 (2) 3:4:5 (3) 4:5:6 (4) 5:6:7
108. The time (in seconds) taken by a train of 240 metres long travelling at 70 kmph to cross another train of length 110 metres standing on a parallel track is
(1) 20 (2) 18 (3) 17 (4) 16

13. STREAMS AND BOATS

Introduction: In solving problems based on stream and boats, change the word problems into the form of quadratic equations according to the given conditions and solve the quadratic equations. The basic definitions used in problem solving are discussed below,

Still water: The speed of water in the river is zero.

Stream water: The water in the river is flowing or moving.

Speed of boat and stream: Assume the man's rate of rowing in still water = x km/hr.

Speed of stream = y km/hr

- a) Down stream rate = $(x + y)$ km/hr
(i.e.) direction of rowing and direction of flow is same.
- b) Up stream rate = $(x - y)$ km/hr
(i.e.) direction of rowing and direction of stream are opposite.

Speed of still water and stream: Assume, speed downstream = a km/hr

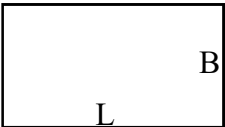
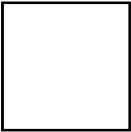
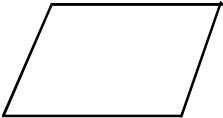
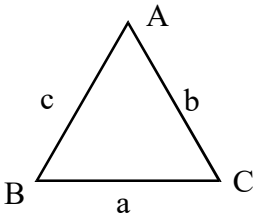
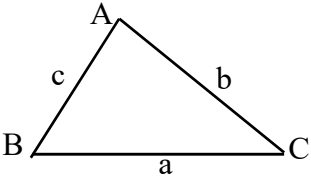
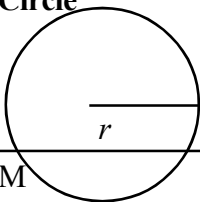
Speed upstream = b km/hr

Then, speed in still water = $\frac{1}{2}(a + b)$ km/hr

Rate of stream = $\frac{1}{2}(a - b)$ km/hr

14. MENSURATION - AREAS AND PERIMETERS

Introduction: The term 'area' refers to the space occupied by the figure in two dimensions. The area is expressed in square units. The measurement of the length of the lines enclosing the space is called its perimeter.

Figure	Area	Perimeter
Rectangle 	$L \times B$	$2(L + B)$
Square 	Side^2	$4 \times \text{Side}$
Parallelogram 	Base x Altitude	Sum of the sides
Triangle 1) Equilateral triangle 	a) $\frac{\sqrt{3}}{4} \times \text{Side}^2$ (or) b) $\frac{1}{2} \times \text{Base} \times \text{Altitude}$	$3 \times \text{sides}$ Sum of sides
2) Other triangles 	a) $\frac{1}{2} \times \text{Base} \times \text{Altitude}$ b) $\sqrt{s(s-a)(s-b)(s-c)}$	Sum of sides
Circle 	πr^2	$2\pi r$
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PROBLEMS

1. If the sides of a rectangle are in the ratio 2 : 1 and if its area is same as that of a square of side 8 cm., then the perimeter of the rectangle in cm. is

1. $24\sqrt{2}$ 2. $12\sqrt{2}$ 3. $8\sqrt{2}$ 4. $4\sqrt{2}$

Solution: Length $l = 2x$; breadth $b = x$.

Side of a square = 8cm. $\Rightarrow$ Area = $8^2 = 64\text{cm}$. So $l \times b = 8\sqrt{2}$, $b = 4\sqrt{2}$.

Perimeter of the rectangle = $2(l + b) = 2(8\sqrt{2} + 4\sqrt{2}) = 2(12\sqrt{2}) = 24\sqrt{2}$.

So the answer is 1.

2. If the perimeter of a regular hexagon is 24 cm. then its area in sq. cm. is

1. $12\sqrt{6}$ 2. 18 3. $18\sqrt{3}$ 4. $24\sqrt{3}$

Solution: A simple closed figure bounded by six sides and all its angles and sides are equal is called a regular hexagon. Let 'a' be the side of it.

So perimeter = $6a$. So $6a = 24\text{cm}$. $\Rightarrow a = 4\text{cm}$.

Area of a regular hexagon = $\frac{3\sqrt{3}}{2} \times a^2 = \frac{3\sqrt{3}}{2} \times 4^2 = \frac{3\sqrt{3}}{2} \times 16 = 3\sqrt{3}(8) = 24\sqrt{3} \text{ sq.cm.}$

So the answer is 4.

3. The perimeter of a rhombus is 100cm and one of its diagonals is 40cm. The area of the rhombus in sq.cm. is

1. 400 2. 500 3. 600 4. 800

Solution: Perimeter = 45 = 100cm $\Rightarrow s = 25\text{cm}$.; $d_1 = 40\text{cm} \Rightarrow \frac{d_1}{2} = 20\text{cm}$.

Now $\left(\frac{d_2}{2}\right)^2 = 25^2 - 20^2 \Rightarrow \frac{d_2}{2} = \sqrt{625 - 400} = \sqrt{225} = 15 \Rightarrow d_2 = 30$.

Area of Rhombus = $\frac{1}{2} \times$ product of its diagonals = $\frac{1}{2} \times 30 \times 40 = 600$.

So the answer is 3.

4. The height of a cone is 84cm and the area of its base is 3850 sq. cm. The area of the curved surface of the cone in sq.cm. is (taking the value of π as $\frac{22}{7}$)

1. 1010 2. 10001 3. 10010 4. 11010

Solution: $h = 84\text{cm}$, $\pi r^2 = 3850 \Rightarrow r^2 = \frac{3850}{\pi} = 3850 \times \frac{7}{22}$

$$\Rightarrow r^2 = 175 \times 7 = 25 \times 7 \times 7 \Rightarrow r = 5 \times 7 = 35\text{cm.}$$

Curved surface area = $\pi r l$. Where l is slant height = $\pi r \sqrt{h^2 + r^2}$.

$$\Rightarrow \frac{22}{7} \times 35 \sqrt{(84)^2 + (35)^2} = 110 \sqrt{7056 + 1225} = 110 \sqrt{8281} = 110(91) = 10010.$$

So the answer is 3.

5. A rectangular plot is of 50 m x 30 m dimensions. Roads of width 2 m are laid joining the mid points of opposite sides and also a path of same width running inside and along the length and the breadth of it. What is the total area of the roads and the path in sq. metres?

1. 444 2. 448 3. 928 4. 1056

Solution: $l=50, b=30$.

$$\text{Roads} + \text{paths} = 50(6) + 6(24) = 300 + 144 = 444.$$

So the answer is 1.

6. The lengths of parallel sides of a trapezium are 20 m and 35 m and the distance between them is 8 m. The area of the trapezium in sq.m. is

1. 110 2. 220 3. 330 4. 440

Solution: $h = 8\text{mt}, a = 20, b = 35$.

$$\text{Area of trapezium} = \frac{1}{2} \text{height (sum of paralel sides)}$$

$$= \frac{1}{2} h(a + b) = \frac{1}{2} 8(20 + 35) = 4(55) = 220. \text{ So the answer is 2.}$$

7. The area of a right isosceles triangle is 4.5sq.m. Its perimeter in metres is

1. $6 + 3\sqrt{2}$ 2. $3 + 3\sqrt{2}$ 3. $1 + 3\sqrt{2}$ 4. $3 + \sqrt{2}$

Solution: Area = $\frac{1}{2}$ base x height = 4.5.

$$\Rightarrow \frac{1}{2} a \times a = 4.5 \Rightarrow \frac{a^2}{2} = 4.5 \Rightarrow a^2 = 9 \Rightarrow a = 3.$$

$$\text{Perimeter} = a + a + a\sqrt{2} = 3 + 3 + 3\sqrt{2} = 6 + 3\sqrt{2}. \text{ So the answer is 1.}$$

(Note: A right angled isosceles triangle is a triangle in which two sides are equal)

8. A circular road runs around a circular ground. If the difference between the circumferences of the outer circle and inner circle is 66 m, the width of the road in metres is (taking the value of

$$\pi \text{ as } \frac{22}{7})$$

1. 10 2. 10.5 3. 9.5 4. 9

Solution: $2\pi R - 2\pi r = 66 \Rightarrow 2\pi(R - r) = 66 \Rightarrow R - r = \frac{66}{2\pi} = \frac{66 \times 7}{2 \times 22} = \frac{21}{2} = 10.5 \text{ cm.}$

So width of the road = 10.5 cm. **So the answer is 2.**

9. If C and S respectively denote the areas of a circle and a square having the same perimeter, then

1. $C = S$ 2. $C < S$ 3. $C > S$ 4. $C = \pi S$

Solution: Area of circle = $C = \pi r^2$; S = Area of square = s^2 where s is the side.

Given perimeter of circle = $2\pi r = 4s$ = perimeter of square.

So $s = \frac{\pi r}{2}$. Now $S = s^2 = \left(\frac{\pi r}{2}\right)^2 = \frac{\pi}{4} \cdot \pi r^2 = \frac{\pi}{4} C$. So $S > C$ (because $\frac{\pi}{4} < 1$).

So the answer is 2.

10. The length of the diagonal of a square, whose area is equal to the area of a rectangle of length 81m and breadth 50m, is

1. 45 m 2. 90 m 3. $40\sqrt{2}$ m 4. $45\sqrt{2}$ m

Solution: Area of a square = s^2 = Area of rectangle

$\Rightarrow s^2 = 81(50) \Rightarrow s = 9\sqrt{50} = 9(5\sqrt{2}) = 45\sqrt{2}$.

Diagonal of a square = $\sqrt{2}s = \sqrt{2}(45\sqrt{2}) = 45(2) = 90 \text{ m.}$ **So the answer is 2.**

11. Two cubes each of the edges 20cm are joined to form a single cuboid. Then the surface area of the new cuboid so formed is

1. 4000 sq.cm 2. 6000 sq.cm. 3. 5400 sq.cm. 4. 6400 sq.cm.

Solution: Length of cuboid = $20 + 20 = 40$, breadth of cuboid = 20, height of cuboid = 20.

So surface area of cuboid = $2(lb + bh + lh) = 2[(40)(20) + (20)(20) + (40)(20)]$
 $= 2[800 + 400 + 800] = 2[2000] = 4000$. **So the answer is 1.**

12. For a cylinder of height and base radius r , the curved surface area is thrice the area of the base.

Then $h : r =$

1. 3 : 2 2. 3 : 5 3. 2 : 3 4. 5 : 3

Solution: Curved surface area of a cylinder = $2\pi rh$

Base area of cylinder = πr^2 ; given that curved surface area = 3 times base area.

$\Rightarrow 2\pi rh = 3\pi r^2 \Rightarrow 2h = 3r \Rightarrow \frac{h}{r} = \frac{3}{2} = 3 : 2$. **So the answer is 1.**

13. The area (in square feet) of a triangle whose sides are 5ft, 12ft and 13ft is

1. 17 2. 18 3. 25 4. 30

Solution: The sides of a Triangular field = 5 ft, 12ft, 13ft.

It forms a right angled Triangle.

Area of the field = $\frac{1}{2} \times 5 \times 12$ sq.ft = 30 sq.ft. **So the answer is 4.**

14. A rope can make 140 rounds on the circumference of a cylinder whose base radius is 14cm. The number of rounds the rope make around the cylinder with base radius 20 cms is
 1. 200 2. 100 3. 98 4. 17

Solution: Radii of the given Cylinder $r_1 = 14$ cms, $r_2 = 20$ cms. The number of make by a rope on, the circumference of the first cylinder = $h_1 = 140$.

$$2\pi r_1 h_1 = 2\pi r_2 h_2 \Rightarrow 14 \times 140 = 20 \times h_2 \Rightarrow h_2 = 98.$$

So the answer is 3.

15. A rectangular carpet has an area of 120 sq.m. and a perimeter 47 metres. The length of its diagonal (in metres) is
 1. 20 2. 17 3. 15 4. 13

Solution: Let the length and breadth of a rectangular Carpet = l, b .

It area $lb = 120$ and perimeter $2(l + b) = 46$. $l + b = 23$, $lb = 120$.

$$\text{Length of its diagenel } d = \sqrt{l^2 + b^2} = \sqrt{(l + b)^2 - 2lb} = \sqrt{(23)^2 - 240} = \sqrt{289} = 17.$$

So the answer is 2.

16. An aluminium wire of length 8m 96cms and a copper wire of length 5m 12cms are cut into pieces of equal length/cms. The maximum possible value of l is
 1. 16 2. 32 3. 64 4. 128

Solution: The H.C.F of 896cms and 512cms.

The maximum possible length = 128cms. **So the answer is 4.**

17. A rectangular lawn of dimensions 65m x 35m has two roads each of 5 metres wide running in the middle of it, one parallel to the length and the other parallel to the breadth. The cost of repairing the road at the rate of Rs.3 per square metre (in rupees) is
 1. 1500 2. 1475 3. 1450 4. 1425

Solution: The dimensions of a rectangular Lawn = 65m x 35m.

The width the roads parallel to the length and breadth = 5mts.

The area of Road = $(l + b - w)w$ sq.mts.

The total cost of repairing the roads at the rate of Rs.3/- per sq.mts = $475 \times 3 = 1425/-$

So the answer is 2.

18. The curved surface area of a cylinder is thrice the area of its base. If r is the radius of the base and h is the height, then $r : h =$
 1. 3 : 2 2. 3 : 5 3. 2 : 3 4. 2 : 5

Solution: Curved surface area of cylinder = $3 \times$

$$(\text{Area of its base}) \Rightarrow 2\pi r h = 3\pi r^2 \Rightarrow r : h = 2 : 3. \text{ So the answer is 3.}$$

19. The ratio of the sides of a rectangle is 4 : 9 and the area is equal to 144 sq.m. The perimeter in meter is

1. 52 2. 26 3. 18 4. 30

Solution: Let the sides of a rectangle = $4x, 9x$. Its area $36x^2 = 144$ sq.mts $x = 2$.

Perimeter of rectangle = $2(l + b) = 2(8 + 18) = 2(26) = 52$ mts.

So the answer is 1.

20. The area (in square cms) of a trapezium, for which the lengths of parallel sides are 20 cms and 23 cms while the distance between the parallel sides is 12 cms, is

1. 238 2. 248 3. 258 4. 264

Solution: Area of the Trapezium = $\frac{1}{2}(a + b)h \Rightarrow \frac{1}{2}(20 + 23)12 = \frac{1}{2}(43)12 = 258$ sq.mts.

So the answer is 3.

21. The area (in sq.cms.) of the regular hexagon whose perimeter is 12cms, is

1. $18\sqrt{3}$ 2. $15\sqrt{3}$ 3. $12\sqrt{3}$ 4. $6\sqrt{3}$

Solution: The side of given hexagon = 2cms.

Its area = $\frac{3\sqrt{3}}{2}a^2 = \frac{3\sqrt{3}}{2}2^2 = 6\sqrt{3}$. **So the answer is 4.**

22. If the ratio of the circumferences of two circles is 2 : 3 then the ratio of their areas is

1. 4 : 9 2. 3 : 5 3. 5 : 6 4. 3 : 2

Solution: The ratio between the circle circumference of two circles = 2 : 3

The ratio between their areas = $2^2 : 3^2 = 4 : 9$ (or) 2 : 3. **So the answer is 1.**

23. Six spherical balls radius r are melted and cast into a cylindrical rod of the same radius. The height of the rod is

1. $4r$ 2. $6r$ 3. $8r$ 4. $12r$

Solution: Let the height of the rod = h .

$6 \frac{4}{3} \pi r^3 = \pi r^2 h \Rightarrow h = 8r$. **So the answer is 3.**

24. A circle and a square of same perimeter have areas c and s respectively. Then

1. $s = c$ 2. $s > c$ 3. $c > s$ 4. $c = \pi s$

Solution: Let the perimeter = x .

Area of the circle $c = \frac{x^2}{4\pi}$; Area of the square $s = \frac{x^2}{16} \Rightarrow c > s$. **So the answer is 3.**

25. A cube, made of a metal, with edge 3cms weights 12gms. The weight (in grams) of the cube of edge 12cm, made of the same metal, is

1. 48 2. 64 3. 758 4. 768

Solution: The weight of a cub with edge 3cms = 12gms. (i.e) $27\text{cm}^3 = 12\text{gms}$.

Weight of the cube with edge 12cms = $\frac{12^3}{27} \times 12 = 768\text{gms}$. **So the answer is 3.**

26. An isosceles triangle of area 12 sq.cm. has one of its equal sides as 5cm. The lengths of the base of the triangle (in cms) is

1. 6 2. 7 3. 8 4. 9

Solution: (1) or (3). Let the third side = x .

Area of the triangle = $\frac{x}{4} \sqrt{10^2 - x^2} = 12 \Rightarrow x = 6 \text{ or } 8$. **So the answer is 1 and 3.**

27. The radius of the circle (in feet) that can circumscribe a rectangle of length 12 feet and breadth 5 feet, is

1. 6 2. 6.5 3. 7 4. 8.5

Solution: The measurements of a rectangle = 12ft x 5 ft

The diameter of circle circumscribe the rectangle = $\sqrt{12^2 + 5^2} = 13$.

The radius of circum circle = 6.5 ft. **So the answer is 2.**

28. The inner and outer radius of a circular track are respectively 21m and 28m. The cost of livelling the track at Rs. 5 per square meter is (in rupees)

1. 1078 2. 2156 3. 4312 4. 5390

Solution: The area of the circular track = $\pi(r_1^2 - r_2^2) = \pi(28^2 - 21^2) = 1078 \text{ sq.mts}$.

The cost of leveling the track = $1078 \times 5 = 5390$. **So the answer is 4.**

29. The curved surface area of a cylinder is thrice the area of its base. Then the ratio of its base radius and height is

1. 4 : 3 2. 3 : 5 3. 2 : 3 4. 3 : 2

Solution: $2\pi rh = 3\pi r^2 \Rightarrow r : h = 2 : 3$. **So the answer is 3.**

30. A rectangular tank has 2.6 cubic metres of water. If the area of the base of the tank is 6500sq.cms. then the depth of water (in metres) is

1. 3.5 2. 4 3. 5 4. 8

Solution: The volume of the water in the tank = 2.6cu.mts.

The base area of the tank = 6500 sq.cms.

Then $6500 \times h = 2.6 \times 100 \times 100 \Rightarrow h = 4\text{mts}$. **So the answer is 2.**

31. A cylinder is of height 8 metres and has base radius 8 meters. The maximum length (in meters) of the rod that can be placed in it is

1. $8\sqrt{5}$ 2. $8\sqrt{2}$ 3. $8\sqrt{3}$ 4. $8(2\pi + 1)$

Solution: Base radius of the cylinder $r = 8\text{mts} \Rightarrow \text{diameter} = 16\text{mts}$.

Height of the cylinder $h = 8\text{mts}$.

The maximum length of the that can be place in it = $\sqrt{4r^2 + h^2} = 8\sqrt{5}$ mts.

So the answer is 1.

32. If two circles of diameter 10cm and 6cm touch externally, then the distance between their centres is

1. 16cm 2. 2cm 3. 4cm 4. 8cm

Solution: Radius = $\frac{\text{diameter}}{2}$. So radius = 5cm and another radius = 3cm.

So distance between centres = sum of the radius = $5 + 3 = 8$. **So the answer is 4.**

33. Two circles C_1 and C_2 are such that a square S is inscribed in C_1 and C_2 is inscribed in S. Then the ratio of the areas of C_1 and C_2 is

1. $\sqrt{2} : 1$ 2. $2 : 1$ 3. $2 : \sqrt{2}$ 4. $3 : 2$

Solution: The ratio between the radius of two circles C_1 and C_2 is $r_1 : r_2 = \sqrt{2} : 1$

The ratio between their areas = $(\sqrt{2})^2 : 1^2 = 2 : 1$. **So the answer is 2.**

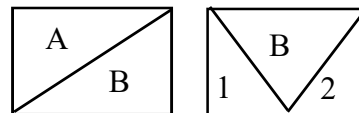
34. A square sheet of paper is cut along the diagonal into two equal triangles. What is the minimum number of pieces into which one of the two triangles shall have to be cut so that these pieces together with other triangle could be arranged a rectangle?

1. 2 2. 3 3. 4 4. 5

Solution: Part A is cut into two parts 1 and 2, and adding it to

B as shown in figure, we get a rectangle.

So the answer is 1.



ICET-2011

35. If the area of a triangle with base x is equal to the area of a square with side x , then the altitude of the triangle is

1. $\frac{x}{2}$ 2. x 3. $2x$ 4. $3x$

Solution: Area of triangle = Area of square $\Rightarrow \frac{1}{2} xh = x^2 \Rightarrow h = 2x$. **Answer is 3.**

36. The area of a trapezium is 220 sq.cm. and its height is 8cm. If the sum of the non-parallel sides is 20cm., its perimeter (in cm) is

1. 75 2. 110 3. 100 4. 65

Solution: Area of trapezium = $\frac{1}{2} h(a + b)$ where a, b are parallel sides and h is the $\perp$

distance between them. $220 = \frac{1}{2} \cdot 8(a + b) \Rightarrow a + b = 55 = \text{sum of parallel sides.}$

Perimeter = $55 + 20 = 75$. **Answer is 1.**

37. If the diagonals of a rhombus are 12cm and 18cm, then its area (in sq.cm.) is

1. 216 2. 108 3. 54 4. 180

Solution: Area of rhombus = $\frac{1}{2} d_1 d_2$ where d_1 and d_2 are two diagonals.

Area = $\frac{1}{2} \times 12 \times 18 = 6 \times 18 = 108$. **Answer is 2.**

38. A rectangle of length 12cm and breadth 5cm is inscribed in a circle of radius r cm. Then r (in cm) is

1. 13 2. 12 3. 6.5 4. 6

Solution: $(2r)^2 = 5^2 + 12^2 = 169 = 13^2$ (by using pythagorous theorem)

$\Rightarrow 2r^2 = 13 \Rightarrow r = 6.5$. **Answer is 3.**

ICET-2012

39. The lengths of the sides of a right angled triangle are in the ratio 3 : 4. The area of the triangle is 726 square units. Then the length of the hypotenuse (in proper units) is

1. 33 2. 44 3. 55 4. 66

Solution: $\frac{1}{2} \times 3x \times 4x = 726 \Rightarrow x^2 = \frac{726}{6} = 121 = 11^2 \Rightarrow x = 11$.

By Pythagorous Theorem Hypotenuse = $11\sqrt{4^2 + 3^2} = 11(5) = 55$. **Answer is 3.**

40. The length and breadth of a rectangle are changed by +20% and -10% respectively. Then the percentage change in the area of the rectangle is

1. 15 2. 10 3. 8 4. 5

Solution: Initial area = $A_1 = lb$;

Increased area = $A_2 = \left(l + \frac{l}{5}\right) \left(b - \frac{b}{10}\right) = (1.2 l) (0.9)b = (1.08) lb$

Change = $1.08 - 1 = 0.08$

% change = $0.08 \times 100 = 8\%$. **Answer is 3.**

ICET-2013

110. A window is in the shape of a rectangle surmounted by a semicircle. If the length of the rectangle is 6 feet and the radius of the semicircle is 2 feet, then the area of the window, in square feet, is

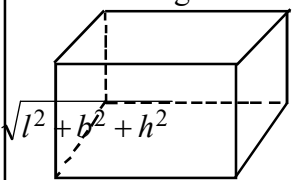
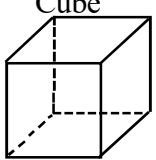
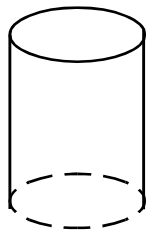
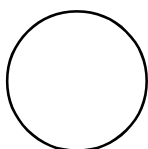
- (1) $18 + 4\pi$ (2) $24 + 4\pi$ (3) $24 + 2\pi$ (4) $18 + 2\pi$

15. VOLUME AND SURFACE AREA

Introduction: The term ‘Volume’ refers to the space occupied by the figure in ‘three dimensions’. Example, cub, cuboid, cone, cylinder, sphere etc.

Volume of a Combination of Solids: The volume of the solid formed by joining two basic solids will actually be the sum of the volumes of the constituents.

Total Surface Area (TSA): The total surface area of a solid is the sum of the curved surface area + the sum of the area of the smooth surface.

Figure	Volume	Surface Area	Others
Room or a Rectangular solid 	$l \times b \times h$	$2(lb + lh + bh)$	a) Area of 4 walls $2(l + b) \times h$ b) Diagonal $=$
Cube 	Side ³	$6 \times \text{side}^2$	a) Diagonal $= \sqrt{3} \times \text{sides}$ b) Sum of edges $= 12 \times \text{side}$
Right Circular Cylinder 	$\pi r^2 h$	a) of sides $= 2\pi r h$ b) To surface $= 2\pi r (r + h)$	
Sphere 	$\left(\frac{4}{3}\right) \times \pi r^3$	$4\pi r^2$	
Cone 	$\left(\frac{1}{3}\right) \times \pi r^2 h$	a) Of sides $= 2\pi r l$ b) To surface $= \pi r^2 + \pi r l$	$h^2 + r^2 = l^2$
CEDM	173		ICET

PROBLEMS

1. A cylinder and a cone have the same height and the radius of the base. The ratio between the volumes of the cylinder and the cone is

1. 2 : 1 2. 3 : 1 3. 2 : 3 4. 3 : 2

Solution: Volume of a cylinder = $\pi r^2 h$. Volume of cone = $\frac{1}{3} \pi r^2 h$.

So $\pi r^2 h : \frac{1}{3} \pi r^2 h \Rightarrow 3 : 1$. **So the answer is 2.**

2. The side of a cube is 5 cm. Its total surface area in sq. cm. is

1. 30 2. 90 3. 150 4. 200

Solution: Total surface area of a cube = $6a^2$, where a is the side = $6(5)^2 = 150$.

So the answer is 3.

3. The ratio of the weights of three solid spheres is 8 : 27 : 64. The ratio of their diameters is

1. 1 : 2 : 3 2. 1 : 3 : 4 3. 2 : 4 : 6 4. 4 : 6 : 8

Solution: Volume of a sphere = $\frac{4}{3} \pi r^3 = \frac{\pi}{6} d^3$

Where r is the radius and d is the diameter. So $r_1^3 : r_2^3 : r_3^3 = 8 : 27 : 64 \Rightarrow r_1 : r_2 : r_3 = 2 : 3 : 4$.

The ratio of the diameters = $2r_1 : 2r_2 : 2r_3 = 4 : 6 : 8$. **So the answer is 4.**

4. If the ratio of the radii of two spheres is 2 : 3, then the ratio of their volumes is

1. 8 : 9 2. 4 : 9 3. 8 : 27 4. 2 : 3

Solution: Ratio of their volumes is $\frac{4}{3} \pi r_1^3 : \frac{4}{3} \pi r_2^3 \Rightarrow r_1^3 : r_2^3 \Rightarrow (2)^3 : (3)^3 \Rightarrow 8 : 27$.

So the answer is 3.

5. The maximum number of boxes, each length 2m, breadth 4m and height 5m that can be placed in a box of length 20m, breadth 10m and height 5m, is

1. 30 2. 40 3. 20 4. 25

Solution: No. of small boxes = $\frac{\text{volume of big box}}{\text{volume of each small box}} = \frac{20 \times 10 \times 5}{2 \times 4 \times 5} = 25$.

So the answer is 4.

6. The radius ' r ' of a circular cylinder is the same as that of a sphere. If their volumes are equal then the height of the cylinder is

1. $\frac{2r}{3}$ 2. $\frac{4r}{3}$ 3. $2r$ 4. r

Solution: Area of the cylinder = Area of asphere

$$\frac{1}{3} \times \pi \times r^2 \times h = \pi \times r^3 \Rightarrow h = \frac{4\pi}{3}. \text{ So the answer is 2.}$$

7. To prepare an aluminium sheet of 10000 square metres the volume of the aluminium required is one cubic metre. The thickness of the sheet (in cms) is

1. 10 2. 0.1 3. 0.01 4. 0.001

Solution: Volume of aluminium = bare area x thinkners

1 cubic meter = 10,000 sq.meter x thickners

1 meter = 100 cms; 1 sq.m. = 100 x 100

1 cubic m = 100 x 100 x 100

100 x 100 x 100 = 10,000 x 100 x 100 x thickness

$$\text{thickness} = \frac{1}{100} = 0.01\text{cm. So the answer is 3.}$$

8. If the base radius of two cylinders are in the ratio 2 : 3 and their heights are in the ratio 9 : 5, then the ratio of their volumes is

1. 11 : 8 2. 4 : 5 3. 1 : 4 4. 5 : 4

Solution: Volume of cyliner = $\pi r^2 h$; ratio of base radii of two cylinders = 2 : 3

ratio of heights of two cylinders = 9 : 5; $\pi \times (2)^2 \times 9 : \pi (3)^2 \times 5 = 36\pi : 45\pi = 4 : 5$.

So the answer is 2.

ICET-2011

9. If the diagonal of a cube is $5\sqrt{3}$ m, its volume (in cubic metres) is

1. 150 2. 145 3. 125 4. 120

Solution: Formula: Let the edge (side) of a cube be 'a' units then Volume = a^3 ,

Total surface area = $6a^2$, Diagonal of a cube = $(\sqrt{3} a)$ units.

Given $\sqrt{3} a = 5\sqrt{3} \Rightarrow a = \text{side} = 5 \text{ mt.} \therefore \text{Volume} = a^3 = 5^3 = 125. \text{ Answer is 3.}$

ICET-2012

10. A cube has a volume of 128cm^3 . It is divided into 8 equal cubes. Then the ratio of an edge of a smaller cube to an edge of the original cube is

1. 1 : 8 2. 1 : 16 3. 1 : 2 4. 2 : 1

Solution: Volume of a cube = a^3 .

$$128 : \frac{128}{8} \text{ (because it is divided into 8 equal cubes)}$$

$\Rightarrow 2 : 1. \text{ So ratio of edge of smaller cube : edge of original cube} = 1 : 2. \text{ Answer is 3.}$

11. The volume of a cube (in cubic centimeters), whose total surface area is 384 square centimeters is,

1. 64 2. 512 3. 128 4. 256

Solution: Total surface area is $6a^2 = 384 \Rightarrow a^2 = 64 \Rightarrow a = 8$.

Volume of a cube = $a^3 = 8 \times 8 \times 8 = 512$. **Answer is 2.**

12. The volume (in proper units) of the cone with r as the radius of the circular base and having height h is

1. $\frac{1}{3}\pi r^2 h$ 2. $\frac{2}{3}\pi r^2 h$ 3. $\pi r^2 h$ 4. $\frac{4}{3}\pi r^2 h$

Solution: Volume of cone = $\frac{1}{3}\pi r^2 h$. **Answer is 1.**

13. If n is the maximum number of solid cubes with an edge of length 0.2 cm that can be put in a box whose dimensions are 1 cm x 1 cm x 4 cm then $n =$

1. 250 2. 150 3. 500 4. 350

Solution: Number of cubes of edge 0.2 cm that can be put in the box = $\frac{1 \times 1 \times 4}{0.2 \times 0.2 \times 0.2}$

$$= \frac{4000}{8} = 500. \text{ Answer is 3.}$$

14. The ratio of the radii of two circular cylinders A and B is 2 : 3 and that of their height is 5 : 3. If the volume of the cylinder B is $27 m^3$, then the volume of the cylinder A in cubic meters is

1. 22 2. 30 3. 40 4. 20

Solution: $r_1 : r_2 = 2 : 3 \Rightarrow \frac{r_1}{r_2} = \frac{2}{3} \Rightarrow 3r_1 = 2r_2;$

$$h_1 : h_2 = 5 : 3 \Rightarrow \frac{h_1}{h_2} = \frac{5}{3} \Rightarrow 3h_1 = 5h_2.$$

Volume = $27 m^3 \Rightarrow \pi r_2^2 h_2 = 27 \Rightarrow \pi \cdot \frac{9}{4} r_1^2 \cdot \frac{3}{5} h_1 = 27 \Rightarrow \pi r_1^2 h_1 = \frac{27 \times 5 \times 4}{9 \times 3} = 20$. **Answer is 4.**

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109. The radius of a cone is 3 times the radius of a cylinder and their heights are same. Then the ratio of their volumes in that order is

- (1) 9:1 (2) 1:3 (3) 3:1 (4) 1:9

106. 11 cubic metres of steel is cast into cylindrical bars of diameter 10 cms and length 1.4 metres. Then the number of such bars that can be cast with the given metal is (Take $\pi =$

$$\frac{22}{7})$$

- (1) 10 2) 100 (3) 1000 (4) 10000

16. THEORY OF INDICIES

Let 'a' be a real number and 'n' be a natural number then the product of a's up to n terms by a^n i.e.,

$$a^n = a \times a \times a \times \dots n \text{ terms.}$$

In a^n , a is called base and n is called index or exponent.

Laws of Indices:

1. $a^m \times a^n = a^{m+n}$
2. $a^m \div a^n = a^{m-n}$
3. $(a^m)^n = a^{mn}$
4. $(ab)^m = a^m b^m$
5. $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$
6. $\sqrt[n]{a} = a^{\frac{1}{n}}$
7. $\sqrt[n]{a^m} = a^{\frac{m}{n}}$
8. $\sqrt[m]{\sqrt[n]{a}} = \sqrt[mn]{a} = a^{\frac{1}{mn}}$
9. $a^{-m} = \frac{1}{a^m}$
10. $\left(\frac{a}{b}\right)^{-m} = \left(\frac{b}{a}\right)^m$
11. $a^0 = 1$
12. $\Sigma(b-c) = 0$
13. $\Sigma a(b-c) = 0$
14. $\Sigma \frac{a-b}{ab} = 0$
15. $\Sigma \frac{1}{(a-b)(a-c)} = 0$

PROBLEMS

1. If $\frac{8^{\frac{3}{4}} \times 9^{\frac{4}{3}}}{27^{\frac{3}{2}} \times 16^{\frac{3}{3}}} = 2^a \cdot 3^b$, then $a - b =$

1. $\frac{6}{11}$
2. $\frac{11}{6}$
3. $\frac{17}{12}$
4. $\frac{12}{17}$

Solution: $\frac{8^{\frac{3}{4}} \times 9^{\frac{4}{3}}}{27^{\frac{3}{2}} \times 16^{\frac{3}{3}}} = 2^a \cdot 3^b \Rightarrow \frac{(2^3)^{\frac{3}{4}} \times (3^2)^{\frac{4}{3}}}{(3^3)^{\frac{3}{2}} \times (2^4)^{\frac{3}{3}}} = \frac{2^{\frac{9}{4}} \times 3^{\frac{8}{3}}}{3^{\frac{9}{2}} \times 2^3} = 2^{\frac{9}{4}-3} \times 3^{\frac{8}{3}-\frac{9}{2}}$

$$= 2^{\frac{27-32}{12}} \times 3^{\frac{16-27}{6}} = 2^{\frac{-5}{12}} \times 3^{\frac{-11}{6}}. \text{ So } a = \frac{-5}{12}, b = \frac{-11}{6}.$$

$$\text{So } a - b = \frac{-5}{12} + \frac{-11}{6} = \frac{-5+22}{12} = \frac{17}{12}. \text{ So the answer is 3.}$$

2. $16^{\frac{3}{4}} - 8^{\frac{1}{3}} + 49^{\frac{1}{2}} =$

1. 17
2. 13
3. 3
4. -1

Solution: $16^{\frac{3}{4}} - 8^{\frac{1}{3}} + 49^{\frac{1}{2}} = (2^4)^{\frac{3}{4}} - (2^3)^{\frac{1}{3}} + (7^2)^{\frac{1}{2}} = 2^3 - 2^1 + 7^1 = 8 - 2 + 7 = 13.$

So the answer is 2.

$$3. \frac{\left(a^{\frac{1}{3}}b^{\frac{1}{6}}\right)^3 - \left(a^{\frac{1}{6}}b^{\frac{1}{3}}\right)^3}{a^{\frac{1}{2}} - b^{\frac{1}{2}}} =$$

1. $\sqrt{a} + \sqrt{b}$

2. $a^{\frac{1}{3}} + b^{\frac{1}{3}}$

3. $\sqrt{ab}$

4. $(ab)^{\frac{1}{3}}$

Solution:
$$\frac{\left(a^{\frac{1}{3}}b^{\frac{1}{6}}\right)^3 - \left(a^{\frac{1}{6}}b^{\frac{1}{3}}\right)^3}{a^{\frac{1}{2}} - b^{\frac{1}{2}}} = \frac{a.b^{\frac{1}{2}} - a^{\frac{1}{2}}b}{a^{\frac{1}{2}} - b^{\frac{1}{2}}} = \frac{a^{\frac{1}{2}}.b^{\frac{1}{2}}(a^{\frac{1}{2}} - b^{\frac{1}{2}})}{a^{\frac{1}{2}} - b^{\frac{1}{2}}}$$

$= a^{\frac{1}{2}}.b^{\frac{1}{2}} = \sqrt{a}\sqrt{b} = \sqrt{ab}.$ **So the answer is 3.**

4. If $(81)^x = \frac{1}{(243)^y}$, then $4x + 5y =$

1. 5

2. 3

3. 2

4. 0

Solution: $(81)^x = \frac{1}{(243)^y} \Rightarrow (3^4)^x = (3^5)^{-y} \Rightarrow 3^{4x} = 3^{-5y}$

$\Rightarrow 4x = -5y \Rightarrow 4x + 5y = 0.$ **So the answer is 4.**

5. $8^{\frac{2}{3}} - 16^{\frac{1}{4}} + 9^{\frac{1}{2}} =$

1. 3

2. 5

3. $\sqrt{2}$

4. $\sqrt{2} + \sqrt{3}$

Solution: $8^{\frac{2}{3}} - 16^{\frac{1}{4}} + 9^{\frac{1}{2}} = (2^3)^{\frac{2}{3}} - (2^4)^{\frac{1}{4}} + (3^2)^{\frac{1}{2}} = 4 - 2 + 3 = 5.$

So the answer is 2.

6. If x, y and z are three integers such that $x + y = 16, y + z = 20$ and $z + x = 22$, then $x \ y \ z$

1. 880

2. 981

3. 900

4. 819

Solution: $x + y = 16$ -----(1); $y + z = 20$ -----(2); $z + x = 22$ -----(3)

$(1) + (2) + (3) \Rightarrow 2x + 2y + 2z = 58; x + y + z = 29.$

$z = 13, x = 9, y = 7; xyz = 9 \times 7 \times 13 = 819.$ **So the answer is 4.**

7. If $\left(\sqrt{2}^{\sqrt{2}}\right)^{\sqrt{2}} = 2^x$, then $x =$

1. 4 2. 2 3. 1 4. $\sqrt{2}$

Solution: $(\sqrt{2}^{\sqrt{2}})^{\sqrt{2}} = 2^x$ (note: $(x^m)^n = x^{mn}$)

$(\sqrt{2})^2 = 2^x \Rightarrow 2^1 = 2^x \Rightarrow x = 1$. **So the answer is 3.**

8. If $9^{2x+1} = 27^{x+2}$ then $x =$

1. 2 2. 4 3. 8 4. 16

Solution: $9^{2x+1} = 27^{x+2}$ then x ; $3^{4x-2} = 3^{3x+6}$; $4x - 2 = 3x + 6 \Rightarrow x = 8$.

So the answer is 3.

9. If $a + b + c = 0$, then the value of $x^{\left(\frac{a^5}{3a^3bc}\right)} \cdot x^{\left(\frac{b^5}{3ab^3c}\right)} \cdot x^{\left(\frac{c^5}{3abc^3}\right)}$ is

1. x^3 2. x^2 3. x 4. 1

Solution: $x^{\left(\frac{a^5}{3a^3bc}\right)} \cdot x^{\left(\frac{b^5}{3ab^3c}\right)} \cdot x^{\left(\frac{c^5}{3abc^3}\right)} = \frac{a^2}{x^{3bc}} \cdot \frac{b^2}{x^{3ac}} \cdot \frac{c^2}{x^{3ab}}$

$= \frac{a^3+b^3+c^3}{x^{3abc}}$ (If $a + bc + c = 0$; $a^3 + b^3 + c^3 = 3abc$)

$= \frac{3abc}{x^{3abc}} = x^1 = x$. **So the answer is 3.**

10. If $a^x = b^y = c^z \neq 0$ and $a^2 = bc$ then $xy + yz + zx =$

1. $2xy$ 2. $3xy$ 3. $2yz$ 4. $3yz$

Solution: $a^x = b^y = c^z = 0$, then take $a^x = b^y = c^z = k$

So, if $a^x = k$ then $a = \frac{1}{k^{\frac{1}{x}}}$, similarly $b = \frac{1}{k^{\frac{1}{y}}}$, $c = \frac{1}{kk^{\frac{1}{y}}}$.

Also given that $a^2 = bc \Rightarrow \left(\frac{1}{k^{\frac{1}{x}}}\right)^2 = \frac{1}{k^{\frac{1}{y}}} \cdot \frac{1}{k^{\frac{1}{z}}} \Rightarrow \frac{2}{k^{\frac{1}{x}}} = \frac{1}{k^{\frac{1}{y} + \frac{1}{z}}} \Rightarrow \frac{2}{x} = \frac{1}{y} + \frac{1}{z}$

$\Rightarrow xz + xy = 2yz$. Adding yz both sides, we get $xy + yz + zx = 3yz$.

So the answer is 4.

11. For any $\alpha \neq 0$, $\frac{1}{1+\alpha^2+\alpha^4} + \frac{1}{1+\alpha^2+\alpha^{-2}} + \frac{1}{1+\alpha^{-2}+\alpha^{-4}} =$

1. $1+\alpha^2+\alpha^4$ 2. α^7 3. 1 4. 0

Solution: $\frac{1}{1+\alpha^2+\alpha^4} + \frac{1}{1+\alpha^2+\alpha^{-2}} + \frac{1}{1+\alpha^{-2}+\alpha^{-4}}$

$$\Rightarrow \frac{1}{1+\alpha^2+\alpha^4} + \frac{1}{1+\alpha^2+\frac{1}{\alpha^2}} + \frac{1}{1+\frac{1}{\alpha^2}+\frac{1}{\alpha^4}} = \frac{1}{1+\alpha^2+\alpha^4} + \frac{\alpha^2}{1+\alpha^2+\alpha^4} + \frac{\alpha^4}{1+\alpha^2+\alpha^4}$$

$$= \frac{1+\alpha^4+\alpha^2}{1+\alpha^2+\alpha^4} = 1. \text{ So the answer is 1.}$$

12. If $a = k^{1/3} - \frac{1}{k^{1/3}}$, where $k \neq 0$, then $a^3 + 3a =$

1. $\frac{k}{k^2-1}$

2. $\frac{k-1}{k^2}$

3. $\frac{k^2-1}{k}$

4. $\frac{k-1}{k^2+1}$

Solution: Given that $a = k^{\frac{1}{3}} - \frac{1}{k^{\frac{1}{3}}}$, $k \neq 0$, then $a^3 = \left(k^{\frac{1}{3}} - \frac{1}{k^{\frac{1}{3}}}\right)^3$

$$\Rightarrow a^3 = \left(k^{\frac{1}{3}}\right)^3 - \left(\frac{1}{k^{\frac{1}{3}}}\right)^3 - 3 \cdot k^{\frac{1}{3}} \cdot \frac{1}{k^{\frac{1}{3}}} \left(k^{\frac{1}{3}} - \frac{1}{k^{\frac{1}{3}}}\right)$$

$$[(a-b)^3 = a^3 - b^3 - 3ab(a-b)] \Rightarrow a^3 = k - \frac{1}{k} - 3(a) \left(k^{\frac{1}{3}} - \frac{1}{k^{\frac{1}{3}}} = a\right)$$

$$\Rightarrow a^3 + 3a = k - \frac{1}{k} \Rightarrow a^3 + 3a = \frac{k^2-1}{k}. \text{ So the answer is 3.}$$

13. A value of x such that $\sqrt[4]{x}$ is rational, is

1. 125

2. 1250

3. 2401

4. 5625

Solution: If $\sqrt[4]{x}$ to be rational, then x should be written in the form of k^4 , k is an integer.

From options, $2401 = 7^4$. **So the answer is 3.**

14. The least number by which $3^7 \cdot 7^4 \cdot 11$ has to be multiplied to make it a perfect square is

1. 16

2. 32

3. 64

4. 128

Solution: To make $3^7, 7^4, 11$ as a perfect square, then we should multiply with 3×11 .

Logic here is to make it perfect square, the powers should be even numbers.

So the answer is 3.

15. The reciprocal of the sum of the reciprocals of $\frac{3}{5}$ and $\frac{5}{7}$ is

1. $\frac{2}{3}$ 2. $\frac{5}{12}$ 3. $\frac{15}{46}$ 4. $\frac{46}{15}$

Solution: Reciprocals of $\frac{3}{5}$ and $\frac{5}{7}$ are $\frac{5}{3}$ and $\frac{7}{5}$.

Sum of these numbers are $\frac{5}{3} + \frac{7}{5} = \frac{25+21}{15} = \frac{46}{15}$.

Then the reciprocal of this sum is $\frac{15}{46}$. **So the answer is 3.**

16. $\frac{5 \times (2^{k-2}) + 10 \times (2^{k-1})}{10^{k+2}} =$

1. $\frac{1}{8 \times (5^k)}$ 2. $\frac{1}{16 \times (5^k)}$ 3. $\frac{1}{32 \times (5^k)}$ 4. $\frac{1}{4 \times (5^k)}$

Solution: $\frac{5^{\frac{2}{3}} \times \sqrt[3]{5^8}}{\sqrt[3]{5^7}} = \frac{5 \times (2^{k+2}) + 10 \times 2^{k-1}}{10^{k-2}} = \frac{5 \left(\frac{2^k}{4} + 2^{k-1+1} \right)}{10^k \cdot 10^2}$

$$= \frac{2^k + 2^k \cdot 2^2}{4 \times 10^k \times 20} \quad |a^k \cdot b^k = (ab)^k|$$

$$= \frac{2^{k(5)}}{4 \times 2^k \times 5^k \times 20} = \frac{1}{16 \times 5^k} \cdot \text{So the answer is 2.}$$

17. $\frac{5^{\frac{2}{3}} \times \sqrt[3]{5^8}}{\sqrt[3]{5^7}} =$

1. 5 2. 25 3. $\sqrt[3]{5}$ 4. 1

Solution: $\frac{5^{\frac{2}{3}} \times \sqrt[3]{5^8}}{\sqrt[3]{5^7}} = \frac{5^{\frac{2}{3}} \times 5^{\frac{8}{3}}}{5^{\frac{7}{3}}} = \frac{5^{\frac{10}{3}}}{5^{\frac{7}{3}}} = 5^{\frac{10}{3} - \frac{7}{3}} = 5^1 = 5$. **So the answer is 1.**

[Note: $\sqrt[n]{a^m} = a^{\frac{m}{n}}$; $a^m \times a^n = a^{m+n}$; $\frac{a^m}{a^n} = a^{m-n}$]

$$18. \left[\frac{\sqrt[4]{ab} - \sqrt{b}}{\sqrt{a} - \sqrt[4]{ab}} \right]^{-4} =$$

$$1. \frac{a^2}{b^2}$$

$$2. -\frac{a}{b}$$

$$3. \sqrt{\frac{a}{b}}$$

$$4. \frac{a}{b}$$

$$\text{Solution: } \left[\frac{\sqrt[4]{ab} - \sqrt{b}}{\sqrt{a} - \sqrt[4]{ab}} \right]^{-4} = \left[\frac{\sqrt[4]{b} + \sqrt[4]{a} - \sqrt[4]{b}}{\sqrt[4]{a}(\sqrt[4]{a} - \sqrt[4]{b})} \right]^{-4} = \frac{\sqrt[4]{x} \cdot \sqrt[4]{x} = \sqrt{x}}{\sqrt{x} \cdot \sqrt[4]{x} = \sqrt{x}}$$

$$= \left(\frac{\sqrt{a}}{\sqrt{b}} \right)^4 = \sqrt{\frac{a}{b}}. \text{ So the answer is 3.}$$

$$19. \frac{2^{4n+1} - 2^2 4^{2n-1}}{16^n} =$$

$$1. 0$$

$$2. 4$$

$$3. 2$$

$$4. 1$$

$$\text{Solution: } \frac{2^{4n+1} - 2^2 4^{2n-1}}{16^n} = \frac{2^{4n} \cdot 2^1 - 2^2 \cdot 4^{4n} \cdot 2^{-2}}{2^{4n}} = 2^{4n} \frac{2^1 - 2^2 \cdot \frac{1}{2^2}}{2^{4n}} = (2 - 1) = 1.$$

So the answer is 4.

$$20. \frac{(0.63)^2 + (0.05)^2 + (0.032)^2}{(0.063)^2 + (0.005)^2 + (0.0032)^2} =$$

$$1. 1$$

$$2. 10$$

$$3. 100$$

$$4. 1000$$

$$\text{Solution: } \frac{(0.63)^2 + (0.05)^2 + (0.032)^2}{(0.063)^2 + (0.005)^2 + (0.0032)^2} = \frac{\left(\frac{63}{100}\right)^2 + \left(\frac{5}{100}\right)^2 + \left(\frac{3.2}{100}\right)^2}{\left(\frac{63}{1000}\right)^2 + \left(\frac{5}{1000}\right)^2 + \left(\frac{3.2}{1000}\right)^2}$$

$$= \frac{\left(\frac{1}{100}\right)^2}{\left(\frac{1}{1000}\right)^2} = \frac{1}{100} \times \frac{1}{100} \times 1000 \times 1000 = 100. \text{ So the answer is 3.}$$

ICET-2011

21. If $\frac{6^{4/3} \cdot (24)^{2/5}}{9^{1/4} \cdot 12^{1/2}} = 3^a 2^b$ then $a + b =$

1. $\frac{34}{15}$ 2. $\frac{29}{15}$ 3. $\frac{31}{15}$ 4. $\frac{22}{15}$

Solution: $3^a 2^b = \frac{6^{4/3} \cdot (24)^{2/5}}{9^{1/4} \cdot 12^{1/2}} = \frac{2^{\frac{4}{3}} \cdot 3^{\frac{6}{3}} \cdot 2^{\frac{4}{5}} \cdot 3^{\frac{2}{5}}}{3^{\frac{1}{4}} \cdot 2^{\frac{1}{2}} \cdot 3^{\frac{1}{2}} \cdot 2^{\frac{1}{2}}} = 2^{\frac{4}{3} + \frac{6}{5} - 1} \cdot 3^{\frac{4}{5} + \frac{2}{5} - 1} = 2^{\frac{20+18-15}{15}} \cdot 3^{\frac{20+6-15}{15}}.$

Equating the powers of 3 and 2 we get $a = \frac{11}{15}$ and $b = \frac{23}{15}$.

So $a + b = \frac{11}{15} + \frac{23}{15} = \frac{34}{15}$. **Answer is 1.**

22. If $x + y + z = 0$, then for any $a > 0$, $a^{x^2/yz} a^{y^2/zx} a^{z^2/xy} =$

1. 1 2. a 3. a^2 4. a^3

Solution: Formula $a^3 + b^3 + c^3 - 3abc = (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$

$$a^{x^2/yz} a^{y^2/zx} a^{z^2/xy} = \frac{x^3}{a^{xyz}} + \frac{y^3}{a^{xyz}} + \frac{z^3}{a^{xyz}} = \frac{x^3 + y^3 + z^3}{a^{xyz}} = \frac{(x+y+z)^3 + 3xyz}{a^{xyz}} = a^{0+3} = a^3.$$

Answer is 4.

ICET-2012

23. The maximum of 33^{33} , 3^{33^3} , 333^3 and 3^{333}

1. 3^{333} 2. 33^{33} 3. 3^{33^3} 4. 333^3

Solution: Using the properties of index we get maximum among the given is 3. **Answer is 3.**

24. If a, b, c are all non-zero such that $2^a = 3^b = 6^c$, then $c(a + b) =$

1. a 2. b 3. ab 4. $a-b$

Solution: We have $2^a = 3^b = 6^c \Rightarrow 2^{ab} = 6^{bc}$ and $3^{ab} = 6^{ac}$

Consider $6^{c(a+b)} = 6^{ac} \times 6^{bc} = 2^{ab} \times 3^{ab} = (2 \times 3)^{ab} = (6)^{ab} \Rightarrow c(a + b) = ab$. **Answer is 3.**

25. If $x + 2y = 19$ and $2x + y = 17$, then the value of x^{3y-4x} is

1. 7 2. 7^5 3. 2^7 4. 5

Solution: $x + 2y = 19$ -----(1); $2x + y = 17$ -----(2);

Now (2) $\Rightarrow 4x + 2y = 34$ -----(3). Now subtracting (1) from (3) we get $3x = 15 \Rightarrow x = 5$, using this in (1) we get $y = 7$. So $x^{3y-4x} = 5^{21-20} = 5$. **So the answer is 4.**

17. PRIMARY NUMBER THEORY

1. The set of integral solutions of the equation $x + 8 \equiv 9 \pmod{2}$ is

1. $2\mathbb{Z}$ 2. $3\mathbb{Z}$ 3. $\mathbb{Z} - 3\mathbb{Z}$ 4. $\mathbb{Z} - 2\mathbb{Z}$

Solution: $x + 8 \equiv 9 \pmod{2} \Rightarrow x \equiv 1 \pmod{2} \Rightarrow x - 1 \equiv 0 \pmod{2} \Rightarrow x \in \mathbb{Z} - 2\mathbb{Z}$.

So the answer is 4.

2. The number of divisors of 36000 is

1. 30 2. 72 3. 640 4. 720

Solution: The number of divisors of 36000 is $36000 = 2^5 \times 3^2 \times 5^3$.

So number of divisors $= (5 + 1)(2 + 1)(3 + 1) = (6)(3)(4) = 72$.

So the answer is 2.

3. The number of diagonals of a regular polygon with 18 sides is

1. 189 2. 171 3. 153 4. 135

Solution: Number of diagonals of a regular polygon with n sides is $\frac{n(n-3)}{2}$.

Hence $n = 18$. So $\frac{18(18-3)}{2} = \frac{18(15)}{2} = 135$. **So the answer is 4.**

4. The least 3 digit positive integer x such that $x \equiv 3 \pmod{8}$ is

1. 105 2. 107 3. 108 4. 115

Solution: $x \equiv 3 \pmod{8} \Rightarrow x - 3 \equiv 0 \pmod{8} \Rightarrow x = 8y + 3$ for some integer y
 $\Rightarrow x = 107$. **So the answer is 2.**

5. If n, a, b are natural numbers, $n < 9$ and $n^5 = 10a + b$, then $b =$

1. 2 2. n 3. 3 4. 9

Solution: $n^5 = 10a + b$, then $b = 2^5 = 32 = 10(3) + 2 \Rightarrow b = 2$.

So the answer is 2.

6. The least integer value of n such that $\frac{54}{n^3}$ is an even integer is

1. 1 2. -1 3. -3 4. 3

Solution: $\frac{54}{n^3}$ is an even integer. If $n = 1$, then $\frac{54}{n^3} = 54$. If $n = -1$,

then $\frac{54}{n^3} = -54$. If $n = -3$, then $\frac{54}{n^3} = \frac{54}{-27} = -2$. If $n = 3$, then $\frac{54}{n^3} = \frac{54}{27} = 2$.

Every time we are getting an even integer. Among the values of n , the least integer is -3.

So the answer is 4.

7. What is the remainder when 2^{13416} is divided by 5?

1. 4 2. 3 3. 2 4. 1

Solution: 2^1 gives remainder 2 when divided by 5; 2^2 gives remainder 4 when divided by 5; 2^3 gives remainder 3 when divided by 5; 2^4 gives remainder 1 when divided by 5.

So the answer is 4.

8. The digit in the units place of 3^{741} is

1. 3 2. 9 3. 7 4. 1

Solution: $3^1 = 3$, $3^2 = 9$, $3^3 = 27$, $3^4 = 81$, $3^5 = 243$, $3^6 = 729$, $3^7 = 2187$, $3^8 = 6561$, $3^9 = 19683$

$741 = 3(247) + 0$, so the digit in the unit place is 1. **So the answer is 1.**

9. The remainder when 5^{20} is divided by 7 is

1. 4 2. 3 3. 2 4. 1

Answer is 1.

10. What is the remainder when 2^{13215} is divided by 3?

1. 1 2. 2 3. 0 4.

Solution: $2^1 \div 3$ the remainder is 2; $2^2 \div 3$ the remainder is 1; $2^3 \div 3$ the remainder is 2; $2^4 \div \dots$ 1. So $2^{13215} \div 3$ the remainder is '2'. **So the answer is 2.**

11. The number of divisors of 1800, other than the number itself if

1. 34 2. 35 3. 36 4. 40

Solution: $1800 = 2^3 \times 3^2 \times 5^2$.

The total number of factors = $(3 + 1)(2 + 1)(2 + 1) = 36$

Other than the number itself is $36 - 2 = 34$. **So the answer is 1.**

12. If the square of a prime $p \geq 5$ is divided by 12, then the remainder is always

1. 3 2. 1 3. 7 4. 11

Solution: $5^2 = 25$, leaves remainder 1 when divided by 12. (because $25 = 2 \times 12 + 1$)

$7^2 = 49$, leaves remainder 1 when divided by 12. (because $49 = 4 \times 12 + 1$)

$11^2 = 121$, leaves remainder 1 when divided by 12. (because $121 = 10 \times 12 + 1$)

$13^2 = 169$, leaves remainder 1 when divided by 12. (because $169 = 14 \times 12 + 1$)

So the answer is 2.

13. The smallest three digit number which satisfies $x \equiv 5 \pmod{3}$ is

1. 104 2. 103 3. 102 4. 101

Solution: $x \equiv 5 \pmod{3}$ if $x - 5$ is divisible by 3.

$104 - 5 = 99$ is divisible by 3; $103 - 5 = 98$ is not divisible by 3.

$102 - 5 = 97$ is not divisible by 3; $101 - 5 = 96$ is divisible by 3.

So the answer is 4.

14. If $a + 5 \equiv 4 \pmod{2}$, then the value of 'a' can be the form (n is a positive integer)

1. $2n$ 2. $2n + 2$ 3. $2n - 1$ 4. n

Solution: $a + 5 - 4$ is divisible by 2 $\Rightarrow a + 1$ is divisible by 2.

So $a + 1 = 2n \Rightarrow a = 2n - 1$. **So the answer is 3.**

15. If $\frac{5}{6}$ th of a number is $\frac{1}{4}$, then one-third of the number is

1. $\frac{5}{8}$ 2. $\frac{1}{12}$ 3. $\frac{5}{24}$ 4. $\frac{1}{10}$

Solution: $\frac{x}{6} = \frac{1}{4} \Rightarrow \frac{6x}{5} = \frac{1}{4} \Rightarrow x = \frac{5}{24}$. So $\frac{x}{3} = \frac{5}{8}$. **So the answer is 1.**

16. If a regular polygon has 15 sides, then the number of diagonals that can be drawn is

1. 60 2. 75 3. 30 4. 90

Solution: Number of diagonals = $\frac{n(n-3)}{2}$. Here $n = 15$. So $\frac{15(15-3)}{2} = 90$.

So the answer is 4.

17. The digit in the units place of the product $51 \cdot 52 \cdot 53 \dots 59$ is

1. 3 2. 2 3. 1 4. 0

Solution: The digit in the unit place is 0. (because $52 \cdot 55$ gives 0 in unit place)

So the answer is 4.

18. If one-third of a number is $\frac{1}{10}$ then the $\frac{5}{6}$ th of that number is

1. $\frac{1}{2}$ 2. $\frac{1}{3}$ 3. $\frac{1}{4}$ 4. $\frac{1}{5}$

Solution: Let the number be x . So $\frac{x}{3} = \frac{1}{10}$. So $x = \frac{3}{10}$. So $\frac{5x}{6} = \frac{5}{6} \times \frac{3}{10} = \frac{1}{4}$.

So the answer is 3.

19. If the least positive integer divisible by $2^3 \cdot 3 \cdot 5$, $3^2 \cdot 5 \cdot 7$ and $5^2 \cdot 7 \cdot 11$ has k distinct prime factors then $k =$

1. 9 2. 7 3. 5 4. 3

Solution: The lcm of given numbers = $2^3 \times 3^2 \times 5^2 \times 7 \times 11$.

So the number of distinct prime factors $k = 5$. **So the answer is 3.**

20. $|1 - 2x| > 3 - x, x > 0 \Rightarrow x >$

1. $\frac{4}{3}$ 2. $\frac{3}{4}$ 3. $\frac{4}{5}$ 4. 1

Solution: $|1 - 2x| > 3 - x \Rightarrow 1 - 2x < x - 3 \Rightarrow x > \frac{4}{3}$. **So the answer is 1.**

21. For any integer a , let $a^* = 2a - 5$. Then $\{x : \{x^*\}^* = x\} =$

1. ϕ 2. $\{0\}$ 3. $\{5\}$ 4. $\{0, 5\}$

Solution: $0^* = 2 \times 0 - 5 = -5$; $(0^*)^* = (-5)^* = 2(-5) - 5 = -10 - 5 = -15$.

$5^* = 2 \times 5 - 5 = 5$; $(5^*)^* = (5)^* = 2(5) - 5 = 10 - 5 = 5$.

So $(5^*)^* = 5$. **So the answer is 3.**

22. We write $a \equiv b \pmod{m}$ if m divides $(a - b)$. Then the correct, among the following, is

1. $100 \equiv 1 \pmod{7}$ 2. $100 \equiv 2 \pmod{8}$
3. $100 \equiv 3 \pmod{9}$ 4. $100 \equiv 4 \pmod{12}$

Solution: $100 - 1 = 99$ is not divisible by 7; $100 - 2 = 98$ is not divisible by 8.

$100 - 3 = 97$ is not divisible by 9; $100 - 4 = 96$ is divisible by 12.

So the answer is 4.

23. For any integer a , if $a^* = 5a - 17$ then $(5^*)^* =$

1. 23 2. 17 3. 11 4. 5

Solution: $5^* = 5(5) - 17 = 25 - 17 = 8$; $(5^*)^* = 8^* = 5(8) - 17 = 40 - 17 = 23$.

So the answer is 1.

24. If m divides $a - b$ we write $a \equiv b \pmod{m}$, then the incorrect statement, among the following, is

1. $80 \equiv -1 \pmod{9}$ 2. $81 \equiv 1 \pmod{10}$
3. $82 \equiv 5 \pmod{11}$ 4. $83 \equiv -2 \pmod{12}$

Solution: $80 + 1$ is divisible by 9; $81 - 1 = 80$ is divisible by 10;

$82 - 5 = 77$ is divisible by 11; $83 + 2 = 85$ is not divisible by 12.

So the answer is 4.

25. For integers a and b , if $a \oplus b$ denotes the remainder when $a + b$ is divided by 9, then

$$(4 \oplus 6) \oplus 8 =$$

1. 0 2. 1 3. 2 4. 3

Solution: So $4 \oplus 6 = 1$ (because $4 + 6 = 10$, when divided by 9, gives remainder 1)

$(4 \oplus 6) \oplus 8 = 1 \oplus 8 = 0$ (because $1 + 8 = 9$, when divided by 9, gives remainder 0)

So the answer is 1.

26. $(0.333\ldots)^2 =$

1. $0.\overline{09}$ 2. $0.0\overline{9}$ 3. $0.\overline{1}$ 4. $0.\overline{9}$

Solution: $(0.333.....)^2 = (0.3)^2 = \left(\frac{3}{9}\right)^2 = \frac{1}{9} = 0.\overline{1}$. **So the answer is 3.**

27. If x is a real number, then the maximum value of $f(x) = 13 - |7 + x|$, is
 1. 6 2. 26 3. 13 4. 20

Solution: Maximum value of $13 - |7 + x| = 13$.
 Since $|7 - x|$ is non negative. **So the answer is 3.**

28. If $1.8x = 0.06y$, then the value of $\frac{y-x}{y+x}$ is

1. $\frac{0.026}{0.031}$ 2. $\frac{0.27}{0.31}$ 3. $\frac{29}{31}$ 4. $\frac{2.8}{3.1}$

Solution: $1.8x = 0.06y \Rightarrow \frac{x}{y} = \frac{6}{180} = \frac{1}{30}$.

$$\frac{y-x}{y+x} = \frac{1 - \frac{x}{y}}{1 + \frac{x}{y}} = \frac{1 - \frac{1}{30}}{1 + \frac{1}{30}} = \frac{29}{31}. \text{ So the answer is 3.}$$

29. If $(n+2)! = 12n!$, then $n =$

1. 2 2. 4 3. 6 4. 8

Solution: $(n+2)! = 12n! \Rightarrow (n+2)(n+1)n! = 12n! \Rightarrow (n+2)(n+1) = 12$.
 So $n = 2$. **So the answer is 1.**

ICET-2011

30. If $\left(\frac{1}{3}\right)^{rd}$ of a number is $\frac{1}{10}$, then $\left(\frac{4}{5}\right)^{th}$ of that number is

1. $\frac{5}{6}$ 2. $\frac{25}{6}$ 3. $\frac{6}{25}$ 4. $\frac{6}{5}$

Solution: $\frac{x}{3} = \frac{1}{10} \Rightarrow x = \frac{3}{10}$. Therefore $\frac{4}{5}x = \frac{3}{10} \times \frac{4}{5} = \frac{6}{25}$. **Answer is 3.**

31. The sum of the even numbers from 100 to 200 (both numbers included) is

1. 3875 2. 7650 3. 3825 4. 7750

Solution: $100 + 102 + 104 + 106 + \dots + 200 \Rightarrow n = \text{number of terms} = 51$.

This is an arithmetic progression. So sum of 51 terms of arithmetic progression is

$$s_n = \frac{n}{2} [2a + (n - 1)d] = \frac{51}{2} [200 + 100] = \frac{51}{2} (300) = 51(150)$$

$$= 7650 \text{ where } a = 100, d = 2$$

Answer is 2.

32. If $n = 10838$, then the digit in the units place of n^9 is

1. 4 2. 2 3. 6 4. 8

Solution: $n^9 = (10838)^9 = (10830 + 8)^9 = \dots + 8^9 = \dots + 8$. **Answer is 4.**

Because $8^1 = 8, 8^2 = 64, 8^3 = 512, 8^4 = 6$ in units place, $8^5 = 8$ in units place, $8^6 = 4$ in units place,

$8^7 = 2$ in units place, $8^8 = 6$ in units place, $8^9 = 8$ in units place.

33. If $9x - 3y = 12$ and $3x - 5y = 7$, then $6x - 2y =$

1. -5 2. 4 3. 2 4. 8

Solution: $9x - 3y = 12$ -----(1); $3x - 5y = 7$ -----(2);

(2) $\Rightarrow 9x - 15y = 21$ -----(3). Now subtracting (3) from (1) we get $12y = -9 \Rightarrow y = \frac{-3}{4}$,

using this in (1) we get $x = \frac{13}{12}$.

So $6x - 2y = \frac{13}{2} + \frac{3}{2} = \frac{16}{2} = 8$. **Answer is 4.**

34. The least value of k such that $735 \times k$ is a perfect square is

1. 3 2. 5 3. 7 4. 15

Solution: $735 = 3 \times 7^2 \times 5$

The least value of $k = 3 \times 5 = 15$. **Answer is 4.**

35. What is the remainder when 3^{10} is divided by 4?

1. 3 2. 2 3. 1 4. 0

Solution: $3^0 \equiv 1 \pmod{4}$; $3^1 \equiv 3 \pmod{4}$; $3^2 \equiv 1 \pmod{4}$; $(3^2)^5 \equiv (1)^5 \pmod{4}$

$\Rightarrow 3^{10} \equiv 1 \pmod{4}$. So the remainder is 1. **Answer is 3.**

36. The average of all the prime numbers less than 20 is

1. 9 2. 9.15 3. 9.55 4. 9.625

Solution: $\frac{20 + 3 + 5 + 7 + 11 + 13 + 17 + 19}{8} = \frac{77}{8} = 9.625$. **Answer is 4.**

ICET-2012

37. If $3^{58} \equiv r \pmod{5}$ and $0 \leq r \leq 4$, then $r =$

1. 1 2. 2 3. 4 4. 3

Solution: $3^1 \equiv 3 \pmod{5}$; $3^2 \equiv 4 \pmod{5} \Rightarrow 3^4 \equiv 1 \pmod{5}$

$\Rightarrow 3^8 \equiv 1 \pmod{5} \Rightarrow 3^{56} \equiv 1 \pmod{5} \Rightarrow 3^{58} \equiv 4 \pmod{5}$. **Answer is 3.**

38. The number of distinct prime factors of $8!$ is:

1. 3 2. 4 3. 5 4. 8

Solution: $8! = 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$.

7, 5, 3, 2 are prime factors. So the number of distinct prime factors = 4. **Answer is 2.**

ICET -2013 ARITHMETICAL ABILITY ALL 35 QUESTIONS

76. If $(a+b):(b+c):(c+a) = 2:3:4$ and $a+b+c = 9$, then the value of $c =$

- (1) 3 (2) 1 (3) 9 (4) 5

77. A circle and a square have the same area. Then the ratio of the side of the square to the radius of the circle is

- (1) $\pi : 1$ (2) $1 : \pi$ (3) $\sqrt{\pi} : 1$ (4) $1 : \sqrt{\pi}$

78. $\sqrt{6 + 2\sqrt{2} + 2\sqrt{3} + 2\sqrt{6}} =$

- (1) $1 + \sqrt{2} + \sqrt{6}$ (2) $1 + \sqrt{2} + \sqrt{3}$
(3) $2 + \sqrt{2} + \sqrt{3}$ (4) $2 + \sqrt{6} + \sqrt{3}$

79. $\left(\frac{\sqrt{5} + \sqrt{7}}{\sqrt{5} - \sqrt{7}} + \frac{\sqrt{5} - \sqrt{7}}{\sqrt{5} + \sqrt{7}} \right)^2 =$

- (1) 196 (2) 28 (3) $4\sqrt{35}$ (4) 144

80. The number that is exactly divisible by 11 among the following is

- (1) 9999999 (2) 88888 (3) 1873410 (4) 2345432

81. If $\frac{8^3 \cdot (27)^4 \cdot 6^5}{(36)^2 \cdot 9^4 \cdot (18)^2} = 2^\alpha \cdot 3^\beta$, then $\alpha + \beta =$

- (1) -7 (2) -8 (3) 9 (4) 8

82. The smallest number among $\sqrt[3]{4}, \sqrt[5]{7}, \sqrt[4]{5}, \sqrt{3}$ is

- (1) $\sqrt[3]{4}$, (2) $\sqrt[5]{7}$ (3) $\sqrt[4]{5}$ (4) $\sqrt{3}$

83. If the l.c.m. of the positive integers a and b is 60 and $a^2 \cdot b^2 = 32400$, then the g.c.d. of a and b is

- (1) 30 (2) 18 (3) 3 (4) 9

84. If $|x - 6| = 5$ and $|3y - 12| = 6$, then the maximum value of $\frac{x}{y} =$

- (1) 2 (2) 6 (3) $\frac{11}{6}$ (4) $\frac{11}{2}$
85. If 3 is added to the denominator of a rational number then that number becomes $\frac{1}{3}$ and if 4 is added to numerator of the same rational number, then it becomes $\frac{3}{4}$, then that rational number is
- (1) $\frac{4}{9}$ (2) $\frac{3}{7}$ (3) $\frac{5}{12}$ (4) $\frac{7}{12}$
86. The difference between the biggest and smallest fractions among $\frac{1}{2}, \frac{5}{6}, \frac{7}{9}, \frac{4}{5}$ is
- (1) $\frac{1}{3}$ (2) $\frac{5}{18}$ (3) $\frac{3}{10}$ (4) $\frac{1}{4}$
87. The remainder when $73 \times 79 \times 81$ is divided by 11 is
- (1) 1 (2) 5 (3) 7 (4) 9
88. The greatest 4-digit number which is exactly divisible by each of the numbers 18, 24 and 36 is
- (1) 1008 (2) 9999 (3) 9972 (4) 9936
89. If the length and breadth of a rectangle are increased by 20% each, then the area of the rectangle increases by $x\%$, then $x =$
- (1) 20 (2) 120 (3) 44 (4) 144
90. An article when sold at a gain of 5% yields rupees 15 more than when it is sold at a loss of 5%. Then the cost price of that article in rupees is
- (1) 75 (2) 100 (3) 150 (4) 200
91. By selling 15 items, a seller recovers the cost price of 20 items. Then his profit percent is
- (1) 25 (2) $33\frac{1}{3}$ (3) 20 (4) $35\frac{1}{5}$
92. A, B, C entered into a business with a total capital of Rs.50,000/-. A invested Rs. 4,000/- more than B and B invested Rs. 5,000/- more than C. If there is a total profit of Rs.35,000/- then A's share in the profit, in rupees is
- (1) 8,400 (2) 11,900 (3) 14,700 (4) 15,000
93. The ascending order of the rational numbers $\frac{13}{14}, \frac{11}{12}, \frac{15}{16}, \frac{8}{11}$ is
- (1) $\frac{8}{11} < \frac{13}{14} < \frac{15}{16} < \frac{11}{12}$ (2) $\frac{8}{11} < \frac{13}{14} < \frac{11}{12} < \frac{15}{16}$

- (3) $\frac{8}{11} < \frac{11}{12} < \frac{13}{14} < \frac{15}{16}$ (4) $\frac{13}{14} < \frac{11}{12} < \frac{15}{16} < \frac{8}{11}$
94. If 7% of 5% of 8% of x is 105, then $x =$
 (1) 375 (2) 3750 (3) 37500 (4) 375000
95. Tap A can fill an empty tank in one hour, while a drain pipe B can empty that full tank in 6 hours. If both A and B are opened at the same instant, the total time taken to fill that empty tank, in hours, is
 (1) $\frac{5}{6}$ (2) $\frac{3}{2}$ (3) $\frac{2}{3}$ (4) $\frac{6}{5}$
96. A train travels a distance of 60 km in 40 minutes. If its velocity is decreased by 15 km/hour, then the time required by that train to travel the same distance, in minutes, is
 (1) 45 (2) 60 (3) 54 (4) 48
97. A person travels from A to B at a speed of 75 km/hour in a car and returns from B to A by reducing his speed by 15 km/hour. If the total time taken is 3 hours, then the distance between A and B, in kilometers, is
 (1) 100 (2) 80 (3) 120 (4) 160
98. A, B and C are running a business by investing the capitals in the ratio 2 : 4 : 5. If C's share in the profit is Rs. 2,200/-, then A's share in the profit, in rupees, is
 (1) 400 (2) 800 (3) 840 (4) 880
99. Two pipes A and B can fill a tank independently in 20 and 30 minutes respectively. Both the pipes are opened simultaneously and after 6 minutes tap B is closed. Then the total time taken, in minutes, to fill the tank, is (assume that the tank is empty initially)
 (1) 10 (2) 15 (3) 16 (4) 12
100. If the length of the hypotenuse of right angled isosceles triangle is 12 cm, then the area of that triangle, in square centimeters, is
 (1) 72 (2) 36 (3) 144 (4) 24
101. If the lengths of the diagonals of a rhombus are 18 cm and 24 cm, then the area of the rhombus, in square centimeters, is
 (1) 108 (2) 225 (3) 432 (4) 216
102. A cylindrical bar of height 1 metre and base radius 0.75 metres is melted and cast as a sphere. Then the diameter of that sphere in metres is
 (1) 2 (2) 1.5 (3) 0.75 (4) 0.50
103. Two boxes have square bases. The sides of these bases are in the ratio 2 : 1. If the heights of the boxes are in the ratio 1 : 2 respectively, then the ratio of the volumes of the boxes in that order is
 (1) 1 : 1 (2) 1 : 2 (3) 3 : 1 (4) 2 : 1
104. Two persons A, B can together complete a piece of work in 12 days, B and C together complete the same work in 8 days. If A, B, C work together, then that work can be finished in 6 days. Then the number of days B alone can finish the same work is
 (1) 16 (2) 18 (3) 24 (4) 30
105. A, B, C can individually complete a work in 20 days, 15 days, 12 days respectively. B and

- C start the work and they worked for 3 days and left. Then the number of days required by A to finish the remaining work is
 (1) 11 (2) 14 (3) 12 (4) 9
106. 11 cubic metres of steel is cast into cylindrical bars of diameter 10 cms and length 1.4 metres. Then the number of such bars that can be cast with the given metal is (Take $\pi = \frac{22}{7}$)
 (1) 10 (2) 100 (3) 1000 (4) 10000
107. The difference between the largest 3 digit natural number x satisfying $x \equiv 5 \pmod{8}$ and the smallest 3 digit natural number y satisfying $y \equiv 2 \pmod{5}$ is
 (1) 985 (2) 0 (3) 1 (4) 995
108. If $3^{48} \equiv x \pmod{10}$ and if $0 \leq x \leq 9$, then $x =$
 (1) 1 (2) 3 (3) 5 (4) 9
109. The radius of a cone is 3 times the radius of a cylinder and their heights are same. Then the ratio of their volumes in that order is
 (1) 9:1 (2) 1:3 (3) 3:1 (4) 1:9
110. A window is in the shape of a rectangle surmounted by a semicircle. If the length of the rectangle is 6 feet and the radius of the semicircle is 2 feet, then the area of the window, in square feet, is
 (1) $18+4\pi$ (2) $24+4\pi$ (3) $24+2\pi$ (4) $18+2\pi$

ICET-2014 ARITHMETICAL ABILITY ALL 35 QUESTIONS

76. $\left(a^{\frac{1}{z-x}}\right)^{\frac{1}{z-y}} \cdot \left(a^{\frac{1}{x-y}}\right)^{\frac{1}{x-z}} \cdot \left(a^{\frac{1}{y-z}}\right)^{\frac{1}{y-x}} =$ **Answer: [4]**
 (1) a (2) 0 (3) xyz (4) 1
77. If $\left(\sqrt{\frac{3}{5}}\right)^a = \left(\sqrt{\frac{625}{81}}\right)^{\frac{a+3}{2}}$, then $a =$ **Answer: [4]**
 (1) 2 (2) 1 (3) -1 (4) -2
78. In a mixture of 35 litres the ratio of milk and water is 4 : 1. If one litre of water is added to the mixture the ratio of milk and water in the new mixture is
 (1) 2:7 (2) 7:2 (3) 4:3 (4) 2:1 **Answer: [2]**
79. The salaries of two persons are in the ratio 4 : 7. Both spend 80% of their salaries and save the rest. The ratio of their savings is
 (1) 8:2 (2) 7:5 (3) 5:3 (4) 2:1 **Answer: [4]**
80. If $(\sqrt{2})^{x+5} = (\sqrt[4]{2})^{2x^2-2}$, then the value of $(x^2 - 1)$ is **Answer: [4]**
 (1) 2 (2) 4 (3) 6 (4) 8

81. $\left| \sqrt{10+2\sqrt{6}+2\sqrt{10}+2\sqrt{15}} \right| + \left| \sqrt{10-2\sqrt{6}-2\sqrt{10}+2\sqrt{15}} \right| =$ **Answer: [1]**
 (1) $2(\sqrt{3} + \sqrt{5})$ (2) $2\sqrt{3}$ (3) $2\sqrt{5}$ (4) $2\sqrt{10}$
82. The least value of k such that $315 \times k$ is a perfect square is **Answer: [1]**
 (1) 35 (2) 31 (3) 21 (4) 15
83. Which among the following numbers leaves remainders 1, 2 and 2 respectively when divided by 2, 3 and 7 ? **Answer: [3]**
 (1) 130 (2) 68 (3) 65 (4) 57
84. The L.C.M. of two integers is 144 and their G.C.D is 12. If one of the integers is 36, then the other integer is **Answer: [3]**
 (1) 18 (2) 24 (3) 48 (4) 432
85. The least number that is to be subtracted from 2580 so that it leaves a remainder 4 when divided by 9, 11 and 13 is **Answer: [2]**
 (1) 1 (2) 2 (3) 3 (4) 4
86. Three numbers are in the ratio 1:2:3 and the sum of their squares is 504. The largest of the numbers is **Answer: [3]**
 (1) 6 (2) 12 (3) 18 (4) 24
87. The ascending order of the fractions : $\frac{5}{7}, \frac{6}{8}, \frac{9}{11}, \frac{11}{14}$ **Answer: [4]**
 (1) $\frac{5}{7}, \frac{6}{8}, \frac{9}{11}, \frac{11}{14}$ (2) $\frac{5}{7}, \frac{9}{11}, \frac{6}{8}, \frac{11}{14}$ (3) $\frac{5}{7}, \frac{11}{14}, \frac{9}{11}, \frac{6}{8}$ (4) $\frac{5}{7}, \frac{6}{8}, \frac{11}{14}, \frac{9}{11}$
88. The persons A, B, C share a property in such a way that A and B get $\frac{3}{7}$ th and $\frac{5}{14}$ th and C getting the rest. The person or persons who get the least property **Answer: [1]**
 (1) C (2) B (3) A and B (4) A and C
89. The descending order of $\sqrt[4]{10}, \sqrt[3]{6}, \sqrt{3}$ is **Answer: [4]**
 (1) $\sqrt[4]{10}, \sqrt{3}, \sqrt[3]{6}$ (2) $\sqrt[4]{10}, \sqrt[3]{6}, \sqrt{3}$ (3) $\sqrt{3}, \sqrt[3]{6}, \sqrt[4]{10}$ (4) $\sqrt[3]{6}, \sqrt[4]{10}, \sqrt{3}$
90. In a face to face election the winner got 65% of votes and won by a margin of 12000 votes. The total votes polled (in lakhs) is **Answer: [2]**
 (1) 4 (2) 0.4 (3) 0.04 (4) 0.004
91. In a library 23% of the books are in Arts, 30% in Commerce, 35% in Science and the rest are in Telugu language. If there are 1440 books in Telugu language, the number of books in Arts is **Answer: [1]**
 (1) 2760 (2) 3000 (3) 3600 (4) 4200
92. A person bought a pen and sold it for a loss of 10%. If he had bought it for 20% less and sold it for Rs. 44 more than earlier sale price he would have made a profit of 40%. The cost price of the pen is (in Rs.) **Answer: [1]**

- (1) 200 (2) 225 (3) 250 (4) 280
93. If an article is sold at a profit of 15% instead of a profit of 9% the person gets Rs. 60 more. The cost price of the article (in rupees) is **Answer: [3]**
 (1) 1200 (2) 1050 (3) 1000 (4) 800
94. A and B started a business investing Rs.10 lakhs and Rs.15 lakhs respectively. After 6 months C joined them by investing Rs.20 lakhs. If the profit at the end of the year is Rs. 5.6 lakhs, then the share of A in the profit (in lakhs of rupees) is **Answer: [1]**
 (1) 1.6 (2) 2.4 (3) 3.2 (4) 4.8
95. In a joint business A, B and C invested capital in the ratio 5 : 6 : 8. At the end of the business they shared profits in the ratio 4:3:12. The ratio of the number of months in which A, B and C kept, their capital is **Answer: [3]**
 (1) 2 : 1 : 3 (2) 5 : 3 : 12 (3) 8 : 5 : 15 (4) 25 : 18 : 16
96. Pipe A fills a tank in 8 hours while pipe B empties the full tank in 10 hours. If both the pipes A and B are opened simultaneously the time taken (in hours) to fill the tank is **Answer: [3]**
 (1) $33\frac{1}{2}$ (2) $36\frac{1}{2}$ (3) 40 (4) 42
97. Two pipes A and B can fill a tank in 10 hours and 15 hours respectively. If they are opened alternately for one hour each and if A is opened first, the time (in hours) required to fill the tank is
 (1) 10 (2) 11 (3) 12 (4) 13 **Answer: [3]**
98. If a man starts at A and walks at 5 kmph he will reach B late by 7 minutes. But if walks at 6 kmph he will reach B early by 5 minutes. The distance between A and B (in km) is **Answer: [3]**
 (1) 9 (2) 12 (3) 14 (4) 16
99. A train of 270 metres long crosses a platform of 390 metres length in 33 seconds. The speed of the train (in kmph) is **Answer: [3]**
 (1) 66 (2) 68 (3) 72 (4) 75
100. Three persons A, B, C together can complete a work in 8 days where as A alone requires 24 days to complete the same work. The number of days required for B and C together to complete the same work is **Answer: [3]**
 (1) 18 (2) 16 (3) 12 (4) 10
101. A man completes $\frac{4}{5}$ of the work in $1\frac{1}{2}$ days. The number of hours required to complete the remaining work by him is **Answer: [2]**
 (1) 6 (2) 9 (3) 7 (4) 8
102. A circle is inscribed in an equilateral triangle. If the area of the circle is 462 cm^2 , then the perimeter (in cm) of the triangle is **Answer: [4]**
 (1) 72 (2) 84 (3) 96 (4) 126
103. The area of a rectangular metal sheet is 60 sq.m. The sum of its length and diagonal is equal to 5 times its breadth. Then the difference (in metres) between length and breadth is

Answer: [4]

- (1) 4 (2) 5 (3) 6 (4) 7

104. A cone of height 24 cm and radius of its base 6 cm is made up of clay. If that clay is reshaped in the form of a sphere, then the diameter of that sphere (in cms) is

Answer: [3]

- (1) 6 (2) 8 (3) 12 (4) 14

105. The surface area of a sphere is same as the curved surface area of a right circular cylinder whose height and diameter are 12 cm each. Then the radius of the sphere (in cm) is

Answer: [4]

- (1) 3 (2) 4 (3) 5 (4) 6

106. Let 's' be the surface area of a cube of edge 9 cm. This cube is cut into smaller cubes of edge 3 cm each. If 'S' is the sum of the surface areas of all the smaller cubes, then s : S =

- (1) 3 : 1 (2) 1 : 3 (3) 3 : 2 (4) 2 : 3 **Answer: [2]**

107. The number of revolutions made by a wheel of 42 cm diameter in travelling a distance of 1320 metres is

Answer: [4]

- (1) 300 (2) 400 (3) 500 (4) 1000

108. The radius r of a right circular cylinder is the same as that of a sphere. If the volume of the sphere is twice that of the cylinder, then the height of the cylinder is

Answer: [2]

- (1) $\frac{r}{3}$ (2) $\frac{2r}{3}$ (3) $\frac{4r}{3}$ (4) $2r$

109. The digit in the units place of the number 13^{400} is

Answer: [4]

- (1) 4 (2) 3 (3) 2 (4) 1

110. If $a * k$ denotes that k is the remainder when 8a is divided by 7, then $100 * =$

- (1) 1 (2) 2 (3) 5 (4) 6 **Answer: [2]**

ICET-2015 TS ICET ARITHMETICAL ABILITY ALL 35 QUESTIONS

TS ICET -2015 Arithmetical Ability

76. The area of a square S is equal to the area of the rectangle of sides 56 metres and 14 metres. The length (in metres) of diagonal of S is

- (1) 42 (2) $28\sqrt{2}$ (3) $14\sqrt{2}$ (4) $12\sqrt{2}$

77. The area of a rhombus is 144 square units. If one of its diagonals is 18 units then the length of the other diagonal (in units) is

- (1) 9 (2) 12 (3) 14 (4) 16

78. A brick measures 20 cms x 10 cms x 7.5 cms. The number of bricks required to build a wall of dimensions 25 m x 2 m x 0.75 m is

- (1) 24000 (2) 25000 (3) 26000 (4) 27000

79. The volume of a cone is 108π cubic cms and its height is 9 cms. The base radius (in cms) of the cone is

- (1) 4 (2) 5 (3) 6 (4) 8

80. A rectangular plot R of perimeter 46 metres has area 120 square metres. The area of the

- square whose side is equal to the diagonal of R, is
 (1) 361 sq. m (2) 289 sq. m (3) 225 sq. m (4) 169 sq. m
81. A wheel makes 50 revolutions in covering a distance of 440 m. The radius (in meters) of the wheel is
 (1) 4.2 m (2) 2.8 (3) 1.4 (4) 0.7
82. The ratio of the curved surface area to the total surface area of a right circular cylinder is 1:2. its total surface area is 616 sq. cms., then the volume of the cylinder (in cubic cms) is
 (1) 1120 (2) 1080 (3) 1078 (4) 1000
83. If $x > 0$ and $|1 - 3x| > 4 - x$, then
 (1) $x > \frac{5}{4}$ (2) $x > \frac{4}{5}$ (3) $x > \frac{3}{5}$ (4) $x > \frac{2}{5}$
84. $(1100101)_2 - (10112011)_2 =$
 (1) $(1010)_2$ (2) $(1100)_2$ (3) $(1001)_2$ (4) $(1101)_2$
85. If $m = 7^1 \cdot 5^2 \cdot 3^4 \cdot 2^8$, then the greatest integer value of k such that 21^k divides m is
 (1) 1 (2) 2 (3) 4 (4) 8
86. If $a^x = b^y = c^z \neq 0$ and $b^2 = ac$, then the progression in which x, y, z are is
 (1) an arithmetic progression (2) a geometric progression
 (3) a harmonic progression (4) an arithmetico-geometric progression
87. Three numbers are in the ratio 1:2:3 and the sum of the cubes of them is 36. The smallest number among them is
 (1) 1 (2) 2 (3) 3 (4) 4
88. The earnings of A, B, C are in the ratio 7: 9 : 12 and their expenditures are in the ratio 8:9:15. If A saves 25% of his earnings, then the ratio of their savings is
 (1) 46:99:59 (2) 56 : 99 : 69 (3) 69:56:99 (4) 59:46:99
89. If $x = \frac{\sqrt{5} + \sqrt{3}}{\sqrt{5} - \sqrt{3}}$ and $xy = 1$, then $x + y =$
 (1) 6 (2) 7 (3) 8 (4) 9
90. If $a \neq b$ and $a^2 + b^2 \neq 0$, then $\frac{(a-b)(\sqrt{a}-\sqrt{b})}{(a+b)(\sqrt{a}+\sqrt{b})} =$
 (1) $1 - \frac{2\sqrt{ab}}{a+b}$ (2) $1 + \frac{2\sqrt{ab}}{a+b}$ (3) $1 + 2\sqrt{\frac{1}{a} + \frac{1}{b}}$ (4) $1 - 2\sqrt{\frac{1}{a} + \frac{1}{b}}$
91. The least positive integer m to be added to 3096 so that their sum is divisible by 39 is
 (1) 2 (2) 12 (3) 24 (4) 32
92. If a number k is of the form $18m + 7$ for some integer m, then the remainder when k is divided by 6 is "
 (1) 5 (2) 3 (3) 2 (4) 1

93. The largest number m such that the numbers 947, 639 and 1051 leave the same remainder when divided by m is
 (1) 3 (2) 4 (3) 7 (4) 11
94. The number of pairs of positive integers a and b such that $a + b = 594$ and $\gcd(a, b) = 27$ is
 (1) 4 (2) 5 (3) 6 (4) 7
95. Taking $\frac{1}{6.198} = 0.16134$, the value of $\frac{1}{0.0006198}$ is
 (1) 0.016134 (2) 0.16134 (3) 16134 (4) 1613.4
96. The rational number r that becomes $\frac{1}{2}$ when 1 is subtracted from the numerator and becomes $\frac{3}{5}$ when 1 is subtracted from the denominator is
 (1) $\frac{17}{32}$ (2) $\frac{15}{26}$ (3) $\frac{13}{24}$ (4) $\frac{9}{16}$
97. The descending order of the fractions $\frac{8}{13}, \frac{5}{12}, \frac{9}{11}$ and $\frac{7}{15}$ is
 (1) $\frac{9}{11}, \frac{8}{13}, \frac{7}{15}, \frac{5}{12}$ (2) $\frac{9}{11}, \frac{7}{15}, \frac{8}{13}, \frac{5}{12}$ (3) $\frac{5}{12}, \frac{7}{15}, \frac{8}{13}, \frac{9}{11}$ (4) $\frac{5}{12}, \frac{8}{13}, \frac{7}{15}, \frac{9}{11}$
98. $1.57777\ldots =$
 (1) $\frac{69}{45}$ (2) $\frac{71}{45}$ (3) $\frac{74}{45}$ (4) $\frac{77}{45}$
99. In a fraction if the numerator is increased by 20% and the denominator is decreased by 20% we get new fraction $\frac{3}{7}$. The sum of the new fraction and the original fraction is
 (1) $\frac{2}{7}$ (2) $\frac{4}{7}$ (3) $\frac{5}{7}$ (4) $\frac{6}{7}$
100. If 25% of a number is 25 more than 25% of 500, then the number is
 (1) 500 (2) 550 (3) 600 (4) 650
101. By selling an item for Rs. 189, a trader gets a profit of 12.5%. The cost price (in rupees) of the item is
 (1) 148 (2) 158 (3) 168 (4) 178
102. The cost price of an item is Rs. 250. Its marked price is Rs. 360. The maximum possible discount that can be given so that a profit of 20% is made is
 (1) Rs. 30 (2) Rs. 40 (3) Rs. 50 (4) Rs. 60
103. In a partnership, A invests $\frac{1}{4}$ of the capital for $\frac{1}{4}$ of the time; B invests $\frac{1}{5}$ of the capital for $\frac{1}{2}$ of the time while C invests the rest of the capital for the whole time. The share of A

- (in thousands of rupees) in the profit of Rs.2.28 lakhs is
 (1) 26 (2) 24 (3) 22 (4) 20
104. In a joint business, A invests Rs. 20,000 for 6 months while B invested certain amount for the whole year. In the year-end profit of Rs. 9,000 the share of A is Rs. 6,000. The amount (in rupees) invested by B is
 (1) 8,000 (2) 6,000 (3) 5,000 (4) 4,000
105. Pipes A, B, C can fill a tank individually in 2 hours, 3 hours and 4 hours respectively. All the three are opened for 15 minutes and pipe C is closed. The time (in minutes) required further to fill the tank is
 (1) 48 (2) 52.5 (3) 54 (4) 70
106. Pipes A and B can fill a tank in 9 minutes and 12 minutes respectively. A is opened and after sometime B is opened; and the tank is full in 4 minutes. The time difference (in minutes) between the opening of A and B is
 (1) 4 (2) 3 (3) 2 (4) 1.5
107. Three trains A, B and C moving at speeds s_1, s_2 and s_3 respectively take times t_1, t_2 and t_3 respectively to cover a distance of x kms. If $t_1 : t_2 : t_3 = 20 : 15 : 12$, then $s_1 : s_2 : s_3 =$
 (1) 2:3:4 (2) 3:4:5 (3) 4:5:6 (4) 5:6:7
108. The time (in seconds) taken by a train of 240 metres long travelling at 70 kmph to cross another train of length 110 metres standing on a parallel track is
 (1) 20 (2) 18 (3) 17 (4) 16
109. 10 men and 15 women can complete a work in 6 days; and 12 men and 27 women can complete the same work in 4 days. The number of days required for 2 men and 12 women to complete the same work is
 (1) 8 (2) 9 (3) 10 (4) 12
110. A and B can do a work in 8 hours; B and C can complete the same work in 6 hours while C and A require 12 hours to complete that work. The time required by C alone to complete that work is
 (1) 16 hours (2) 9 hours 36 minutes (3) 48 hours (4) 10 hours 30 minutes

ICET-2015 APICET ARITHMETICAL ABILITY ALL 35 QUESTIONS

APICET-2015 Arithmetical Ability (Marks : 35) : 35)

76. The radius of the base of a right circular cylinder is r and the radius of a sphere is $\frac{r}{2}$. If the volumes of that cylinder and the sphere are equal, then the height of the circular cylinder h in proper units is
 (1) $\frac{r}{2}$ (2) $\frac{r}{4}$ (3) $\frac{r}{6}$ (4) $\frac{r}{8}$
77. The volume of a cube (in cubic feet) whose total surface area is 384 square feet is
 (1) 468 (2) 512 (3) 525 (4) 1000
78. A copper sphere of 6 cm diameter is melted to prepare a long wire of diameter 0.2 cm.

- Then the length of the wire (in metres) is
 (1) 36 (2) 34 (3) 32 (4) 28
79. If $\left| \frac{7-2x}{4} \right| = 2$, then $x =$
 (1) $\frac{15}{4}$ (2) $\frac{15}{6}$ (3) $\frac{15}{2}$ (4) $\frac{-15}{2}$
80. For integers a, b and $m > 0$, write $a \equiv b \pmod{m}$ if m divides $a - b$. Then which one of the following is true?
 (1) $110 \equiv -1 \pmod{11}$ (2) $120 \equiv -1 \pmod{11}$
 (3) $130 \equiv -1 \pmod{11}$ (4) $140 \equiv -1 \pmod{11}$
81. A copper rod of diameter 1 cm and length 8 cm is drawn into a wire of length 18 metres of uniform diameter. Then the diameter of the wire in centimetres is
 (1) $\frac{1}{15}$ (2) $\frac{1}{12}$ (3) $\frac{1}{9}$ (4) $\frac{1}{8}$
82. In a class, the number of boys and girls are in the ratio 2:1. If five boys leave the class and five girls join class, then the ratio becomes 7:5. The number of boys in that class at the beginning is
 (1) 20 (2) 30 (3) 40 (4) 50
83. If $A:B:C::2:3:4$, then $\frac{A}{B} : \frac{B}{C} : \frac{C}{A}$ is
 (1) 4:9:16 (2) 8:9:24 (3) 6:9:8 (4) 5:7:6
84. $\frac{1}{\sqrt{3} + \sqrt{2}} = x\sqrt{2} + y\sqrt{3} \Rightarrow x - y =$
 (1) 0 (2) 1 (3) -2 (4) 2
85. The curved surface area of a cone is 4070 sq. cm. If the diameter of the base of that cone is 70 cm, then its slant height in centimeters is
 (1) 22 (2) 37 (3) 44 (4) 23
86. A solution of $8x \equiv 3 \pmod{21}$ is
 (1) 1 (2) 3 (3) 7 (4) 9
87. If 20 and 24 are factors of n , then which one of the following is a factor of n ?
 (1) 120 (2) 240 (3) 50 (4) 25
88. The value of $(1 - \frac{1}{5})(1 - \frac{1}{6})(1 - \frac{1}{7}) \dots (1 - \frac{1}{20}) =$
 (1) $\frac{5}{19}$ (2) 5 (3) $\frac{19}{5}$ (4) $\frac{1}{5}$
89. If 12% of $x = 8\%$ of y , then the ratio $x : y =$
 (1) 2 : 3 (2) 3 : 2 (3) 4 : 3 (4) 3 : 4

90. The rate of simple interest per annum that makes some amount of money double in 12 years is
 (1) 10% (2) 12% (3) $8\frac{1}{3}\%$ (4) 15%
91. $\frac{3^{\frac{3}{5}} \cdot \sqrt[5]{3^{12}}}{27^{5/3}} =$
 (1) 1 (2) $\frac{1}{3}$ (3) $\frac{1}{9}$ (4) $\frac{1}{27}$
92. If a, b, c are real and $a + b + c = 0$, then $x^{a^2b^{-1}c^{-1}} \cdot x^{a^{-1}b^2c^{-1}} \cdot x^{a^{-1}b^{-1}c^2} =$
 (1) 1 (2) x^2 (3) x^3 (4) x^{-2}
93. If $7^{3x+1} = 49^{x+2}$, then $x =$
 (1) 1 (2) 2 (3) 3 (4) 4
94. If $9x^2 + 16y^2 - 24xy = 0$, then $x : y =$
 (1) 4:3 (2) 2:3 (3) 3:4 (4) 3:2
95. If $\sqrt{19 - 4\sqrt{x}} = \sqrt{12} - \sqrt{7}$, then $x - 1 =$
 (1) 15 (2) 20 (3) 24 (4) 22
96. $\sqrt{15 + 2\sqrt{15} + 2\sqrt{21} + 2\sqrt{35}} + \sqrt{15 - 2\sqrt{15} - 2\sqrt{21} + 2\sqrt{35}} =$
 (1) $\sqrt{5} + \sqrt{7}$ (2) $2(\sqrt{5} + \sqrt{7})$ (3) $2\sqrt{5}$ (4) $2\sqrt{7}$
97. The greatest three digit number which when divided by 6, 9 and 12 leaves the remainder 4 in each case is
 (1) 976 (2) 963 (3) 939 (4) 924
98. The greatest number which divides 121, 134 and 147 leaving 4 as the remainder in each case is
 (1) 17 (2) 14 (3) 13 (4) 9
99. The reciprocal of the sum of the reciprocals of $\frac{5}{8}$ and $\frac{3}{4}$ is
 (1) $\frac{5}{22}$ (2) $\frac{15}{22}$ (3) $\frac{15}{44}$ (4) $\frac{25}{44}$
100. The correct order of $a = \frac{3}{4}, b = \frac{4}{7}, c = \frac{11}{13}$ and $d = \frac{13}{15}$ is
 (1) $b < c < d < a$ (2) $b < a < c < d$
 (3) $a < b < c < d$ (4) $a < c < b < d$

101. $2\frac{1}{3} + 3\frac{3}{4} \div \frac{3}{4} - 2\frac{1}{3} \left(6\frac{1}{2} - 2\frac{1}{4} \right) \div 2\frac{1}{4} =$
- (1) $\frac{73}{27}$ (2) $\frac{77}{27}$ (3) $\frac{79}{27}$ (4) $\frac{83}{27}$
102. Two numbers x and y are respectively 20% and 25% more than the third number z . If x is $a\%$ of y , then $a =$
- (1) 80 (2) 90 (3) 96 (4) 85
103. By selling an item for Rs.754, a trader gets 16% profit. Then the cost price of the item in rupees is
- (1) 680 (2) 670 (3) 660 (4) 650
104. A pipe can fill an empty tank in 15 hours. Due to a leak at the bottom, the tank is filled in 20 hours. If the tank is full, then in how much time (in hours) will the leak take to empty the tank?
- (1) 35 (2) 30 (3) 60 (4) 75
105. Two pipes A and B can fill an empty tank independently in 3 hours and 4 hours, respectively. If the pipes A and B are opened in alternate hours starting with B, then the total time taken, in hours, to fill the tank is
- (1) $2\frac{1}{2}$ (2) $3\frac{1}{2}$ (3) $3\frac{2}{3}$ (4) $2\frac{3}{4}$
106. Two cars A and B start at the same time and move in opposite directions between the places x and y . The time taken by Car A and Car B to reach their destinations after they meet each other on their way is 4 hours and 9 hours respectively. Then the ratio of the speeds of cars A and B is
- (1) 3:2 (2) 2:3 (3) 9:4 (4) 4:9
107. A car travels at $\frac{8}{7}$ times its usual speed and reaches the destination 15 minutes early. Then the time taken by the car in hours to reach its destination with its usual speed is
- (1) 2 (2) 1.5 (3) 3 (4) 2.5
108. A can turnout twice the amount of work that B can do. If B alone can complete that work in 12 days, then in how many days can A and B complete that work together ?
- (1) 3 (2) 4 (3) 5 (4) 6
109. 2 men and 3 women can do a particular work in 10 days, whereas 4 men can do that work in 10 days. Then in how many days can 3 men and 3 women complete the same work ?
- (1) 8 (2) 6 (3) 5 (4) 4
110. The sides of a rectangle of perimeter 52 metres are in the ratio 4 : 9. Then the area in square metres of that rectangle is
- (1) 100 (2) 120 (3) 132 (4) 144

SETS AND RELATIONS

Concepts and Formulae

1. Definition: A set is a collection of defined objects. We denote a set by capital letters A, B, C.

2. Operations on Sets: If A, B are two sets, then we define

- i) $A \cup B = \{x/x \in A \text{ or } x \in B\}$; $A \cup B$ is called the union of A and B.
- ii) $A \cap B = \{x/x \in A \text{ and } x \in B\}$; $A \cap B$ is called the intersection of A and B.
- iii) $A - B = \{x/x \in A \text{ and } x \notin B\}$; $A - B$ is called the difference of A with B.
- iv) $A \Delta B = (A - B) \cup (B - A)$; $A \Delta B$ is called the symmetric difference of A and B

3. Types of sets:

- i) **Null set:** A set having no elements is called null set or empty set and it is denoted by ϕ .
- ii) **Subset, Super set:** If A, B are two sets, we say that A is a subset of B and write $A \subseteq B$ if $x \in A \Rightarrow x \in B$. In this case we also say that B is a super set of A and write $B \supseteq A$. Note that $A \subseteq A$ always.
- iii) **Disjoint sets:** If A, B are two sets such that $A \cap B = \phi$ (that is A, B have no common elements), then A, B are called disjoint sets.
- iv) **Power set:** If A is a set, then the set of all subsets of A is called the power set of A and is denoted by $P(A)$.
- v) **Complement of a set:** Let A be any set and $B \subseteq A$. Then the complement of B in A (denoted by $\overline{B}$, when A is fixed) is defined as $\overline{B} = \{x \in A / x \notin B\}$. Note that $\overline{\overline{B}} = B$.
- vi) **Finite set, Infinite set:** If the number of elements in a set A is finite (i.e., a non-negative integer), then A is called a finite set. In this case the number of elements in A is denoted by $n(A)$. A set which is not finite is called an infinite set.

4. Properties:

I) If A, B, C are three sets, then

- i) $A \cup A = A = A \cap A$ (Idempotent Laws)
- ii) $A \cup B = B \cup A$, $A \cap B = B \cap A$ (Commutative Laws)
- iii) $(A \cup B) \cup C = A \cup (B \cup C)$, $(A \cap B) \cap C = A \cap (B \cap C)$ (Associative Laws)
- iv) $(A \cup B) \cap A = A$, $(A \cap B) \cup A = A$ (Absorption Law)
- v) $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$, $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ (Distributive)
- vi) $A - ((B \cup C)) = (A - B) \cap (A - C)$, $A - (B \cap C) = (A - B) \cup (A - C)$.

These laws can also be stated as,

vii) If $B, C \subseteq A$ then $\overline{(B \cup C)} = \overline{B} \cap \overline{C}$ and $\overline{(B \cap C)} = (\overline{B} \cup \overline{C})$ (De-morgan's Law)

viii) $\phi \subseteq A$, $A \subseteq A$, $\overline{\phi} = A$ and $\overline{\overline{A}} = A$

II. If A, B are two sets, then (i) $A \subset B \Leftrightarrow A \cup B = B \Leftrightarrow A \cap B = A$

(ii) $A \subset B$ and $B \subset A \Leftrightarrow A = B$

$$(iii) A - A = \phi$$

$$iv) A - B = A - (A \cap B) = (A \cup B) - B$$

$$(v) A - (A - B) = (A \cap B)$$

$$vi) (A - B) \cup (A \cap B) = A \\ = A \cup B$$

$$vii) (A - B) \cup (B - A) \cup (A \cap B)$$

III. If B, C are subsets of a set A, then

$$i) B - C = B \cap \bar{C} \quad (ii) B - \bar{C} = B \cap C \quad (iii) \overline{\overline{B}} = B$$

IV. If A, B, C are finite sets, then

$$i) n(A \cup B) = n(A) + n(B) - n(A \cap B)$$

$$ii) \text{ If A, B are disjoint sets, then } n(A \cup B) = n(A) + n(B)$$

$$iii) n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C) - n(C \cap A) + n(A \cap B \cap C)$$

$$iv) n(A - B) = n(A) - n(A \cap B)$$

5. Relations:

1. If A, B are two sets, then we define their cartesian product $A \times B$ as $A \times B = \{x, y / x \in A, y \in B\}$

Then we have the following properties.

$$i) \text{ In general, } A \times B \neq B \times A$$

$$ii) (A \times B) \cap (C \times D) = (A \cap C) \times (B \cap D)$$

$$iii) (A \times B) \cap (B \times A) = (A \cap B) \times (A \cap B)$$

$$iv) A \times B = B \times A \text{ if } A = \phi \text{ or } B = \phi \text{ or } A = B$$

$$v) A \times (B \cup C) = (A \times B) \cup (A \times C)$$

$$vi) A \times (B \cap C) = (A \times B) \cap (A \times C)$$

6. i) Let A be a finite sets and $n(A) = m$, then $n(p(A)) = 2^m$.

ii) If A, B are finite sets and if $n(A) = m, n(B) = n$ then $n(A \times B) = mn$.

iii) If A, B are finite set and if $n(A) = m, n(B) = n$, then the number of relations from A to B $= 2^{mn}$.

7. Let A be a finite set and $n(A) = n$, then

$$i) n(A \times A) = n^2.$$

$$ii) \text{ The number of relations on A} = 2^{n^2}.$$

$$iii) \text{ The number of reflexive relations on A} = 2^{n^2-n}$$

$$iv) \text{ The number of symmetric relations on A} = 2^{\frac{n^2+n}{2}}$$

PROBLEMS

1. If a set A has 5 elements, then the number of subsets of A with not exceeding 4 elements is

1. 31 2. 26 3. 5 4. 16

$$\text{Solution: } 5_{c_0} + 5_{c_1} + 5_{c_2} + 5_{c_3} + 5_{c_4} = 1 + 5 + 10 + 10 + 5 = 31.$$

So the answer is 1.

2. For any positive integer n , let A_n = set of all positive integral divisors of n , then the number of elements in $A_{18} \cap A_{24}$ is

1. 4 2. 6 3. 72 4. 36

Solution: $A_{18} = \{1, 2, 3, 6, 9, 18\}$; $A_{24} = \{1, 2, 3, 4, 6, 8, 12, 24\}$.

$A_{18} \cap A_{24} = \{1, 2, 3, 6\}$. So the number of elements in $A_{18} \cap A_{24}$ is 4.

So the answer is 4.

3. If A, B, C are three sets then $A - (B \cap C) =$

1. $(A - B) \cap (A - C)$ 2. $A - (B \cup C)$
3. $(A - B) \cup (A - C)$ 4. $A - (B - C)$

Solution: $A - (B \cap C) = A \cap (B \cap C)^c = A \cap (B^c \cup C^c) = (A \cap B^c) \cup (A \cap C^c)$
 $= (A - B) \cup (A - C)$. **So the answer is 3.**

4. If a set A has 6 elements, then the number of subsets of A containing atleast 3 elements is

1. 63 2. 57 3. 42 4. 40

Solution: ${}^6C_0 + {}^6C_1 + {}^6C_2 + {}^6C_3 = 1 + 6 + 15 + 20 = 42$.

So the answer is 3.

5. If A and B are any two sets then $((A^c \cup B^c) \cap B^c)^c =$

1. A 2. $A \cup B$ 3. A^c 4. B

Solution: $((A^c \cup B^c) \cap B^c)^c = ((A^c \cup B^c)^c) \cup (B^c)^c = ((A^c)^c \cap (B^c)^c) \cup B$
 $= (A \cap B) \cup B = B$. **So the answer is 4.**

- 6.. If A and B are sets with 3 and 6 elements respectively then the minimum number of elements in $A \cup B$ is

1. 9 2. 8 3. 7 4. 6

Solution: Minimum number of element in $A \cup B = \text{Maximum of } \{3, 6\} = 6$.

So the answer is 4.

7. If $D_n = \left\{x \in R : 0 < x < \frac{1}{n}\right\}$ for $n = 1, 2, 3, \dots$ then $\bigcap_{n=1}^{\infty} D_n =$

1. $\{0\}$ 2. ϕ 3. $\{1\}$ 4. $\{x \in R : 0 < x < 1\}$

Solution: $\bigcap_{n=1}^{\infty} D_n = D_1 \cap D_2 \cap D_3 \cap \dots$

$= \{x \in R : 0 < x < 1\} \cap \left\{x \in R : 0 < x < \frac{1}{2}\right\} \cap \left\{x \in R : 0 < x < \frac{1}{3}\right\} \cap \dots = \phi$.

So the answer is 2.

8. The set of values of x that satisfy $|5x - 3| = 7$, is

1. $\left\{\frac{4}{5}, 2\right\}$ 2. $\left\{-\frac{4}{5}, -2\right\}$ 3. $\left\{-\frac{4}{5}, +2\right\}$ 4. $\{3, 7\}$

Solution: $|5 \cdot \frac{4}{5} - 3| = |4 - 3| = 1;$ $|5 \cdot 2 - 3| = |10 - 3| = 7;$

$|5 \cdot (-\frac{4}{5}) - 3| = |-4 - 3| = |-7| = 7.$ **So the answer is 3.**

9. If $D_n = \left\{x \in R : 0 < x < \frac{1}{n}\right\}$ for $n = 1, 2, 3, \dots$ then $D_3 \cap D_7 =$

1. D_3 2. D_7 3. D_{10} 4. D_{21}

Solution: $D_3 \cap D_7 = \left\{x \in R : 0 < x < \frac{1}{3}\right\} \cap \left\{x \in R : 0 < x < \frac{1}{7}\right\} = \left\{x \in R : 0 < x < \frac{1}{7}\right\} = D_7.$

So the answer is 2.

10. If A_n is the set of all multiples of n for $n = 1, 2, 3, \dots$ and P is the set of all prime numbers

then $\bigcup_{p \in P} A_p =$

1. P 2. $\{1, 2, 3, \dots\}$ 3. $\{2, 3, 4, 5, \dots\}$ 4. $\{0, \pm 1, \pm 2, \dots\}$

Solution: $\bigcup_{p \in P} A_p = A_2 \cup A_3 \cup A_5 \cup A_7 \cup \dots$

$= \{2, 4, 6, 8, \dots\} \cup \{3, 6, 9, 12, \dots\} \cup \{5, 10, 15, 20, \dots\} \cup \{7, 14, 21, 28, \dots\}$

$= \{2, 3, 4, 5, 6, 7, 8, 9, 10, 11, \dots\}.$ **So the answer is 3.**

11. If $B_n = \{m \in N / m \text{ is a multiple of } n\}$, where $n \in N$, then $B_6 \cap B_8 =$

1. B_6 2. B_2 3. B_{12} 4. B_{24}

Solution: $B_6 = \{6, 12, 18, 24, 30, 36, 42, 48, \dots\};$ $B_8 = \{8, 16, 24, 32, 40, 48, 56, 64, \dots\}$

$B_6 \cap B_8 = \{24, 48, 72, \dots\} = B_{24}.$ **So the answer is 4.**

12. If $A = \{n \in Z : 1 \leq n \leq 40 \text{ and } 3 \text{ divides } n\}$ and $B = \{n \in Z : 1 \leq n \leq 35 \text{ and } 6 \text{ divides } n\}$ then $A - B =$

1. ϕ 2. A 3. B 4. $\{3, 9, 15, 21, 27, 33, 36, 39\}$

Solution: $A = \{3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39\};$

$B = \{6, 12, 18, 24, 30\}.$ So $A - B = \{3, 9, 15, 21, 27, 33, 36, 39\}.$

So the answer is 4.

13. A, B, C respectively denote the set of letters in the words 'FOLLOW'; 'FCOW' and 'WOLF' then

1. $B = C; A + B$ 2. $A = B; B \pm C$ 3. $A = B = C$ 4. $A \neq B \neq C$

Solution: $A = \{F, O, L, W\}$; $B = \{F, L, O, W\}$; $C = \{W, O, L, F\}$

So $A = B + C$. **So the answer is 3.**

14. If $n(S)$ denotes the number of elements in the set S , $n(A) = 20$, $n(B) = 40$, $n(A \cup B) = 50$, then the $n(A \cap B) =$

1. 30 2. 20 3. 10 4. 8

Solution: $n(A \cup B) = n(A) + n(B) - n(A \cap B) \Rightarrow n(A \cap B) = n(A) + n(B) - n(A \cup B)$
 $= 20 + 40 - 50 = 10$. So $n(A \cap B) = 10$. **So the answer is 3.**

15. If N is the set of positive integers, then $\{n \in N \mid |n - 2| < 3\} =$

1. $\{1, 2, 3, 4, 5\}$ 2. $\{1, 2, 3, 4\}$
3. $\{2, 3, 4, 5\}$ 4. $\{2, 3\}$

Solution: The given set $= \{n \in N : |n - 2| < 3\} = |n - 2| < 3 \Rightarrow -3 < n - 2 < 3 \Rightarrow -1 < n < 5$ and $n \in N \Rightarrow n \in \{1, 2, 3, 4\}$. **So the answer is 2.**

16. If N is the set of all positive integer, then $\{n \in N : |n - 4| \leq 2\} = ?$

1. $\{3, 4, 5\}$ 2. $\{2, 3, 4, 5, 6\}$
3. $\{2, 3, 4, 5\}$ 4. $\{3, 4, 5, 6\}$

Solution: $|n - 4| \leq 2 \Rightarrow 2 \leq n \leq 6$. (i.e) The required set $= \{2, 3, 4, 5, 6\}$.

So the answer is 2.

17. Let Z denote the set of integers, $A = \{a \in Z : |a - 1| < 3\}$, $B = \{a \in Z : |a - 3| < 4\}$. Then the least element $B - A$ is

1. 1 2. 2 3. 3 4. 4

Solution: $A = \{a \in Z : |a - 1| < 3\} = \{-1, 0, 1, 2, 3\}$;

$B = \{a \in Z : |a - 3| < 4\} = \{-1, 0, 1, 2, 3, 4, 5, 6\}$; $B - A = \{4, 5, 6\}$

The least element of $B - A = 4$. **So the answer is 4.**

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18. If the number of elements in the sets A, B are respectively 5, 7, then the number of relations that can be defined from A to B is

1. 2^7 2. 2^{12} 3. 2^{35} 4. 2^5

Solution: $n(A) = 5$; $n(B) = 7$; $n(A \times B) = n(A) \times n(B) = 5 \times 7 = 35$.

The number of relations that can be defined from A to B is 2^{35} . **So the answer is 3.**

20. If a set A has 8 elements, then the number of subsets of A having atmost 4 elements is

1. 256 2. 126 3. 93 4. 163

Solution: The number of subsets of A having atmost 4 elements is

$$8_{C_0} + 8_{C_1} + 8_{C_2} + 8_{C_3} + 8_{C_4} = 1 + 8 + 28 + 56 + 70 = 163. \quad \text{So the answer is 4.}$$

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21. If a set A has 3 elements and another set B has 5 elements, then the number of relations from A to B is

1. 15 2. 2^3 3. 2^5 4. 2^{15}

Solution: $n(A) = 3$; $n(B) = 5$; $n(A \times B) = n(A) \times n(B) = 3 \times 5 = 15$.

The number of relations that can be defined from A to B is 2^{15} . **So the answer is 4.**

22. If $A = \{4, 5, 6, 7, 8, 9\}$, $B = \{1, 2, 3, 4, 5, 6\}$ and $C = \{2, 4, 6, 8\}$, then $A - (B \cap C) =$

1. $\{4, 6\}$ 2. $\{5, 7, 8, 9\}$ 3. $\{2, 4, 6\}$ 4. $\{7, 8, 9\}$

Solution: $B \cap C = \{2, 4, 6\}$. So $A - (B \cap C) = \{5, 7, 8, 9\}$. **So the answer is 2.**

23. If a set A has 4 elements and another set B has 2 elements, then the number of functions from A into B that are not surjections is

1. 16 2. 2 3. 14 4. 8

Solution: If $n(A) = m$, $n(B) = n$, then the number of functions from A to B $= n^m$.

If $n(A) = m$, $n(B) = 2$, then the number of onto functions from A to B $= 2^m - 2$.

The number of functions from A into B that are not surjections is $= n^m - (2^m - 2) = 2^4 - 2^4 + 2 = 2$

So the answer is 2.

24. If a set A has 7 elements, then the number of subsets of A having exactly one element in each is

1. 2^6 2. 2^7 3. 7^2 4. 7

Solution: If $n(A) = m$, then the number of subsets of A $= 2^m$.

The number of subsets of A having exactly one element in each is 7. **So the answer is 4.**

STATEMENTS

1. **Definition:** A sentence is called a statement (or a mathematically acceptable statement) if it is either true or false but not both.
Ex: New Delhi is the capital of India.
2. The truth or falsehood of a statement is called its truth value. The truth value of a true statement is 'True' and is denoted by T. The truth value of a false statement is 'False' and is denoted by F.
3. **Negation:** Let p be a statement. The statement 'It is not the case that p' is called the negation of p. The negation of p is denoted by $\sim p$. The statement $\sim p$ is read 'not p'.
4. **Truth table:** The truth table displays the relationship between truth values of statements.
5. **Conjunction:** Let p and q be statements. The statement 'p and q', denoted by $p \wedge q$, is the statement that is true when both p and q are true and is false otherwise. The statement $p \wedge q$ is called the conjunction of p and q.

p	$\sim p$	p	q	$p \wedge q$
T	F	T	T	T
F	T	T	F	F
		F	T	F
		F	F	F

6. **Disjunction:** Let p and q be statements. The statement 'p or q' denoted by $p \vee q$, is the statement that is false when p and q are both false and true otherwise. The statement $p \vee q$ is called the disjunction of p and q.

p	q	$p \vee q$
T	T	T
T	F	T
F	T	T
F	F	F

7. **Implication:** Let p and q be statements. The implication $p \rightarrow q$ is the statement that is false when p is true and q is false and true otherwise. In this implication p is called the hypothesis (or antecedent or premise) and q is called the conclusion (or consequence).

p	q	$p \rightarrow q$	$q \rightarrow p$
T	T	T	T
T	F	F	T
F	T	T	F
F	F	T	T

8. **Converse:** The statement $q \rightarrow p$ is called the converse of $p \rightarrow q$.
9. **Contrapositive:** The statement $\sim q \rightarrow \sim p$ is called the contrapositive of $p \rightarrow q$.

10. **Biconditional:** Let p and q be statements. The biconditional $p \leftrightarrow q$ is the statement that is true when p and q have the same values and false otherwise. The truth table for $p \leftrightarrow q$ is given below.

p	q	$p \leftrightarrow q$
T	T	T
T	F	F
F	T	F
F	F	T

11. **Tautology:** A compound statement that is always true, no matter what the truth values of the statements that occur in it are, is called a tautology.
12. **Contradiction:** A compound statement that is always false is called a contradiction.

		Tautology	Contradiction
p	q	$p \vee \sim p$	$p \wedge \sim p$
T	F	T	F
F	T	T	F

13. **Converse:** The statement $q \rightarrow p$ is called the converse of $p \rightarrow q$.
14. **Inverse:** The statement $\sim p \rightarrow \sim q$ is called the iverse of $p \rightarrow q$.
15. **Contrapositive:** The statement $\sim q \rightarrow \sim p$ is called the contrapositive of $p \rightarrow q$.

Ex. Show that $\sim(p \vee q)$ and $\sim p \wedge \sim q$ are logically equivalent.

Sol. The truth table for the statements is displayed below. Since the truth values of the statements $\sim(p \vee q)$ and $\sim p \wedge \sim q$ agree for all possible combinations of the truth values of p and q , it follows that these statements are logically equivalent.

p	q	$p \vee q$	$\sim(p \vee q)$	$\sim p$	$\sim q$	$\sim p \wedge \sim q$	$(p \vee q) \rightarrow p$
T	T	T	F	F	F	F	T
T	F	T	F	F	T	F	T
F	T	T	F	T	T	F	F
F	F	F	T	T	T	T	T

Ex. Show that the statements $p \rightarrow q$ and $\sim p \vee q$ are equivalent.

Sol. Following is the truth table for these statements.

p	q	$\sim p$	$\sim p \vee q$	$p \rightarrow q$
T	T	F	T	T
T	F	F	F	F
F	T	T	T	T

F F T T T

Since the truth values of $\sim p \vee q$ and $p \rightarrow q$ agree, these statements are equivalent.

PROBLEMS

1. Which of the following is a tautology?

1. $p \rightarrow (p - q)$ 2. $(p \wedge q) \rightarrow p$ 3. $(p - q) \rightarrow (p \wedge q)$ 4. $p \vee q \rightarrow p$

Solution:	p	q	$p \wedge q$	$(p \wedge q) \rightarrow p$
	T	T	T	T
	T	F	F	T
	F	T	F	T
	F	F	F	T

So the answer is 2.

2. $\sim((\sim p) \vee q)$ is equivalent to

1. $p \vee (\sim q)$ 2. $(\sim p) \vee q$ 3. $p \wedge (\sim q)$ 4. $(\sim p) \wedge q$

Solution: $\sim((\sim p) \vee q) \equiv \sim(\sim p) \wedge (\sim q) \equiv p \wedge (\sim q)$. **So the answer is 3.**

3. If p, q are two statements, then $\sim(p \rightarrow q)$ is equivalent to

1. $(\sim p) \vee q$ 2. $(\sim p) \wedge q$ 3. $p \vee (\sim q)$ 4. $p \wedge (\sim q)$

Solution: $\sim(p \rightarrow q) \equiv p \wedge (\sim q)$. **So the answer is 4.**

4. If p and q are statements then $p \vee (p \wedge q)$ is equivalent to

1. p 2. q 3. $p \wedge q$ 4. $p \vee q$

Solution: $p \vee (p \wedge q) = (p \vee p) \wedge (p \vee q) = p \wedge (p \vee q) = p$ (by absorption law).

So the answer is 1.

5. If p and q are statements then $\sim(p \vee q)$ is equivalent to

1. $\sim p \vee \sim q$ 2. $\sim p \wedge \sim q$ 3. $\sim p \wedge q$ 4. $p \wedge \sim q$

Solution: $\sim(p \vee q) \equiv \sim p \wedge \sim q$ by De morgan's law. **So the answer is 2.**

6. If p, q are two statements then $\sim(p \vee \sim q)$ is equivalent to

1. $p \wedge \sim q$ 2. $\sim p \wedge \sim q$ 3. $\sim p \wedge q$ 4. $p \vee \sim q$

Solution: $\sim(p \vee \sim q) \equiv \sim p \wedge \sim(\sim q)$ (by De morgan's law)

$\equiv \sim p \wedge q$ (since $\sim(\sim q) = q$). **So the answer is 3.**

7. The statement $\sim(\sim p \rightarrow \sim q)$ is equivalent to

1. $\sim p \wedge q$ 2. $p \wedge \sim q$ 3. $\sim p \vee q$ 4. $p \vee \sim q$

Solution: $\sim(\sim p \rightarrow \sim q) \equiv \sim p \wedge \sim(\sim q) \equiv \sim p \wedge q$ (since $\sim(p \rightarrow q) = p \wedge \sim q$).

So the answer is 2.

8. If p is a statement, then which of the following is a tautology ?

1. $p \wedge (\sim p)$ 2. $p \vee (\sim p)$ 3. $\sim(\sim p)$ 4. $(\sim p) \wedge (\sim p)$

Solution: $p \vee (\sim p)$ is a tautology. Because $p \vee (\sim p)$ is always true.

So the answer is 1.

9. If p, q are two statements, then $\sim(p \Rightarrow q)$ is equivalent to

1. $\sim p \vee q$ 2. $\sim p \wedge q$ 3. $p \vee (\sim q)$ 4. $p \wedge (\sim q)$

The answer is 3.

10. If p and q are statements $p \vee (p \wedge q)$ is equivalent to

1. p 2. q 3. $p \wedge q$ 4. $p \vee q$

The answer is 1.

11. If p, q are two statements then which of the following is equivalent to $p \vee [(\sim p) \wedge q]$ is

1. $p \wedge q$ 2. $p \vee q$ 3. $(\sim p) \vee q$ 4. $p \vee (\sim q)$

The answer is 1.

12. If p, q are two statements then the inverse of the statement $\sim p \Rightarrow q$ is

1. $q \Rightarrow \sim p$ 2. $\sim q \Rightarrow p$ 3. $(\sim p) \Rightarrow (\sim q)$ 4. $p \Rightarrow \sim q$

The answer is 4.

13. If p and q are two statements then the symbolic form of p and not q is

1. $p \wedge (\sim q)$ 2. $p \vee (\sim q)$ 3. $p \wedge q$ 4. $(\sim p) \wedge q$

The answer is 1.

14. If p and q are any two statements then the converse of $p \Rightarrow q$ is

1. $q \Rightarrow p$ 2. $(\sim p) \Rightarrow (\sim q)$ 3. $(\sim q) \Rightarrow (\sim p)$ 4. $p \Rightarrow (\sim q)$

The answer is 1.

Note:

p	q	$\sim q$	$p \rightarrow q$	$\sim(p \rightarrow q)$	$p \wedge (\sim q)$
T	T	F	T	F	F
T	F	T	F	T	T
F	T	F	T	F	F
F	F	T	T	F	F

From the last two columns $\sim(p \rightarrow q) \equiv p \wedge (\sim q)$

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15. The statement $(p \rightarrow q) \rightarrow p$ is equivalent to

1. p 2. q 3. $q \rightarrow p$ 4. $p \rightarrow q$

Solution: $(p \rightarrow q) \rightarrow p \equiv (\sim p \vee q) \rightarrow p \equiv \sim(\sim p \vee q) \vee p$

$$\equiv (p \wedge \sim q) \vee p \equiv p \vee \sim q \equiv \sim q \vee p \equiv q \rightarrow p$$

So the answer is

3.

16. The contrapositive of the statement $p \rightarrow q$

1. $(\sim p) \rightarrow q$ 2. $(\sim p) \rightarrow (\sim q)$ 3. $q \rightarrow p$ 4. $(\sim q) \rightarrow (\sim p)$

Converse: The statement $q \rightarrow p$ is called the converse of $p \rightarrow q$.

Inverse: The statement $\sim p \rightarrow \sim q$ is called the iverse of $p \rightarrow q$.

Contrapositive: The statement $\sim q \rightarrow \sim p$ is called the contrapositive of $p \rightarrow q$. **Answer 4.**

17. If the statement " $\frac{1}{2}$ is rational and $\sqrt{3}$ is irrational" is denoted by p , then which of the following statement represent $\sim p$?

1. $\frac{1}{2}$ is rational or $\sqrt{3}$ is irrational. 2. $\frac{1}{2}$ is irrational or $\sqrt{3}$ is rational
3. $\frac{1}{2}$ is irrational or $\sqrt{3}$ is irrational 4. $\frac{1}{2}$ is rational $\sqrt{3}$ is rational

Answer 2.

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18. Among the following $(p \rightarrow q) \rightarrow \sim p$ is equivalent to

1. $p \wedge q$ 2. $\sim (p \wedge q)$ 3. p 4. q

Solution: $(p \rightarrow q) \rightarrow \sim p \equiv (\sim p \vee q) \rightarrow \sim p \equiv \sim(\sim p \vee q) \vee \sim p$

$$\equiv (p \wedge \sim q) \vee \sim p \equiv \sim p \vee \sim q \equiv \sim (p \wedge q)$$

So the answer is

2.

19. Among the following, the converse of $p \rightarrow (q \rightarrow r)$ is equivalent to

1. $(p \vee q) \wedge (r \rightarrow p)$ 2. $\sim r \vee (p \wedge q)$
3. $(r \rightarrow q) \rightarrow p$ 4. $(p \wedge q) \vee (r \rightarrow p)$

Solution: The converse of $p \rightarrow (q \rightarrow r) \equiv (q \rightarrow r) \rightarrow p \equiv (\sim q \vee r) \rightarrow p$

$$\equiv \sim(\sim q \vee r) \vee p \equiv (q \wedge \sim r) \vee p \equiv p \vee (q \wedge \sim r) \equiv (p \vee q) \wedge (p \vee \sim r)$$

$$\equiv (p \vee q) \wedge (\sim r \vee p) \equiv (p \vee q) \wedge (r \rightarrow p) \quad \text{So the answer is 2. } \vee \wedge$$

FUNCTIONS

1. **Functions:** A relation of $f: A \rightarrow B$ is said to be a function if every element of set A have unique image in set B.
Types of functions:
2. **Into Function:** A function $f: A \rightarrow B$ is said to be an into function if atleast one element of set B does not have pre-image in set A.
3. **One-One Function:** A function $f: A \rightarrow B$ is said to be a 1 - 1 function if distinct element of set A have distinct images in set B. It is also known as injection.
 i) For a 1 - 1 function if $f(x) = f(y)$ then $x = y$.
 ii) For a 1 - 1 function $n(A) \leq n(B)$.
4. **Onto Function:** A function $f: A \rightarrow B$ is said to be an onto function if all the elements of set B have pre-images in set A. It is also known as surjection.
 i) For an onto function $f(A) = B$.
 ii) For an onto function $n(A) \geq n(B)$.
 iii) If A, B are two finite sets and $n(B) = 2$, then the number of onto functions that can be defined from A onto B is $2^{n(A)} - 2$.
5. **Bijection:** A function $f: A \rightarrow B$ is said to be bijection if it is 1 - 1 and onto. If A, B are two finite sets and $f: A \rightarrow B$ is bijection, then $n(A) = n(B)$.
6. **Composite Function:** If $f: A \rightarrow B$, $g: B \rightarrow C$ are two functions then $g \circ f: A \rightarrow C$ defined by $(g \circ f)(x) = g[f(x)]$ for all $x \in A$ is known as composite function.
7. **Constant Function:** A function $f: A \rightarrow B$ is said to be a constant function if all the element of set A have same image in set B. The range of a constant function always consists of only one element.
8. **Identity Function:** A function $I: A \rightarrow A$ is said to be an identity function if the element and its image are equal,
 i) For an identity function. $I(x) = x$
 ii) Identity function is always a bijection.
9. **Inverse Function:** A function $f: A \rightarrow B$ will have its inverse function $f^{-1}: B \rightarrow A$ if f is a bijection.
10. **Real Variable Function:** A function is said to be a real variable function if its domain belongs to set of real numbers.
11. **Real Valued Function:** A function is said to be a real valued function if its codomain belongs to set of real numbers.
12. **Real Function:** A function is said to be a real function if its domain and co-domain both belong to set of real numbers.
13. **Even Function:** If $f(-x) = f(x)$ then $f(x)$ is known as even function.
14. **Odd Function:** If $f(-x) = -f(x)$ then $f(x)$ is known as odd function.
15. If A, B are two finite sets, then the number of functions that can be defined from A to B are $n(B)^{n(A)}$.
16. If A, B are two finite sets, then the number of functions that can be defined from B to A are $n(A)^{n(B)}$.
17. The number of constant functions from A to B are $n(B)$.
18. The number of one-one functions that can be defined from A to B is $n(B)_{P_{n(A)}}$.

19. The number of one-one functions that can be defined from a finite set A into a finite set B is $n(B)P_{n(A)}$ if $n(B) > n(A)$ and of in $n(B) < n(A)$.
20. If A, B are two finite sets and $n(A) = n(B)$ then the number of onto functions that can be defined from A onto B is $n(A)!$.
21. If A, B are two finite sets and $n(A) = n(B)$ then the number of bijections that can be defined from A onto B is $n(A)!$.

PROBLEMS

1. If a set A has 5 elements, then the number of bijections from A to A is

1. 2^5 2. 5^5 3. $5!$ 4. 1

Solution: The number of bijections from A to A = $n(A)! = 5!$.

So the answer is 3.

2. If R denotes the set of all real numbers and if a function $f: R \rightarrow R$ is defined by

$f(x) = x^2 \forall x \in R$, then f is

1. a one-one function 2. an onto function
3. a function but neither one-one nor onto 4. a bijection

Solution: It is a function, but not one-one. (because $f(2) = 4$ and $f(-2) = 4$, it is not onto, because -2 has no preimage). **So the answer is 3.**

3. If set A has 4 elements, then the number of relations from A to A is

1. 4^{16} 2. 2^4 3. 2^8 4. 4^3

Solution: The number of binary operations or relations from a set containing n elements to itself is $n^{(n^2)}$. So $4^{(4^2)} = 4^{16}$. **So the answer is 1.**

(Note) The number of functions from A to A is $n(A)^{n(A)} = 4^4$

4. If a set A has 5 elements, then the number of injections from A to A is

1. 120 2. 5^5 3. 0 4. 25

Solution: The number of one-one functions from A to A = $n(A)! = 5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$.

So the answer is 1.

5. If $f(x) = 2\left(x^2 + \frac{1}{x^2}\right) - 3\left(x + \frac{1}{x}\right) - 1$ then $\{\alpha \in R : f(\alpha) = 0\} =$

1. $\left\{1, \frac{1}{2}\right\}$ 2. $\left\{2, \frac{1}{2}\right\}$ 3. $\left\{3, \frac{1}{3}\right\}$ 4. $\left\{-2, \frac{1}{2}\right\}$

Solution: We have to find $\alpha \in R$ such that $f(\alpha) = 0$, using the given options we have the following

$$f(1) = 2\left(1 + \frac{1}{1}\right) - 3\left(1 + \frac{1}{1}\right) - 1 = 2(2) - 3(2) - 1 = 4 - 6 - 1 = -3 \neq 0.$$

$$f(2) = 2\left(4 + \frac{1}{4}\right) - 3\left(2 + \frac{1}{2}\right) - 1 = 8 + \frac{1}{2} - 6 - \frac{3}{2} - 1 = 1 - 1 = 0.$$

So the answer is 2.

6. If $f(x) = 2x^2 + 5x + 1$ and $g(x) = x - 4$ then $\{\alpha \in R : g(f(\alpha)) = 0\} =$

1. $\left\{-\frac{1}{2}, 3\right\}$ 2. $\left\{-\frac{1}{2}, -3\right\}$ 3. $\left\{\frac{1}{2}, -3\right\}$ 4. $\left\{\frac{1}{2}, 3\right\}$

Solution: $g(f(\alpha)) = 0 \Rightarrow g(2\alpha^2 + 5\alpha + 1) = 0 \Rightarrow 2\alpha^2 + 5\alpha + 1 - 4 = 0$
 $\Rightarrow 2\alpha^2 + 5\alpha - 3 = 0 \Rightarrow 2\alpha^2 + 6\alpha - \alpha - 3 = 0 \Rightarrow 2\alpha(\alpha + 3) - 1(\alpha + 3) = 0$
 $\Rightarrow (2\alpha - 1)(\alpha + 3) = 0 \Rightarrow \alpha = \frac{1}{2}, \alpha = -3$. **So the answer is 3.**

7. If $f(x) = a^x$ then $\frac{f(x+k)}{f(x-l)} =$

1. $f(k)$ 2. $f(-l)$ 3. $f(k-l)$ 4. $f(k+l)$

Solution: $\frac{f(x+k)}{f(x-l)} = \frac{a^{x+k}}{a^{x-l}} = a^{x+k-x+l} = a^{k+l} = f(k+l)$.

So the answer is 4.

8. If $f(x) = \log \left[\frac{1+x}{1-x} \right]$ and $g(x) = f \left[\frac{2x}{1+x^2} \right]$ then $\frac{g(x)}{f(x)} =$

1. 1 2. 2 3. $\frac{1}{2}$ 4. $\frac{1}{3}$

Solution: $g(x) = f \left[\frac{2x}{1+x^2} \right] = \log \left(\frac{1 + \frac{2x}{1+x^2}}{1 - \frac{2x}{1+x^2}} \right) = \log \left(\frac{(1+x)^2}{(1-x)^2} \right) = \log \left(\frac{1+x}{1-x} \right)^2 = 2 \log \left(\frac{1+x}{1-x} \right)$
 $= 2f(x)$. So $\frac{g(x)}{f(x)} = 2$. **So the answer is 2.**

9. If $f(x) = \frac{1}{x}$, $x \neq 0$ and $f^n(x) = f(f^{n-1}(x))$ then $f^{50} \left(\frac{1}{50} \right) =$

1. 1 2. 100 3. 50 4. $\frac{1}{50}$

Solution: Given that $f^n(x) = f(f^{n-1}(x))$. Put $n = 2$, then $f^2(x) = f(f(x)) = f \left(\frac{1}{x} \right) = \frac{1}{\frac{1}{x}} = x$.

So $f^{50}(x) = x$. So $f^{50} \left(\frac{1}{50} \right) = \frac{1}{50}$. **So the answer is 4.**

10. If $f: R \rightarrow R$ and $g: R \rightarrow R$ are defined by $f(x) = x - [x]$ and $g(x) = [x]$ for each $x \in R$, where $[x]$ is the greatest integer not exceeding x , then the range of $g \circ f$ is

1. ϕ 2. $\{0\}$ 3. $\mathbb{Z}$ 4. $\mathbb{R}$

Solution: $(g \circ f)(x) = g(f(x)) = g(x - [x]) = [x - [x]]$.

So the answer is 3.

11. The number of injections of the set $\{1, 2, 3\}$ in to the set $\{1, 2, 3, 4, 5, 6\}$ is

1. 10 2. 30 3. 60 4. 120

Solution: The number of one-one functions from a set A to a set B is $n(B)_{P_{n(A)}}$.

Here $n(A) = 3$, $n(B) = 6$. So number of injections of $6_{P_3} = \frac{6!}{3!} = \frac{6 \times 5 \times 4 \times 3 \times 2 \times 1}{3 \times 2 \times 1} = 120$.

So the answer is 4.

12. The number of functions that can be defined from B to A when $A = \{x_1, x_2, x_3, x_4\}$ and $B = \{5, 6, 7\}$ is

1. 4 2. 64 3. 81 4. 105

Solution: The number of functions defined from B to A = $n(A)^{n(B)} = 4^3 = 64$.

So the answer is 2.

13. If $f(x) = 3 + 4x$ and $g(x) = x^2 - 1$ for all real x then $[g \circ (g \circ f)](1) =$

1. 48 2. 50 3. 2303 4. 2499

Solution: $g[(g \circ f)](1) = g[g(f(1))] = g[g(7)] = g[48] = 2303$.

So the answer is 3.

14. The function $f(x) = 2x^4 - 6x^2 + 9$ defined on $\mathbb{R}$ is

1. an even function 2. an odd function
3. neither odd nor even 4. both odd and even

Solution: $f(-x) = 2(-x)^4 + 6(-x)^2 + 9 = 2x^4 + 6x^2 + 9 = f(x) = f(x)$ is an even function.

So the answer is 1.

15. If $f(x) = \log_9 x$ then $f^{-1}(x) =$

1. 9 2. 9^x 3. x^9 4. 9^{-x}

Solution: Let $f(x) = \log_9 x = y \Rightarrow x = 9^y \Rightarrow f^{-1}(y) = 9^y \Rightarrow f^{-1}(x) = 9^x$.

So the answer is 2.

16. If $y = f(x) = \frac{3x+4}{2x-3}$ then $f(y) =$

1. y 2. x 3. $f(x)$ 4. $3x$

Solution: $y = \frac{3x+4}{2x-3} \Rightarrow y(2x-3) = 3x+4 \Rightarrow (2y-3)x = 3y+4$

$\Rightarrow x = \frac{3y+4}{2y-3} = f(y)$. $\therefore f(y) = x$. **So the answer is 2.**

BINOMIAL THEOREM

1. If 'n' is a positive integer then

$$(x + a)^n = n_{c_0} x^n + n_{c_1} x^{n-1} \cdot a + n_{c_2} x^{n-2} \cdot a^2 + \dots + n_{c_r} x^{n-r} \cdot a^r + \dots + n_{c_n} a^n.$$
2. General term $T_{r+1} = n_{c_r} x^{n-r} a^r$
3. In an expansion of $(ax^p + \frac{b}{x^q})^n$, the coefficient of x^m is $n_{c_r} a^{n-r} \cdot b^r$ where $r = \frac{np - m}{p + q}$.
4. The term independent of 'x' in the expansion of $(ax^p + \frac{b}{x^q})^n$ is T_{r+1} where $r = \frac{np}{p + q}$.
5. Number of terms in the expansion of $(a + b)^n = n + 1$.
6. Number of terms in the expansion of $(a + b + c)^n$ is $(n + 1)(n + 2)/3!$.
7. Numerically greatest term in $(1 + x)^n$.
 a) If $\frac{(n+1)|x|}{|x|+1} = P$ where 'P' is integer, then Pth and (P + 1)th terms are numerically greatest terms.
 b) If $\frac{(n+1)|x|}{|x|+1} = P + f$ where P is integer and $0 < f < 1$ then (P + 1)th term is numerically greatest term.
8. $C_0 + C_1 + C_2 + \dots + C_n = 2^n$.
9. $C_0 - C_1 + C_2 - C_3 + \dots + (-1)^n C_n = 0$.
10. $C_0 + C_2 + C_4 + C_6 + \dots = 2^{n-1}$.
11. $C_1 + C_3 + C_5 + \dots = 2^{n-1}$.
12. $1C_1 + 2C_2 + 3C_3 + \dots + nC_n = n2^{n-1}$.
13. $1C_1 - 2C_2 + 3C_3 + \dots + (-1)^{n-1} nC_n = 0$.
14. $(1 - x)^{-1} = 1 + x + x^2 + x^3 + x^4 + \dots$
15. $(1 + x)^{-1} = 1 - x + x^2 - x^3 + x^4 - x^5 + \dots$

PROBLEMS

1. The coefficient of $\frac{1}{x^2}$ in the expansion of $\left(\frac{2}{x^2} - 3x\right)^4$ is

1. 36 2. -36 3. 216 4. -216

Solution: The coefficient of x^m in $\left(ax^p + \frac{b}{x^q}\right)^n$ is $n_{c_r} a^{n-r} \cdot b^r$ where $r = \frac{np - m}{p + q}$

Here $m = -2$, $n = 4$, $a = -3$, $b = 2$, $p = 1$, $q = 2$.

$$\text{So } r = \frac{(4)(1) - (-2)}{1 + 2} = \frac{4 + 2}{3} = 2.$$

So $n_{c_r} a^{n-r} . b^r = 4_{c_2} (-3)^{4-2} . (2)^2 = (6) (9) (4) = 216$. **So the answer is 3.**

2. The term independent of x in the binomial expansion of $\left(x^3 - \frac{1}{x^2}\right)^9$ is

1. 84 2. 56 3. 0 4. 9

Solution: Let the independent term be $T_{r+1} = 9_{c_r} (x^3)^{9-r} \left(\frac{1}{x^2}\right)^r$

$$= 9_{c_r} x^{27-3r-2r} = 9_{c_r} x^{27-5r}. \text{ So } 27 - 5r = 0 \Rightarrow r = \frac{27}{5}.$$

Hence it is not possible to get term independent of x . **So the answer is 3.**

3. The 4th term in the binomial expansion of $\left(\frac{1}{x^2} + x^2 . 2^x\right)^6$ is 160. Then the value of x is

1. 8 2. -8 3. -1 4. 1

Solution: $T_4 = T_{3+1} = 6_{c_3} \left(\frac{1}{x^2}\right)^{6-3} (x^2 2^x)^3 = 160 \Rightarrow \frac{6 \times 5 \times 4}{1 \times 2 \times 3} \cdot \left(\frac{1}{x^6}\right) (x^6 . 2^{3x}) = 160$
 $\Rightarrow 20 . 2^{3x} = 160 \Rightarrow 2^{3x} = 8 = 2^3 \Rightarrow 3x = 3 \Rightarrow x = 1$. **So the answer is 4.**

4. The coefficient of x^5 in the expansion of $(1 + 3x)^4 (1 - x)^3$ is

1. 18 2. 25 3. 27 4. 32

Solution: $(1 + 3x)^4 (1 - x)^3 = [1 + 4(3x) + 6(3x)^2 + 4(3x)^3 + (3x)^4] [1 - 3x + 3x^2 - x^3]$
 $= [1 + 12x + 54x^2 + 108x^3 + 81x^4] [1 - 3x + 3x^2 - x^3]$

So efficient of x^5 is $54(-1) + (108)(3) + 81(-3) = -54 + 324 - 243 = -297 + 324 = 27$.

So the answer is 3.

5. If the coefficients of the $(2k + 1)^{\text{th}}$ term and of the $(4k + 5)^{\text{th}}$ term in the expansion of $(1 + x)^{10}$ are equal then $k =$

1. 1 2. 2 3. 3 4. 0

Solution: Co-efficient of $T_{2k+1} = \text{coefficient of } T_{4k+5}$

$$\Rightarrow 10_{c_{2k}} = 10_{c_{(4k+4)}} \Rightarrow 2k + 4k + 4 = 10 \text{ (or) } 2k = 4k + 4 \text{ (} \because n_{c_r} = n_{c_s} \Rightarrow r + s = n \text{ (or) } r = s \text{)}$$

$$\Rightarrow 6k = 6 \text{ (or) } 2k = -4 \Rightarrow k = 1 \text{ (or) } k = -2. \text{ So } k = 1. \text{ **So the answer is 1.}**$$

6. The coefficient of term independent of x in the expansion of $\left[\frac{3}{2}x^2 - \frac{1}{3x}\right]^9$ is

1. $\frac{7}{18}$ 2. $-\frac{11}{2}$ 3. $\frac{21}{2}$ 4. None

Solution: The term independent of ' x ' in the expansion of $(ax^p + \frac{b}{x^q})^n$ is T_{r+1} where $r =$

$\frac{np}{p+q}$ Here $n = 9$, $a = \frac{3}{2}$, $p = 2$, $b = -\frac{1}{3}$, $q = 1$. So $r = \frac{18}{3} = 6$.

So $T_{6+1} = {}^9C_6 \left(\frac{3}{2}\right)^{9-6} \left(-\frac{1}{3}\right)^6 = \frac{9 \times 8 \times 7}{1 \times 2 \times 3} \times \frac{27}{8} \times \frac{1}{27 \times 27} = \frac{7}{18}$. **So the answer is 1.**

7. If the 21st and 22nd terms in the expansion $(1+a)^{44}$ are equal then $a =$

1. $\frac{7}{8}$ 2. $\frac{8}{7}$ 3. $\frac{5}{8}$ 4. $\frac{8}{5}$

Solution: $T_{22} = T_{21} \Rightarrow {}^{44}C_{21} a^{21} = {}^{44}C_{20} a^{20} \Rightarrow \frac{44!}{21! \times 23!} a = \frac{44!}{20! \times 24!} \Rightarrow a = \frac{21 \times 23!}{20! \times 24!} = \frac{21}{24} =$

$\frac{7}{8}$.

So the answer is 1.

8. The 9th term in the expansion $\left(\frac{a}{3} - \frac{b}{2}\right)^{12}$ is

1. $\frac{55a^4b^8}{2403}$ 2. $\frac{55a^4b^8}{2304}$ 3. $\frac{55a^8b^4}{2304}$ 4. $\frac{56a^4b^8}{2304}$

Solution: $T_9 = T_{8+1} = {}^{12}C_8 \cdot \left(\frac{a}{3}\right)^{12-8} \left(-\frac{1}{2}\right)^8 b^8 = \frac{12 \times 11 \times 10 \times 9}{1 \times 2 \times 3 \times 4} \cdot \frac{a^4}{3^4} \cdot \frac{b^8}{2^8} = \frac{55a^4b^8}{2304}$.

So the answer is 4.

9. The number of integral terms in the expansion of $\left(5^{\frac{1}{2}} + 7^{\frac{1}{8}}\right)^{1024}$ is

1. 129 2. 128 3. 130 4. 132

Solution: The power of $5^{\frac{1}{2}}$ and $7^{\frac{1}{8}}$ must be multiple of LCM of 2, 8 = 8.

There are $\frac{1024}{8} = 128$ multiples hence integral terms are 128. **So the answer is 2.**

10. The coefficient of x^4 in $\left(\frac{x}{2} - \frac{2}{x^2}\right)^{10}$ is

1. $\frac{45}{256}$ 2. $\frac{45}{64}$ 3. $\frac{68}{45}$ 4. $\frac{64}{256}$

In an expansion of $(ax^p + \frac{b}{x^q})^n$, the coefficient of x^m is $n_{c_r} a^{n-r} \cdot b^r$ where $r = \frac{np-m}{p+q}$.

Here $m = 4, n = 10, a = \frac{1}{2}, b = -2, p = 1, q = 2$. So $r = \frac{10-4}{1+2} = 2$.

Substituting these in $n_{c_r} a^{n-r} \cdot b^r$ we get $10_{c_2} \cdot \frac{1}{2^8} \cdot (-2)^2 = \frac{10 \times 9}{1 \times 2} \cdot \frac{1}{256} \cdot 4 = \frac{45}{64}$.

So the answer is 2.

11. If the 5th term of $\left[2x^2 + \frac{3}{x}\right]^5$ is to 10 then $x =$

1. 6 2. -6 3. 9 4. 8

Solution: $T_5 = 10 \Rightarrow T_{4+1} = 10 \Rightarrow 5_{c_4} (2x^2)^{5-4} \cdot \left(\frac{3}{x}\right)^4 = 10 \Rightarrow 5 \cdot 2x^2 \cdot \frac{81}{x^4} = 10 \Rightarrow \frac{81}{x^2} = 1$.

$\Rightarrow x^2 = 81 \Rightarrow x = 9$. **So the answer is 3.**

12. If the term independent of x in $\left(\sqrt{x} + \frac{k}{x^2}\right)^{10}$ is 405 then $k =$

1. ± 2 2. ± 3 3. ± 4 4. ± 5

Solution: The term independent of 'x' in the expansion of $(ax^p + \frac{b}{x^q})^n$ is T_{r+1}

where $r = \frac{np}{p+q}$. Here $a = 1, p = \frac{1}{2}, b = k, q = 2, n = 10$. So $r = \frac{5}{2.5} = 2$. So $T_3 = 405$.

$\Rightarrow 10_{c_2} \cdot (\sqrt{x})^{10-2} \cdot \left(\frac{k}{x^2}\right)^2 = 405 \Rightarrow \frac{10 \times 9}{1 \times 2} k^2 = 405 \Rightarrow k = \pm 3$. **So the answer is 2.**

13. If the coefficients of x^7 and x^8 in the expansion of $\left(3 + \frac{x}{2}\right)^n$ are equal then $n =$

1. 55 2. 52 3. 48 4. 44

Solution: Given that coefficient of $x^7 =$ coefficient of x^8

$$\Rightarrow n_{c_7} \cdot 3^{n-7} \cdot \left(\frac{x}{2}\right)^7 = n_{c_8} \cdot 3^{n-8} \cdot \left(\frac{x}{2}\right)^8 \Rightarrow \frac{n_{c_8}}{n_{c_7}} = \frac{3^{n-7} \cdot 2^8}{3^{n-8} \cdot 2^7}$$

$$\Rightarrow \frac{n-8+1}{8} = 6 \Rightarrow n = 55. \text{ So the answer is 1.}$$

(Note: $\frac{n_{c_r}}{n_{c_{r-1}}} = \frac{n-r+1}{r}$)

ICET-2012

14. The coefficient of x in the expansion of $\left(3x^2 - \frac{1}{2x}\right)^{10}$ is

1. $\frac{45}{4}$ 2. $\frac{-45}{4}$ 3. $\frac{45}{8}$ 4. $\frac{-45}{8}$

Solution: $T_{r+1} = n_{c_r} x^{n-r} y^r, \quad 5_{c_r} (3x^2)^{5-r} \left(\frac{-1}{2x}\right)^r = x$

Equating the power / index of x we get $10 - 3r = 1 \Rightarrow r = 3$.

So the coefficient of x is $5_{c_3} 3^2 \left(\frac{-1}{8}\right) = 10 \times 9 \times \frac{-1}{8} = \frac{-45}{4}$. **Answer is 2.**

15. If $(2 + 3x)^5 = \sum_{n=0}^5 a_n x^n$, $\sum_{n=0}^5 a_n =$

1. 32 2. 243 3. 1024 4. 3125

Solution: $(2 + 3x)^5 = \sum_{n=0}^5 a_n x^n$. Put $x = 1$, then $\sum_{n=0}^5 a_n = (2 + 3)^5 = 5^5 = 3125$. **Answer is 4.**

ICET-2011

16.. The coefficient of x^{15} in the product $(x - 1)(x - 2) \dots (x - 16)$ is

1. $(16)!$ 2. 136 3. -136 4. $-(16)!$

Solution: Coefficient of $x^{15} = -(1+2+3+4+5+6+7+8+9+10+11+12+13+14+15+16)$

$$= -\frac{16(16+1)}{2} = -8 \times 17 = -136. \text{ Answer is 3.}$$

17. If the sum of all the coefficients in the expansion of $(1 + 3x - 2x^2)^n$ is 128, then the greatest coefficient in the expansion of $(1 + x)^n$ is

1. 35 2. 21 3. 49 4. 14

Solution: Put $x = 1$. Then $(1+3-2)^n = 128 \Rightarrow 2^n = 2^7 \Rightarrow n = 7$.

So the greatest coefficient in expansion of $(1 + x)^7$ is $7_{c_3} = 35$. **Answer is 1.**

SURDS

1. **Surd:** If 'a' is a positive rational number, 'n' is a natural number such that $\sqrt[n]{a} = \frac{1}{a^n}$ is not a rational number then $\sqrt[n]{a}$ is called as a surd, (or) n^{th} order surd (or) a surd of n^{th} order.
2. **Simple Surd:** A surd consisting of a single term is called a simple surd.
3. **Mixed Surd:** If 'a' is a rational number and $\sqrt{b}$ is surd, then $a \pm \sqrt{b}$ is called mixed surd.
4. **Compound Surd:** A surd which is the sum of two or more simple surds is called a compound surd.
5. **Binomial Surd:** It is an expression containing two terms of which at least one is a simple surd.
6. **Similar Surds:** If the surds are different rational multiplies of same surd, they are called similar surds.
7. **Dissimilar Surds:** Two surds which are not similar are called dissimilar surds.
8. **Square Root of a Surd**

- i) If $a, b, \sqrt{a^2 - b}$ are positive rational numbers and $\sqrt{b}$ is surd then,

$$\sqrt{a + \sqrt{b}} = \sqrt{\frac{1}{2}[a + \sqrt{a^2 - b}]} + \sqrt{\frac{1}{2}[a - \sqrt{a^2 - b}]}$$

The results holds good even if $\sqrt{a^2 - b}$ is surd.

Note: If $\sqrt{a + \sqrt{b}} = \sqrt{x} + \sqrt{y}$ and $x > y$ then $\sqrt{a - \sqrt{b}} = \sqrt{x} - \sqrt{y}$.

- ii) If $\sqrt{a + \sqrt{b} + \sqrt{c} + \sqrt{d}} = \sqrt{x} + \sqrt{y} + \sqrt{z}$ where a, b, c, d are positive rationals and

$$\sqrt{b}, \sqrt{c}, \sqrt{d} \text{ are dissimilar surds then } x = \frac{1}{2} \sqrt{\frac{bd}{c}}, y = \frac{1}{2} \sqrt{\frac{bc}{d}}, z = \frac{1}{2} \sqrt{\frac{dc}{b}} \text{ and}$$

$$x + y + z = a$$

Note: If $\sqrt{a + \sqrt{b} + \sqrt{c} + \sqrt{d}} = \sqrt{x} + \sqrt{y} + \sqrt{z}$ and $(\sqrt{x} + \sqrt{y}) > \sqrt{z}$ then

$$\sqrt{a + \sqrt{b} - \sqrt{c} - \sqrt{d}} = \sqrt{x} + \sqrt{y} - \sqrt{z}$$

9. **Cube Root fo Surd:** If $\sqrt[3]{a + \sqrt{b}} = x + \sqrt{y}$ then $\sqrt[3]{a - \sqrt{b}} = x - \sqrt{y}$ where a, x are rationals and b, y are positive rationals $\sqrt{b}, \sqrt{y}$ are surds. Here $x^3 + 3xy = a$ and $\sqrt[3]{a^2 - b} = x^2 - y$.
10. **Conjugate Surds:** The sum and product of two binomial surds is a rational number then they are called conjugate surds.

Example: $a + \sqrt{b}$ and $a - \sqrt{b}$.

PROBLEMS

1. $\sqrt{47 - 4\sqrt{33}} =$

1. $\sqrt{22} - \sqrt{6}$ 2. $\sqrt{45} - \sqrt{2}$ 3. $\sqrt{44} - \sqrt{3}$ 4. $\sqrt{35} - \sqrt{12}$

Solution: $\sqrt{47 - 4\sqrt{33}} = \sqrt{47 - 2\sqrt{132}} = \sqrt{(\sqrt{44})^2 + (\sqrt{3})^2 - 2\sqrt{44}\sqrt{3}}$
 $= \sqrt{(\sqrt{44} - \sqrt{3})^2} = \sqrt{44} - \sqrt{3}$. **So the answer is 3.**

2. $\left[\frac{\sqrt{7} + \sqrt{5}}{\sqrt{7} - \sqrt{5}} + \frac{\sqrt{7} - \sqrt{5}}{\sqrt{7} + \sqrt{5}} \right]^3 =$

1. 1728 2. 1827 3. $(\sqrt{14} + \sqrt{10})^3$ 4. $(12 + 2\sqrt{35})^3$

Solution: $\left[\frac{\sqrt{7} + \sqrt{5}}{\sqrt{7} - \sqrt{5}} + \frac{\sqrt{7} - \sqrt{5}}{\sqrt{7} + \sqrt{5}} \right]^3 = \left[\frac{(\sqrt{7} + \sqrt{5})^2 + (\sqrt{7} - \sqrt{5})^2}{(\sqrt{7})^2 - (\sqrt{5})^2} \right]^3$
 $= \left[\frac{(\sqrt{7})^2 + (\sqrt{5})^2 + 2\sqrt{7}\sqrt{5} + (\sqrt{7})^2 + (\sqrt{5})^2 - 2\sqrt{7}\sqrt{5}}{7 - 5} \right]^3 = \left[\frac{7 + 5 + 7 + 5}{2} \right]^3 = 12^3 = 1728.$

So the answer is 1.

3. $\frac{2}{\sqrt{5} + \sqrt{3}} + \frac{2}{\sqrt{7} + \sqrt{5}} =$

1. $\sqrt{5} - \sqrt{3}$ 2. $\sqrt{7} - \sqrt{5}$ 3. $\sqrt{7} - \sqrt{3}$ 4. $\sqrt{7} - 2\sqrt{5} + \sqrt{3}$

Solution: $\frac{2}{\sqrt{5} + \sqrt{3}} + \frac{2}{\sqrt{7} + \sqrt{5}} = \frac{2(\sqrt{5} - \sqrt{3})}{(\sqrt{5} + \sqrt{3})(\sqrt{5} - \sqrt{3})} + \frac{2(\sqrt{7} - \sqrt{5})}{(\sqrt{7} + \sqrt{5})(\sqrt{7} - \sqrt{5})}$
 $= \frac{2(\sqrt{5} - \sqrt{3})}{(\sqrt{5})^2 - (\sqrt{3})^2} + \frac{2(\sqrt{7} - \sqrt{5})}{(\sqrt{7})^2 - (\sqrt{5})^2} = \frac{2(\sqrt{5} - \sqrt{3})}{5 - 3} + \frac{2(\sqrt{7} - \sqrt{5})}{7 - 5}$
 $= \frac{2(\sqrt{5} - \sqrt{3})}{2} + \frac{2(\sqrt{7} - \sqrt{5})}{2} = \sqrt{5} - \sqrt{3} + \sqrt{7} - \sqrt{5} = \sqrt{7} - \sqrt{3}$. **So the answer is 3.**

4. $\left[\frac{\sqrt[4]{ab} - \sqrt{b}}{\sqrt{a} - \sqrt[4]{ab}} \right]^4 =$

1. $\frac{b}{a}$ 2. $\frac{a}{b}$ c. $-\frac{b}{a}$ 4. $-\frac{a}{b}$

Solution:
$$\left[\frac{\sqrt[4]{ab} - \sqrt{b}}{\sqrt{a} - \sqrt[4]{ab}} \right]^4 = \left[\frac{\sqrt[4]{a}\sqrt[4]{b} - \sqrt[4]{b}\sqrt[4]{b}}{\sqrt[4]{a}\sqrt[4]{a} - \sqrt[4]{ab}} \right]^4 = \left[\frac{\sqrt[4]{b}(\sqrt[4]{a} - \sqrt[4]{b})}{\sqrt[4]{a}(\sqrt[4]{a} - \sqrt[4]{b})} \right]^4 = \left[\frac{\sqrt[4]{b}}{\sqrt[4]{a}} \right]^4 = \left[\frac{b^{\frac{1}{4}}}{a^{\frac{1}{4}}} \right]^4 = \frac{b}{a}.$$

So the answer is 1.

5. If $x = 5 + 2\sqrt{6}$ then $\sqrt{x} - \frac{1}{\sqrt{x}} =$

1. 5 2. $2\sqrt{6}$ 3. $2\sqrt{3}$ 4. $\sqrt{8}$

Solution: $\sqrt{x} = \sqrt{5 + 2\sqrt{6}} = \sqrt{3 + 2 + 2\sqrt{2}\sqrt{3}} = \sqrt{(\sqrt{3} + \sqrt{2})^2} = \sqrt{3} + \sqrt{2}.$

So $\frac{1}{\sqrt{x}} = \frac{1}{\sqrt{3} + \sqrt{2}} = \frac{\sqrt{3} - \sqrt{2}}{(\sqrt{3} + \sqrt{2})(\sqrt{3} - \sqrt{2})} = \frac{\sqrt{3} - \sqrt{2}}{3 - 2} = \sqrt{3} - \sqrt{2}.$

So $\sqrt{x} - \frac{1}{\sqrt{x}} = \sqrt{3} + \sqrt{2} - \sqrt{3} + \sqrt{2} = 2\sqrt{2} = \sqrt{8}.$ **So the answer is 4.**

6. $3\sqrt{\frac{2}{3}} - 2\sqrt{\frac{3}{2}} + \sqrt{6} + \sqrt{216} =$

1. $4\sqrt{6}$ 2. $5\sqrt{6}$ 3. $6\sqrt{6}$ 4. $7\sqrt{6}$

Solution: $3\sqrt{\frac{2}{3}} - 2\sqrt{\frac{3}{2}} + \sqrt{6} + \sqrt{216} = \frac{3\sqrt{2}}{\sqrt{3}} - \frac{2\sqrt{3}}{\sqrt{2}} + \sqrt{6} + \sqrt{36(6)}$

$= \sqrt{6} - \sqrt{6} + \sqrt{6} + 6\sqrt{6} = 7\sqrt{6}.$ **So the answer is 4.**

7. If $x = \frac{5 - \sqrt{21}}{2}$ then $x^2 + \frac{1}{x^2} =$

1. $\frac{27}{2}$ 2. $\frac{25}{2}$ 3. 23 4. 25

Solution: $x^2 = \left(\frac{5 - \sqrt{21}}{2} \right)^2 = \left(\frac{25 + 21 - 10\sqrt{21}}{4} \right) = \frac{46 - 10\sqrt{21}}{4} = \frac{23 - 5\sqrt{21}}{2}$

$\frac{1}{x^2} = \frac{2}{23 - 5\sqrt{21}} = \frac{2(23 + 5\sqrt{21})}{(23 - 5\sqrt{21})(23 + 5\sqrt{21})} = \frac{2(23 + 5\sqrt{21})}{23^2 - 25(21)}$

$= \frac{2(23 + 5\sqrt{21})}{529 - 525} = \frac{2(23 + 5\sqrt{21})}{4} = \frac{23 + 5\sqrt{21}}{2}.$

So $x^2 + \frac{1}{x^2} = \frac{23 - 5\sqrt{21}}{2} + \frac{23 + 5\sqrt{21}}{2} = 23.$ **So the answer is 3.**

8. If $x = \sqrt{\frac{7+4\sqrt{3}}{7-4\sqrt{3}}}$ then $x(x-14) =$

1. 1 2. -1 3. $\frac{1}{\sqrt{3}}$ 4. $-\frac{1}{\sqrt{3}}$

Solution: $x = \sqrt{\frac{7+4\sqrt{3}}{7-4\sqrt{3}}} = \sqrt{\frac{2^2+3+2.2.\sqrt{3}}{2^2+3-2.2.3}} = \sqrt{\frac{(2+\sqrt{3})^2}{(2-\sqrt{3})^2}} = \frac{2+\sqrt{3}}{2-\sqrt{3}}$

$$= \frac{2+\sqrt{3}}{2-\sqrt{3}} \cdot \frac{2+\sqrt{3}}{2+\sqrt{3}} = \frac{4+3+4\sqrt{3}}{4-3} = 7+4\sqrt{3}.$$

So $x(x-14) = (7+4\sqrt{3})(7+4\sqrt{3}-14) = (4\sqrt{3}+7) \cdot (4\sqrt{3}-7) = 16(3)-49 = 48-49 = -1.$

So the answer is 2.

9. $\frac{\sqrt{7}+\sqrt{5}}{\sqrt{7}-\sqrt{5}} + \frac{\sqrt{7}-\sqrt{5}}{\sqrt{7}+\sqrt{5}} =$

1. $2\sqrt{35}$ 2. $-2\sqrt{35}$ 3. 12 4. -12

Solution: $\left[\frac{\sqrt{7}+\sqrt{5}}{\sqrt{7}-\sqrt{5}} + \frac{\sqrt{7}-\sqrt{5}}{\sqrt{7}+\sqrt{5}} \right] = \left[\frac{(\sqrt{7}+\sqrt{5})^2 + (\sqrt{7}-\sqrt{5})^2}{(\sqrt{7})^2 - (\sqrt{5})^2} \right]$

$$= \left[\frac{(\sqrt{7})^2 + (\sqrt{5})^2 + 2\sqrt{7}\sqrt{5} + (\sqrt{7})^2 + (\sqrt{5})^2 - 2\sqrt{7}\sqrt{5}}{7-5} \right] = \left[\frac{7+5+7+5}{2} \right] = 12.$$

So the answer is 3.

10. Among the surds $\sqrt{2}$, $\sqrt[3]{4}$, $\sqrt[3]{2}$ and $\sqrt[4]{6}$, the largest one is

1. $\sqrt{2}$ 2. $\sqrt[3]{4}$ 3. $\sqrt[3]{2}$ 4. $\sqrt[4]{6}$

Solution: $\sqrt{2} = 2^{\frac{1}{2}}$; $\sqrt[3]{4} = 4^{\frac{1}{3}}$; $\sqrt[3]{2} = 2^{\frac{1}{3}}$; $\sqrt[4]{6} = 6^{\frac{1}{4}}$.

The LCM of $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$ is 12. Raising the given surds to the power 12 we get

$$2^{\frac{12}{2}}; 4^{\frac{12}{3}}; 2^{\frac{12}{3}}; 6^{\frac{12}{4}} \Rightarrow 2^6; 4^4; 2^4; 6^3 \Rightarrow 64; 256; 16; 216.$$

So the second surd is the largest i.e. $\sqrt[3]{4}$. **So the answer is 2.**

11. $\frac{6}{2\sqrt{3}+\sqrt{6}} - \frac{1}{\sqrt{3}-\sqrt{2}} + \frac{4}{\sqrt{6}-\sqrt{2}} =$

1. $\sqrt{3}$ 2. $\sqrt{2}$ 3. $\sqrt{6}$ 4. $\sqrt{2}-\sqrt{3}+\sqrt{6}$

Solution: $\frac{6}{2\sqrt{3}+\sqrt{6}} - \frac{1}{\sqrt{3}-\sqrt{2}} + \frac{4}{\sqrt{6}-\sqrt{2}}$

$$= \frac{6(2\sqrt{3}-\sqrt{6})}{(2\sqrt{3}+\sqrt{6})(2\sqrt{3}-\sqrt{6})} - \frac{\sqrt{3}+\sqrt{2}}{(\sqrt{3}+\sqrt{2})(\sqrt{3}-\sqrt{2})} + \frac{4(\sqrt{6}+\sqrt{2})}{(\sqrt{6}+\sqrt{2})(\sqrt{6}-\sqrt{2})}$$

$$= 2\sqrt{3}-\sqrt{6} - \sqrt{3}-\sqrt{2} + \sqrt{6}+\sqrt{2} = \sqrt{3}. \text{ So the answer is 1.}$$

ICET-2011

12. $\sqrt{\sqrt{60}+8} =$

1. $2\sqrt{2}+3$ 2. $\sqrt{3}+\sqrt{5}$ 3. $\sqrt{3}+\sqrt{15}$ 4. $\sqrt{5}+\sqrt{7}$

Solution: $(a+b)^2 = a^2 + 2ab + b^2$;

$$(2\sqrt{2}+3)^2 = 4(2) + 2(2\sqrt{2})3 + 9 = 8 + 12\sqrt{2} + 9 = 17 + 12\sqrt{2}.$$

$$(\sqrt{3}+\sqrt{5})^2 = 3 + 2\sqrt{3}\sqrt{5} + 5 = 3 + 2\sqrt{15} + 5 = 8 + 2\sqrt{15} = 8 + \sqrt{60}.$$

$$\sqrt{\sqrt{60}+8} = \sqrt{(\sqrt{3}+\sqrt{5})^2} = \sqrt{3}+\sqrt{5}$$

$$(\sqrt{3}+\sqrt{15})^2 = 3 + 2\sqrt{3}\sqrt{15} + 15 = 3 + 2\sqrt{45} + 15 = 18 + 2\sqrt{45}.$$

$$(\sqrt{5}+\sqrt{7})^2 = 5 + 2\sqrt{5}\sqrt{7} + 7 = 5 + 2\sqrt{35} + 7 = 12 + 2\sqrt{35}.$$

Answer 2.

ICET-2012

14. If $a = \sqrt{2} + \sqrt{3}$, then $\frac{a+1}{a-1} + \frac{1-a}{1+a} =$

1. $\sqrt{2}$ 2. $\sqrt{3}$ 3. $1+\sqrt{2}$ 4. $1+\sqrt{3}$

Solution: $\frac{a+1}{a-1} + \frac{1-a}{1+a} = \frac{(a+1)^2 - (a-1)^2}{a^2-1} = \frac{a^2+2a+1-a^2+2a-1}{a^2-1} = \frac{4a}{a^2-1} =$

$$= \frac{4(\sqrt{2}+\sqrt{3})}{2+3+2\sqrt{2}\sqrt{3}-1} = \frac{4(\sqrt{2}+\sqrt{3})}{4+2\sqrt{2}\sqrt{3}} = \frac{2(\sqrt{2}+\sqrt{3})}{2+\sqrt{2}\sqrt{3}} = \frac{2(\sqrt{2}+\sqrt{3})}{\sqrt{2}(\sqrt{2}+\sqrt{3})} = \frac{2}{\sqrt{2}} = \sqrt{2}. \quad \text{Answer}$$

1.

15. If $x = 3 + \sqrt{5}$, then the value of $x^4 + 12x^3 + 36x^2$ is

1. 4 2. -4 3. -16 4. 16

Solution: no answer add score to all.

16. $\sqrt{10+\sqrt{25+\sqrt{108+\sqrt{154+\sqrt{225}}}}} =$

1. 16 2. 10 3. 5 4. 4

Solution: $\sqrt{225} = 15$;

$$\sqrt{154 + \sqrt{225}} = \sqrt{154 + 15} = \sqrt{169} = 13.$$

$$\sqrt{108 + \sqrt{154 + \sqrt{225}}} = \sqrt{108 + 13} = \sqrt{121} = 11$$

$$\sqrt{25 + \sqrt{108 + \sqrt{154 + \sqrt{225}}}} = \sqrt{25 + 11} = \sqrt{36} = 6$$

$$\sqrt{10 + \sqrt{25 + \sqrt{108 + \sqrt{154 + \sqrt{225}}}}} = \sqrt{10 + 6} = \sqrt{16} = 4.$$

Answer 1.

GEOMETRY

Angle: An angle is a figure formed by two rays with the same initial point. The common initial point is called the vertex of the angle and the rays forming the angle are called its arms or sides.

Types of Angle

Acute Angle: An angle which is greater than zero but less than a right angle (90°) is called an acute angle.

Right Angle: An angle whose measure is exactly equal to 90° is called a right angle.

Obtuse Angle: An angle which is greater than a right angle but less than 180° (i.e.,) a straight angle, is called an obtuse angle.

Straight Angle: An angle whose measure is 180° is called a straight angle.

Reflex Angle: An angle which is greater than 180° but less than 360° is called a reflex angle.

Complete Angle: An angle whose measures in 360° is called a complete angle.

Types of pairs of Angle:

Let l and m be two parallel lines, n be a transversal for l and m .

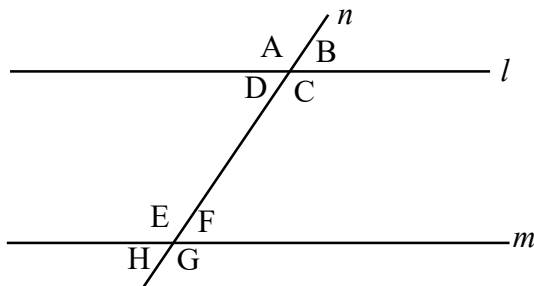
Adjacent Angles: Two angles are said to be adjacent, if they have a common vertex and common arm (ray).

Linear Pair: Two adjacent angles are said to form a linear pair of angles, if their two non common are opposite rays. The sum of measures of angles of the linear pair is 180° .

Vertically Opposite Angles: Two angles formed by two intersecting lines having no common arm are called vertically opposite angles.

Interior Angles: Angles which are within the parallel lines l, m are called Interior Angles.

Exterior Angles: Angles which are not within the parallel lines are called exterior angles.



Corresponding Angles: $(A, E), (B, F), (D, H), (C, G)$ are called corresponding angles.

These pair of angles are equal.

Alternate Interior Angles: $(C, E), (D, F)$ are alternate interior angles. These pair of alternate interior angles are equal.

Alternate Exterior Angles: $(B, H), (A, G)$ are alternate exterior angles. These pair of alternate exterior angles are equal.

Complementary Angles: If the sum of two angles is 90° , then the pair of angles are said to be complementary angles.

Supplementary Angles: If the sum of two angles is 180° , then the pair of angles are said to be supplementary angles.

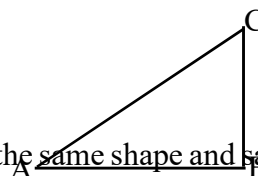
Triangle: Definition: A triangle is a 3-sided polygon. If two sides of a triangle are equal, it is called isosceles triangle. If all the three are equal, it is called equilateral triangle. If all of the sides have different lengths, the triangle is scalene.

Properties of Triangle: The sum of the angles of a triangle is 180° .

The sum of the lengths of any two sides of the triangle is greater than the third side.

Pythagoras Theorem: The square of the length of the hypotenuse is equal to the sum of the squares of the lengths of the other two sides.

$AB^2 + BC^2 = AC^2$, where AC is the hypotenuse.



Similarity: If two geometric figures are congruent, they have the same shape and same size. Geometric figures which are of the same shape but not necessarily of the size are called similar figures.

Similar Triangles: Two triangles, which have the three angles of one triangle equal to the three angles of the other triangle and all the ratios between the measures of corresponding sides equal are said to be similar. If triangle ABC is similar to $\triangle A'B'C'$ then we write $\triangle ABC \sim \triangle A'B'C'$

Note: i) $\triangle ABC$ is equiangular to $\triangle A'B'C'$, then, $\angle A = \angle A'$, $\angle B = \angle B'$, $\angle C = \angle C'$.

$$\text{ii) } \frac{a}{a'} = \frac{b}{b'} = \frac{c}{c'}$$

Important Results:

1. In a triangle, a line drawn parallel to one side to intersect the other sides in distinct points divides the two sides in the same ratio.
2. If a line divides any two sides of a triangle in the same ratio, then it is parallel to the third side.
3. The bisector of an angle of a triangle divides the opposite side in the ratio of the sides containing the angle.
4. In two triangles, corresponding angles are equal (i.e.) the two triangles are equiangular, then the triangles are similar.
5. If corresponding sides of two triangles are proportional, then they are similar.
6. If in two triangles one pair of corresponding sides are proportional and the included angles are equal, then the two triangles are similar.

Quadrilateral: Definition: A figure formed by joining four points in an order is called a quadrilateral. A quadrilateral has four sides, four angles and four vertices.

Types of Quadrilateral: Different types of quadrilateral are drawn below,

Square: A quadrilateral having all sides equal and all angles $= 90^\circ$

Rhombus: A special type of parallelogram having opposite sides equal and all angles $= 90^\circ$

Rhombus: All sides are equal and sides are not perpendicular.

Parallelogram: Opposite sides are equal and parallel.

Trapezium: One pair of opposite side is parallel.

Important Points: 1. The sum of angles of quadrilateral = 360° .

2. A square is a rectangle and also a rhombus.
3. A parallelogram is a trapezium but the converse is not true.
4. A rectangle or a rhombus is not a square.
5. The diagonal of a parallelogram divides it into two congruent triangles.
6. The diagonals of a parallelogram bisect each other.

Circle: Definition: The collection of all the points in a plane, which are at a fixed distance from a fixed point in the plane, is called a circle.

Radius: The line segment joining the centre and any point on the circle is called the radius of the circle.

Chord: The line segment joining any two points on the circle is called the chord of the circle. The diameter is the biggest chord of the circle.

Circumference: The length of the complete circle is called its circumference.

Important points:

1. Equal chords of a circle are equidistant from the centre.
2. Chords equidistant from the centre of a circle are equal in length.
3. If two chords of a circle are equal, then their corresponding arcs are congruent and conversely, if two arcs are congruent, then their corresponding chords are equal.
4. The angle subtended by an arc at the centre is double the angle subtended by it at any point on the remaining part of the circle.
5. Angle in a semicircle is a right angle.
6. If the sum of either pair of opposite angles of a quadrilateral is 180° , then the quadrilateral is cyclic (the converse is also true).
7. Angles in the same segment of a circle are equal.

Note: A quadrilateral is called cyclic, if all the four of its vertices lie on a circle.

Tangent to a circle: A tangent to a circle is a line that intersects the circle in exactly one point.

Regular Hexagon: A simple closed figure bounded by six sides and all its angles and sides are equal is called Regular Hexagon.

The angle subtended by a regular hexagon at the centre of circumscribed circle is 60° .

Area of regular hexagon = $\frac{3\sqrt{3}}{2} a^2$ or $\frac{6\sqrt{3}}{4} a^2$, where a = side of the regular hexagon.

Regular Octagon: The angle subtended by a regular octagon at the centre of circumscribed circle is 45° .

Area of the regular octagon = $2(1 + \sqrt{2})a^2$, where a = side of the regular octagon.

Regular Polygon: Let ' n ' be the number of sides.

Then sum of interior angles of a convex polygon of n sides = $(2n - 4)$ right angles.

Each interior angle = $\frac{(2n - 4)}{n}$ right angles. Each exterior angle = $\left(\frac{360}{n}\right)^\circ$.

$$\text{Number of sides} = \frac{360^0}{\text{Exterior Angle}}.$$

PROBLEMS

1. If the perimeter of a circle is equal to the length of the side of a square of area $64m^2$, then the area of the circle is

1. $\frac{16}{\pi^2} m^2$ 2. $\frac{16}{\pi} m^2$ 3. $\frac{8}{\pi^2} m^2$ 4. $\frac{8}{\pi} m^2$

Solution: Area of a square $= s^2 = 64m^2 \Rightarrow s = 8m$.

Perimeter of a circle $= 2\pi r = s = 8m$. So $r = \frac{8m}{2\pi} = \frac{4m}{\pi}$.

Area of a circle $= \pi r^2 = \pi \cdot \frac{4m}{\pi} \cdot \frac{4m}{\pi} = \frac{16}{\pi} m^2$. **So the answer is 2.**

2. If the internal angle between any two consecutive sides of a regular polygon with n sides is 120^0 , then $n =$

1. 4 2. 5 3. 6 4. 8

Solution: Each interior angle of a regular polygon $= \frac{(n-2)180}{n}$.

So $\frac{(n-2)180}{n} = 120 \Rightarrow n = 6$. **So the answer is 3.**

3. If two circles intersect at n points then the maximum possible value for n is

1. 1 2. 2 3. 3 4. 4

Solution: Two circles can intersect maximum at two points only. **So the answer is 2.**

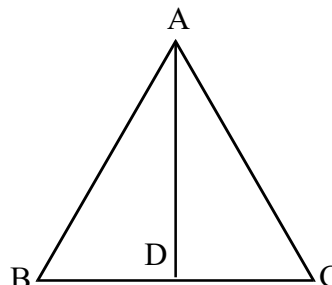
4. In $\triangle ABC$, AD is drawn perpendicular to BC. The correct relation, among the following is

1. $AC^2 - CD^2 = AB^2 - BD^2$
 2. $AB^2 - CD^2 = AC^2 - BD^2$
 3. $AC^2 - AB^2 = BD^2 - CD^2$
 4. $AC^2 - BD^2 = AB^2 - CD^2$

Solution: $AC^2 = AD^2 + CD^2$ and

$AB^2 = AD^2 + BD^2$ (by Pythagorous theorem)

$\Rightarrow AC^2 - CD^2 = AD^2 = AB^2 - BD^2$. **So the answer is 1.**



5. A parallelogram and a triangle lie on the same base; and the third vertex of the triangle lies on the opposite side parallel to the base. If the area of the parallelogram is 72sq.cm. then the area of the triangle (in sq.cms.) is

1. 144 2. 72 3. 36 4. 18

Solution: Area of parallelogram = 72sq.cm.

Area of triangle = $\frac{1}{2}$. Area of parallelogram = $\frac{1}{2} \times 72 = 36$. **So the answer is 3.**

6. If p is a point on the circle with centre C and if AB is a chord of the circle such that $\angle APB = 30^\circ$ then $\angle ACB =$

1. 30° 2. 45° 3. 60° 4. 90°

Solution: $\angle ACB = 2 \angle APB = 2(30) = 60^\circ$. **So the answer is 3.**

7. If the wheel of a motor cycle makes 1000 revolution in moving a distance 550 meters, then the radius in (in centimetres) of the wheel.

1. 87.5 2. 8.75 3. 0.875 4. 9

Solution: $1000 \times 2\pi r = 550 \times 100$ cm. So $r = \frac{35}{4} = 8.75$ cm.

So the answer is 2.

8. If M, N, R are respectively, the middle points AB, BC and CA of triangle ABC, then the ratio $\Delta ABC : \Delta MNR =$

1. 2 : 3 2. 3 : 2 3. 4 : 1 4. 1 : 4

Solution: Area of triangle MNR = $\frac{1}{4}$ area of triangle ABC.

So $\Delta ABC : \Delta MNR = 4 : 1$. **So the answer is 3.**

9. If PQRS is a cyclic rhombus, then $\angle Q =$

1. 60° 2. 150° 3. 120° 4. 90°

Solution: A cyclic rhombus is a square. So $\angle Q = 90^\circ$. **So the answer is 4.**

10. In a ΔABC , $AB = 4$, $AC = 6$ and D is a point on BC such that AD is the bisector of $\angle A$ then $BD : DC =$

1. 3 : 2 2. 2 : 3 3. 1 : 4 4. 4 : 1

Solution: $BD : DC = AB : AC = 4 : 6 = 2 : 3$. **So the answer is 2.**

11. An angle θ degrees is such that its complement is equal to one-fourth of its supplement, then $\theta =$

1. 60° 2. 90° 3. 180° 4. 45°

Solution: If sum of two angles = 90° . Then the angles are said to be complementary.

If sum of two angles = 180° . Then the angles are said to be supplementary.

So $90 - A = \frac{1}{4}(180 - A) \Rightarrow A = 60^\circ$. **So the answer is 1.**

12. The sum of the angles in a regular hexagon is =

1. 600° 2. 720° 3. 900° 4. 480°

Solution: Sum of all interior angles of a regular polygon = $(2n - 4)$ right angles.

Here $n = 6$. So $(12 - 4)90 = 720^\circ$. **So the answer is 2.**

13. Each interior angle of a regular 18-gon is =

1. 180° 2. 200° 3. 160° 4. 360°

Solution: Each interior angle of a regular polygon = $\frac{(n-2)180}{n}$.

Here $n = 18$. So $\frac{(18-2)180}{18} = 160^\circ$. **So the answer is 3.**

14. A, B and C are points on a circle with centre O. If $\angle AOC = 130^\circ$, then $\angle ABC =$

1. 65° 2. 60° 3. 55° 4. 50°

Solution: The angle subtended by an arc of a circle at the centre is double the angle subtended by the same arc at any point on the circumference of the circle.

So $\frac{130}{2} = 65^\circ$. **So the answer is 1.**

15. An equilateral triangle is inscribed in a circle of radius 6 units. Then the area of the triangle in square units is

1. $27\sqrt{3}$ 2. $\sqrt{27}$ 3. 27 4. $\frac{27}{\sqrt{3}}$

Solution: $a = \text{side} = \sqrt{3}$ radius = $6\sqrt{3}$.

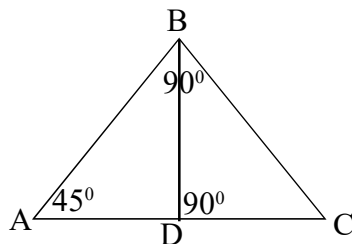
Area of the equilateral triangle = $\frac{\sqrt{3}}{4} a^2 = \frac{\sqrt{3}}{4} \cdot 6\sqrt{3} \cdot 6\sqrt{3} = 27\sqrt{3}$.

So the answer is 1.

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21.



In the above figure if $\angle ABC = \angle BDC = 90^\circ$, $BD = AD$, then $\angle BCD =$

1. 30° 2. 45° 3. 60° 4. 75°

Solution: $\angle BCD = 45^\circ$

So the answer is 1.

QUADRATIC EQUATIONS

Concepts and Formulae:

1. If $a \neq 0$, b, c are real or complex numbers then $ax^2 + bx + c$ is called a quadratic expression in x and $ax^2 + bx + c = 0$ is called a quadratic equation.
2. A real or complex number ' α ' is said to be a root or solution of the quadratic equation $ax^2 + bx + c = 0$ if $a\alpha^2 + b\alpha + c = 0$.
3. i) A quadratic equation cannot have more than two roots (or) solutions.
ii) If $ax^2 + bx + c = 0$ is satisfied for more than two values of x , then $a = b = c = 0$.
4. The roots of the quadratic equation $ax^2 + bx + c = 0$ are $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.
5. $\Delta = b^2 - 4ac$ is called the discriminant of the quadratic equation $ax^2 + bx + c = 0$.
6. i) If α, β are the roots of the quadratic equation $ax^2 + bx + c = 0$ then $\alpha + \beta = \frac{-b}{a}$, $\alpha\beta = \frac{c}{a}$
and $ax^2 + bx + c = a(x - \alpha)(x - \beta)$.
ii) The quadratic equation whose roots are α and β is,
 $(x - \alpha)(x - \beta) = 0 \Rightarrow x^2 - (\alpha + \beta)x + \alpha\beta = 0$.
7. i) $\sqrt{b}$ is irrational. If $a + \sqrt{b}$ is the root to the rational quadratic equation then $a - \sqrt{b}$ is also a root.
ii) If $a + ib$ is a root of the real quadratic equation then $a - ib$ is also a root.
8. If a, b, c are real then the nature of the roots of equation $ax^2 + bx + c = 0$ is as follows,
i) If $\Delta > 0$, then the roots are real and distinct.
ii) If $\Delta = 0$, then the roots are real and equal. In this case each root $= -\frac{b}{2a}$, this root is called the double root or a repeated root.
iii) If $\Delta < 0$, then the roots are two non-real conjugate complex numbers.
9. If a, b, c are rational and $a \neq 0$, then the nature of the roots of equation $ax^2 + bx + c = 0$ is as follows,
i) If $\Delta > 0$ and is perfect square then the roots are rational and distinct.
ii) If $\Delta > 0$ and is not perfect square then the roots are conjugate surds (irrationals).
iii) If $\Delta = 0$, then the roots are rational and equal.
iv) If $\Delta < 0$, then the roots are non-real conjugate complex numbers.
10. Relation between the roots α, β of $ax^2 + bx + c = 0$, a, b, c are real,

$$\text{i) } \alpha + \beta = -\frac{b}{a}, \alpha\beta = \frac{c}{a} \quad \text{ii) } \alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta = \frac{b^2 - 2ac}{a^2}$$

$$\text{iii) } (\alpha - \beta)^2 = (\alpha + \beta)^2 - 4\alpha\beta \Rightarrow |\alpha - \beta| = \frac{\sqrt{b^2 - 4ac}}{|a|} \text{ [if } b^2 - 4ac \geq 0]$$

$$\text{iv) } \frac{1}{\alpha} + \frac{1}{\beta} = \frac{\beta + \alpha}{\alpha\beta} = -\frac{b}{c} \text{ if } c \neq 0$$

$$\text{v) } \alpha^2 - \beta^2 = (\alpha + \beta)(\alpha - \beta) = -\frac{b}{a} = \frac{\sqrt{b^2 - 4ac}}{|a|} \text{ [if } b^2 - 4ac \geq 0]$$

$$\text{vi) } \frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{\alpha^2 + \beta^2}{\alpha\beta} = \frac{b^2 - 2ac}{ac} \text{ [if } c \neq 0]$$

$$\text{vii) } \frac{1}{\alpha^2} + \frac{1}{\beta^2} = \frac{b^2 - 2ac}{ac} \text{ [if } c \neq 0]$$

11. For any quadratic equation $ax^2 + bx + c = 0$,

i) If 'a' and 'c' are of the same sign then product of roots = $\frac{c}{a}$ is +ve

$\Rightarrow$ the roots have the same sign.

ii) If 'a' and 'c' are of opposite signs then product of roots = $\frac{c}{a}$ is -ve

$\Rightarrow$ the roots will have opposite sign.

iii) If both the roots are -ve then a, b, c will have the same sign.

iv) If the two roots are +ve then a, c will have the same sign different from the sign 'b'.

v) If $a = c$ then the roots are reciprocal to each other [product of the roots is 1].

vi) If $b = 0$ then the sum of the roots is equals to zero [the roots have the same absolute value i.e., the roots are in the form $\alpha, -\alpha$].

vii) If $a + b + c = 0$ then the roots are 1 and $\frac{c}{a}$.

viii) If $a - b + c = 0$ i.e., $a + c = b$ then the roots are -1 and $-\frac{c}{a}$.

ix) If one root is zero then $c = 0$.

x) If $a = 1, b, c$ are integers and the roots are rational numbers, then these roots must be integers.

xi) If the roots are in the ratio $m : n$, then $\frac{(m+n)^2}{mn} = \frac{b^2}{ac} \Rightarrow (m+n)^2 ac = mn b^2$.

xii) If one root is k times the other ($1 : k$), then $(1+k)^2 ac = kb^2$.

xiii) If one root is equal to the n^{th} power of the other root (α, α^n) , then

$$(ac^n)^{\frac{1}{n+1}} + (a^n c)^{\frac{1}{n+1}} + b = 0.$$

xiv) If one root is the square of the other (α, α^2) , then $ac^2 + a^2c + b^3 = 3abc$.

xv) If roots differ by unity $(\alpha, \alpha + 1)$, then $b^2 = 4ac + a^2$.

12. If $a_1x^2 + b_1x + c_1 = 0$ and $a_2x^2 + b_2x + c_2 = 0$ have the same roots then $a_1 : a_2 = b_1 : b_2 = c_1 : c_2$.

13. If the equations $a_1x^2 + b_1x + c_1 = 0$ and $a_2x^2 + b_2x + c_2 = 0$, $(a_1b_1 - a_2b_1 \neq 0)$ have a common root

then $(c_1a_2 - c_2a_1)^2 = (a_1b_2 - a_2b_1)(b_1c_2 - b_2c_1)$ and the common root is $\frac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1}$.

14. If α, β are the roots of $f(x) = ax^2 + bx + c = 0$ then

S.No.	Roots	Quadratic Equation
1.	$-\alpha, -\beta$	$f(-x) = 0$
2.	$\frac{1}{\alpha}, \frac{1}{\beta}$	$f\left(\frac{1}{x}\right) = 0$
3.	$k\alpha, k\beta (k \neq 0)$	$f\left(\frac{x}{k}\right) = 0$
4.	$\frac{\alpha}{k}, \frac{\beta}{k} (k \neq 0)$	$f(kx) = 0$
5.	$\alpha + h, \beta + h$	$f(x - h) = 0$
6.	$\alpha - h, \beta - h$	$f(x + h) = 0$
7.	α^2, β^2	$f(-\sqrt{x}) \cdot f(\sqrt{x}) = 0$
8.	α^3, β^3	$f(\sqrt[3]{x}) = 0$ or $a^3x^2 + (b^3 - 3abc)x + c^3 = 0$
9.	$\frac{\alpha}{1+\alpha}, \frac{\beta}{1+\beta}$	$f\left(\frac{x}{1-x}\right) = 0$
10.	$m\alpha + k, m\beta + k$	$f\left(\frac{x-k}{m}\right) = 0 (m \neq 0)$

15. Let $f(x) = ax^2 + bx + c$ be a quadratic function. Then,

i) If $a > 0$, then $f(x)$ has minimum value at $x = -\frac{b}{2a}$ and the minimum value $= \frac{4ac - b^2}{4a}$.

ii) If $a < 0$, then $f(x)$ has maximum value at $x = -\frac{b}{2a}$ and the maximum value $= \frac{4ac - b^2}{4a}$.

16. If $ax^2 + bx + c$ is a quadratic expression then $ax^2 + bx + c > 0$ (or) $ax^2 + bx + c \geq 0$ (or) $ax^2 + bx + c < 0$ (or) $ax^2 + bx + c \leq 0$ is called a quadratic inequation (or) quadratic inequality.

PROBLEMS

1. If α, β are the roots of the equation $x^2 + x + 1 = 0$, then the value of $\alpha^{28} - \beta^{56} =$

1. -1 2. $\alpha - \beta$ 3. $\alpha + \beta$ 4. 0

Solution: The roots of $x^2 + x + 1 = 0$ are $\alpha + \beta = -1$ -----(1).

We also have $\alpha^2 + \alpha + 1 = 0$, $\beta^2 + \beta + 1 = 0$. So $\beta^2 = -1 - \beta = \alpha \Rightarrow \beta^2 = \alpha \Rightarrow (\beta^2)^{28} = (\alpha)^{28}$

$\Rightarrow \beta^{56} = \alpha^{28} \Rightarrow \alpha^{28} - \beta^{56} = 0$. **So the answer is 4.**

2. If α and β are the roots of the equation $x^2 - ax + b = 0$ then the quadratic equation whose roots are $\alpha + \beta + \alpha\beta$ and $\alpha\beta - \alpha - \beta$ is

1. $x^2 - 2ax + a^2 - b^2 = 0$ 2. $x^2 - 2ax = a^2 - b^2$
3. $x^2 - 2bx - a^2 + b^2 = 0$ 4. $x^2 - 2bx = b^2 - a^2$

Solution: $\alpha + \beta = a$ and $\alpha\beta = b$. So $\alpha + \beta + \alpha\beta = a + b$ and $\alpha\beta - \alpha - \beta = b - a$.

So the required equation is $x^2 - x(a + b + b - a) + (a + b)(b - a) = 0$.

$\Rightarrow x^2 - 2bx + b^2 - a^2 = 0$. **So the answer is 3.**

3. If r is the ratio of the roots of the equation $ax^2 + bx + c = 0$ then $\frac{r}{(r+1)^2} =$

1. $ac - b^2$ 2. $\frac{ac}{b^2}$ 3. $ac + b^2$ 4. $\frac{b^2}{ac}$

Solution: Let α, β be the roots of the equation, then $r = \frac{\alpha}{\beta}$.

$$\text{So } \frac{r}{(r+1)^2} = \frac{\frac{\alpha}{\beta}}{\left(\frac{\alpha}{\beta} + 1\right)^2} = \frac{\alpha}{\beta} \cdot \frac{\beta^2}{(\alpha + \beta)^2} = \frac{\alpha\beta}{(\alpha + \beta)^2} = \frac{\frac{c}{a}}{\left(\frac{-b}{a}\right)^2} = \frac{c}{a} \cdot \frac{a^2}{b^2} = \frac{ac}{b^2}.$$

So the answer is 2.

4. If the product and sum of the roots of a quadratic equation are $\frac{1}{4}$ and $\frac{5}{4}$ respectively, then the equation is

1. $12x^2 - 4x + 3 = 0$

2. $x^2 - 15x + 3 = 0$

3. $4x^2 - 5x + 1 = 0$

4. $4x^2 + 5x - 1 = 0$

Solution: Let α, β be the roots. Given that $\alpha\beta = \frac{1}{4}$, $\alpha + \beta = \frac{5}{4}$. **So the answer is 3.**

(**Note:** If α, β are the roots of the quadratic equation $ax^2 + bx + c = 0$ then $\alpha + \beta = \frac{-b}{a}$, $\alpha\beta = \frac{c}{a}$ and $ax^2 + bx + c = a(x - \alpha)(x - \beta)$).

5. If α and β are the roots of the equation $ax^2 + bx + c = 0$, where a and c are not equal to zero

then $\frac{\alpha}{\beta^2} + \frac{\beta}{\alpha^2} =$

1. $\frac{3abc - b^3}{ac^3}$

2. $\frac{3abc - b^3}{ac^2}$

3. $\frac{3abc - b^3}{ac}$

4. 0

Solution: $\frac{\alpha^3 + \beta^3}{\alpha^2\beta^2} = \frac{(\alpha + \beta)(\alpha^2 - \alpha\beta + \beta^2)}{\alpha^2\beta^2} = \frac{(\alpha + \beta)[(\alpha + \beta)^2 - 3\alpha\beta]}{\alpha^2\beta^2} = \frac{\frac{-b}{a} \left[\frac{b^2}{a^2} - \frac{3c}{a} \right]}{\frac{c^2}{a^2}}$

$= -\frac{b}{a} \left[\frac{b^2 - 3ac}{a^2} \right] \frac{a^2}{c^2} = \frac{3abc - b^3}{ac^2}$. **So the answer is 2.**

6. The maximum value of the expression $5 + 6x - x^2$ is

1. 11

2. 12

3. 13

4. 14

Solution: Let $f(x) = ax^2 + bx + c$ be a quadratic function. Then, if $a < 0$, then $f(x)$ has

maximum value at $x = -\frac{b}{2a}$ and the maximum value $= \frac{4ac - b^2}{4a}$.

Here $a = -1$, $b = 6$, $c = 5$. So the maximum value $= \frac{4(-1)(5) - 6^2}{4(-1)} = \frac{-20 - 36}{-4} = \frac{56}{4} = 14$.

So the answer is 4.

7. If one root of the equation $ax^2 + bx + c = 0$ is double the other root, then

1. $2b^2 = 9ac$

2. $2b^2 = 8ac$

3. $b^2 = 9ac$

4. $2b^2 = ac$

Solution: Let α and β are the roots of the equation $ax^2 + bx + c = 0$.

Given that $\alpha = 2\beta$. Now product of the roots $= \frac{c}{a} \Rightarrow \alpha\beta = \frac{c}{a} \Rightarrow 2\beta^2 = \frac{c}{a}$ -----(1)

Sum of the roots $= -\frac{b}{a} \Rightarrow \alpha + \beta = -\frac{b}{a} \Rightarrow 2\beta + \beta = -\frac{b}{a} \Rightarrow 3\beta = -\frac{b}{a}$ -----(2)

From (1) and (2) $2\left(\frac{-b}{3a}\right)^2 = \frac{c}{a} \Rightarrow \frac{2b^2}{9a^2} = \frac{c}{a} \Rightarrow 2b^2 = 9ac$. **So the answer is 1.**

8. If $x^2 + 2(k+2)x + 36 = 0$ has equal roots, then $k =$

1. 4 2. 8 3. -4 4. 9

Solution: Let α, α be the roots, then $\alpha + \alpha = -2(k+2) \Rightarrow 2\alpha = -2(k+2) \Rightarrow \alpha = -(k+2)$

Now product of the roots $= \alpha^2 = 36 \Rightarrow \alpha = \pm 6$. So $k = -8$ or 4 .

So the answer is 1.

9. If the roots of $x^2 + px + 12 = 0$ are in the ratio 1 : 3 then $p^2 =$

1. 49 2. 36 3. 64 4. 25

Solution: Let α, β be the roots. So $\alpha = k, \beta = 3k$. Now sum of the roots $k + 3k = -p$

$\Rightarrow 4k = -p$ and product of the roots $k(3k) = 12 \Rightarrow 3k^2 = 12 \Rightarrow k^2 = 4 \Rightarrow k = \pm 2$.

$p^2 = (4k)^2 = 16k^2 = 16(4) = 64$. **So the answer is 3.**

10. The value of x for which $x^2 - 5x + 6 > 0$ are

1. $x < 2$ only 2. $x > 3$ only 3. $2 < x < 3$ 4. $x < 2$ (or) $x > 3$

Solution: $x^2 - 5x + 6 > 0 \Rightarrow (x-2)(x-3) > 0$. Now we have two cases

case (1) $x-2 > 0$ and $x-3 > 0$ (or) case (2) $x-2 < 0$ and $x-3 < 0$

$\Rightarrow x > 2$ and $x > 3$ (or) $x < 2$ and $x < 3$

$\Rightarrow x > 3$ (or) $x < 2$. **So the answer is 4.**

11. If $\sin \theta$ and $\cos \theta$ are the roots of the equation $px^2 + qx + r = 0$ then $q^2 - p^2 =$

1. $2rp$ 2. rp 3. $2p$ 3. $2r$

Solution: Sum of the roots $\Rightarrow \sin \theta + \cos \theta = -\frac{q}{p}$,

Product of the roots $\Rightarrow \sin \theta \cdot \cos \theta = \frac{r}{p}$. Therefore $(\sin \theta + \cos \theta)^2 = \frac{q^2}{p^2}$

$\Rightarrow \sin^2 \theta + \cos^2 \theta + 2 \sin \theta \cos \theta = \frac{q^2}{p^2} \Rightarrow 1 + 2\frac{r}{p} = \frac{q^2}{p^2} \Rightarrow p^2 + 2rp = q^2$.

So $q^2 - p^2 = 2rp$. **So the answer is 1.**

12. The number of solutions of $x^2 - 7|x| + 12 = 0$ is

1. 1 2. 2 3. 3 4. 4

Solution: $|x|^2 - 7|x| + 12 = 0 \Rightarrow (|x| - 3)(|x| - 4) = 0 \Rightarrow |x| = 3, |x| = 4$

$\Rightarrow x = \pm 3, \pm 4$. **So the answer is 4.**

13. If $x + y = 15$ and $\frac{1}{x} + \frac{1}{y} = \frac{3}{10}$ then the values of x and y are

1. 5, 10 2. 6, 10 3. -5, -10 4. -6, -10

Solution: $x + y = 15$ -----(1) $\frac{x+y}{xy} = \frac{3}{10} \Rightarrow 10(x+y) = 3xy$

$\therefore 3xy = 150$; $xy = 50$ -----(2). From (1) and (2) $x = 5, y = 10$. **So the answer is 1.**

14. If $\frac{11}{x} - \frac{7}{y} = 1$ and $\frac{19}{x} - \frac{4}{y} = 6$ then $(x, y) =$

1. $\left\{\frac{1}{2}, \frac{1}{3}\right\}$ 2. $\left\{\frac{1}{3}, -\frac{1}{2}\right\}$ 3. $\left\{\frac{1}{2}, -\frac{1}{3}\right\}$ 4. $-\frac{1}{3}, -\frac{1}{2}$

Solution: Verifying the given options by substituting the values we get the **answer as 1.**

ICET-2011

29. If α, β are the roots of the equation $7x^2 - 8x + 6 = 0$ then $(\alpha^2 + \beta^2)(\alpha + \beta) =$

1. $-\frac{20}{49}$ 2. $\frac{20}{49}$ 3. $-\frac{160}{343}$ 4. $\frac{160}{343}$

Solution: If α, β are the roots of the equation $ax^2 + bx + c = 0$ then $\alpha + \beta = \frac{-b}{a}$, $\alpha\beta = \frac{c}{a}$

Let α, β be the roots of the equation $7x^2 - 8x + 6 = 0$.

Now sum of the roots $\alpha + \beta = \frac{-b}{a} = \frac{8}{7}$ and product of the roots $\alpha\beta = \frac{c}{a} = \frac{6}{7}$.

Now $(\alpha^2 + \beta^2)(\alpha + \beta) = [(\alpha + \beta)^2 - 2\alpha\beta](\alpha + \beta) = \left(\frac{64}{49} - \frac{12}{7}\right)\left(\frac{8}{7}\right) = \frac{-160}{343}$.

So the answer is 3.

ICET-2012 - NO QUESTION FROM THIS.

PROGRESSIONS

1. i) A function $f: N \rightarrow R$ is called a sequence of real numbers (or real sequence).
- ii) $\{f(n)/n \in N\}$ is the range of the sequence.
- iii) We denote the elements of sequence as $\{f(n)\}$ and write them as $\{a_n\}$.
- iv) If $\{a_n\}$ is a sequence $s_n = a_1 + a_2 + \dots + a_n$ is called the sum of 'n' terms of the sequence.
- v) The sequence $\{s_n\}$ is called the series corresponding to $\{a_n\}$. We write it as $\sum a_n$.
- vi) If $\sum a_n$ consists finite number of terms it is called finite series, otherwise it is said to be infinite.

Arithmetic Progression (A.P.)

2. i) A sequence of numbers $a_1, a_2, \dots, a_n$ is said to be an Arithmetic Progression or A.P., if the difference between any two successive terms is the same (i.e. a constant)
- ii) $a, a + d, a + 2d, \dots, a + (n-1)d, \dots$ is taken as a standard A.P. 'a' is called the first term and 'd' is called the Common Difference.
- iii) For an A.P., there are two unknowns, (i) First term and (ii) Common difference.
- iv) The n^{th} term of an A.P. with first term 'a' said and Common difference 'd' is ' $a + (n-1)d$ '.

We denote it by $T_n = a + (n-1)d$.

3. The sum of first 'n' terms of an A.P. is $S_n = \frac{n}{2}(2a + (n-1)d)$, where 'a' is the first term and

'd' is the common difference. Also $S_n = \frac{n}{2}(a + T_n)$

4. Arithmetic means between two given numbers

- i) If a, b, c are in A.P. then 'b' is called the Arithmetic Mean (A.M.) of two numbers a and c .

- ii) If a, b, c are in A.P. then $b = \frac{a+c}{2}$. Hence the A.M. between two numbers a and c is

$$\frac{a+c}{2}$$

- iii) If $a, a_1, a_2, \dots, a_n, b$ are in A.P. then $a_1, a_2, \dots, a_n$ are called 'n' A.M.'s between a and b .

- iv) If there are 'n' A.M.'s between a and b then the of the A.P. is $\frac{b-a}{n+1}$.

- v) The sum of 'n' A.M.'s between a and b is $\frac{n}{2}(a+b) = n$ times the A.M. of a and b .

- vi) The 'n' A.M.'s between a and b , are given by

$$a_1 = a + \left[\frac{b-a}{n+1} \right]; a_2 = a + \left[\frac{b-a}{n+1} \right] \dots a_n = a + \frac{n(b-a)}{n+1}$$

vii) The Arithmetic mean of 'n' numbers is $\frac{a_1 + a_2 + a_3 + \dots + a_n}{n}$

5. Properties of Arithmetic Progression (A.P.)

- i) If $a_1, a_2, \dots, a_n$ are in A.P. and k is any constant then $a_1 + k, a_2 + k, \dots, a_n + k$ are also in A.P. with same common difference.
- ii) If $a_1, a_2, \dots, a_n$ are in A.P. and k is any number then $a_1 \cdot k, a_2 \cdot k, \dots, a_n \cdot k$ are also in A.P. with of the resulting A.P. is k times that of original A.P.
- iii) If $a_1, a_2, \dots, a_n$ are in A.P., then $\frac{a_1}{k}, \frac{a_2}{k}, \dots, \frac{a_n}{k}$ are also in A.P., where $k \neq 0$.
- iv) In an A.P. with finite number of terms, the sum of terms equidistant from both the ends is a constant and equal to the sum of the first and last terms i.e. if $a_1, a_2, \dots, a_n$ are in A.P. then

$$a_1 + a_n = a_2 + a_{n-1} = a_3 + a_{n-2}.$$
- v) In an A.P., with first term a and common difference d , $T_{n-k} = a + (n - k - 1)d$, $T_{n+k} = a + (n + k - 1)d$ and $T_n = a + (n - 1)d$ for $n > k$, $n \neq 1$, then $T_n = \frac{T_{n-k} + T_{n+k}}{2}$, i.e., if the terms of A.P. are chosen in regular intervals, then the terms form an A.P.

6. General ways of selecting certain terms of A.P. to make easy calculation

- i) Three numbers in A.P. may be taken as $a - d, a, a + d$.
- ii) Four numbers in A.P. may be taken as $a - 3d, a - d, a + d, a + 3d$.
- iii) Five numbers in A.P. may be taken as $a - 2d, a - d, a, a + d, a + 2d$.

7. Geometric Progression (G.P.)

- i) A sequence of non-zero numbers is said to be in G.P. if the ratio between two successive terms is a constant. The constant ratio is called the Common Ratio (C.R.)
- ii) $a, ar, ar^2, \dots, ar^{n-1}, \dots$, of non zero terms form a G.P. with first term 'a' and common ratio $= r$.
- iii) In a G.P. there are two unknowns (i) First term 'a' and (ii) common ratio 'r'.
- iv) The n^{th} term of a G.P. with first term 'a' and C.R. $= r$ is $T_n = a \cdot r^{n-1}$.
- v) If a G.P. consists of 'm' terms and $m > n$, then n^{th} term from the end is $a \cdot r^{m-n}$.

8. Geometric Means (G.M.'s)

- i) If a, b, c are positive and in G.P., b is called the G.M. between a and c and $b = \sqrt{ac}$.
- ii) If $a, g_1, g_2, \dots, g_n, b$ are positive and in G.P. then $g_1, g_2, \dots, g_n$ are called 'n' G.M.'s between a and b .
- iii) The common ratio of the G.P., with 'n' geometric means is $\left[\frac{b}{a} \right]^{\frac{1}{n+1}}$.

iv) The geometric means are given by $g_1 = a \left[\frac{b}{a} \right]^{\frac{1}{n+1}}, g_2 = a \left[\frac{b}{a} \right]^{\frac{2}{n+1}}, \dots, g_n = a \left[\frac{b}{a} \right]^{\frac{n}{n+1}}$

9. Sum of 'n' terms of a G.P.

i) The sum of first n terms of a G.P., with first term ' a ' and Common Ratio $= r$ is

$$S_n = a \frac{(1-r^n)}{(1-r)}, \text{ if } r < 1; \quad S_n = a \frac{(r^n - 1)}{(r - 1)}, \text{ if } r > 1.$$

ii) If $r = 1$, $a + a + a + \dots + a = na$. Observe the sequence $a, a, a, a, \dots$ is both in A.P. and G.P.

iii) The sum of infinite of G.P. is $S_\infty = \frac{a}{1-r}$ if $|r| < 1$ and $S_\infty = \frac{a}{1-r}$ if $r > 1$.

10. Harmonic Progression (H.P.):

i) A sequence $a_1, a_2, \dots, a_n$ of non zero numbers is said to be in H.P. if the sequence of their reciprocals $\frac{1}{a_1}, \frac{1}{a_2}, \dots, \frac{1}{a_n}, \dots$ is in A.P.

ii) A H.P. may be written as $\frac{1}{a}, \frac{1}{a+d}, \frac{1}{a+2d}, \dots, \frac{1}{a+(n-1)d}, \dots$

iii) If $a_1, a_2, \dots, a_n$ are in H.P. then the n^{th} term of the corresponding A.P. is

$$T_n = \frac{1}{a_1} + (n-1) \left[\frac{1}{a_2} - \frac{1}{a_1} \right] \quad \therefore n^{\text{th}} \text{ terms of H.P. is } T_n = \frac{1}{\frac{1}{a_1} + (n-1) \left[\frac{1}{a_2} - \frac{1}{a_1} \right]}$$

iv) If a, b, c are in H.P., then b is called the Harmonic Mean (H.M) between a and c .

$$\therefore b = \frac{2ac}{a+c}$$

v) If $a, h_1, h_2, \dots, h_n, b$ are in H.P. then $h_1, h_2, \dots, h_n$ are called ' n ' H.M.'s between a and b .

The common difference of the corresponding A.P. is $d = \frac{a-b}{(n+1)ab}$.

11. Harmonic Mean of 'n' non zero numbers

i) If $a_1, a_2, \dots, a_n$ are ' n ' non zero numbers then their H.M. $= \frac{n}{\frac{1}{a_1} + \frac{1}{a_2} + \dots + \frac{1}{a_n}}$.

12. Relationship of A, G, H (A.M., G.M. and H.M.)

i) If A is the A.M., G is the G.M. and H is the H.M. between two positive numbers then (1) $A \geq G \geq H$ and (2) $G^2 = AH$.

- ii) A, G, H form a descending G.P.

13. Arithmetic - Geometric Progression (A.G.P)

- i) A sequence of the form $a, (a + d)r, (a + 2d)r^2, \dots, [a + (n - 1)d]r^{n-1}, \dots$ is called an Arithmetico Geometric Progression or shortly A.G.P.
- ii) In the A.G.P. $a, (a + d)r, (a + 2d)r^2, \dots, [a + (n - 1)d]r^{n-1}, \dots$
- a) $a, a + d, a + 2d, \dots$ is an A.P.
- b) $1, r, r^2, \dots$ is a G.P.
- iii) n^{th} term of A.G.P. is $[a + (n - 1)d]r^{n-1}$.
- iv) $S_n = \frac{a}{1-r} + \frac{dr(1-r^{n-1})}{(1-r)^2} - \frac{[a + (n-1)d]r^n}{1-r}$
- v) If $|r| < 1$, $S_\infty = \frac{a}{1-r} + \frac{dr}{(1-r)^2}$

14. i) The sum of the first 'n' natural numbers is denoted by $\sum n \quad 1 + 2 + 3 + \dots + n = \frac{n(n+1)}{2}$.

- ii) The sum of the squares of first n-natural numbers is

$$= \sum n^2 = 1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

- iii) The sum of the cubes of first n-natural numbers is

$$= \sum n^3 = 1^3 + 2^3 + 3^3 + \dots + n^3 = \frac{n^2(n+1)^2}{4} (\sum n)^2.$$

PROBLEMS

1. The harmonic mean of 15, 10 is

1. 12.5 2. 13 3. 13.5 4. 12

Solution: The harmonic mean of a and b is $\frac{2ab}{a+b}$. Here $a = 15, b = 10$.

The harmonic mean = $\frac{2(10)(15)}{10+15} = 12$. **So the answer is 4.**

2. The Geometric mean of 4 and x is 10, then x is equal to

1. $\frac{5}{2}$ 2. 5 3. 25 4. 50

Solution: The harmonic mean of a and b is $\sqrt{ab}$. So $\sqrt{4x} = 10 \Rightarrow 4x = 100 \Rightarrow x = 25$.

So the answer is 3.

3. If the 3rd and 7th terms of an arithmetic progression are 8 and 20 respectively, then the 5th term in that progression is

1. 10 2. 12 3. 14 4. 16

Solution: $t_3 = a + (3 - 1)d = 8 \Rightarrow a + 2d = 8$;

$t_7 = a + (7 - 1)d = 20 \Rightarrow a + 6d = 20$; From these we get $4d = 12 \Rightarrow d = 3$. Then $a = 2$.

$t_5 = a + (5 - 1)d = 2 + 4(3) = 2 + 12 = 14$. **So the answer is 3.**

4. The least value of n such that $1 + 3 + 3^2 + \dots + 3^n > 2007$ is

1. 7 2. 8 3. 9 4. 10

Solution: The sum of first n terms of a G.P., with first term ' a ' and Common Ratio $= r$ is

$$S_n = a \frac{(r^n - 1)}{(r - 1)}, \text{ if } r > 1. \text{ Here } a = 1, r = 3.$$

Let us try with $n = 7$, then $S_7 = 1 \frac{(3^7 - 1)}{(3 - 1)} = \frac{2187 - 1}{2} = \frac{2186}{2} = 1093$.

Let us try with $n = 8$, then $S_8 = 1 \frac{(3^8 - 1)}{(3 - 1)} = \frac{6561 - 1}{2} = \frac{6560}{2} = 3280$.

So the least value of $n = 8$. **So the answer is 2.**

Note: $3^3 = 27$; $3^4 = 81$; $3^5 = 243$; $3^6 = 729$; $3^7 = 2187$; $3^8 = 6561$;

5. If $a_k = (\sqrt{3})^k$ for $k = 1, 2, 3, \dots$ and $\sum_{k=1}^n a_k = 39 + 13\sqrt{3}$ then $n =$

1. 6 2. 8 3. 7 4. 2

Solution: $\sum_{k=1}^n a_k = a_1 + a_2 + a_3 + a_4 + a_5 + a_6 + a_7 + \dots$

$$= (\sqrt{3})^1 + (\sqrt{3})^2 + (\sqrt{3})^3 + (\sqrt{3})^4 + (\sqrt{3})^5 + (\sqrt{3})^6 + (\sqrt{3})^7 + \dots$$

$$= \sqrt{3} + 3 + 3\sqrt{3} + 9 + 9\sqrt{3} + 27 + 27\sqrt{3} + \dots$$

$$= 39 + 13\sqrt{3} + 27\sqrt{3}. \text{ So } n = 6. \text{ So the answer is 1.}$$

6. If m, n, r are in arithmetic progression and a, b, c are in geometric progression then

$$a^{n-r} \cdot b^{r-m} \cdot c^{m-n} =$$

1. 0 2. 1 3. $\sqrt{2}$ 4. 2

Solution: m, n, r are in arithmetic progression, so $n = \frac{m+r}{2} \Rightarrow r = 2n - m$.

and a, b, c are in geometric progression then, $b = \sqrt{ac}$. So $c = \frac{b^2}{a}$.

$$\text{Substituting these in } a^{n-r} \cdot b^{r-m} \cdot c^{m-n} = a^{n-2n+m} \cdot b^{2n-m-m} \cdot \left(\frac{b^2}{a}\right)^{m-n} = a^{m-n} \cdot b^{2n-2m} \cdot (b^2)^{m-n} \cdot a^{n-m}$$

$$= a^{m-n+n-m} \cdot b^{2n-2m+2m-2n} = a^0 \cdot b^0 = 1 \cdot 1 = 1. \text{ So the answer is 2.}$$

7. If $a = b^2$ then $a^{\frac{1}{3}} \cdot a^{\frac{1}{9}} \cdot a^{\frac{1}{27}} \dots =$

1. a 2. b 3. $\frac{1}{a}$ 4. $\frac{1}{b}$

Solution: $a^{\frac{1}{3}} \cdot a^{\frac{1}{9}} \cdot a^{\frac{1}{27}} \dots = a^{\frac{1}{3} + \frac{1}{9} + \frac{1}{27} + \dots} = a^{\frac{1}{3} + \frac{1}{3^2} + \frac{1}{3^3} + \dots} = \frac{a^{\frac{1}{3}}}{1 - \frac{1}{3}} = \frac{1}{a^{\frac{1}{2}}} = b.$

So the answer is 2.

(Note: $\frac{1}{3} + \frac{1}{3^2} + \frac{1}{3^3} + \dots$ is an infinite geometric progression. The sum of infinite of G.P. is

$$S_{\infty} = \frac{a}{1-r} \text{ if } |r| < 1. \text{ Here } a = \frac{1}{3}, r = \frac{1}{3})$$

8. If the second term of an arithmetic progression is 20 and its fifth term is double the first then the sum to 20 terms of the series is

1. 64 2. 108 3. 1080 4. 2160

Solution: $t_2 = a + d = 20 \Rightarrow a = 20 - d$ -----(1)

Given that $t_5 = 2t_1 \Rightarrow a + 4d = 2a \Rightarrow 4d = a = 20 - d$ (from(1))

$\Rightarrow 5d = 20 \Rightarrow d = 4$, then from (1) $a = 20 - 4 = 16$. Some of the first 20 terms

$$S_{20} = \frac{20}{2} [2a + (20 - 1)d] = 10[2(16) + (19)4] = 10[32 + 76] = 10[108] = 1080.$$

So the answer is 3.

9. If $a_1 = 7$, $a_2 = 11$, $a_3 = 15, \dots$ and $a_n = 403$ then $n =$

1. 97 2. 98 3. 99 4. 100

Solution: $t_1 = a_1 = a = 7$; $t_2 = a_2 = a + d = 11 \Rightarrow d = 11 - a = 11 - 7 = 4$.

$t_3 = a + 2d = 15 \Rightarrow 2d = 15 - a = 15 - 7 = 8 \Rightarrow d = 4$. So the given series is an A.P.

$t_n = a_n = a + (n - 1)d = 403 \Rightarrow 7 + (n - 1)4 = 403 \Rightarrow 4n - 4 = 403 - 7 = 396$

$\Rightarrow 4n = 396 + 4 = 400 \Rightarrow n = 100$. **So the answer is 4.**

10. $16^{\frac{1}{3}} \times 16^{\frac{1}{9}} \times 16^{\frac{1}{27}} \times \dots \infty =$

1. 1 2. 4 3. 6 4. 16

Solution: $16^{\frac{1}{3}} \times 16^{\frac{1}{9}} \times 16^{\frac{1}{27}} \times \dots \infty = 16^{\frac{1}{3} + \frac{1}{9} + \frac{1}{27} + \dots} = 16^{\frac{1}{3} + \frac{1}{3^2} + \frac{1}{3^3} + \dots} = \frac{16^{\frac{1}{3}}}{1 - \frac{1}{3}} = 16^{\frac{1}{2}} = 4.$

So the answer is 2.

(Note: $\frac{1}{3} + \frac{1}{3^2} + \frac{1}{3^3} + \dots$ is an infinite geometric progression. The sum of infinite of G.P. is

$$S_{\infty} = \frac{a}{1-r} \text{ if } |r| < 1. \text{ Here } a = \frac{1}{3}, r = \frac{1}{3})$$

11. If the first two terms in an H.P are 6 and 3 then the third term is

1. 1 2. 2 3. 3 4. 5

Solution: $t_1 = \frac{1}{a} = 6 \Rightarrow a = \frac{1}{6}$; $t_2 = \frac{1}{a+d} = 3 \Rightarrow a+d = \frac{1}{3}$.

So $d = \frac{1}{3} - a = \frac{1}{3} - \frac{1}{6} = \frac{1}{6}$. Now $a+2d = \frac{1}{6} + 2 \cdot \frac{1}{6} = \frac{3}{6} = \frac{1}{2} \Rightarrow \frac{1}{a+2d} = 2$.

So $t_3 = \frac{1}{a+2d} = 2$. **So the answer is 2.**

12. $\tan\left(\frac{7\pi}{6}\right)$, $\tan\left(\frac{9\pi}{4}\right)$ and $\tan\left(\frac{10\pi}{3}\right)$ are in

1. A.P. 2. H.P. 3. G.P. 4. the ratio 1 : 2 : 3

Solution: $\tan\left(\frac{7\pi}{6}\right) = \tan\left(\pi + \frac{\pi}{6}\right) = \tan\frac{\pi}{6} = \frac{1}{\sqrt{3}}$; $\tan\left(\frac{9\pi}{4}\right) = \tan\left(2\pi + \frac{\pi}{4}\right) = \tan\frac{\pi}{4} = 1$;

$\tan\left(\frac{10\pi}{3}\right) = \tan\left(3\pi + \frac{\pi}{3}\right) = \frac{\pi}{3} = \sqrt{3}$. So they are in G.P., where $a = \frac{1}{\sqrt{3}}$;

$r = \text{common ratio} = \frac{1}{\sqrt{3}}$. **So the answer is 3.**

13. If the n^{th} term of an A.P. is $3n+2$ then the sum of the first 8 terms is

1. 112 2. 124 3. 136 4. 169

Solution: Given that $t_n = 3n+2 \Rightarrow t_1 = a = 3+2 = 5$ and $t_2 = a+d = 3(2)+2 = 6+2 = 8$.

So $d = 8 - a = 8 - 5 = 3$. Now the sum of first 8 terms, $S_8 = \frac{8}{2} [2a + (8-1)d] = 4[2(5) + 7(3)]$
 $= 4[10 + 21] = 4[31] = 124$. **So the answer is 2.**

14. If $k+2$, $4k-6$ and $3k-2$ are three consecutive terms of an A.P. then k is

1. 4 2. 3 3. 2 4. 1

Solution: $t_1 = k+2$; $t_2 = 4k-6$; $t_3 = 3k-2$.

So $t_3 - t_2 = t_2 - t_1 \Rightarrow (3k-2) - (4k-6) = (4k-6) - (k+2) \Rightarrow 3k-2-4k+6 = 4k-6-k-2$
 $\Rightarrow -k+4 = 3k-8 \Rightarrow 8+4 = 3k+k \Rightarrow 12 = 4k \Rightarrow k = 3$. **So the answer is 2.**

15. The Geometric mean between a^2 and b^2 is

1. $|ab|$ 2. a^2b^2 3. ab 4. $\frac{b^2}{a^2}$

Solution: The Geometric mean between a^2 and b^2 is $\sqrt{a^2b^2} = \pm ab = |ab|$.

So the answer is 1.

16. If the first and the ninth terms of an A.P. are -2 and 22 respectively then the thirteenth term in it is

1. 7 2. 8 3. 34 4. 22

Solution: $t_1 = a = -2$; $t_9 = a + 8d = 22 \Rightarrow 8d = 22 - a = 22 + 2 = 24 \Rightarrow d = 3$.

$t_{13} = a + 12d = -2 + 12(3) = -2 + 36 = 34$. **So the answer is 3.**

17. If a, b, c are three unequal numbers in A.P. and $a, b - a, c - a$ are in G.P. then $a : b : c =$

1. $1 : 3 : 5$ 2. $3 : 5 : 1$ 3. $5 : 1 : 3$ 4. $2 : 3 : 4$

Solution: Considering the first option, let $a = k, b = 3k, c = 5k$.

Clearly $a, b - a, c - a$ respectively $k, 2k, 4k$ are in G.P. So $a : b : c = k : 3k : 5k = 1 : 3 : 5$.

So the answer is 1.

18. If $\frac{1}{a^x} = \frac{1}{b^y} = \frac{1}{c^z}$ and a, b, c are in G.P., then $x + 3 =$

1. $2y$ 2. y 3. y^2 4. $-y$

Solution: $\frac{1}{a^x} = \frac{1}{b^y} = \frac{1}{c^z} = k$. So $a = k^x = b = k^y = c = k^z$

Since a, b, c are in G.P. $b^2 = ac \Rightarrow (k^y)^2 = k^x \cdot k^z \Rightarrow 2y = x + z$. **So the answer is 1.**

19. If 8th term of an A.P. is 17 and term is 39 then its 25th term is

1. 45 2. 47 3. 51 4. 56

Solution: $t_8 = a + 7d = 17$; $t_9 = a + 8d = 39$. Subtracting we get $d = 22 \Rightarrow d = 2$.

So $a = 17 - 7d = 17 - 14 = 3$. So $t_{25} = a + 24d = 3 + 48 = 51$. **So the answer is 3.**

20. If $a_1, a_2, \dots, a_{10}$ are arithmetic means between two numbers 3 and 47 then $a_5 =$

1. 19 2. 23 3. 29 4. 32

Solution: The ' n ' A.M.'s between a and b , are given by

$$a_1 = a + \left[\frac{b-a}{n+1} \right]; a_2 = a + \left[\frac{b-a}{n+1} \right] \dots a_n = a + \frac{n(b-a)}{n+1}.$$

$$\text{Here } a = 3; b = 47; d = \frac{b-a}{10+1} = \frac{47-3}{11} = \frac{44}{11} = 4.$$

So $a_5 = a + 5d = 3 + 5(4) = 23$. **So the answer is 2.**

21. If $x = \frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \dots + \frac{1}{n(n+1)}$, $y = \frac{1}{2} + \frac{1}{2^2} + \frac{1}{2^3} + \dots$ then $xy =$

1. 1 2. $\frac{1}{2}$ 3. $\frac{1}{3}$ 4. $\frac{1}{4}$

Solution: $x = \sum \frac{1}{n(n+1)} = \sum \left(\frac{1}{n} - \frac{1}{n+1} \right) = \left(1 - \frac{1}{2} \right) + \left(\frac{1}{2} - \frac{1}{3} \right) + \dots = 1$

$y = y_{\infty} = \frac{a}{1-r} = \frac{\frac{1}{2}}{1-\frac{1}{2}} = 1$. So $xy = 1$. **So the answer is 1.**

22. If the third and fifth terms of a G.P. are 12 and 48 respectively then the second term in it is

1. $\frac{1}{2}$ 2. 6 3. 4 4. 9

Solution: $t_3 = ar^2 = 12$; $t_5 = ar^4 = 48$. So $\frac{t_5}{t_3} = r^2 = \frac{48}{12} \Rightarrow r = 2$.

Then $a = \frac{12}{r^2} = \frac{12}{2^2} = \frac{12}{4} = 3$. So $t_2 = ar = 3(2) = 6$. **So the answer is 2.**

ICET-2012

23. The 8th term of the progression 162, 54, 18,... is

1. $\frac{2}{9}$ 2. $\frac{2}{81}$ 3. $\frac{2}{27}$ 4. $\frac{2}{243}$

Solution: The given series is a geometric progression with first term 'a' and common ratio = r. The n^{th} term of a G.P. with first term 'a' and C.R. = r is $T_n = a.r^{n-1}$. Here $a = 162$;

Common ratio $= r = \frac{1}{3}$. So 8th term $= 162 \times \left(\frac{1}{3} \right)^{8-1} = 162 \times \left(\frac{1}{3} \right)^7 = \frac{2}{27}$.

So the answer is 3.

24. The sum of the first 10 terms of the series 1, 3, 5, 7,... is

1. 75 2. 50 3. 100 4. 121

Solution: The given series is arithmetic progression first term $a = 1$. So $d = 3 - 1 = 2$.

Now the sum of first 10 terms, $S_{10} = \frac{10}{2} [2a + (10 - 1)d] = 5[2(1) + 9(2)]$
 $= 5[2 + 18] = 5[20] = 100$. **So the answer is 3.**

ICET-2011

25. The 11th term of the series 81, 27, 9,... is

1. $\frac{1}{729}$ 2. $\frac{1}{243}$ 3. $\frac{1}{2187}$ 4. $\frac{1}{3^{10}}$

Solution: The given series is a geometric progression with first term 'a' and common ratio = r.

The n^{th} term of a G.P. with first term 'a' and C.R. = r is $T_n = a.r^{n-1}$. Here $a = 81$;

$$\text{Common ratio} = r = \frac{1}{3}. \text{ So 11 th term} = 81 \times \left(\frac{1}{3}\right)^{10-1} = 81 \times \left(\frac{1}{3}\right)^9 = \frac{1}{729}.$$

So the answer is 1.

26. The sum of first 12 terms of the series 5, 3, 1, -1,... is

1. -72

2. -36

3. -48

4. -108

Solution: The given series is arithmetic progression first term $a = 5$. So $d = 3 - 5 = -2$.

$$\begin{aligned} \text{Now the sum of first 12 terms, } S_{12} &= \frac{12}{2} [2a + (12 - 1)d] = 6[2(5) + 11(-2)] \\ &= 6[10 - 22] = 6[-12] = -72. \text{ So the answer is 1.} \end{aligned}$$

POLYNOMIALS

1. If n is a non negative integer and $a_0, a_1, a_2, \dots, a_n$ are real or complex numbers and $a_0 \neq 0$, then an expression $f(x) = a_0x^n + a_1x^{n-1} + a_2x^{n-2} + \dots + a_n$ is called a polynomial in x of degree n .
2. If $f(x)$ is a polynomial of degree $n > 0$, then the equation $f(x) = 0$ is called a polynomial equation of degree n . It is also called as an algebraic equation of degree n . If $n = 0$, then $f(x)$ is said to be constant polynomial.
If $a_i = 0 \forall i$, we call the resulting polynomial as the zero polynomial.
3. If $f(x)$ is a polynomial, then the remainder of $f(x)$ when divided by $(x - a)$ is $f(a)$.
4. If $f(x)$ is a polynomial, then $f(a) = 0 \Leftrightarrow (x - a)$ is a factor of $f(x)$.
5. If $f(\alpha) = 0$ then $\alpha \in C$ is a root of the equation $f(x) = 0$.
6. Every non constant non zero polynomial equation has atleast one root.
7. Every polynomial equation of degree ' n ' has atmost ' n ' distinct roots.
8. For a polynomial equation with real coefficients, complex roots occur in conjugate pairs.
9. In an equation with rational coefficients, irrational roots occur in pairs of conjugate surds.
10. A polynomial equation of odd degree with real coefficients, has atleast one real root.
11. In an equation, if all the power of x are odd and all the coefficients are of the same sign, then the equation has no real roots except 0.
12. In an equation, if all the powers of x are even and all the coefficients are of the same signs, then the equation has no non zero real root.
13. If the expressions $f(a)$ and $f(b)$ have opposite signs then atleast one (or) an odd number of roots of $f(x) = 0$ will lie between a and b ; and if $f(a)f(b) > 0$ then either an even number of roots lie between a and b or no root lies between a and b .
14. If a root α of a polynomial equation $f(x) = 0$ occurs exactly m times (m being a positive integer greater than one), then α is said to be a repeated root or a multiple root of multiplicity m .
15. If α is a multiple root of $f(x) = 0$ of multiplicity m , then α is a root of $f'(x) = 0$ of multiplicity $(m - 1)$ if $m > 2$ and α is a root of $f'(x) = 0$ if $m = 2$.
16. Let $f(x) = 0$ be a polynomial equation. Let $g(x)$ be a H.C.F. of $f(x)$ and $f'(x)$. If α is a root of $g(x) = 0$ with multiplicity k , then α is a multiple root of $f(x) = 0$ with multiplicity $(k + 1)$.
17. Suppose $\alpha_1, \alpha_2, \dots, \alpha_n$ are the roots of $f(x) = 0$, then
 - i) The equation whose roots are $-\alpha_1, -\alpha_2, \dots, -\alpha_n$ is $f(-x) = 0$.
 - ii) The equation whose roots are $k\alpha_1, k\alpha_2, \dots, k\alpha_n$ ($k \neq 0$) is $f\left(\frac{x}{k}\right) = 0$.
 - iii) If $\alpha_i \neq 0$, for $i = 1, 2, \dots, n$, the equation whose roots are $\frac{1}{\alpha_1}, \frac{1}{\alpha_2}, \dots, \frac{1}{\alpha_n}$ is $x^n f\left(\frac{1}{x}\right) = 0$.
 - iv) The equation whose roots are $\alpha_1 + k, \alpha_2 + k, \dots, \alpha_n + k$ is $f(x - k) = 0$

v) The equation whose roots are $\alpha_1^2, \alpha_2^2, \dots, \alpha_n^2$ is $f(\sqrt{x}) f(-\sqrt{x}) = 0$

PROBLEMS

1. When $x^3 - 2x^2 - 3$ is divided by $x - 3$, the remainder is

1. -48 2. 48 3. -6 4. 6

Solution: Let $f(x) = x^3 - 2x^2 - 3$. So the remainder is $f(3) = 3^3 - 2(3)^2 - 3 = 27 - 18 - 3 = 6$.

So the answer is 4.

2. A polynomial $p(x)$ leaves remainders -1 and 3 when divided by $x - 3$ and $x + 1$ respectively. Then the remainder, when the polynomial $p(x)$ is divided by $x^2 - 2x - 3$ is

1. $x + 1$ 2. $1 - x$ 3. $2 + x$ 4. $2 - x$

Solution: Let $r(x) = ax + b$, be the remainder when $p(x)$ is divided by $x^2 - 2x - 3 = (x - 3)(x + 1)$

but given that $r(3) = -1 \Rightarrow 3a + b = -1$ -----(1) and $r(-1) = 3 \Rightarrow -a + b = 3$ -----(2).

From (1) and (2) we get $a = -1, b = 2$. So $r(x) = 2 - x$. **So the answer is 4.**

3. For any $x \in R$ the maximum value of the polynomial $7 + 10x - 5x^2$ is

1. 14 2. 12 3. 10 4. 8

Solution: The maximum value of the polynomial $ax^2 + bx + c$ is $\frac{4ac - b^2}{4a}$.

Here $a = -5, b = 10, c = 7$. Substituting and simplifying we get maximum value = 12.

So the answer is 2.

4. A factor of $(a + b + c)^3 - a^3 - b^3 - c^3$, among the following, is

1. $a + 2b$ 2. $b + 2c$ 3. $c + 2a$ 4. $a + b$

Solution: $(a + b + c)^3 - a^3 - b^3 - c^3$

$$= (a + b + c)^3 - (a^3 + b^3 + c^3)$$

$$= (a + b + c)^3 - (a + b + c)^3 + 3(a + b)(b + c)(c + a)$$

$$= 3(a + b)(b + c)(c + a)$$

So the answer is 4.

5. If $f(x) = x^2 - 4$ and $g(x) = x^3 - 3$ then the degree of the polynomial $f(g(x))$ is

1. 6 2. 5 3. 3 4. 1

Solution: $f(g(x)) = f(x^3 - 3) = (x^3 - 3)^2 - 4 = x^6 - 6x^3 + 9 - 4 = x^6 - 6x^3 + 5$.

So the degree of the polynomial $f(g(x))$ is 6. **So the answer is 1.**

6. If $x^2 + x - 2$ is a factor of the polynomial $x^4 + ax^3 + bx^2 - 12x + 16$ then the ordered pair $(a, b) =$

1. $(-3, 8)$ 2. $(3, -8)$ 3. $(-3, -8)$ 4. $(3, 8)$

Solution: $x^2 + x - 2 = (x + 2)(x - 1)$.

$x - 1$ is a factor. So $1 + a + b - 12 + 16 = 0 \Rightarrow a + b + 5 = 0 \Rightarrow a + b + 5 = 0$

$x + 2$ is a factor. So $16 - 8a + 4b + 24 + 16 = 0 \Rightarrow -8a + 4b + 56 = 0 \Rightarrow -2a + b + 14 = 0$.

Subtract this values we get $3a - 9 = 0 \Rightarrow a = 3$. So $b = -8$

So the answer is 2.

7. If $x^2 - 1$ divides $x^3 + ax^2 - bx + 6$, then the ordered pair $(a, b) =$

1. $(6, 1)$ 2. $(-6, -1)$ 3. $(-6, 1)$ 4. $(6, -1)$

Solution: $x^2 - 1 = (x - 1)(x + 1)$.

$x - 1$ is a factor. So $1 + a - b + 6 = 0 \Rightarrow a - b + 7 = 0$ -----(1)

$x + 1$ is a factor. So $-1 + a + b + 6 = 0 \Rightarrow a + b + 5 = 0$ -----(2)

Adding (1) and (2) we get $2a + 12 = 0 \Rightarrow a = -6$. So $b = 1$. So $(a, b) = (-6, 1)$

So the answer is 3.

8. If $f(x) = 2x^2 + 5x + 1$ and $g(x) = x - 4$ then $\{a \in R : g(f(Q)) = 0\}$

1. $\left\{-\frac{1}{2}, 1\right\}$ 2. $\left\{-\frac{1}{2}, -3\right\}$ 3. $\left\{\frac{1}{2}, 3\right\}$ 4. $\left\{\frac{1}{2}, -3\right\}$

Solution: $f(\alpha) = 2\alpha^2 + 5\alpha + 1$; $g(f(\alpha)) = 2\alpha^2 + 5\alpha + 1 - 4 = 0 \Rightarrow 2\alpha^2 + 5\alpha - 3 = 0$

$\alpha = \frac{-5 \pm \sqrt{25 + 24}}{4} = \frac{-5 \pm 7}{4} = \frac{-5 + 7}{4}, \frac{-5 - 7}{4} = \frac{1}{2}, -3$. **So the answer is 4.**

9. If $\frac{11}{x} - \frac{7}{y} = 1$ and $\frac{9}{x} - \frac{4}{y} = 6$ then $(x, y) =$

1. $\left(-\frac{1}{2}, \frac{1}{3}\right)$ 2. $\left(-\frac{1}{2}, -\frac{1}{3}\right)$ 3. $\left(\frac{1}{2}, -\frac{1}{3}\right)$ 4. $\left(\frac{1}{2}, \frac{1}{3}\right)$.

Solution: $\left(\frac{11}{x} - \frac{7}{y}\right)4 = 4 \Rightarrow \frac{44}{x} - 4 = \frac{28}{y} \Rightarrow \frac{44}{x} - 4 = \frac{63}{x} - 42$

$\left(\frac{9}{x} - \frac{4}{y}\right)7 = 42 \Rightarrow \frac{63}{x} - 42 = \frac{28}{y} \Rightarrow \frac{44}{x} - \frac{63}{x} = -42 - 4 \Rightarrow -\frac{19}{x} = -38 \Rightarrow x = \frac{1}{2}$

Using this we get $18 - 6 = \frac{4}{y} \Rightarrow y = \frac{4}{12} = \frac{1}{3}$. So $(x, y) = \left(\frac{1}{2}, \frac{1}{3}\right)$.

So the answer is 4.

10. If $3^{x+1} + 3^{2x+1} = 270$, then $x =$

1. 1 2. 0 3. 2 4. 4

Solution: $3(3^x + 3^{2x}) = 90 \Rightarrow 3^x + 3^{2x} = 90$. So $x = 2$. ($3^2 + 3^4 = 9 + 81 = 90$)

So the answer is 3.

11. The remainder when $x^5 + x^4 + x^3 + x^2 + x + 1$ is divided by $x + 1$ is

1. 0 2. 1 3. 2 4. 6

Solution: Let $f(x) = x^5 + x^4 + x^3 + x^2 + x + 1$.

When $f(x)$ is divided by $x + 1$, the remainder is $f(-1) = -1 + 1 - 1 + 1 - 1 + 1 = 0$

So the answer is 1.

12. If $f(x) = a^3(b - c) + b^3(c - a) + c^3(a - b)$, then the remainder when $f(a)$ is divided by $a + b + c$ is

1. $a - b$ 2. $b - c$ 3. -1 4. 0

Solution: $f(a) = a^3(b - c) + b^3(c - a) + c^3(a - b)$

$$\begin{aligned} f(a + b + c) &= (a + b + c)^3 (b - c) + b^3(c - a - b - c) + c^3(a + b + c - b) \\ &= (a + b + c)^3 (b - c) - b^3(a + b) + c^3(a + c) = 0 \end{aligned}$$

So the answer is 4.

13. If $x - a$ is a factor of $x^3 - a^2x + x + 2$ then $a =$

1. -2 2. 2 3. 1 4. -1

Solution: $f(a) = 0 \Rightarrow a^3 - a^3 + a + 2 = 0 \Rightarrow a = -2$.

So the answer is 1.

14. The remainder when $x^4 + 2x^3 - 3x^2 + x - 1$ is divided by $(x + 2)$ is

1. 15 2. -15 3. 16 4. -16

Solution: $f(x) = x^4 + 2x^3 - 3x^2 + x - 1$.

$$f(-2) = (-2)^4 + 2(-2)^3 - 3(-2)^2 - 2 - 1 = 16 - 16 - 12 - 2 - 1 = -15.$$

So the answer is 2.

15. If $f(x) = 2\left(x^2 + \frac{1}{x^2}\right) - 3\left(x + \frac{1}{x}\right)$ then $\{\alpha \in R / f(\alpha) = 0\}$ is

1. $\left\{1, \frac{1}{2}\right\}$ 2. $\left\{2, \frac{1}{2}\right\}$ 3. $\left\{3, \frac{1}{3}\right\}$ 4. $\left\{-2, \frac{1}{2}\right\}$

Solution: We have to find $\alpha \in R$ such that $f(\alpha) = 0$, using the given options we have the following

$$f(1) = 2\left(1 + \frac{1}{1}\right) - 3\left(1 + \frac{1}{1}\right) - 1 = 2(2) - 3(2) - 1 = 4 - 6 - 1 = -3 \neq 0.$$

$$f(2) = 2\left(4 + \frac{1}{4}\right) - 3\left(2 + \frac{1}{2}\right) - 1 = 8 + \frac{1}{2} - 6 - \frac{3}{2} - 1 = 1 - 1 = 0.$$

So the answer is 2.

16. The remainder when $6x^3 - 3x + 2$ is divided by $2x - 3$ is

1. $\frac{71}{4}$ 2. $\frac{71}{2}$ 3. $\frac{70}{4}$ 4. $\frac{70}{2}$

Solution: Let $f(x) = 6x^3 - 3x + 2$. The remainder is $f\left(\frac{3}{2}\right) = 6\left(\frac{3}{2}\right)^3 - 3\left(\frac{3}{2}\right) + 2$
 $= 6\left(\frac{27}{8}\right) - \frac{9}{2} + 2 = \frac{81}{4} - \frac{9}{2} + 2 = \frac{81-18+8}{4} = \frac{71}{4}$. **So the answer is 1.**

ICET-2012

17. A polynomial in x leaves remainders -1 and 7 when it is divided by $x+1$ and $x-3$ respectively.

If that polynomial is divided by $x^2 - 2x - 3$, then the remainder is

1. -7 2. $7x - 1$ 3. 6 4. $2x + 1$

Solution: $f(x) = 2x + 1$.

$f(-1) = -2 + 1 = -1$; $f(3) = 6 + 1 = 7$. **So the answer is 4.**

18. If $73 \times 74 \times 75 \times 76$ is divided by 14, then the remainder is

1. 0 2. 5 3. 10 4. 12

Solution: $73 \times 74 \times 75 \times 76 = (70+3)(70+4)(70+5)(70+6)$

= a multiple of 70 + (3)(4)(5)(6). Then the remainder is 10.

Because $(3)(4)(5)(6)/14 = 360/14$ leaves remainder 10. **Answer is 4.**

19. If $f: \mathbf{R} \rightarrow \mathbf{R}$ is a function satisfying the condition $2f(x) - 3f\left(\frac{1}{x}\right) = x^2$ for any $x \neq 0$, then $f(3)$
 =

1. $-\frac{11}{3}$ 2. 3 3. -3 4. $-\frac{10}{3}$

Solution: $2f(x) - 3f\left(\frac{1}{x}\right) = x^2 \Rightarrow 2f(3) - 3f\left(\frac{1}{3}\right) = 9$ and $2f\left(\frac{1}{3}\right) - 3f(3) = \frac{1}{9}$.

$\Rightarrow 4f(3) - 6f\left(\frac{1}{3}\right) = 18$ and $6f\left(\frac{1}{3}\right) - 9f(3) = \frac{1}{3}$.

Adding these we get $f(3) = -\frac{11}{3}$. **So the answer is 1.**

20. If the polynomial $-a^2x^3 - 2ax^2 + b^2x + 1$ is divisible by $x+1$, then $a-1 =$

1. $\pm b$ 2. $\pm 2b$ 3. $\pm(b+1)$ 4. $\pm(b-1)$

Solution: Let $f(x) = -a^2x^3 - 2ax^2 + b^2x + 1$.

Now $-a^2x^3 - 2ax^2 + b^2x + 1$ is divisible by $x+1$.

$\Rightarrow f(-1) = 0 \Rightarrow a^2 - 2a - b^2 + 1 = 0 \Rightarrow (a-1)^2 - b^2 = 0 \Rightarrow (a-1)^2 = b^2 \Rightarrow a-1 = \pm b$

So the answer is 1.

ICET-2011

21. If $x^4 - 8x^3 + 18x^2 - 8x + 1 = 0$, then the value of $x + \frac{1}{x}$ is

1. 1 2. 2 3. 3 4. 4

Solution: $x^4 - 8x^3 + 18x^2 - 8x + 1 = 0 \Rightarrow x^4 + 18x^2 + 1 = 8x^3 + 8x = 8x(x^2 + 1)$

$$\Rightarrow \frac{x^2 + 1}{x} = \frac{x^4 + 18x^2 + 1}{8x^2} = \frac{1}{8} \left(x^2 + 18 + \frac{1}{x^2} \right) = \frac{1}{8} \left(\left(x + \frac{1}{x} \right)^2 + 16 \right).$$

Let $a = x + \frac{1}{x}$, then from the above we get $a = \frac{1}{8}(a^2 + 16) \Rightarrow a^2 + 16 = 8a$

$$\Rightarrow a^2 + 16 - 8a = 0 \Rightarrow (a - 4)^2 = 0 \Rightarrow a = 4. \text{ So } x + \frac{1}{x} = 4. \text{ Answer is 4.}$$

22. The remainder when $91 \times 93 \times 95 \times 97$ is divided by 18 is

1. 12 2. 10 3. 15 4. 8

Solution: $91 \times 93 \times 95 \times 97 = (90 + 1)(90 + 3)(90 + 5)(90 + 7)$

= a multiple of $90 + (1)(3)(5)(7)$. Then the remainder is 15.

Because $(1)(3)(5)(7)/18 = 105/18$ leaves remainder 15. **Answer is 3.**

23. If $f(x) = 12x^3 - 8x^2 + 4x - 1$ then $f(-2) + f(2) + f(-1) + f(1) =$

1. -84 2. 84 3. 0 4. 434

Solution: $f(x) = 12x^3 - 8x^2 + 4x - 1$.

$$\Rightarrow f(-2) = -96 - 32 - 8 - 1; f(2) = 96 - 32 + 8 - 1; f(-1) = -12 - 8 - 4 - 1 \text{ and } f(1) = 12 - 8 + 4 - 1$$

$$f(-2) + f(2) + f(-1) + f(1) = -84 \quad \text{Answer is 1.}$$

24. A polynomial in x leaves remainders 2 and 3 when divided by $x + 1$ and $x - 1$ respectively. Then the remainder we get when that polynomial is divided by $x^2 - 1$ is

1. $\frac{3x+2}{2}$ 2. $\frac{3x-2}{2}$ 3. $\frac{x-5}{2}$ 4. $\frac{x+5}{2}$

Solution: $f(x) = \frac{x+5}{2}$

$$f(-1) = \frac{-1+5}{2} = 2; \quad f(1) = \frac{1+5}{2} = 3. \quad \text{So the answer is 4.}$$

Coordinate Geometry

1. Origin = (0, 0).
2. Equation of the line in standard form is $ax + by + c = 0$.
3. Equation of the line having slope ' m ' and passing through the point (x_1, y_1) is $y - y_1 = m(x - x_1)$. It is known as point slope form.
4. Equation of a line whose slope is ' m ' and ' y ' intercept is ' c ' is $y = mx + c$. It is known as slope intercept form.
5. Equation of a line having slope m and x intercept ' a ' is $y = m(x - a)$.
6. Equation of the line passing through the points (x_1, y_1) and (x_2, y_2) is $(x_1, x_2)(y - y_1) = (y_1 - y_2)(x - x_1)$. It is known as two point form.
7. Equation of the line having x intercept a and y -intercept b is $\frac{x}{a} + \frac{y}{b} = 1$.
8. The area of the triangle formed by coordinate axis and the line $\frac{x}{a} + \frac{y}{b} = 1$ is $\frac{1}{2} |ab|$ sq units.
9. The area of the triangle formed by the coordinate axis and the line $ax + by + c = 0$ is $\frac{c^2}{2ab}$ sq units.
10. If $a = b$ then the line $\frac{x}{a} + \frac{y}{b} = 1$ encloses maximum area with the co-ordinate axes.
11. The figure formed by the lines $ax + by + c = 0$ (or) $|ax| + |by| + c = 0$ is a rhombus and its area is $\frac{2c^2}{ab}$ sq. units.
12. The perpendicular distance from a point $P(x_1, y_1)$ to the line $ax + by + c = 0$ is $\frac{|ax_1 + by_1 + c|}{\sqrt{a^2 + b^2}}$.
13. If (h, k) is the image form (x_1, y_1) to the line $ax + by + c = 0$ then

$$\frac{(h - x_1)}{a} = \frac{(k - y_1)}{b} = \frac{-2(ax_1 + by_1 + c)}{(a^2 + b^2)}.$$
14. The image of the line $lx + my + n = 0$ with respect to $ax + by + c = 0$ is $(a^2 + b^2)(lx + my + n) - 2(la + mb)(ax + by + c) = 0$.
15. Reflection $ax + by + c = 0$ in the line $lx + my + n = 0$ is $(ax + by + c) / (l^2 + m^2) - 2(la + mb)(lx + my + n = 0)$.
16. The lines $a_1x + b_1y + c_1 = 0$, $a_2x + b_2y + c_2 = 0$ are

a) Coincident if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

b) Parallel if $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

- c) Perpendicular if $a_1a_2 + b_1b_2 = 0$
- d) Intersect if $a_2b_2 - a_2b_1 \neq 0$ and point of intersection $= \frac{(b_1c_2 - b_2c_1)}{(a_1b_2 - a_2b_1)}, \frac{(c_1a_2 - c_2a_1)}{(a_1b_2 - a_2b_1)}$
17. The distance between two parallel lines $ax + by + c_1 = 0$ and $ax + by + c_2 = 0$ is $\frac{|c_1 - c_2|}{\sqrt{a^2 + b^2}}$.
18. The distance between the points $A(x_1, y_1)$ and $B(x_2, y_2)$ is $AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.
19. The point which divides the line segment joining the points $A(x_1, y_1), B(x_2, y_2)$ in the ratio $l : m$.
- i) internally is $\left(\frac{lx_2 + mx_1}{l + m}, \frac{ly_2 + my_1}{l + m} \right) (l + m \neq 0)$
- ii) externally is $\left(\frac{lx_2 - mx_1}{l - m}, \frac{ly_2 - my_1}{l - m} \right) (l \neq m)$
20. Let A, B be two points. The point which divide $\overline{AB}$ in the ratio $1 : 2$ and $2 : 1$ are called points of trisection of $\overline{AB}$.
21. If $P(x, y)$ lies on the line joining $A(x_1, y_1), B(x_2, y_2)$ then $\frac{x_1 - x}{x - x_2} = \frac{y_1 - y}{y - y_2}$ and P divides $\overline{AB}$ in the ratio $x_1 - x : x - x_2$ that is also equals to $y_1 - y : y - y_2$.
22. x -axis divides the line segment joining $(x_1, y_1), (x_2, y_2)$ in the ratio $-y_1 : y_2$.
23. y -axis divides the line segment joining $(x_1, y_1), (x_2, y_2)$ in the ratio $-x_1 : x_2$.
24. If $D(\alpha_1, \beta_1), E(\alpha_2, \beta_2), F(\alpha_3, \beta_3)$ are the mid points of the sides $\overline{BC}, \overline{CA}, \overline{AB}$ of $\triangle ABC$, then $A(\alpha_2 + \alpha_3 - \alpha_1, \beta_2 + \beta_3 - \beta_1), B(\alpha_3 + \alpha_1 - \alpha_2, \beta_3 + \beta_1 - \beta_2), C(\alpha_1 + \alpha_2 - \alpha_3, \beta_1 + \beta_2 - \beta_3)$.
25. If $(x_1, y_1), (x_2, y_2), (x_3, y_3)$ are three consecutive vertices of a parallelogram, then the fourth vertex is $(x_1 - x_2 + x_3, y_1 - y_2 + y_3)$.
26. If a point P divides the line segment joining the points A, B in the ratio $l : m$, then the point Q which divides $\overline{AB}$ in the ratio $l : -m$ is called harmonic conjugate of P with respect to A and B .
27. The line passing through a vertex and mid-point of its opposite side of a triangle is called a median. The medians of a triangle are concurrent and the point of concurrence is called centroid or centre of gravity of the triangle.
28. Let G be the centroid of $\triangle ABC$ and D, E, F be the mid points of BC, CA, AB respectively. Then G divides the medians AD, BE, CF in the ratio $2 : 1$.
29. The centroid of the triangle formed by the points $A(x_1, y_1), B(x_2, y_2), C(x_3, y_3)$ is

$$\left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3} \right)$$

30. If the perpendicular bisectors of the sides of a triangle are concurrent then the point of concurrence is called circumcentre of the triangle.
31. If S is the circumcentre of $\triangle ABC$, then $SA = SB = SC$. The circle with centre S and radius SA passes through the three vertices A, B, C of the triangle. The circle is called circumcircle of the triangle. The radius of circumcircle of $\triangle ABC$ is called circumradius and it is denoted by R .
32. The circumcentre of a right angled triangle is the mid point of the hypotenuse.
33. The altitudes of a triangle are concurrent. The point of concurrent is called orthocenter of the triangle.
34. The orthocenter of a right angled triangle is the vertex at the right angle.
35. The internal bisectors of angles of a triangle are concurrent. The point of concurrence is called incentre. It is denoted by I .
36. If $A(x_1, y_1), B(x_2, y_2), C(x_3, y_3)$ are the vertices of $\triangle ABC$ and if $a = BC, b = CA, c = AB$ then incentre $I = \left[\frac{ax_1 + bx_2 + cx_3}{a + b + c}, \frac{ay_1 + by_2 + cy_3}{a + b + c} \right]$.
37. Orthocenter H , centroid G , circumcentre S of a triangle are collinear and G divides HS in the ratio $2 : 1$. The line passing through H, G, S is called Euler's line. If the triangle is an equilateral triangle then $H = G = S = I$ where I is the incentre.
38. The area of the triangle formed by the points $A(x_1, y_1), B(x_2, y_2)$ and $C(x_3, y_3)$ is

$$\frac{1}{2} \begin{vmatrix} x_1 & x_2 & x_3 & x_1 \\ y_1 & y_2 & y_3 & y_1 \end{vmatrix}.$$

39. The area of the triangle is denoted by $\frac{1}{2} |\sum x_1(y_2 - y_1)|$ or $\frac{1}{2} |\sum x_1y_2 - x_2y_1| =$.
40. The area of the quadrilateral formed by the points $A(x_1, y_1), B(x_2, y_2), C(x_3, y_3), D(x_4, y_4)$

$$\text{taken in order is } \frac{1}{2} \begin{vmatrix} x_1 & x_2 & x_3 & x_4 & x_1 \\ y_1 & y_2 & y_3 & y_4 & y_1 \end{vmatrix}.$$

41. The incentre of the triangle formed by $(0, 0), (a, 0), (0, b)$ is

$$\left[\frac{ab}{a + b + \sqrt{a^2 + b^2}}, \frac{ab}{a + b + \sqrt{a^2 + b^2}} \right].$$

Problems

1. The area, in square units, of the rectangle formed by the lines $x = \pm 4$ and $y = \pm 3$ is
1. 12 2. 48 3. 144 4. 72

Solution: Length = 8, breadth = 6. So area = $l \times b = 8 \times 6 = 48$. So the answer is 2.

2. The equation of the straight line that makes intercepts $\frac{1}{5}$ and $\frac{1}{7}$ on X and Y-axis respectively is

1. $5x + 7y = 35$ 2. $5x + 7y = 1$ 3. $7x + 5y = 35$ 4. $7x + 5y = 1$

Solution. Formula is $\frac{x}{a} + \frac{y}{b} = 1$ where $a = \frac{1}{5}$, $b = \frac{1}{7}$. So we get $5x + 7y = 1$.

So the answer is 2.

3. The perpendicular distance from the point (2, -3) to the line $3x + 4y - 4 = 0$ is

1. $\frac{4}{5}$ units 2. 2 units 3. $\frac{2}{5}$ units 4. 4 units

Solution: The perpendicular distance from the point (x, y) to the line $ax + by + c = 0$ is

$$\frac{|ax_1 + by_1 + c|}{\sqrt{a^2 + b^2}}. \text{ Here } x_1 = 2, y_1 = -3, a = 3, b = 4, c = -4.$$

$$\text{So the distance} = \frac{|6 - 12 - 4|}{\sqrt{3^2 + 4^2}} = \frac{10}{\sqrt{9 + 16}} = \frac{10}{\sqrt{25}} = \frac{10}{5} = 2 \text{ units. So the answer is 2.}$$

4. The intercept made by the line passing through the points (4, -5), (5, 1) on X-axis is

1. $\frac{29}{6}$ 2. $\frac{31}{6}$ 3. 29 4. 31

Solution: The equation of the line passing through

$$(x_1, y_1), (x_2, y_2) \text{ is } (y - y_1)(x_2 - x_1) = (y_2 - y_1)(x - x_1).$$

$$\text{Here } x_1 = 4, y_1 = -5, x_2 = 5, y_2 = 1.$$

$$\text{Substituting these we get } (y + 5)(5 - 4) = (1 + 5)(x - 4) \Rightarrow (y + 5) = 6x - 24.$$

$$6x - y = 29 \Rightarrow \frac{6x}{29} - \frac{y}{29} = 1. \text{ So X-intercept} = \frac{29}{6}. \text{ So the answer is 1.}$$

5. A line drawn through A(5, 3) makes an angle of 45° , with the X-axis at B. Then the distance between the points A and B is

1. $4\sqrt{3}$ 2. $4\sqrt{2}$ 3. $2\sqrt{3}$ 4. $3\sqrt{2}$

Solution: Let the point B on X axis is $(a, 0)$. Given that the line through A(5, 3) makes an

$$\text{angle } 45^\circ \text{ with X-axis. So } \tan 45^\circ = \text{slope} = \frac{y_2 - y_1}{x_2 - x_1} \Rightarrow 1 = \frac{0 - 3}{a - 5} \Rightarrow a - 5 = -3 \Rightarrow a = 2.$$

$$\text{So distance between A(5, 3), B(2, 0) is } = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{(2 - 5)^2 + (0 - 3)^2} = \sqrt{9 + 9} = \sqrt{18} = \sqrt{9 \times 2} = 3\sqrt{2}. \text{ So the answer is 4.}$$

6. The foot of the perpendicular from the point (3, -4) to Y-axis is

1. (3, 0) 2. (0, -4) 3. (-3, 4) 4. (-4, 0)

Solution: If (h, k) is the foot of the perpendicular from (x_1, y_1) on to the line $ax + by + c = 0$

then $\frac{h-x_1}{a} = \frac{k-y_1}{b} = \frac{-(ax_1+by_1+c)}{a^2+b^2}$.

Here Y-axis $\Rightarrow x=0$. So $a=1, b=0, c=0 \Rightarrow x_1=3, y_1=-4$.

Substituting these we get $\frac{h-3}{1} = \frac{k+4}{0} = \frac{-(3+0+0)}{1^2+0^2} \Rightarrow \frac{h-3}{1} = \frac{k+4}{0} = \frac{-3}{1}$

So we get $h-3=-3 \Rightarrow h=0$ and $k+4=0 \Rightarrow k=-4$.

So the answer = $(h, k) = (0, -4)$. **So the answer is 2.**

7. The equation of the straight line passing through the points $(2, -3), (3, 5)$ is
 1. $8x - y = 19$ 2. $6x + y = 9$ 3. $x + 3y = 10$ 4. $5x - 3y = 0$

The equation of the line passing through $(x_1, y_1), (x_2, y_2)$ is

$(y - y_1)(x_2 - x_1) = (y_2 - y_1)(x - x_1)$. Here $x_1=2, y_1=-3, x_2=3, y_2=5$.

Substituting we get $(y+3)(3-2) = (5+3)(x-2) \Rightarrow y+3 = 8x-16 \Rightarrow 8x - y = 19$.

So the answer is 3.

8. The point of intersection of $7x - 2y + 10 = 0$ and $7x + 2y - 10 = 0$ is
 1. $(5, 0)$ 2. $(-5, 0)$ 3. $(0, 5)$ 4. $(0, -5)$

Solution: Adding the equations we get $14x = 0 \Rightarrow x = 0$.

Substituting $x = 0$ in II-equation $0 + 2y - 10 = 0 \Rightarrow 2y = 10 \Rightarrow y = 5$.

So the point of intersection is $(0, 5)$. **So the answer is 3.**

9. The equation of the line passing through $(4, 5)$ and whose sum of intercepts is zero, is
 1. $x - y - 1 = 0$ 2. $x + y - 1 = 0$ 3. $x - y + 1 = 0$ 4. $x + y + 1 = 0$

Solution: The equation of the line with intercepts a and b is $\frac{x}{a} + \frac{y}{b} = 1$.

Given that $a + b = 0 \Rightarrow b = -a$. So we get $\frac{x}{a} + \frac{y}{-a} = 1 \Rightarrow x - y = a$.

It is passing through $(4, 5)$. So $4 - 5 = a \Rightarrow a = -1$.

So the required equation is $x - y = -1 \Rightarrow x - y + 1 = 0$. **So the answer is 3.**

10. The point of concurrence of the attitudes of a triangle is its
 1. Incentre 2. Orthocentre 3. Circumcentre 4. Centroid

Solution: Point of concurrence of the attitudes of a triangle is **orthocentre**.

Point of concurrence of the medians of a triangle is centroid.

Point of concurrence of the perpendicular bisectors of sides of a triangle is circumcentre.

Point of concurrence of the internal angular bisectors of a triangle is incentre.

So the answer is 2.

11. If the points $(k, -3), (2, -5)$ and $(-1, -8)$ are collinear then $k =$
 1. 0 2. 4 3. -2 4. -3

Solution: Slopes are equal $\frac{-5+3}{2-k} = \frac{-8+5}{-1-2} \Rightarrow (-2)(-3) = -3(2-k) \Rightarrow 6 = -6 + 3k \Rightarrow 3k = 12 \Rightarrow k = 4$. **So the answer is 2.**

12. The equation of the line with slope $-\frac{3}{4}$ and y-intercept 2 is

1. $3x + 4y = 8$ 2. $3x - 4y = 8$ 3. $4x + 3y = 2$ 4. $3x + 4y = 4$

Solution: $y = mx + c$, $y = -\frac{3}{4}x + 2 = \frac{-3x+8}{4}$ ($m = -\frac{3}{4}$, $c = 2$)

$4y = -3x + 8 \Rightarrow 3x + 4y = 8$. **So the answer is 1.**

13. If the lines $\alpha x + 2y + 1 = 0$, $\beta x + 3y + 1 = 0$ and $\gamma x + 4y + 1 = 0$ pass through a point then $\alpha + \gamma =$

1. β 2. 2β 3. $1/\beta$ 4. $1/2\beta$

Solution: $\alpha(3, -4) - \beta(2, -4) + \gamma(2, -3) = 0$

$-\alpha + 2\beta - \gamma = 0 \Rightarrow \alpha + \beta = 2\beta$. **So the answer is 2.**

14. The area of the quadrilateral formed by the points $A=(a, 0)$, $B=(0, a)$, $C=(-a, 0)$ and $D=(0, -1)$ is

1. $4a^2$ 2. $2a^2$ 3. a^2 4. $8a^2$

Solution: It is a square. With side $\sqrt{2}a$. So area $= (a\sqrt{2})^2 = 2a^2$. **So the answer is 2.**

15. If the point of intersection of the lines $x + 2y - 10 = 0$ and $2x - y - 5 = 0$ lies on the straight line

$x - 2y + k = 0$, then the value of k is

1. -2 2. 2 3. 0 4. 1

Solution: We have $2x - y - 5 = 0$ and $x + 2y - 10 = 0$.

Solving these we get $x = 4$, $y = 3$. Substituting these in $x - 2y + k = 0$.

We get $4 - 6 + k = 0 \Rightarrow k = 2$. **So the answer is 2.**

16. The image of the origin with respect to the straight line $4x + 3y - 25 = 0$ is

1. $(2, 3)$ 2. $(8, 6)$ 3. $(-8, 6)$ 4. $(6, -8)$

Solution: If (h, k) is the image of the point (x_1, y_1) with respect to the line $ax + by + c = 0$

then $\frac{h-x_1}{a} = \frac{k-y_1}{b} = \frac{-2(ax_1+by_1+c)}{a^2+b^2}$.

Here $a = 4$, $b = 3$, $c = -25$, $x_1 = 0$, $y_1 = 0$.

Substituting these we get $\frac{h-0}{4} = \frac{k-0}{3} = \frac{-2(0+0-25)}{4^2+3^2} \Rightarrow \frac{h}{4} = \frac{k}{3} = \frac{2}{1}$

So we get $h = 8$ and $k = 6$. So the answer is $(8, 6)$. **So the answer is 2.**

17. If $x + y + \mu = 0$ and $\lambda x - 5y - 5 = 0$ represent the same line then $\lambda + \mu =$

1. 1 2. 0 3. -4 4. -1

Solution: If $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ represents the same line, then

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}; \quad \frac{\lambda}{1} = \frac{-5}{1} = \frac{-5}{\mu} = \lambda = -5; \quad \mu = 1; \quad \lambda + \mu = -5 + 1 = -4.$$

So the answer is 3.

18. The points $(x, 2)$, $(-3, 4)$ and $(7, -1)$ are collinear, then the value of x is

1. 1 2. 0 3. -1 4. 2

Solution: Points are collinear means slopes are equal. So $\frac{4-2}{-3-x} = \frac{-1-4}{7+3}$

$$\Rightarrow 2(10) = -5(-3-x) \Rightarrow 20 = 15 + 5x \Rightarrow 5x = 5 \Rightarrow x = 1. \text{ So the answer is 1.}$$

19. Equation of the line passing through the point $(2, -3)$ and perpendicular to the line segment joining the points $(1, 2)$, $(-1, 5)$ is

1. $2x - 3y - 13 = 0$ 2. $2x - 3y - 9 = 0$ 3. $2x - 3y - 11 = 0$ 4. $2x - 3y - 7 = 0$

Solution: Slope of the line passing through $(1, 2)$, $(-1, 5)$ is $\frac{5-2}{-1-1} = -\frac{3}{2}$.

Slope of the line perpendicular to this line = $\frac{2}{3}$. So equation of the line is $y + 3 = \frac{2}{3}(x - 2)$.

We get $2x - 3y - 13 = 0$. **So the answer is 1.**

20. The two sides forming the right angle of a triangle whose area is 24 sq.cm. are in the ratio 3 : 4. Then the length of the hypotenuse in cm is

1. 12 2. 10 3. 8 4. 5

Solution: Let sides be $3x, 4x$. Area of the triangle = $\frac{1}{2} \times 3x \times 4x = 6x^2$.

But it was given as 24. So $6x^2 = 24 \Rightarrow x = 2$. So the two sides are 6, 8.

Hypotenuse = $\sqrt{6^2 + 8^2} = \sqrt{100} = 10$. **So the answer is 2.**

21. The equation of the straight line which cuts off equal intercepts from the axis and passes through the point $(1, -2)$ is

1. $2x + 2y + 1 = 0$ 2. $x + y + 1 = 0$ 3. $x + y - 1 = 0$ 4. $2x + 2y - 1 = 0$

Solution: The equation of the line with intercepts a and b is $\frac{x}{a} + \frac{y}{b} = 1$.

Given that $a = b$. So we get $x + y = a$. It is passing through $(1, -2)$. So $a = 1 - 2 = -1$.

So required equation is $x + y = -1$ or $x + y + 1 = 0$. **So the answer is 2.**

22. If the lines $2x + 3y = 6$, $8x - 9y + 4 = 0$, $ax + 6y - 13 = 0$ are concurrent, then $a =$

1. 3 2. 4 3. 5 4. 7

Solution: Solving the first two equations, we get $x = 1, y = \frac{4}{3}$.

Substituting these in third equation, we get $a + 8 - 13 = 0$. So $a = 5$. **So the answer is 3.**

23. In $\triangle ABC$ if $\angle A = \frac{\pi}{2}$, then the ortho center of the triangle lies at the point

1. A 2. B 3. C 4. P the mid point of AC

Solution: It is a right angle triangle. So the orthocentre is mid point of AC.

So the answer is 4.

24. The distance between the lines $3x + 4y + 1 = 0$ and $6x + 8y - 1 = 0$ is

1. 0.1 2. 0.2 3. 0.3 4. 0.4

Solution: The distance between two parallel lines $ax + by + c_1 = 0$ and $a_2x + by + c_2 = 0$ is

$$\frac{|c_1 - c_2|}{\sqrt{a^2 + b^2}}. \text{ Here } a = 3, b = 4, c_1 = 1, c_2 = \frac{-1}{2}. \text{ Substituting these we get } \frac{1}{10} = 0.1.$$

So the answer is 1.

25. If $a \neq b$, the point of intersection of the lines $\frac{x}{a} + \frac{y}{b} = 1$ and $\frac{x}{b} + \frac{y}{a} = 1$ lies on

1. $ax + by = 0$ 2. $ay + bx = 0$ 3. $x + y = 0$ 4. $x - y = 0$

Solution: The given equations are $bx + ay - ab = 0$ and $ax + by - ab = 0$.

From these we have $bx + ay = ab = ax + by \Rightarrow (b - a)x - (b - a)y = 0$

$\Rightarrow x - y = 0$. **So the answer is 4.**

26. The equation of the line passing through $(1, -1)$ and perpendicular to $5x - 2y + 4 = 0$ is

1. $2x + 5y + 3 = 0$ 2. $2x + 5y - 3 = 0$ 3. $2x - 5y + 3 = 0$ 4. $2x - 5y - 3 = 0$

Solution: The equation of the line passing through (x_1, y_1) and perpendicular to the line $ax + by + c = 0$ is $b(x - x_1) - a(y - y_1) = 0$. Here $x_1 = 1, y_1 = -1, a = 5, b = -2$.

Substituting we get $2x + 5y + 3 = 0$. **So the answer is 1.**

27. The lines $x = 2, y = 3$ meet at the point

1. $(0, 3)$ 2. $(2, 3)$ 3. $(2, 0)$ 4. $(3, 2)$

Answer is 2.

28. The equation of the line perpendicular to $y = 4$ and passing through $(10, 4)$ is

1. $y = 10$ 2. $y = -10$ 3. $x = 10$ 4. $x = -10$

Solution: The equation of the line passing through (x_1, y_1) and perpendicular to the line $ax + by + c = 0$ is $b(x - x_1) - a(y - y_1) = 0$. Here $x_1 = 10, y_1 = 4, a = 0, b = 1$.

Substituting these we get $x = 10$. **So the answer is 3.**

ANSWERS

1. **2** 2. **2** 3. **2** 4. **1** 5. **4** 6. **2** 7. **3** 8. **3** 9. **3** 10. **2**
 11. **2** 12. **1** 13. **2** 14. **2** 15. **2** 16. **2** 17. **3** 18. **1** 19. **1** 20. **2**
 21. **2** 22. **3** 23. **4** 24. **1** 25. **4** 26. **1** 27. **2** 28. **3**

ICET-2012

29. If a straight line is passing through the points (3,3) and (7,6), then the length of the portion of the line intercepted between the coordinate axes is

1. $4/5$ 2. $4/7$ 3. $5/4$ 4. $7/4$

Solution: Equation of the line passing through these two points is $(3x - 4y + 3 = 0)$.

The coordinates of the points on the axes are $(0, \frac{3}{4})$ and $(-1, 0)$.

The length of the portion of the line intercepted between the coordinate axes = distance between

$(0, \frac{3}{4})$ and $(-1, 0) = \frac{5}{4}$. **Answer is 3.**

30. The equation of a straightline whose slope is 1 and X-intercept is 4, is

1. $x+y+4=0$ 2. $x+y-4=0$ 3. $x-y-4=0$ 4. $x-y+4=0$

Solution: Equation of the line with the slope m and X-intercept a is $y = m(x - a)$.

Here $m = 1, a = 4$. So we get $y = 1(x - 4) \Rightarrow x - y - 4 = 0$. **Answer is 3.**

31. The foot of the perpendicular of the point (1, 2) on the line $3x + 4y = 1$ is

1. $(\frac{-1}{5}, \frac{2}{5})$ 2. $(\frac{1}{5}, \frac{-2}{5})$ 3. $(\frac{11}{25}, \frac{2}{25})$ 4. $(\frac{1}{25}, \frac{-2}{25})$

Solution: If (h, k) is the foot of the perpendicular from (x_1, y_1) on to the line $ax + by + c = 0$

then $\frac{h - x_1}{a} = \frac{k - y_1}{b} = \frac{-(ax_1 + by_1 + c)}{a^2 + b^2}$.

Here $a = 3, b = 4, c = -1 \Rightarrow x_1 = 1, y_1 = 2$.

Substituting these we get $h = \frac{-1}{5}$ and $k = \frac{2}{5}$. **Answer is 1.**

32. The area (in square units) of the polygon whose vertices taken in order are (0, 0), (6, 0), (6, 6), (4, 4) and (0, 6) is

1. 24 2. 26 3. 30 4. 36

Solution: Area of the polygon = Area of the rectangle formed with the points (0, 0), (6, 0), (4, 4), (0, 4) + area of the triangle formed by the points (0, 4), (4, 4), (0, 6) + area of the triangle formed by the points (4, 4), (6, 6), (6, 4) = 24 + 4 + 2 = 30. **Answer is 3.**

33. If two circles of radii 5cm and 12cm touch each other externally, then the distance between their centres (in centimetres) is

1. 13 2. 17 3. 7 4. 12

Solution: Distance between their centres = sum of radii = 5 + 12 = 17. **Answer is 2.**

ICET-2011

34. The slope of the line $\frac{3x+5}{4y-7} = \frac{1}{2}$ is

1. $\frac{3}{2}$ 2. $-\frac{3}{2}$ 3. $\frac{2}{3}$ 4. $-\frac{2}{3}$

Solution: $\frac{3x+5}{4y-7} = \frac{1}{2} \Rightarrow 6x + 10 = 4y - 7 \Rightarrow 4y = 6x + 17 \Rightarrow y = \frac{6}{4}x + \frac{17}{4} = \frac{3}{2}x + \frac{17}{4}$

$y = mx + c$, where m is slope. Here $m = \frac{3}{2}$. **Answer is 1.**

35. The Y-intercept of the line $\frac{3y-7}{4} = \frac{4x+1}{5}$ is

1. $-\frac{7}{3}$ 2. $\frac{7}{3}$ 3. $-\frac{39}{15}$ 4. $\frac{39}{15}$

Solution: $\frac{3y-7}{4} = \frac{4x+1}{5} \Rightarrow 15y - 35 = 16x + 4 \Rightarrow 16x - 15y = -39 \Rightarrow \frac{x}{-\frac{39}{16}} + \frac{y}{\frac{39}{15}} = 1$.

So Y is intercept is $\frac{39}{15}$. **Answer is 4.**

36. The distance (in metres) between two parallel tangents drawn to a circle of area 616 sq.m is

(Take $\pi = \frac{22}{7}$)

1. 14 2. 28 3. $\frac{14}{\pi}$ 4. $\frac{28}{\pi}$

Solution: $\pi r^2 = 616 \Rightarrow r^2 = 616 \times \frac{7}{22} = 196 \Rightarrow r = 14$.

Distance between two parallel tangents = $2r = 2(14) = 28$. **Answer is 2.**

MATRICES

1. Matrix: A rectangular array of numbers having ' m ' rows and ' n ' columns is called a matrix of order m by n .
2. Square matrix: If $m = n$ then it is known as square matrix.
3. Rectangular matrix: If $m \neq n$ then it is known as rectangular matrix.
4. Row matrix: If only one row is present ($m = 1$) in a matrix then it is known as row matrix.
5. Column matrix: If only one column is present ($n = 1$) in a matrix then it is known as column matrix.
6. Equal matrices: Same type, same order and corresponding elements are equal.
7. Null matrix or zero matrix: all the elements are zero.
8. Principal diagonal: In a matrix all those elements a_{ij} for which $i = j$ is called elements of principle diagonal.
9. Diagonal matrix: The square matrix is called diagonal matrix if all the elements of a matrix are zero except those of principal diagonal matrix.
10. Trace: Sum of the principal diagonal elements of a square matrix is called trace of the matrix.
Trace $(A + B) = \text{Trace } A + \text{Trace } B$; Trace $(KA) = K \text{ Trace } A$
11. Scalar matrix: A diagonal matrix in which the diagonal elements are equal all other elements being zero is called scalar matrix.
12. Identity of Unit matrix (I): In scalar matrix if the diagonal elements are unity then it is identity matrix.
13. Determine of matrix: The determine of the square matrix $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ is the unique number
(determine $= ad - bc$).
14. The determinant of a square matrix is the sum of the product of the element of any column (row) with there corresponding cofactors.
15. Singular matrix; $\det = 0$.
16. Non-singular matrix: $\det \neq 0$.
17. Idempotent matrix: A square matrix A is said to be idempotent matrix is $A^2 = A$.
18. Nilpotent matrix: for square matrix A if $A^n = 0$, then A is called nilpotent matrix.
19. Involuntary matrix: A square matrix A is said to be involuntary matrix $A^2 = I$.
20. Tranpose of matrix: The matrix obtained from a given matrix A by interchanging its rows and columns is called transpose of the matrix A .
1. $(A^T)^T = A$; 2. $(A + B)^T = A^T + B^T$; 3. $(AB)^T = B^T \cdot A^T$ 4. $(ABC)^T = C^T B^T A^T$
21. Orthogonal matrix: A square matrix A is said to be orthogonal matrix if $AA^T = A^T A = I$.

22. Symmetric matrix: A square matrix A is symmetric if $A^T = A$.
23. Skew-symmetric matrix: $A^T = -A$
24. Addition of two matrices are possible if they are of same type and order.
25. Rules for multiplication: The product of two matrices A and B are possible if No. of columns of $A =$ No. of rows of B .
26. Conjugate of matrix: The matrix obtained from any given matrix A on replacing its elements by conjugate complex number is called conjugate of A and is written as $\bar{A}$.
27. Adjoint matrix: Let A be a square matrix. The transpose of matrix obtained from A by replacing the elements of A by cofactors is called the adjoint of A .
28. Inverse of matrix; If $AB = BA = I$ then B is called inverse of A and $B = A^{-1}$.
29. The determinant of a triangular matrix is the product of the elements of the principal diagonal of the matrix.

PROBLEMS

1. If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ and $\det A = 5$, then the determinant of the matrix $\begin{bmatrix} 4a & 4b \\ 3c & 3d \end{bmatrix}$ is
1. 20 2. 15 3. 35 4. 60

Solution: $\det A = ad - bc = 5$. So $\begin{vmatrix} 4a & 4b \\ 3c & 3d \end{vmatrix} = 12ad - 12bc = 12(ad - bc) = 12(5) = 60$.

So the answer is 4.

2. If $A = \begin{bmatrix} 3 & -1 \\ 0 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 1 \\ 4 & -1 \end{bmatrix}$ then the determinant of $2A + 3B$ is
1. 12 2. 72 3. 48 4. 60

Solution: $2A + 3B = 2\begin{bmatrix} 3 & -1 \\ 0 & 5 \end{bmatrix} + 3\begin{bmatrix} 2 & 1 \\ 4 & -1 \end{bmatrix} = \begin{bmatrix} 6 & -2 \\ 0 & 10 \end{bmatrix} + \begin{bmatrix} 6 & 3 \\ 12 & -3 \end{bmatrix} = \begin{bmatrix} 12 & 1 \\ 12 & 7 \end{bmatrix}$

So the determinant of $2A + 3B = 12(7) - 12(1) = 84 - 12 = 72$. **So the answer is 2.**

3. The inverse of the matrix $\begin{bmatrix} \cos \theta & \sin \theta \\ \sin \theta & -\cos \theta \end{bmatrix}$ is

1. $\begin{bmatrix} -\cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{bmatrix}$ 2. $\begin{bmatrix} \cos \theta & \sin \theta \\ \sin \theta & -\cos \theta \end{bmatrix}$
3. $\begin{bmatrix} -\cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix}$ 4. $\begin{bmatrix} -\cos \theta & \sin \theta \\ \sin \theta & \cos \theta \end{bmatrix}$

Solution: If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ and if $ad - bc \neq 0$, then $A^{-1} = \frac{1}{ad - bc} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$.

Here $a = \cos \theta$, $b = \sin \theta$, $c = \sin \theta$, $d = -\cos \theta$. So $ad - bc = -\cos^2 \theta - \sin^2 \theta = -1$.

So the inverse of given matrix $= (-1) \begin{bmatrix} -\cos \theta & -\sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix} = \begin{bmatrix} \cos \theta & \sin \theta \\ \sin \theta & -\cos \theta \end{bmatrix}$

So the answer is 2.

4. If $A = \begin{bmatrix} 4 & -1 \\ 2 & 3 \end{bmatrix}$, then $A^2 - 7A =$

1. 14 2. 14 I 3. -14 4. -14 I

Solution: $A^2 - 7A = \begin{bmatrix} 4 & -1 \\ 2 & 3 \end{bmatrix} \begin{bmatrix} 4 & -1 \\ 2 & 3 \end{bmatrix} - 7 \begin{bmatrix} 4 & -1 \\ 2 & 3 \end{bmatrix} = \begin{bmatrix} 4(4) - 1(2) & 4(-1) - 1(3) \\ 2(4) + 3(2) & 2(-1) + 3(3) \end{bmatrix} -$
 $\begin{bmatrix} 28 & -7 \\ 14 & 21 \end{bmatrix}$

$= \begin{bmatrix} 16 - 2 - 28 & -4 - 3 + 7 \\ 8 + 6 - 14 & -2 + 9 - 21 \end{bmatrix} = \begin{bmatrix} -14 & 0 \\ 0 & -14 \end{bmatrix} = -14 \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = -14 I$. **So the answer is 4.**

5. Let A be a 3 x 3 matrix and $\det A = 5$, then $\det 5A =$

1. 5^4 2. 5^3 3. 5^2 4. 5

Solution: $\det 5A = 5^3 \times \det A = 5^3 \times 5 = 5^4$. **So the answer is 1.**

6. If $i = \sqrt{-1}$ and $A = \begin{bmatrix} i & 0 \\ 0 & -i \end{bmatrix}$ then $A^7 =$

1. I 2. -I 3. A 4. -A

Solution: A is a triangular matrix. So $A^7 = \begin{bmatrix} i^7 & 0 \\ 0 & (-i)^7 \end{bmatrix} = \begin{bmatrix} -i & 0 \\ 0 & i \end{bmatrix} = -A$.

So the answer is 4. (note $i^2 = -1$, $i^4 = 1$, $i^6 = -1$, $i^7 = -i$)

7. $\begin{bmatrix} 2 & 6 \\ 1 & 3 \end{bmatrix} \begin{bmatrix} 3 & -6 \\ -1 & 2 \end{bmatrix} =$

1. $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ 2. $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ 3. $\begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$ 4. $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

Solution: $\begin{bmatrix} 2(3) + 6(-1) & 2(-6) + 6(2) \\ 1(3) + 3(-1) & 1(-6) + 3(2) \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$. **So the answer is 4.**

8. If $f(\alpha) = \begin{bmatrix} \sin \alpha & -\cos \alpha \\ \cos \alpha & \sin \alpha \end{bmatrix}$ then $\sin \alpha \cdot f(\alpha) + \cos \alpha \cdot f\left(\frac{\pi}{2} + \alpha\right) =$

1. $\begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$

2. $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

3. $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$

4. $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$

Solution: $f\left(\frac{\pi}{2} + \alpha\right) = \begin{bmatrix} \sin\left(\frac{\pi}{2} + \alpha\right) & -\cos\left(\frac{\pi}{2} + \alpha\right) \\ \cos\left(\frac{\pi}{2} + \alpha\right) & \sin\left(\frac{\pi}{2} + \alpha\right) \end{bmatrix} = \begin{bmatrix} \cos \alpha & \sin \alpha \\ -\sin \alpha & \cos \alpha \end{bmatrix}$

$$\begin{aligned} \sin \alpha \cdot f(\alpha) + \cos \alpha \cdot f\left(\frac{\pi}{2} + \alpha\right) &= \sin \alpha \begin{bmatrix} \sin \alpha & -\cos \alpha \\ \cos \alpha & \sin \alpha \end{bmatrix} + \cos \alpha \begin{bmatrix} \cos \alpha & \sin \alpha \\ -\sin \alpha & \cos \alpha \end{bmatrix} \\ &= \begin{bmatrix} \sin^2 \alpha & -\sin \alpha \cos \alpha \\ \sin \alpha \cos \alpha & \sin^2 \alpha \end{bmatrix} + \begin{bmatrix} \cos^2 \alpha & \sin \alpha \cos \alpha \\ -\sin \alpha \cos \alpha & \cos^2 \alpha \end{bmatrix} \\ &= \begin{bmatrix} \sin^2 \alpha + \cos^2 \alpha & -\sin \alpha \cos \alpha + \sin \alpha \cos \alpha \\ \sin \alpha \cos \alpha - \sin \alpha \cos \alpha & \sin^2 \alpha + \cos^2 \alpha \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}. \text{ So the answer is 2.} \end{aligned}$$

9. If $0 < \theta < 90^\circ$ and the matrix $\begin{bmatrix} \sin^2 \theta & 1 \\ 1 & \sec^2 \theta \end{bmatrix}$ has no inverse then $\theta =$

1. 30°

2. 45°

3. 60°

4. 75°

Solution: The matrix has no inverse, so its det value = 0. So we get $\sin^2 \theta \cdot \sec^2 \theta - 1 = 0$.

$$\Rightarrow \frac{\sin^2 \theta}{\cos^2 \theta} = 1 \Rightarrow \sin^2 \theta = \cos^2 \theta \Rightarrow \theta = 45^\circ. \text{ So the answer is 2.}$$

10. If $\begin{bmatrix} 2 & -1 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 \\ 5 \end{bmatrix}$, then $2x - 3y =$

1. 1

2. -1

3. 2

4. 0

Solution: $\begin{bmatrix} 2x - y \\ x + y \end{bmatrix} = \begin{bmatrix} 4 \\ 5 \end{bmatrix}$. So $2x - y = 4$ and $x + y = 5$.

Adding we get $3x = 9 \Rightarrow x = 3$. Then we get $y = 2$. So $2x - 3y = 6 - 6 = 0$

So the answer is 4.

11. The inverse of matrix $A = \begin{bmatrix} 3 & 5 \\ 1 & 2 \end{bmatrix}$ is

1. $\begin{bmatrix} 2 & 5 \\ 1 & -3 \end{bmatrix}$ 2. $\begin{bmatrix} 2 & -5 \\ -1 & 3 \end{bmatrix}$ 3. $\begin{bmatrix} -2 & -5 \\ 1 & 0 \end{bmatrix}$ 4. $\begin{bmatrix} 5 & -3 \\ 2 & -1 \end{bmatrix}$

Solution: If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ and if $ad - bc \neq 0$, then $A^{-1} = \frac{1}{ad - bc} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$.

Here $a = 3$, $b = 5$, $c = 1$, $d = 2$. So $ad - bc = 6 - 5 = 1$

So the inverse of given matrix $= (1) \begin{bmatrix} 2 & -5 \\ -1 & 3 \end{bmatrix} = \begin{bmatrix} 2 & -5 \\ -1 & 3 \end{bmatrix}$

So the answer is 2.

ICET-2012

12. If $A = \begin{pmatrix} 0 & -2 \\ 2 & 0 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$, then $AB + BA =$

1. $\begin{pmatrix} 0 & -2 \\ 2 & 0 \end{pmatrix}$ 2. $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$ 3. $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$ 4. $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

Solution: $AB + BA = \begin{bmatrix} 0 & 2 \\ 2 & 0 \end{bmatrix} + \begin{bmatrix} 0 & -2 \\ -2 & 0 \end{bmatrix} = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$.

So the answer is 3.

13. If A, B are square matrices of same order such that $B = -A^{-1}BA$, then $(A+B)^2 =$

1. 0 2. $A + B$ 3. $A^2 + B^2$ 4. $A^2 + 2AB + B^2$

Solution: Given that $B = -A^{-1}BA \Rightarrow AB = A(-A^{-1}BA) = -AA^{-1}BA = -IBA = -BA \Rightarrow AB + BA = O$.

Now $(A+B)^2 = (A+B)(A+B) = A(A+B) + B(A+B) = A^2 + AB + BA + B^2 = A^2 + B^2$. **Answer is 3.**

ICET-2011

14. If A, B are 3×3 matrices such that $A = 2$, $\det B = -1$, then $\det(4AB) =$

1. -8 2. -32 3. 8 4. -128

Solution: $\det(4AB) = 4^3(\det A)(\det B) = 4^3(2)(-1) = -128$. **Answer is 4.**

15. If $A = \begin{bmatrix} 2x+3 & -4 \\ x+7 & 2 \end{bmatrix}$ and if $\det A = 0$, then $x =$

1. $\frac{17}{4}$ 2. $\frac{14}{7}$ 3. $\frac{-14}{7}$ 4. $\frac{-17}{4}$

Solution: $\det A = 0 \Rightarrow \begin{vmatrix} 2x+3 & -4 \\ x+7 & 2 \end{vmatrix} = 0 \Rightarrow 2(2x+3) + 4(x+7) = 0$

$$\Rightarrow 4x + 6 + 4x + 28 = 0 \Rightarrow 8x + 34 = 0 \Rightarrow 8x = -34 \Rightarrow x = \frac{-17}{4}. \text{ Answer is 4.}$$

ICET - 2013

16. If A is a square matrix and A^T denotes its transpose, then the matrix $A \cdot A^T$ is always
 1. a symmetric matrix 2. a skew symmetric matrix
 3. an orthogonal matrix 4. a null matrix

Answer is 1.

17. If A is a 3 x 3 square matrix and if $A \cdot \text{adj} A = \begin{bmatrix} 4 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & 0 \end{bmatrix}$, then $\det(2A) =$

1. 4 2. 32 3. 8 4. 64

Solution: $\det(2A) = 2^3 \times \det A = 8 \times 4 = 32$ **Answer is 2.****ICET - 2014:**

18. If A and B are two matrices such that $AB = A$, $BA = B$, then $A^2 + B^2 =$
 1. $A + B$ 2. $A - B$ 3. $2A + B$ 4. $A + 2B$

Solution: $A^2 + B^2 = AA + BB = ABA + BAB = AB + BA = A + B$ **Answer is 1.**

19. $\begin{bmatrix} 2 & 16 \\ -8 & 0 \end{bmatrix} = \begin{bmatrix} a & b^2 \\ c^3 & 0 \end{bmatrix}$, $c < 0, b < 0 \Rightarrow 3a + b + c =$

1. 2 2. -2 3. 4 4. 0

Solution: $3a + b + c = 3(2) + (-4) + (-2) = 0$ **Answer is 4.****Telangana ICET - 2015:**

20. Let A be a 3 x 3 matrix and $\det A = 5$, then $\det 5A =$
 1. 5^4 2. 5^3 3. 5^2 4. 5

Solution: $\det 5A = 5^3 \times \det A = 5^3 \times 5 = 5^4$. **So the answer is 1.**

21. $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix} \Rightarrow A^2 - 4A =$ **The answer is 4.**

1. $2I$ 2. $3I$ 3. $4I$ 4. $5I$

Trigonometry:

$$1. \sin \theta \operatorname{cosec} \theta = 1; \tan \theta \cot \theta = 1; \cos \theta \sec \theta = 1; \tan \theta = \frac{\sin \theta}{\cos \theta}, \cot \theta = \frac{\cos \theta}{\sin \theta}$$

$$2. \sin^2 \theta + \cos^2 \theta = 1; \sec^2 \theta - \tan^2 \theta = 1; \operatorname{cosec}^2 \theta - \cot^2 \theta = 1$$

$$3. \sin 15^\circ = \frac{\sqrt{3}-1}{2\sqrt{2}}; \cos 15^\circ = \frac{\sqrt{3}+1}{2\sqrt{2}}; \tan 15^\circ = 2-\sqrt{3}; \cot 15^\circ = 2+\sqrt{3}$$

$$4. \sin 18^\circ = \frac{\sqrt{5}-1}{4}; \cos 18^\circ = \frac{\sqrt{10+2\sqrt{5}}}{4}; \cos 36^\circ = \frac{\sqrt{5}+1}{4}; \sin 36^\circ = \frac{\sqrt{10-2\sqrt{5}}}{4}$$

$$5. \sin(A+B) = \sin A \cos B + \cos A \sin B; \sin(A-B) = \sin A \cos B - \cos A \sin B$$

$$6. \cos(A+B) = \cos A \cos B - \sin A \sin B; \cos(A-B) = \cos A \cos B + \sin A \sin B$$

$$7. \tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}; \cot(A+B) = \frac{\cot A \cot B - 1}{\cot B + \cot A}$$

$$8. \sin(A+B) \sin(A-B) = \sin^2 A - \sin^2 B = \cos^2 B - \cos^2 A$$

$$\cos(A+B) \cos(A-B) = \cos^2 A - \sin^2 B = \cos^2 B - \sin^2 A$$

$$9. \tan(A+B) \tan(A-B) = \frac{\tan^2 A - \tan^2 B}{1 - \tan^2 A \tan^2 B}$$

$$10. \cot(A+B) \cot(A-B) = \frac{\cot^2 A \cot^2 B - 1}{\cot^2 B - \cot^2 A}$$

$$11. \tan(45^\circ + \theta) = \frac{1 + \tan \theta}{1 - \tan \theta} = \frac{\cos \theta + \sin \theta}{\cos \theta - \sin \theta}; \tan(45^\circ - \theta) = \frac{1 - \tan \theta}{1 + \tan \theta} = \frac{\cos \theta - \sin \theta}{\cos \theta + \sin \theta}$$

$$12. \sin 2\theta = 2 \sin \theta \cos \theta = \frac{2 \tan \theta}{1 + \tan^2 \theta}$$

$$13. \cos 2\theta = \cos^2 \theta - \sin^2 \theta = 2\cos^2 \theta - 1 = \frac{1 - \tan^2 \theta}{1 + \tan^2 \theta}$$

$$14. \cos^2 \theta = \frac{1 + \cos 2\theta}{2}; \sin^2 \theta = \frac{1 - \cos 2\theta}{2}$$

$$15. \tan 2\theta = \frac{2 \tan \theta}{1 - \tan^2 \theta}; \sin 3\theta = 3 \sin \theta - 4 \sin^3 \theta; \cos 3\theta = 4 \cos^3 \theta - 3 \cos \theta$$

$$16. \sin C + \sin D = 2 \sin \frac{(C+D)}{2} \cos \frac{(C-D)}{2}$$

$$17. \sin C - \sin D = 2 \cos \frac{(C+D)}{2} \sin \frac{(C-D)}{2}$$

$$18. \cos C + \cos D = 2 \cos \frac{(C+D)}{2} \cos \frac{(C-D)}{2}$$

$$19. \cos C - \cos D = 2 \sin \frac{(C+D)}{2} \sin \frac{(C-D)}{2}$$

$$20. \sin(A+B) + \sin(A-B) = 2 \sin A \cos B; \quad \sin(A+B) - \sin(A-B) = 2 \cos A \sin B$$

$$21. \cos(A+B) - \cos(A-B) = 2 \cos A \cos B; \quad \cos(A+B) + \cos(A-B) = 2 \sin A \sin B$$

$$22. \text{Maximum value of } a \cos x + b \sin x + c \text{ is } C + \sqrt{a^2 + b^2}.$$

$$23. \text{Minimum value of } a \cos x + b \sin x + c \text{ is } C - \sqrt{a^2 + b^2}$$

Problems

1. $\cot 15^\circ =$

1. $2 + \sqrt{3}$ 2. $2 - \sqrt{3}$ 3. $\sqrt{3} - 2$ 4. $3 - \sqrt{2}$

Solution: $\cot(A - B) = \frac{\cot A \cot B + 1}{\cot B - \cot A}$. So $\cot 15 = \cot(45 - 30) =$

$$\frac{\cot 45 \cot 30 + 1}{\cot 30 - \cot 45}$$

$$= \frac{1(\sqrt{3}) + 1}{\sqrt{3} - 1} = \frac{\sqrt{3} + 1}{\sqrt{3} - 1} \times \frac{\sqrt{3} + 1}{\sqrt{3} + 1} = \frac{3 + 1 + 2\sqrt{3}}{3 - 1} = 2 + \sqrt{3}. \text{ So the answer is 1.}$$

2. If $0 < \theta < \frac{\pi}{2}$, and $\cot \theta + \operatorname{cosec} \theta = 3$, then $\cos \theta =$

1. $\frac{2}{3}$ 2. $\frac{3}{2}$ 3. $\frac{4}{5}$ 4. $\frac{3}{4}$

Solution: $\operatorname{cosec} \theta + \cot \theta = \frac{p}{q} \Rightarrow \cos \theta = \frac{p^2 - q^2}{p^2 + q^2}.$

Given $\operatorname{cosec} \theta + \cot \theta = 3 \Rightarrow \cos \theta = \frac{3^2 - 1}{3^2 + 1} = \frac{8}{10} = \frac{4}{5}. \text{ So the answer is 3.}$

3. $\frac{\cot 15^\circ - \sin 15^\circ}{\cot 15^\circ + \sin 15^\circ} =$

1. $\frac{\sqrt{3}}{2}$ 2. $2 + \sqrt{3}$ 3. $\sqrt{3}$ 4. $\frac{1}{\sqrt{3}}$

Solution: $\frac{\cos \theta - \sin \theta}{\cos \theta + \sin \theta} = \tan (45^\circ - \theta)$. So $\frac{\cos 15^\circ - \sin 15^\circ}{\cos 15^\circ + \sin 15^\circ} = \tan(45^\circ - 15^\circ) = \tan 30^\circ$
 $= \frac{1}{\sqrt{3}}$.

So the answer is 4.

4. $\sin 945^\circ =$

1. $\frac{\sqrt{3}}{2}$ 2. $-\frac{\sqrt{3}}{2}$ 3. $\frac{1}{\sqrt{2}}$ 4. $-\frac{1}{\sqrt{2}}$

Solution: $\sin(5 \times 180^\circ + 45^\circ) = -\sin 45^\circ = -\frac{1}{\sqrt{2}}$. **So the answer is 4.**

5. A tower on horizontal ground is of height 100m and subtends an angle of 30° at a point A on the ground. Then the distance of A from the foot of the tower is

1. $\frac{100}{\sqrt{3}}$ m 2. 100m 3. $100\sqrt{3}$ 4. $100(2\sqrt{3})$ m

Solution: $\tan 30^\circ = \frac{100}{d}$. So $\frac{1}{\sqrt{3}} = \frac{100}{d}$. So $d = 100\sqrt{3}$. **So the answer is 3.**

6. $\frac{1 + \sin \theta}{\cos \theta} + \frac{\cos \theta}{1 + \sin \theta} =$

1. $2 \sin \theta$ 2. $2 \cos \theta$ 3. $2 \sec \theta$ 4. $2 \tan \theta$

Solution: $\frac{(1 + \sin \theta)^2 + \cos^2 \theta}{\cos \theta(1 + \sin \theta)} = \frac{1 + 2 \sin \theta + \sin^2 \theta + \cos^2 \theta}{\cos \theta(1 + \sin \theta)} = \frac{2(1 + \sin \theta)}{\cos \theta(1 + \sin \theta)} =$
 $2 \sec \theta$.

So the answer is 3.

7. $(\sin A \cos B - \cos A \sin B)^2 + (\cos A \cos B + \sin A \sin B)^2 =$

1. $2 \sin A \cos B$ 2. $2 \cos A \cos B$ 3. 1 4. 0

Solution: $(\sin A \cos B - \cos A \sin B)^2 + (\cos A \cos B + \sin A \sin B)^2$
 $= (\sin(A - B))^2 + (\cos(A - B))^2 = \sin^2(A - B) + \cos^2(A - B) = 1$. **So the answer is 3.**

8. If $\cos \alpha = \sin \beta = \frac{1}{2}$ and $0 < \alpha, \beta < \frac{\pi}{2}$ then $\alpha + 2\beta =$

1. $\frac{\pi}{4}$ 2. $\frac{\pi}{6}$ 3. $\frac{\pi}{3}$ 4. $\frac{2\pi}{3}$

Solution: $\cos \alpha = \frac{1}{2} \Rightarrow \alpha = \frac{\pi}{3}$; $\sin \beta = \frac{1}{2} \Rightarrow \beta = \frac{\pi}{6}$

So $\alpha + 2\beta = \frac{\pi}{3} + \frac{\pi}{6} = \frac{2\pi}{3}$. **So the answer is 4.**

9. From the top of a building of height 85 meters on the bank of a river observed that the angle of depression of the other side of the bank is 45° . The breadth of the river (in meters) is x

1. 42.5 2. 85 3. 130 4. 202

Solution: $\tan 45^\circ = \frac{85}{x} \Rightarrow 1 = \frac{85}{x} \Rightarrow x = 85$. **So the answer is 2.**

10. $\frac{(1 - \sec \theta)^2 + (1 + \sec \theta)^2}{1 + \sec^2 \theta} =$

1. -1 2. 0 3. 1 4. 2

Solution: $\frac{1 + \sec^2 \theta - 2 \sec \theta + 1 + \sec^2 \theta + 2 \sec \theta}{1 + \sec^2 \theta} = \frac{2(1 + \sec^2 \theta)}{1 + \sec^2 \theta} = 2$. **So the answer is 4.**

11. $\cos 90^\circ \cdot \cos 60^\circ + \sin 90^\circ \cdot \sin 60^\circ + (\sin 30^\circ)(\cos 45^\circ) =$

1. $\frac{1}{4}(\sqrt{12} + \sqrt{2})$ 2. $\frac{1}{2}(\sqrt{2} - \sqrt{2})$ 3. $2 + \sqrt{12}$ 4. $2 - \sqrt{12}$

Solution: $\cos(A - B) = \cos A \cos B + \sin A \sin B$.

So $\cos(90 - 60) + (\sin 30^\circ)(\cos 45^\circ) = \frac{\sqrt{3}}{2} + \frac{1}{2} \cdot \frac{1}{\sqrt{2}} = \frac{\sqrt{6} + 1}{2\sqrt{2}} = \frac{1}{4}(\sqrt{12} + \sqrt{2})$. **So**

answer is 1.

12. If $\sin \theta + \operatorname{cosec} \theta = 2$, then $\sin^4 \theta + \operatorname{cosec}^4 \theta =$

1. 16 2. 8 3. 4 4. 2

Solution: $\sin \theta + \operatorname{cosec} \theta = 2 \Rightarrow \theta = 90^\circ$, then $\sin^4 90^\circ + \operatorname{cosec}^4 90^\circ = 1 + 1 = 2$.

So the answer is 4.

13. If $x \cos \theta - y \sin \theta = \alpha$ and $x \sin \theta + y \cos \theta = \beta$, then $x^2 + y^2 =$

1. α^2 2. β^2 3. $\alpha^2 + \beta^2$ 4. $\alpha^2 - \beta^2$

Solution: $\alpha^2 + \beta^2 = x^2(\sin^2 \theta + \cos^2 \theta) + y^2(\sin^2 \theta + \cos^2 \theta) = x^2 + y^2$.

So the answer is 3.

14. $(\tan 47^\circ + \cot 47^\circ)(\sin 47^\circ \times \cos 47^\circ) =$

1. 0 2. 1 3. $\frac{1}{2}$ 4. $\frac{\sqrt{3}}{2}$

Solution: $(\tan 47^\circ + \cot 47^\circ)(\sin 47^\circ \times \cos 47^\circ) = \left(\frac{\sin 47^\circ}{\cos 47^\circ} + \frac{\cos 47^\circ}{\sin 47^\circ}\right)(\sin 47^\circ \times \cos 47^\circ)$
 $= \sin^2 47^\circ + \cos^2 47^\circ = 1$. **So the answer is 2.**

15. For $0 < \theta < \pi$ and $\theta \neq \frac{\pi}{2}$, if $1 + \sin \theta + \sin^2 \theta + \dots + \infty = 4 + 2\sqrt{3}$, then $\sin \theta =$

1. $\frac{1}{\sqrt{2}}$ 2. $\frac{\sqrt{3}}{2}$ 3. $\frac{1}{2}$ 4. $\frac{2}{\sqrt{5}}$

Solution: It is geometric progression. $a =$ first term $= 1$, $r =$ common ratio $= \sin \theta$.

$$\text{Sum of infinite terms} = \frac{a}{1-r} = \frac{1}{1-\sin \theta} = 4 + 2\sqrt{3} \Rightarrow 1 - \sin \theta = \frac{1}{4 + 2\sqrt{3}}$$

$$\Rightarrow \sin \theta = 1 - \frac{1}{4 + 2\sqrt{3}} = 1 - \frac{4 - 2\sqrt{3}}{16 - 12} = 1 - \frac{4 - 2\sqrt{3}}{4} = \frac{\sqrt{3}}{2}. \text{ So the answer is}$$

2.

16. If $\tan \theta + \cot \theta = 2$, then $\tan^8 \theta + \cot^8 \theta =$

1. 1 2. 2 3. 8 4. 16

Solution: $\tan \theta + \cot \theta = 2 \Rightarrow \theta = 45^\circ$, then $\tan^8 \theta + \cot^8 \theta = 1 + 1 = 2$.

So the answer is 2.

17. $\frac{1 + \sec A}{2 \tan A} + \frac{\tan A}{2(1 + \sec A)} =$

1. $\sin A$ 2. $\sec A$ 3. $\operatorname{cosec} A$ 4. $\cos A$

Solution: $\sec A = \frac{1}{\cos A}$, $\tan A = \frac{\sin A}{\cos A}$ substitute these two and simplify we get $\operatorname{cosec} A$.

So the answer is 3.

18. 300 meters away from the foot of a tower, the top of the tower is observed at an angle of elevation of 30° . Then the height of the tower (in meters) is ?

1. 100 2. $100 + \sqrt{3}$ 3. $100 - \sqrt{3}$ 4. $100\sqrt{3}$

Solution: $\tan 30 = \frac{h}{300}$. So $h = 300 \tan 30 = 300 \times \frac{1}{\sqrt{3}} = 100\sqrt{3}$.

So the answer is 4.

19. If $\cos \theta = \frac{5}{13}$, then $\tan \theta =$

1. $\frac{5}{13}$ 2. $\frac{12}{25}$ 3. $\frac{12}{13}$ 4. None

Solution: $\cos \theta = \frac{5}{13}$. So $\sin \theta = \frac{12}{13}$, then $\tan \theta = \frac{12}{5}$. **So the answer is 4.**

20. The angles of elevation of the top of two vertical towers as seen from the middle point of the line joining the foot of the towers, are 60° and 30° respectively. The ratio of their heights of the towers is

1. 2 : 1 2. $\sqrt{3} : 1$ 3. 3 : 2 4. 3 : 1

Solution: $\tan 60 = \frac{h_1}{x}$, $\tan 30 = \frac{h_2}{x}$. So $h_1 : h_2 = x\sqrt{3} : \frac{x}{\sqrt{3}} = 3 : 1$. **So the answer is 4.**

21. If $A + C = B$, then $\tan A \tan B \tan C =$

1. $\tan B - \tan A - \tan C$ 2. $\tan B + \tan A + \tan C$
3. $\tan B - \tan A + \tan C$ 4. $\tan A + \tan B + \tan C$

Solution: $\frac{\tan A + \tan C}{1 - \tan A \tan C} = \tan B \Rightarrow \tan A + \tan C = \tan B - \tan A \tan B \tan C$

So $\tan A \tan B \tan C = \tan B - \tan A - \tan C$. **So the answer is 1.**

22. If $\sin \theta = \frac{15}{17}$, then for $0^\circ < \theta < 90^\circ$ $\frac{15 \cot \theta - 17 \sin \theta}{8 \tan \theta + 16 \sec \theta} =$

1. $\frac{23}{49}$ 2. $\frac{22}{49}$ 3. $\frac{18}{49}$ 4. $\frac{17}{49}$

Solution: $\sin \theta = \frac{15}{17}$. So $\cos \theta = \frac{8}{17}$, $\tan \theta = \frac{15}{8}$, $\cot \theta = \frac{8}{15}$, $\sec \theta = \frac{17}{8}$.

Substituting these and simplifying we get $\frac{23}{49}$. **So the answer is 1.**

23. If a flag staff of 6 metres height, placed on the top of a tower throws a shadow of $2\sqrt{3}$ metres along the ground, then the angle in degrees that the sun makes with the ground is

1. 30° 2. 45° 3. 60° 4. 75°

Solution: $\tan \theta = \frac{6}{2\sqrt{3}} = \sqrt{3}$. So $\theta = 60^\circ$. **So the answer is 3.**

24. The period of $\sin^3 x + \cos^3 x$ is

1. $\frac{\pi}{2}$ 2. π 3. 2π 4. $\frac{2\pi}{3}$

Solution: The period of $\sin^3 x = 2\pi$, the period of $\cos^3 x = 2\pi$.

So the period of $\sin^3 x + \cos^3 x$ is 2π . **So the answer is 3.**

25. If $\sqrt{\sin x} + \cos x = 0$ then $\sin x =$

1. $\frac{\sqrt{5}+1}{2}$ 2. $\frac{\sqrt{5}+1}{8}$ 3. $\frac{\sqrt{5}-1}{8}$ 4. $\frac{\sqrt{5}-1}{2}$

Solution: $\sqrt{\sin x} = -\cos x \Rightarrow \sin x = \cos^2 x = 1 - \sin^2 x \Rightarrow \sin^2 x + \sin x - 1 = 0$

$\sin x = \frac{-1 \pm \sqrt{1+4}}{2} = \frac{\pm\sqrt{5}-1}{2}$. $\sin x > 0 \Rightarrow \sin x = \frac{\sqrt{5}-1}{2}$. **So the answer is 4.**

26. If the area of the triangle ABC is $a^2 - (b - c)^2$, then $\tan \frac{A}{2} =$

1. $\frac{1}{4}$ 2. $\frac{1}{2}$ 3. $\frac{3}{4}$ 4. 0

Solution: Area $\Delta = a^2 - (b - c)^2 = (a + b + c)(a - b + c) = 2(s - b)2(s - c)$

$\Rightarrow \frac{(s-b)(s-c)}{\Delta} = \frac{1}{4}$. So $\tan \frac{A}{2} = \frac{1}{4}$. (because $2s = a + b + c$)

So the answer is 1.

27. $\sin^4 \theta + \cos^4 \theta + 2 \sin^2 \theta \cos^2 \theta - 1 =$

1. 1 2. -1 3. 0 4. 2

Solution: $\sin^4 \theta + \cos^4 \theta + 2 \sin^2 \theta \cos^2 \theta - 1 = (\sin^2 \theta + \cos^2 \theta)^2 - 1 = 1 - 1 = 0$.

So the answer is 3.

28. If $90^\circ < \theta < 180^\circ$ and $\tan \theta = \frac{-12}{5}$, then $\cos \theta =$

1. $-\frac{5}{13}$ 2. $-\frac{5}{12}$ 3. $\frac{5}{13}$ 4. $\frac{5}{12}$

Solution: $\cos \theta = -\frac{5}{13}$ (θ is in second quadrant so it is negative). **So the answer is 1.**

29. If $A + B = 45^\circ$ then $(1 + \tan A)(1 + \tan B) =$

1. -2 2. 1 3. 0 4. 2

Solution: $\tan(A+B) = \tan 45^\circ \Rightarrow \frac{\tan A + \tan B}{1 - \tan A \tan B} = 1 \Rightarrow \tan A + \tan B = 1 - \tan A \tan B$

$\Rightarrow \tan A + \tan B + \tan A \tan B = 1 \Rightarrow (1 + \tan A)(1 + \tan B) = 2$. **So the answer is 4.**

30. From the point, mid way between two towers the angles of elevation of their tops are found to 60° and 45° . The ratio of the heights of the tower is ?

1. $1:2$ 2. $1:\sqrt{2}$ 3. $\sqrt{3}:1$ 4. $\sqrt{2}:\sqrt{3}$

Solution: $\tan 60 = \frac{h_1}{x}$, $\tan 45 = \frac{h_2}{x}$. So $h_1 : h_2 = x\sqrt{3} : x = \sqrt{3} : 1$.

So the answer is 3.

31. If $270^\circ < \theta < 360^\circ$ and $\sin \theta = -\frac{3}{5}$ then $\cos \theta + \tan \theta =$

1. 0.05 2. -0.05 3. 0.01 4. -0.01

Solution: $\cos \theta = \frac{4}{5}$, $\tan \theta = -\frac{3}{4}$ then $\cos \theta + \tan \theta = \frac{4}{5} - \frac{3}{4} = \frac{1}{20} = 0.05$. **So the answer is 1.**

32. $(\sec \theta + \tan \theta - 1)(\sec \theta - \tan \theta + 1) - 2 \tan \theta =$

1. 0 2. -1 3. 1 4. 2

Solution: $(\sec^2 \theta - (\tan \theta - 1)^2 - 2 \tan \theta = \sec^2 \theta - \tan^2 \theta - 1 + 2 \tan \theta - 2 \tan \theta = 1 - 1 = 0$. **So answer is 1.**

33. If $\sin 30^\circ \cos x + \cos 30^\circ \sin x = 1$ then $x =$

1. 30° 2. 45° 3. 60° 4. 90°

Solution: $\sin A \cos B + \cos A \sin B = \sin(A+B)$. We have $\sin 30^\circ \cos x + \cos 30^\circ \sin x = 1$

$\Rightarrow \sin(30^\circ + x) = \sin 90^\circ \Rightarrow 30^\circ + x = 90^\circ \Rightarrow x = 60^\circ$. **So the answer is 3.**

34. The height of a pole is 100mt. The angle of elevation of the top of the pole from two ships on either side of the pole are 45° and 30° . What is the distance between two ships ?

1. 100 2. $\frac{100}{\sqrt{3}}$ 3. $100\sqrt{3}$ 4. $100(1 + \sqrt{3})$

Solution: $\tan 30^\circ = \frac{100}{x} \Rightarrow \frac{1}{\sqrt{3}} = \frac{100}{x} \Rightarrow x = 100\sqrt{3}$.

The distance between two ships $= 100 + 100\sqrt{3} = 100(1 + \sqrt{3})$.

So the answer is 4.

35. $a \sin \theta + b \cos \theta = m$, $a \cos \theta - b \sin \theta = n$ then $m^2 + n^2 =$

1. ab 2. $2ab$ 3. $2(a^2 + b^2)$ 4. $a^2 + b^2$

Solution: $m^2 + n^2 = a^2 \sin^2 \theta + b^2 \cos^2 \theta + 2ab \sin \theta \cos \theta + a^2 \cos^2 \theta + b^2 \sin^2 \theta - 2ab \sin \theta \cos \theta$

$= a^2 (\sin^2 \theta + \cos^2 \theta) + b^2 (\sin^2 \theta + \cos^2 \theta) = a^2 + b^2$. **So the answer is 4.**

36. If $\tan A = \frac{\sqrt{3}}{4 - \sqrt{3}}$, $\tan B = \frac{\sqrt{3}}{4 + \sqrt{3}}$ then $\frac{\tan A - \tan B}{1 + \tan A \tan B} =$

1. 0.375 2. 0.275 3. 0.175 4. 0.075

Solution: Substituting the values and simplifying we get $\frac{3}{8} = 0.375$.

So the answer is 1.

37. $\sin 15^\circ =$

1. $\frac{\sqrt{3} + 1}{\sqrt{2}}$ 2. $\frac{\sqrt{3} - 1}{2\sqrt{2}}$ 3. $\frac{\sqrt{3} + 1}{2\sqrt{2}}$ 4. $\frac{\sqrt{3} - 1}{\sqrt{2}}$

Solution: $\sin 15 = \sin(45 - 30) = \sin 45 \cos 30 - \cos 45 \sin 30 = \frac{1}{\sqrt{2}} \cdot \frac{\sqrt{3}}{2} - \frac{1}{\sqrt{2}} \cdot \frac{1}{2} =$

$$\frac{\sqrt{3} - 1}{2\sqrt{2}}$$

So the answer is 2.

38. A ladder of 20 feet long leans against the side of a building and the angle between the ladder and the building is 30° . Then the distance from the bottom of the ladder to the building is ----- feet ?

1. 5 2. 10 3. 12 4. 14

Solution: $\cos 60^\circ = \frac{x}{20} \Rightarrow x = 20 \cos 60^\circ = 20 \times \frac{1}{2} = 10$. **So the answer is 2.**

39. If $\frac{\sin^2 x}{1 - \cot x} + \frac{\cos^2 x}{1 - \tan x} = \sin x \cos x + k$ then $k =$

1. -1 2. -2 3. 1 4. 2

Solution: $\frac{\sin^2 x}{1 - \cot x} + \frac{\cos^2 x}{1 - \tan x} = \frac{\sin^3 x}{\sin x - \cos x} - \frac{\cos^3 x}{\sin x - \cos x}$

$$= \frac{\sin x - \cos x}{\sin x - \cos x} (\sin^2 x + \cos^2 x + \sin x \cos x) = 1 + \sin x \cos x. \text{ So } k = 1.$$

So the answer is 3.

(note: we have used $a^3 - b^3 = (a - b)(a^2 + b^2 + ab)$).

40. If $x = 2b \cos A \cos 2A - b \cos A$; $y = 2b \cos A \sin 2A - b \sin A$, then $x^2 + y^2 =$

1. $-b^2$ 2. $-2b^2$ 3. $2b^2$ 4. b^2

Solution: Put $A = 0$, then $x = b, y = 0$. So $x^2 + y^2 = b^2$. **So the answer is 4.**

41. If $k(\operatorname{cosec} \alpha - \cot \alpha) = (\operatorname{cosec} \alpha + \cot \alpha) \sin^2 \alpha$, then $k =$

1. $(1 - \cos \alpha)^2$ 2. $(1 + \cos \alpha)^2$ 3. $\sin^2 \alpha$ 4. $\cos^2 \alpha$

Solution: $k(\operatorname{cosec}^2 \alpha - \cot^2 \alpha) = (\operatorname{cosec} \alpha + \cot \alpha)^2 \sin^2 \alpha$ (because multiplying with $\operatorname{cosec} \alpha + \cot \alpha$)

$$\Rightarrow k \cdot 1 = [\operatorname{cosec}^2 \alpha + \cot^2 \alpha + 2 \operatorname{cosec} \alpha \cot \alpha] \sin^2 \alpha = 1 + \cot^2 \alpha \sin^2 \alpha + 2 \cos \alpha$$

$$\Rightarrow k = 1 + (\operatorname{cosec}^2 \alpha - 1) \sin^2 \alpha + 2 \cos \alpha = 1 + 1 - \sin^2 \alpha + 2 \cos \alpha$$

$$= 1 + \cos^2 \alpha + 2 \cos \alpha = (1 + \cos \alpha)^2 \text{ So the answer is 2.}$$

42. $\log_{10} \tan 1^\circ + \log_{10} \tan 2^\circ + \dots + \log_{10} \tan 89^\circ =$

1. 3 2. 2 3. 1 4. 0

Solution: $\log_{10} \tan 1^\circ \tan 2^\circ \dots \tan 89^\circ = \log_{10} 1^0 = 0$. (since $A + B = 90^\circ \Rightarrow \tan A \tan B = 1$)

So the answer is 4.

43. $\cos 1^\circ \cdot \cos 2^\circ \cdot \cos 3^\circ \cdot \cos 4^\circ \dots \cos 179^\circ =$

1. $-\frac{1}{2}$ 2. 0 3. $\frac{1}{4}$ 4. 1

Solution: $\cos 1^\circ \cdot \cos 2^\circ \cdot \cos 3^\circ \cdot \cos 4^\circ \dots \cos 90^\circ \dots \cos 179^\circ = 0$ (since $\cos 90^\circ = 0$)

So the answer is 2.

44. $\sin \theta + \sin^2 \theta = 1$; $\cos^2 \theta + \cos^2 \theta =$

1. 0 2. $\frac{1}{2}$ 3. 1 4. 2

45. If $\sec \theta + \tan \theta = 4$ then $\sec \theta - \tan \theta =$

1. -4 2. $\frac{1}{4}$ 3. 4 4. $-\frac{1}{4}$

Solution: $\sec^2 \theta - \tan^2 \theta = 1 \Rightarrow (\sec \theta + \tan \theta)(\sec \theta - \tan \theta) = 1$

$$\Rightarrow (\sec \theta - \tan \theta) = \frac{1}{4} \text{ So the answer is 2.}$$

46. A tower of height 100 feet. If 2 boys standing on the both sides of the tower observe the top with angles of elevation 30° and 45° , the distance between them (in feet) is

1. 100 2. $100\sqrt{3}$ 3. $100(\sqrt{3} + 1)$ 4. $100\sqrt{2}$

Solution: $\tan 30^\circ = \frac{100}{x} \Rightarrow \frac{1}{\sqrt{3}} = \frac{100}{x} \Rightarrow x = 100\sqrt{3}$.

The distance between two boys $= 100 + 100\sqrt{3} = 100(1 + \sqrt{3})$.

So the answer is 3.

47. $\tan 85^\circ \tan 50^\circ - \tan 85^\circ - \tan 50^\circ =$

1. 1 2. -1 3. $\tan 45^\circ$ 4. $\tan 5^\circ$

Solution: $\tan(135^\circ) = \tan(85^\circ + 50^\circ) = \frac{\tan 85^\circ + \tan 50^\circ}{1 - \tan 85^\circ \tan 50^\circ}$

$\Rightarrow -1 + \tan 85^\circ \tan 50^\circ = \tan 85^\circ + \tan 50^\circ \Rightarrow \tan 85^\circ \tan 50^\circ - \tan 85^\circ - \tan 50^\circ = -1$

So the answer is 1. [because $\tan 135^\circ = \tan(90 + 45) = -\tan 45^\circ = -1$]

48. If $\cos \theta = -\frac{12}{13}$ and θ is not in third quadrant, then $\sin \theta + \tan \theta =$

1. $\frac{125}{156}$ 2. $\frac{5}{156}$ 3. $\frac{-125}{156}$ 4. $\frac{-5}{156}$

Solution: $\sin \theta + \tan \theta = \frac{5}{13} - \frac{5}{12} = \frac{60 - 65}{156} = \frac{-5}{156}$. **So the answer is 4.**

49. $\sin 75^\circ =$

1. $\frac{\sqrt{3}+1}{\sqrt{3}-1}$ 2. $\frac{\sqrt{3}-1}{2\sqrt{2}}$ 3. $\frac{\sqrt{3}-1}{\sqrt{3}+1}$ 4. $\frac{\sqrt{3}+1}{2\sqrt{2}}$

Solution: $\sin(75^\circ) = \sin(45^\circ + 30^\circ) = \sin 45^\circ \cos 30^\circ + \cos 45^\circ \sin 30^\circ$

$= \frac{1}{\sqrt{2}} \cdot \frac{1\sqrt{3}}{2} + \frac{1}{\sqrt{2}} \cdot \frac{1}{2} = \frac{\sqrt{3}+1}{2\sqrt{2}}$. **So the answer is 4.**

50. The maximum value of $7 - 5 \cos x - 12 \sin x$ is

1. 20 2. -5 3. -6 4. 2

Solution: Maximum values of $a \cos x + b \sin x + c$ is $c - \sqrt{a^2 + b^2}$

So maximum value $= 7 + \sqrt{(-5)^2 + (-12)^2} = 7 + \sqrt{25 + 144} = 7 + \sqrt{169} = 7 + 13 = 20$

51. If $\sec \theta - \tan \theta = 5$, then $\sin \theta =$

1. $\frac{12}{13}$ 2. $\frac{5}{13}$ 3. $\frac{-12}{13}$ 4. $\frac{-5}{13}$

Solution: $\sec^2 \theta - \tan^2 \theta = 1$. So $(\sec \theta + \tan \theta)(\sec \theta - \tan \theta) = 1$. So we get

$\sec \theta + \tan \theta = \frac{1}{5}$

Adding $\sec \theta - \tan \theta = 5$ and $\sec \theta + \tan \theta = \frac{1}{5}$ we get $2 \sec \theta = \frac{26}{5}$.

So $\cos \theta = \frac{5}{13}$, $\sin \theta = \frac{12}{13}$. **So the answer is 1.**

52. $\frac{\sin \theta}{\sec \theta - 1} - \frac{\sin \theta}{\sec \theta + 1} =$

1. $2 \cos \theta \cot \theta$ 2. $2 \sin \theta \sec \theta$ 3. $2 \cos \theta \tan \theta$ 4. $2 \cot \theta \operatorname{cosec} \theta$

Solution: $\frac{\sin \theta \sec \theta + \sin \theta - \sin \theta \sec \theta + \sin \theta}{\sec^2 \theta - 1} = \frac{2 \sin \theta}{\tan^2 \theta} = 2 \cos \theta \cot \theta.$

So the answer is 1.

53. The angle of elevation of the sun, when the length of the shadow of a tower is 4 times the height of the tower, is

1. 45° 2. $\tan^{-1} 4$ 3. 60° 4. $\tan^{-1} \frac{1}{4}$

Solution: $\tan \theta = \frac{h}{4h}$. So $\theta = \tan^{-1} \frac{1}{4}$. **So the answer is 4.**

Trigonometry

Answers

1. **1** 2. **3** 3. **4** 4. **4** 5. **3** 6. **3** 7. **3** 8. **4** 9. **2** 10. **4** 11. **1**
 12. **4** 13. **3** 14. **2** 15. **2** 16. **2** 17. **3** 18. **4** 19. **4** 20. **4** 21. **1** 22. **1**
 23. **3** 24. **3** 25. **4** 26. **1** 27. **3** 28. **1** 29. **4** 30. **3** 31. **1** 32. **1** 33. **3**
 34. **4** 35. **4** 36. **1** 37. **2** 38. **2** 39. **3** 40. **4** 41. **2** 42. **4** 43. **2** 44. **1**
 45. **2** 46. **3** 47. **1** 48. **4** 49. **4** 50. **1** 51. **1** 52. **1** 53. **4**

ICET-2012

54. $\cos 208^\circ \sin 238^\circ + \sin 152^\circ \cos 122^\circ =$

1. $\frac{1}{2}$ 2. $\frac{1}{\sqrt{2}}$ 3. $\frac{\sqrt{3}}{2}$ 4. 1

Solution: $\cos 208^\circ \sin 238^\circ + \sin 152^\circ \cos 122^\circ$
 $= \cos(180+28^\circ) \sin(180+58^\circ) + \sin(180-28^\circ) \cos(180-58^\circ)$
 $= \cos 28^\circ \sin 58^\circ - \sin 28^\circ \cos 58^\circ$
 $= \sin(58 - 28) = \sin 30^\circ = 1/2$. **Answer is 1.**

55. If $0 < \alpha, \beta < \frac{\pi}{4}$, $\cos(\alpha + \beta) = \frac{4}{5}$ and $\sin(\alpha - \beta) = \frac{5}{13}$ then $\tan 2\alpha =$

1. $\frac{56}{33}$ 2. $\frac{33}{56}$ 3. $\frac{16}{63}$ 4. $\frac{16}{63}$

Solution: $\cos(\alpha + \beta) = \frac{4}{5} \Rightarrow \tan(\alpha + \beta) = \frac{3}{4}$

$\sin(\alpha - \beta) = \frac{5}{13} \Rightarrow \tan(\alpha - \beta) = \frac{5}{12}$

$\tan 2\alpha = \tan(\alpha + \beta + \alpha - \beta) = \frac{\tan(\alpha + \beta) + \tan(\alpha - \beta)}{1 - \tan(\alpha + \beta)\tan(\alpha - \beta)} = \frac{56}{33}$. **Answer is 1.**

56. If $x = a \cos \theta + b \sin \theta$ and $y = a \sin \theta - b \cos \theta$, then $x^2 + y^2 =$

1. 1 2. a^2 3. b^2 4. $a^2 + b^2$

Solution: $x^2 + y^2 = a^2 \cos^2 \theta + b^2 \sin^2 \theta + 2ab \sin \theta \cos \theta + a^2 \sin^2 \theta + b^2 \cos^2 \theta - 2ab \cos \theta \sin \theta$

$= a^2(\cos^2 \theta + \sin^2 \theta) + b^2(\sin^2 \theta + \cos^2 \theta) = a^2 + b^2$. **Answer is**

4.

57. $\frac{\tan 10^\circ + \tan 50^\circ}{1 - \tan 10^\circ \tan 50^\circ} =$

1. $\frac{\sqrt{3} + 1}{2\sqrt{2}}$ 2. $\frac{\sqrt{3} - 1}{2\sqrt{2}}$ 3. $\sqrt{3}$ 4. $\frac{1}{\sqrt{3}}$

Solution: $\frac{\tan A + \tan B}{1 - \tan A \tan B} = \tan(A + B) = \tan(10^\circ + 50^\circ) = \tan 60^\circ = \sqrt{3}$. **Answer is 3.**

58. A man in a boat rowing away from the cliff 150 meters high, observed that it takes 2 minutes to change the angle of elevation of the top of the cliff from 60° to 45° , then the speed of the boat in km/hour is

1. $\frac{9 - 3\sqrt{3}}{2}$ 2. $\frac{9 + 3\sqrt{3}}{2}$ 3. $9 - \sqrt{3}$ 4. $9 + \sqrt{3}$

Solution: Boat travels $150 - \frac{150}{\sqrt{3}}$ in 2 minutes $\Rightarrow$ It travels $\frac{150 - \frac{150}{\sqrt{3}}}{120}$ mt per second

$\Rightarrow$ It travels $\frac{5\sqrt{3} - 5}{4\sqrt{3}} \times \frac{18}{5}$ km per hour i.e. $\frac{9 - 3\sqrt{3}}{2}$ km/hour. **Answer is 1.**

ICET-2011

59. $\cos 1^\circ \cdot \cos 2^\circ \cdot \cos 3^\circ \dots \cos 179^\circ =$

1. 1 2. 0 3. 180° 4. 90

Solution: $\cos 1^\circ \cdot \cos 2^\circ \cdot \cos 3^\circ \dots \cos 179^\circ = \cos 1^\circ \cdot \cos 2^\circ \cdot \cos 3^\circ \dots \cos 90^\circ \dots \cos 179^\circ = 0$,

because $\cos 90^\circ = 0$.

Answer is 2.

60. $\tan 170^\circ + \tan 55^\circ + \tan 170^\circ \cdot \tan 55^\circ =$

1. $\tan 115^\circ$ 2. $\tan 45^\circ$ 3. $\tan 105^\circ$ 4. $\tan 135^\circ$

Solution: $\tan (170^\circ + 55^\circ) = \tan 225^\circ = \tan (180^\circ + 45^\circ) = \tan 45^\circ = 1$

$$\Rightarrow \tan (170^\circ + 55^\circ) = 1 \Rightarrow \frac{\tan 170^\circ + \tan 55^\circ}{1 - \tan 170^\circ \tan 55^\circ} = 1 \Rightarrow \tan 170^\circ + \tan 55^\circ =$$

$$1 - \tan 170^\circ \tan 55^\circ$$

$$\Rightarrow \tan 170^\circ + \tan 55^\circ + \tan 170^\circ \cdot \tan 55^\circ = 1.$$

Answer is 1.

61. $\sin 83^\circ \cos 53^\circ - \cos 83^\circ \sin 53^\circ =$

1. $\frac{1}{\sqrt{2}}$ 2. $\frac{\sqrt{3}}{2}$ 3. $\frac{1}{2}$ 4. 0

Solution: $\sin A \cos B - \cos A \sin B = \sin (A-B)$

$$\sin 83^\circ \cos 53^\circ - \cos 83^\circ \sin 53^\circ = \sin (83^\circ - 53^\circ) = \sin 30^\circ = \frac{1}{2}.$$

Answer is 3.

62. If $180^\circ < A < 270^\circ$, $90^\circ < B < 180^\circ$, $\tan A = \sqrt{3}$ and $\sin B = \frac{\sqrt{3}}{2}$, then the value of $\sin (A-B) =$

1. 0 2. 1 3. $\frac{1}{2}$ 4. $\frac{\sqrt{3}}{2}$

Solution: $\sin (A-B) = \sin A \cos B - \cos A \sin B$

$$= \left(\frac{-\sqrt{3}}{2} \right) \left(\frac{-1}{2} \right) - \left(\frac{-1}{2} \right) \left(\frac{\sqrt{3}}{2} \right) = \frac{\sqrt{3}}{4} + \frac{\sqrt{3}}{4} = \frac{2\sqrt{3}}{4} = \frac{\sqrt{3}}{2}. \text{ Answer is 4.}$$

63. $\frac{4 \operatorname{cosec} 150^\circ + 3 \sec^2 210^\circ}{5 \tan 225^\circ + 6 \cot^2 330^\circ} =$

1. $\frac{12}{23}$ 2. $\frac{-12}{23}$ 3. $\frac{7}{11}$ 4. $\frac{-7}{11}$

Solution: $\operatorname{cosec} 150^\circ = \operatorname{cosec} (90^\circ + 60^\circ) = \sec 60^\circ = 2.$

$$\sec 210^\circ = \sec (180^\circ + 30^\circ) = -\sec 30^\circ = \frac{-2}{\sqrt{3}}; \tan 225^\circ = \tan (180^\circ + 45^\circ) = \tan 45^\circ = 1$$

$$\cot 330^\circ = \cot (360^\circ - 30^\circ) = -\cot 30^\circ = -\sqrt{3}. \text{Substituting these values}$$

$$\frac{4\operatorname{cosec} 150^\circ + 3\sec^2 210^\circ}{5\tan 225^\circ + 6\cot^2 330^\circ} = \frac{12}{23}.$$

Answer is 1.

64. A person on walking 20 metres towards a chimney in a horizontal line through its base observes that its angle of elevation of the top of chimney changes from 30° to 45° . Then the height (in metres) of the chimney is

1. $10\sqrt{3}$ 2. $10(\sqrt{3} + 1)$ 3. $20\sqrt{3}$ 4. 20

$$\textbf{Solution:} \tan 30^\circ = \frac{x}{x+20} \Rightarrow \frac{1}{\sqrt{3}} = \frac{x}{x+20} \Rightarrow x+20 = x\sqrt{3}$$

$$\Rightarrow x(\sqrt{3} - 1) = 20 \Rightarrow x = \frac{20}{\sqrt{3} - 1} \Rightarrow x = 10(\sqrt{3} + 1). \quad \textbf{Answer is 2.}$$

ICET-2013

65. If θ lies in the first quadrant and $5 \tan \theta = 4$, then $\frac{5 \sin \theta - 3 \cos \theta}{\sin \theta + 2 \cos \theta} =$

1. $\frac{1}{14}$ 2. $\frac{2}{14}$ 3. $\frac{3}{14}$ 4. $\frac{5}{14}$

$$\textbf{Solution:} \frac{5 \sin \theta - 3 \cos \theta}{\sin \theta + 2 \cos \theta} = \frac{5 \tan \theta - 3}{\tan \theta + 2} = \frac{4 - 3}{4/5 + 2} = \frac{5}{14}. \quad \textbf{Answer is 4.}$$

66. Two poles of height 15 metres and 30 metres stand upright on a play ground. If the feet of the poles are 36 metres apart, the distance between their tops are

1. 35 metres 2. 37 metres 3. 39 metres 4. 41 metres

Solution: By Pythagorous theorem

$$x^2 = 15^2 + 36^2 = 9(25 + 144) = 9(169) = 3^2 \times 13^2$$

So the distance between their tops are $3 \times 13 = 39$ metres. **Answer is 3.**

67. If $\theta + \phi = 45^\circ$ then $(1 + \tan \theta)(1 + \tan \phi) =$

1. -2 2. 1 3. 0 4. 2

Solution: $\tan(\theta + \phi) = \tan 45^\circ$.

We know that $\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B} = 1$ and $\tan 45^\circ = 1$.

So using these we get $\tan \theta + \tan \phi = 1 - \tan \theta \tan \phi$

$$\Rightarrow \tan \theta + \tan \phi + \tan \theta \tan \phi = 1 \Rightarrow (1 + \tan \theta)(1 + \tan \phi) = 2.$$

So the answer is 4.

68. $(\cos^2 15^\circ - \cos^2 75^\circ)(\sin 65^\circ \cos 35^\circ - \cos 65^\circ \sin 35^\circ) =$

1. $\frac{1}{2}$ 2. $\frac{\sqrt{3}}{2}$ 3. $\sqrt{3}$ 4. $\frac{\sqrt{3}}{4}$

Solution: We know that $\cos 75^\circ = \sin 15^\circ$,

$\sin(A - B) = \sin A \cos B - \cos A \sin B$ and

$$\cos 2\theta = \cos^2 \theta - \sin^2 \theta, \quad \cos 30^\circ = \frac{\sqrt{3}}{2}, \quad \sin 30^\circ = \frac{1}{2} \quad \text{Answer is 4.}$$

$$(\cos^2 15^\circ - \cos^2 75^\circ)(\sin 65^\circ \cos 35^\circ - \cos 65^\circ \sin 35^\circ) = \cos 30^\circ \sin 30^\circ = \frac{\sqrt{3}}{2} \cdot \frac{1}{2} = \frac{\sqrt{3}}{4}$$

ICET-2014

69. $\sin 120^\circ \cos 60^\circ \cot 30^\circ \operatorname{cosec}^2 30^\circ =$

1. -2 2. 3 3. 0 4. 2

Solution: $\sin 120^\circ \cos 60^\circ \cot 30^\circ \operatorname{cosec}^2 30^\circ =$

$$= \cos 30^\circ \cos 60^\circ \cot 30^\circ \operatorname{cosec}^2 30^\circ = \frac{\sqrt{3}}{2} \cdot \frac{1}{2} \cdot \sqrt{3} \cdot 4 = 3$$

Answer is 2.

70. $\tan \theta = \frac{5}{12} \Rightarrow \frac{5 \sin \theta + 4 \cos \theta}{4 \sin \theta + 5 \cos \theta} =$

1. $\frac{73}{80}$ 2. $\frac{80}{73}$ 3. $\frac{7}{80}$ 4. $\frac{3}{80}$

Solution: $\frac{5 \sin \theta + 4 \cos \theta}{4 \sin \theta + 5 \cos \theta} = \frac{5 \tan \theta + 4}{4 \tan \theta + 5} = \frac{73}{80}$

Answer is 1.

71. $4 \cos \theta \sin^3 \theta - 4 \sin \theta \cos^3 \theta =$

1. 0 2. 1 3. $\sin 4\theta$ 4. $-\sin 4\theta$

Solution: $4 \cos \theta \sin^3 \theta - 4 \sin \theta \cos^3 \theta = 4 \sin \theta \cos \theta [\sin^2 \theta - \cos^2 \theta] =$
 $= 2 \cdot 2 \sin \theta \cos \theta [-\cos 2\theta] = -2 \sin 2\theta \cos 2\theta = -\sin 4\theta.$ **Answer is 4.**

72. A pole subtends angles $30^\circ, 45^\circ, 60^\circ$ respectively at points A, B, C all lying on a horizontal line through the foot of the pole. Then $\frac{AB}{AC} =$

Answer is 3.

1. $\frac{1}{\sqrt{3}}$ 2. $\sqrt{3} + 1$ 3. $\sqrt{3}$ 4. $\sqrt{3} - 1$

Telangana ICET-2015:

73. $\frac{2 \tan \theta}{\tan^2 \theta + 1} =$

1. $\sqrt{3}$ 2. $\frac{\sqrt{3}}{2}$ 3. $-\sqrt{3}$ 4. $-\frac{\sqrt{3}}{2}$

Solution: We know that $\tan 30^\circ = \frac{1}{\sqrt{3}}$. So $\frac{2 \tan \theta}{\tan^2 \theta + 1} = \frac{\sqrt{3}}{2}$ **Answer is 2.**

74. $\left(\frac{\sin 45^\circ + \cos 45^\circ + \tan 45^\circ}{\sin 45^\circ - \cos 45^\circ - \tan 45^\circ} \right)^2 =$

1. $\frac{1}{2}[2 + \sqrt{2}]$ 2. $\frac{1}{2}[2 - \sqrt{2}]$ 3. $3 + 2\sqrt{2}$ 4. $6 + 4\sqrt{2}$

Solution: We know that $\sin 45^\circ = \frac{1}{\sqrt{2}}$, $\cos 45^\circ = \frac{1}{\sqrt{2}}$, $\tan 45^\circ = 1$.

So $\left(\frac{\sin 45^\circ + \cos 45^\circ + \tan 45^\circ}{\sin 45^\circ - \cos 45^\circ - \tan 45^\circ} \right)^2 = \left(\frac{\sqrt{2} + 1}{-1} \right)^2 = 3 + 2\sqrt{2}.$

Answer is 3.

75. $\frac{1 - \cos \theta}{\sin \theta} + \frac{\sin \theta}{1 - \cos \theta} =$

1. $2 \sin \theta$ 2. $2 \cos \theta$ 3. $2 \sec \theta$ 4. $2 \operatorname{cosec} \theta$

Solution: $\frac{(1 - \cos \theta)^2 + \sin^2 \theta}{\sin \theta(1 - \cos \theta)} = \frac{2(1 - \cos \theta)}{\sin \theta(1 - \cos \theta)} = \frac{2}{\sin \theta} = 2 \operatorname{cosec} \theta.$

Answer is 4.

76. In $\triangle ABC$, $\angle ABC = 45^\circ$, $\angle CAB = 30^\circ$ and CD is perpendicular to AB. If CD = 100, then AB =

1. $100(\sqrt{3} + 1)$ 2. $100(\sqrt{3} - 1)$ 3. $50(\sqrt{3} + 1)$ 4. $50(\sqrt{3} - 1)$

Answer is 1.

LIMITS

1. In $n \in N$ and $a \in R$ then $\lim_{x \rightarrow a} x^n = a^n$.
2. If $a > 0$ and $n \in R$ then $\lim_{x \rightarrow a} x^n = a^n$.
3. If m and n are real numbers and a is a positive real number, then

$$\text{i) } \lim_{x \rightarrow a} \frac{x^n - a^n}{x - a} = na^{n-1} \quad \text{ii) } \lim_{x \rightarrow a} \frac{x^n - a^n}{x^m - a^m} = \frac{n}{m} a^{n-m}.$$

When x is measured in radians,

$$\text{i) } \lim_{x \rightarrow 0} \sin x = 0 \quad \text{ii) } \lim_{x \rightarrow 0} \cos x = 1 \quad \text{iii) } \lim_{x \rightarrow 0} \frac{\sin x}{x} = 1 \quad \text{iv) } \lim_{x \rightarrow 0} \frac{\sin ax}{x} = a$$
$$\text{v) } \lim_{x \rightarrow 0} \frac{\tan x}{x} = 1 \quad \text{vi) } \lim_{x \rightarrow 0} \frac{\tan ax}{x} = a \quad \text{vii) } \lim_{x \rightarrow 0} (1+x)^{\frac{1}{x}} = e \quad \text{viii) } \lim_{x \rightarrow 0} (1+px)^{\frac{q}{x}} = e^{pq}$$

$$\text{ix) } \lim_{x \rightarrow 0} \left(1 + \frac{1}{x}\right)^x = e \quad \text{x) } \lim_{x \rightarrow 0} \left(1 + \frac{p}{x}\right)^{qx} = e^{pq}$$

$$\text{xi) } \lim_{x \rightarrow 0} \frac{a^x - 1}{x} = \log_e a \quad \text{xii) } \lim_{x \rightarrow 0} \frac{e^x - 1}{x} = \log_e e = 1$$

L'Hospital's Rule: If $f(x)$ and $g(x)$ are two functions, and $f(a) = g(a) = 0$ or $f(a) = g(a) = \infty$

then $\lim_{x \rightarrow a} \frac{f(x)}{g(x)} = \lim_{x \rightarrow a} \frac{f'(x)}{g'(x)}$ provided the limit on the right exists.

PROBLEMS

$$1. \lim_{\theta \rightarrow 0} \frac{\sin 7\theta - \sin \theta}{\sin 10\theta - \sin 7\theta} =$$

$$1. \ 2 \qquad 2. \ \frac{7}{10} \qquad 3. \ \frac{48}{51} \qquad 4. \ \infty$$

$$\text{Solution: } \lim_{\theta \rightarrow 0} \frac{\sin 7\theta - \sin \theta}{\sin 10\theta - \sin 7\theta} = \lim_{\theta \rightarrow 0} \frac{7 \cos 7\theta - \cos \theta}{10 \cos 10\theta - 7 \cos 7\theta} = \frac{7-1}{10-7} = \frac{6}{3} = 2.$$

So the answer is 1.

$$2. \lim_{x \rightarrow 5} \frac{(x^2 - 4x - 5)^2}{|x - 5|}$$

$$1. \ 6 \qquad 2. \ -6 \qquad 3. \ 0 \qquad 4. \ 36$$

Solution: $\lim_{x \rightarrow 5} \frac{(x^2 - 4x - 5)^2}{|x - 5|} = \lim_{x \rightarrow 5} \frac{(x+1)^2(x-5)^2}{|x-5|}$

R.H.L. = $\lim_{x \rightarrow 5+} \frac{(x+1)^2(x-5)^2}{|x-5|} = \lim_{x \rightarrow 5+} \frac{(x+1)^2(x-5)^2}{x-5} = \lim_{x \rightarrow 5+} (x+1)^2(x-5) = 0$

L.H.L. = $\lim_{x \rightarrow 5-} \frac{(x+1)^2(x-5)^2}{|x-5|} = \lim_{x \rightarrow 5-} \frac{(x+1)^2(x-5)^2}{-(x-5)} = - \lim_{x \rightarrow 5-} (x+1)^2(x-5) = 0$

So the answer is 3.

3. $\lim_{x \rightarrow 0} \frac{\sqrt{4+x} - \sqrt{4-x}}{x} =$

1. 2 2. 4 3. $\frac{1}{2}$ 4. $\frac{1}{4}$

Solution: $\lim_{x \rightarrow 0} \frac{\sqrt{4+x} - \sqrt{4-x}}{x} = \lim_{x \rightarrow 0} \frac{\sqrt{4+x} - \sqrt{4-x}}{x} \cdot \frac{\sqrt{4+x} + \sqrt{4-x}}{\sqrt{4+x} + \sqrt{4-x}}$

$= \lim_{x \rightarrow 0} \frac{4+x-4+x}{x(\sqrt{4+x} + \sqrt{4-x})} = \lim_{x \rightarrow 0} \frac{2}{\sqrt{4+x} + \sqrt{4-x}} = \frac{2}{\sqrt{4} + \sqrt{4}} = \frac{2}{2+2} = \frac{2}{4} = \frac{1}{2}.$

So the answer is 3.

4. $\lim_{x \rightarrow 3} \frac{x^3 - 27}{x^2 - 9} =$

1. 3 2. $\frac{9}{2}$ 3. 9 4. $\frac{27}{2}$

Solution: $\lim_{x \rightarrow 3} \frac{x^3 - 27}{x^2 - 9} = \lim_{x \rightarrow 3} \frac{3x^2}{2x} = \frac{3 \cdot 3^2}{2 \cdot 3} = \frac{9}{2}.$ **So the answer is 2.**

5. $\lim_{x \rightarrow \frac{\pi}{2}} \frac{3 \cos^4 x}{1 - \sin^3 x} =$

1. 0 2. -8 3. 2 4. 3

Solution: $\lim_{x \rightarrow \frac{\pi}{2}} \frac{3 \cos^4 x}{1 - \sin^3 x} = \lim_{x \rightarrow \frac{\pi}{2}} \frac{12(\cos^3 x)(-\sin x)}{-(3 \sin^2 x)(\cos x)} = \lim_{x \rightarrow \frac{\pi}{2}} \frac{4(\cos^2 x)}{(\sin x)} = \frac{4(0)}{1} = 0.$

So the answer is 1.

6. $\lim_{x \rightarrow 3} \frac{x-3}{\sqrt{x-2} - \sqrt{4-x}} =$

1. 0 2. 1 3. 2 4. 4

Solution: $\lim_{x \rightarrow 3} \frac{x-3}{\sqrt{x-2} - \sqrt{4-x}} = \lim_{x \rightarrow 3} \frac{x-3}{\sqrt{x-2} - \sqrt{4-x}} \cdot \frac{\sqrt{x-2} + \sqrt{4-x}}{\sqrt{x-2} + \sqrt{4-x}}$

$$\begin{aligned}
&= \lim_{x \rightarrow 3} \frac{(x-3)(\sqrt{x-2} + \sqrt{4-x})}{x-2-4-x} = \lim_{x \rightarrow 3} \frac{(x-3)(\sqrt{x-2} + \sqrt{4-x})}{2(x-3)} = \\
&\lim_{x \rightarrow 3} \frac{(\sqrt{x-2} + \sqrt{4-x})}{2} \\
&= \frac{(\sqrt{3-2} + \sqrt{4-3})}{2} = \frac{1+1}{2} = 1. \text{ So the answer is 2.}
\end{aligned}$$

7. $\lim_{x \rightarrow 4} \frac{2x^{\frac{3}{2}} - \sqrt{x}}{x^2 - 15} =$

1. 10 2. 11 3. 12 4. 14

Solution: $\lim_{x \rightarrow 4} \frac{2x^{\frac{3}{2}} - \sqrt{x}}{x^2 - 15} = \frac{2(4)^{\frac{3}{2}} - \sqrt{4}}{4^2 - 15} = \frac{2(2^2)^{\frac{3}{2}} - 2}{16 - 15} = \frac{2(2^3) - 2}{1} = 14.$

So the answer is 4.

8. $\lim_{x \rightarrow \frac{\pi}{2}} \frac{1 + \cos 3x}{1 - \cos 5x} =$

1. 0 2. 1 3. $\frac{3}{5}$ 4. $\frac{9}{25}$

Solution: $\lim_{x \rightarrow \frac{\pi}{2}} \frac{1 + \cos 3x}{1 - \cos 5x} = \frac{1-0}{1-0} = 1. \text{ So the answer is 2.}$

9. $\lim_{x \rightarrow 0} \frac{\sqrt{1+x} - \sqrt{1-x}}{x} =$

1. -1 2. 0 3. 1 4. 2

Solution: $\lim_{x \rightarrow 0} \frac{\sqrt{1+x} - \sqrt{1-x}}{x} = \lim_{x \rightarrow 0} \frac{\sqrt{1+x} - \sqrt{1-x}}{x} \cdot \frac{\sqrt{1+x} + \sqrt{1-x}}{\sqrt{1+x} + \sqrt{1-x}}$

$$= \lim_{x \rightarrow 0} \frac{1+x-1-x}{x(\sqrt{1+x} + \sqrt{1-x})} = \lim_{x \rightarrow 0} \frac{2}{(\sqrt{1+x} + \sqrt{1-x})} = \frac{2}{(\sqrt{1+0} + \sqrt{1-0})} = \frac{2}{1+1} = 1.$$

So the answer is 3.

10. $\lim_{x \rightarrow \infty} \frac{\sqrt{x^2+1}}{2x-1} =$

1. 0 2. 1 3. $\frac{1}{2}$ 4. $-\frac{1}{2}$

Solution: $\lim_{x \rightarrow \infty} \frac{\sqrt{x^2+1}}{2x-1} = \lim_{x \rightarrow \infty} \frac{x\sqrt{1+\frac{1}{x^2}}}{x(2-\frac{1}{x})} = \frac{\sqrt{1+\frac{1}{\infty}}}{(2-\frac{1}{\infty})} = \frac{\sqrt{1-0}}{2-0} = \frac{1}{2}$. **So the answer is 3.**

11. $\lim_{x \rightarrow \infty} \frac{x(x+1)(2x+3)}{x^3} =$

1. 0 2. ∞ 3. -2 4. 2

Solution: $\lim_{x \rightarrow \infty} \frac{x(x+1)(2x+3)}{x^3} = \lim_{x \rightarrow \infty} \frac{x \cdot x \left(1 + \frac{1}{x}\right) x \left(2 + \frac{3}{x}\right)}{x^3} = \left(1 + \frac{1}{\infty}\right) \left(2 + \frac{3}{\infty}\right)$

$= (1 + 0)(2 + 0) = 2$. **So the answer is 4.**

12. $\lim_{x \rightarrow 0} \frac{\sqrt[3]{8+x}-2}{x} =$

1. 1 2. 0 3. $\frac{4}{3}$ 4. $-\frac{4}{3}$

Solution: $\lim_{x \rightarrow 0} \frac{\sqrt[3]{8+x}-2}{x} = \lim_{x \rightarrow 0} \frac{1}{3} (8+x)^{\frac{2}{3}} = \frac{1}{3} (8+0)^{\frac{2}{3}} = \frac{1}{3} (2^3)^{\frac{2}{3}} = \frac{1}{3} (2^2) = \frac{4}{3}$.

So the answer is 4.

13. $\lim_{x \rightarrow 1} \frac{x^3 - x^2 + 2x - 2}{x^2 - 1} =$

1. $\frac{3}{2}$ 2. $-\frac{3}{2}$ 3. $-\frac{4}{3}$ 4. $\frac{4}{3}$

Solution: $\lim_{x \rightarrow 1} \frac{x^3 - x^2 + 2x - 2}{x^2 - 1} = \lim_{x \rightarrow 1} \frac{3x^2 - 2x + 2}{2x} = \frac{3-2+2}{2} = \frac{3}{2}$. **So the answer is 1.**

14. $\lim_{x \rightarrow 0} \left(\frac{a^x - b^x}{x} \right) =$

1. $-\log \frac{b}{a}$ 2. $\log \frac{b}{a}$ 3. $-\log \frac{a}{b}$ 4. $\log \frac{a}{b}$

Solution: $\lim_{x \rightarrow 0} \left(\frac{a^x - b^x}{x} \right) = \lim_{x \rightarrow 0} \left(\frac{a^x \log a - b^x \log b}{1} \right) = \left(\frac{a^0 \log a - b^0 \log b}{1} \right)$

$= \log a - \log b = \log \frac{a}{b}$. **So the answer is 4.**

15. $\lim_{x \rightarrow 2} \left(\frac{1}{x-2} - \frac{1}{x^2-3x+2} \right) =$

1. 0 2. ∞ 3. -2 4. 1

$$\begin{aligned} \lim_{x \rightarrow 2} \left(\frac{1}{x-2} - \frac{1}{x^2-3x+2} \right) &= \lim_{x \rightarrow 2} \frac{x^2-3x+2-x+2}{(x-2)(x^2-3x+2)} = \lim_{x \rightarrow 2} \frac{x^2-4x+4}{(x-2)(x^2-3x+2)} = \\ &= \lim_{x \rightarrow 2} \frac{2x-4}{(x-2)(2x-3)+(x^2-3x+2)} = \lim_{x \rightarrow 2} \frac{2}{(2x-3)+2(x-2)+(2x-3)} \\ &= \lim_{x \rightarrow 2} \frac{2}{6x-10} = \frac{2}{12-10} = 1. \text{ So the answer is 4.} \end{aligned}$$

ICET-2012

17. $\lim_{x \rightarrow 1} \frac{x^2 - \sqrt{x}}{\sqrt{x} - 1} =$

1. 1 2. 3 3. 4 4. ∞

Solution: $\lim_{x \rightarrow 1} \frac{x^2 - \sqrt{x}}{\sqrt{x} - 1} = \lim_{x \rightarrow 1} \frac{2x - \frac{1}{2\sqrt{x}}}{\frac{1}{2\sqrt{x}}} = \lim_{x \rightarrow 1} \frac{4x\sqrt{x} - 1}{1} = 4 - 1 = 3.$

So the answer is 2.

18. $\lim_{n \rightarrow \infty} \frac{1^2 + 2^2 + \dots + n^2}{n^3} =$

1. 0 2. 1/2 3. 1/3 4. 1

Solution: $\lim_{n \rightarrow \infty} \frac{1^2 + 2^2 + \dots + n^2}{n^3} = \lim_{n \rightarrow \infty} \frac{n(n+1)(2n+1)}{6n^3} = \frac{(1+0)(2+0)}{6} = \frac{1}{3}.$

Answer is 3.

ICET-2011

21. $\lim_{x \rightarrow 0} \frac{\tan x - x}{x} =$

1. 1 2. -1 3. 0 4. does not exist

Solution: $\lim_{x \rightarrow 0} \frac{\tan x - x}{x} = \lim_{x \rightarrow 0} \frac{\tan x}{x} - 1 = 1 - 1 = 0.$ **Answer is 3.**

22. $\lim_{x \rightarrow -1} \frac{1 + \sqrt[3]{x}}{1 + \sqrt[5]{x}} =$

1. $\frac{5}{3}$

2. $\frac{3}{5}$

3. $\frac{-5}{3}$

4. $\frac{-3}{5}$

Solution: $\lim_{x \rightarrow -1} \frac{1 + \sqrt[3]{x}}{1 + \sqrt[5]{x}} = \lim_{x \rightarrow -1} \frac{\frac{1}{3}x^{-\frac{2}{3}}}{\frac{1}{5}x^{-\frac{4}{5}}} = \frac{5}{3}.$ **Answer is 2.**

ICET - 2013

23. $\lim_{x \rightarrow 5} \frac{x^2 - 3x - 10}{x^2 - 7x + 10} =$

1. $\frac{7}{3}$

2. 0

3. $\frac{-3}{5}$

4. Does not exist

Solution: $\lim_{x \rightarrow 5} \frac{x^2 - 3x - 10}{x^2 - 7x + 10} = \lim_{x \rightarrow 5} \frac{2x - 3}{2x - 7} = \frac{10 - 3}{10 - 7} = \frac{7}{3}.$ **So the answer is 1.**

ICET - 2014

24. $\lim_{x \rightarrow 0} \frac{\tan x}{x^0} =$

1. $\frac{180}{\pi}$

2. $\frac{\pi}{180}$

3. 1

4. -1

Solution: $\lim_{x \rightarrow 0} \frac{\tan x}{x \cdot 1^0} = \lim_{x \rightarrow 0} \frac{\tan x}{x} = \frac{1}{1^0} \cdot \lim_{x \rightarrow 0} \frac{\tan x}{x} = \frac{1}{1^0} = \frac{180}{\pi}$ **Answer is 1.**

Telangana ICET - 2015

25. $\lim_{x \rightarrow \frac{\pi}{2}} \frac{1 - \sin^3 x}{\cos^2 x} =$

1. $\frac{3}{2}$

2. 1

3. $\frac{2}{3}$

4. -1

Solution: $\lim_{x \rightarrow \frac{\pi}{2}} \frac{1 - \sin^3 x}{\cos^2 x} = \lim_{x \rightarrow \frac{\pi}{2}} \frac{0 - 3 \sin^2 x \cos x}{-2 \cos x \sin x} = \frac{3}{2}$ **Answer is 1.**

26. $\lim_{x \rightarrow 3} \frac{x-3}{\sqrt{x-2}-\sqrt{4-x}} =$

1. 0

2. 1

3. 2

4. 4

Solution: $\lim_{x \rightarrow 3} \frac{x-3}{\sqrt{x-2}-\sqrt{4-x}} = \lim_{x \rightarrow 3} \frac{(x-3)[\sqrt{x-2}+\sqrt{4-x}]}{[\sqrt{x-2}-\sqrt{4-x}][\sqrt{x-2}+\sqrt{4-x}]} =$

$$= \lim_{x \rightarrow 3} \frac{(x-3)[\sqrt{x-2}+\sqrt{4-x}]}{x-2-4+x} = \lim_{x \rightarrow 3} \frac{(x-3)[\sqrt{x-2}+\sqrt{4-x}]}{2(x-3)} =$$

$$= \lim_{x \rightarrow 3} \frac{[\sqrt{x-2}+\sqrt{4-x}]}{2} = \frac{1+1}{2} = 1$$

Answer is 3.

DIFFERENTIATION

1. Let f be a function defined in a neighbourhood of 'a'.
2. If $\lim_{x \rightarrow a} \frac{f(x) - f(a)}{x - a}$ (or) $\lim_{h \rightarrow a} \frac{f(a + h) - f(a)}{h}$ exists and is finite then the function $f(x)$ is said to be differentiable at $x = a$ and the limit is denoted by $f'(a)$. Here $f'(a)$ is called the derivative or differential coefficient of $f(x)$ at $x = a$.
 f is said to be a differentiable function if it is differentiable at each point of its domain.
3. If $y = f(x)$ is a function which is differentiable at each point in the domain of f ; then the function

$f'(x) = \lim_{h \rightarrow 0} \frac{f(x + h) - f(x)}{h}$ also denoted by $\frac{df}{dx}$ is called derivative of $f(x)$ with respect to x .

5. $Lf'(c) = Rf'(c) \Leftrightarrow f$ is differentiable at $c \in (a, b)$.

List of derivatives of some standard functions.

S.No.	Function $y = f(x)$	Derivative $y' = f'(x)$
1.	k (constant)	0
2.	x	1
3.	x^n ($n \in R$)	nx^{n-1}
4.	$\sin x$	$\cos x$
5.	$\cos x$	$-\sin x$
6.	$\tan x$	$\sec^2 x$
7.	$\cot x$	$-\operatorname{cosec}^2 x$
8.	$\sec x$	$\sec x \tan x$
9.	$\operatorname{cosec} x$	$-\operatorname{cosec} x \cot x$
10.	$\sin^{-1} x$	$\frac{1}{\sqrt{1-x^2}}$
11.	$\cos^{-1} x$	$\frac{-1}{\sqrt{1-x^2}}$
12.	$\tan^{-1} x$	$\frac{1}{1+x^2}$
13.	$\cot^{-1} x$	$\frac{-1}{1+x^2}$
14.	$\sec^{-1} x$	$\frac{1}{ x \sqrt{x^2 - 1}}$

15.	$\operatorname{cosec}^{-1}x$	$\frac{-1}{ x \sqrt{x^2-1}}$
16.	e^x	e^x
17.	$a^x, a > 0$	$a^x \log a$
18.	$ x (x \neq 0)$	$\frac{ x }{x}$
19.	$\log x $	$\frac{1}{x}$
20.	$x^x, x > 0$	$x^x(1 + \log x)$
21.	$\sin hx$	$\cos hx$
22.	$\cos hx$	$\sin hx$
23.	$\tan hx$	$\sec h^2x$
24.	$\cot hx$	$-\operatorname{cosec} h^2x$
25.	$\sec hx$	$-\sec hx \tan hx$
26.	$\operatorname{cosec} hx$	$-\operatorname{cosec} h^2x \cot hx$
27.	$\sin h^{-1}x$	$\frac{1}{\sqrt{1+x^2}}$
28.	$\cos h^{-1}x$	$\frac{1}{\sqrt{x^2-1}}, x > 1$
29.	$\tan h^{-1}x$	$\frac{1}{1-x^2} \text{ in } (-1, 1)$
30.	$\cot h^{-1}x$	$\frac{1}{1-x^2} \text{ in } R - [-1, 1]$
31.	$\sec h^{-1}x$	$\frac{-1}{ x \sqrt{1-x^2}} \quad x < 1, x \neq 0$
32.	$\operatorname{cosec} h^{-1}x$	$\frac{-1}{ x \sqrt{x^2+1}} \text{ for } x \neq 0$

If $u(x)$ and $v(x)$ are two functions, differentiable in the common domain, then

$$1. \quad \frac{d}{dx}(uv) = u \frac{dv}{dx} + v \frac{du}{dx}.$$

$$2. \quad \frac{d}{dx} \left(\frac{u}{v} \right) = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2} \text{ if } v(x) \neq 0 \forall x$$

Chain Rule: If f is a function differentiable at x and g is a function differentiable at $f(x)$, then $g \circ f$ is also differentiable at x and

$$(g \circ f)'(x) = g'(f(x))f'(x) \quad \text{or} \quad \frac{dg}{dx} = \frac{dg}{df} \cdot \frac{df}{dx}.$$

PROBLEMS

1. $\frac{d}{dx}(\log_x 10) =$

1. 0 2. $\frac{-\log 10}{x(\log x)^2}$ 3. $\frac{-\log 10}{(\log x)^2}$ 4. $\frac{x}{\log 10}$

Solution: $\frac{d}{dx}(\log_x 10) = \frac{d}{dx} \left(\frac{\log 10}{\log x} \right) = \frac{-\log 10}{x(\log x)^2}$. So the answer is 2.

2. If $f(x) = \frac{1}{\sqrt{x}}$ then $f'(x)$ at $x = 4$ is

1. $\frac{-1}{16}$ 2. $\frac{-1}{8}$ 3. $\frac{-1}{4}$ 4. $\frac{1}{8}$

Solution: $f(x) = \frac{1}{\sqrt{x}} = x^{-\frac{1}{2}} \Rightarrow f'(x) = \frac{-1}{2} \cdot x^{-\frac{1}{2}-1} = \frac{-x^{-\frac{3}{2}}}{2}$. So $f'(x)$ at $x = 4$ is $\frac{-4^{-\frac{3}{2}}}{2} =$

$$\frac{-1}{16}.$$

So the answer is 1.

3. If $f(x) = 2^{\cot x}$, then $f'(x)$ at $x = \frac{\pi}{4}$ is

1. $-2 \log 2$ 2. $-4 \log 2$ 3. $2 \log 2$ 4. $4 \log 2$

Solution: $f(x) = 2^{\cot x}$, then $f'(x) = 2^{\cot x} \log 2$. So $f'(x)$ at $x = \frac{\pi}{4}$ is $2^{\cot \frac{\pi}{4}} \log 2 = 2 \log 2$.

So the answer is 3.

4. If $x = \sqrt{2y + \sqrt{2y + \sqrt{2y + \dots \infty}}}$ then $\frac{dy}{dx} =$

1. $x + 1$ 2. $x - 1$ 3. $x + \frac{1}{2}$ 4. $x - \frac{1}{2}$

Solution: $x = \sqrt{2y + \sqrt{2y + \sqrt{2y + \dots \infty}}} = \sqrt{2y + x}$. So $x = \sqrt{2y + x}$. Squaring both sides

$x^2 = 2y + x$. Differentiating with respect to x we get $2x = \frac{2dy}{dx} + 1$.

So $\frac{dy}{dx} = \frac{2x-1}{2} = x - \frac{1}{2}$. **So the answer is 4.**

5. The derivative of $\sin x$ with respect to $\tan x$ is
 1. $\cos x$ 2. $\cos^2 x$ 3. $\cos^3 x$ 4. $\cos^4 x$

Solution: Let $y = \sin x$. So $\frac{dy}{dx} = \cos x$. Let $z = \tan x$. $\frac{dz}{dx} = \sec^2 x$.

So $\frac{dy}{dz} = \frac{\frac{dy}{dx}}{\frac{dz}{dx}} = \frac{\cos x}{\sec^2 x} = \cos^3 x$. **So the answer is 3.**

6. If $y = \sqrt{x + \sqrt{x + \sqrt{x + \dots}}}$ then $\frac{dx}{dy} =$

1. $1 - y$ 2. $1 - 2y$ 3. $2y - 1$ 4. $y - 1$

Solution: $y = \sqrt{x + \sqrt{x + \sqrt{x + \dots}}} = \sqrt{x + y}$. So $y = \sqrt{x + y}$. Squaring both sides we get

$y^2 = x + y$. Differentiating with respect to y , we get $2y = \frac{dx}{dy} + 1$. So $\frac{dx}{dy} = 2y - 1$.

So the answer is 3.

7. If $x = \sqrt{y + \sqrt{y + \sqrt{y + \dots}}}$ then $\frac{dy}{dx} =$

1. $x - 1$ 2. $x + 1$ 3. $2x - 1$ 4. $2x + 1$

Solution: $x = \sqrt{y + \sqrt{y + \sqrt{y + \dots}}} = \sqrt{y + x}$. So $x = \sqrt{y + x}$. Squaring both sides we get

$x^2 = y + x$. Differentiating with respect to x , we get $2x = \frac{dy}{dx} + 1$. So $\frac{dy}{dx} = 2x - 1$.

So the answer is 3.

8. If $y = 4x^3 - 3x^2 + 2x - 1$, then $\frac{dy}{dx}$ at $x = \frac{1}{2}$ is

1. 0 2. 1 3. 2 4. 3

Solution: $\frac{dy}{dx} = 12x^2 - 6x + 2$. So $\frac{dy}{dx}$ at $x = \frac{1}{2}$ is $12 \cdot \left(\frac{1}{2}\right)^2 - 6 \cdot \left(\frac{1}{2}\right) + 2 = 2$.

So the answer is 2.

9. If $x^2 y = 1$, then $\frac{dy}{dx} =$

1. $-\frac{2}{x^3}$ 2. $\frac{2}{x^3}$ 3. $\frac{1}{x^3}$ 4. $-\frac{1}{x^3}$

Solution: $x^2y = 1$. Differentiating we get $2xy + x^2 \frac{dy}{dx} = 0$.

$$\text{So } \frac{dy}{dx} = \frac{2xy}{x^2} = -\frac{2y}{x} = -\frac{2}{x} \left(\frac{1}{x^2} \right) = -\frac{2}{x^3}.$$

So the answer is 1.

ICET-2012

10. If $3x^2 + 2xy + y^2 = 6$, then $\left(\frac{dy}{dx} \right)_{(-1, 2)} =$

1. -1 2. 1 3. -2 4. 2

Solution: We have $3x^2 + 2xy + y^2 = 6$

Differentiating with respect to x , we get $6x + 2x \frac{dy}{dx} + 2y + 2y \frac{dy}{dx} = 0 \Rightarrow \frac{dy}{dx} = \frac{-3x - y}{x + y}$.

$$\text{So } \left(\frac{dy}{dx} \right)_{(-1, 2)} = \frac{+3 - 2}{-1 + 2} = 1$$

So the answer is 2.

11. The derivative of $\tan^{-1}(x^2 + 1)$ with respect to x at $x = 2$ is

1. $\frac{2}{13}$ 2. $\frac{3}{26}$ 3. $\frac{1}{13}$ 4. $\frac{1}{26}$

Solution: $\frac{d}{dx} \tan^{-1}(x^2 + 1) = \frac{1}{1 + (x^2 + 1)^2} \cdot 2x$

$$\left. \frac{d}{dx} \tan^{-1}(x^2 + 1) \right|_{x=2} = \frac{4}{1 + (5)^2} = \frac{2}{13}. \quad \text{So the answer is 1.}$$

ICET-2011

12. If $y = 2^{\sec x}$, then $\left(\frac{dy}{dx} \right)_{x=0} =$

1. 0 2. $2 \ln 2$ 3. $\ln 2$ 4. $-2 \ln 2$

Solution: $\frac{dy}{dx} = \frac{d}{dx} 2^{\sec x} = (2^{\sec x} \cdot \log \sec x)(\sec x \tan x)$

$$\left(\frac{dy}{dx} \right)_{x=0} = (2^{\sec 0} \cdot \log \sec 0)(\sec 0 \tan 0) = (2^1 \cdot \log 1)(1 \cdot 0) = 0. \quad \text{So the answer is 1.}$$

13. If $f(x) = \frac{x^2+1}{x^2-1}$, then $f'(2) =$

1. $\frac{8}{9}$

2. $\frac{-8}{9}$

3. $\frac{5}{3}$

4. $\frac{-5}{3}$

Solution: $f'(x) = \frac{2x(x^2-1) - 2x(x^2+1)}{(x^2-1)^2} = \frac{-4x}{(x^2-1)^2}$

$f'(2) = \frac{-8}{9}$. **So the answer is 2.**

STATISTICS

Group of collection is called data. There are two types of data. One is ungrouped data and the other is grouped data. The arrangement of raw data under various class intervals is called group data or classified data or tabulation.

1. **Frequency Distribution table:** The table showing the class intervals along with the corresponding class frequencies is known as 'Frequency distribution table'.
2. **Frequency :** The number of times an observation occurs in the given data is called frequency of observation.
3. **Cumulative frequency :** It is the sum of the frequencies of that class and all the previous classes of it
4. **Length of the class:** The difference between the upper and lower boundaries is called 'Length of the class'
5. **Range:** The difference between upper and least values of the data.
6. **Mid value :** The average of lower and upper limit is called 'mid value' of a class interval.
7. **The following are measure of central tendency values:**
 - a) Arithmetic Mean (A.M); b) Geometric Mean (G.M);
 - c) Harmonic Mean (H.M)d) Median; e) Mode

- a. **A.M. (or) Mean :** A.M. (or) Mean for ungrouped data = $\frac{\text{sum of the items}}{\text{Number of items}}$

If $x_1, x_2, \dots, x_n$ are the mid values and $f_1, f_2, \dots, f_n$ are frequencies of a grouped data then A.M

$$= \frac{\sum f_i x_i}{\sum f_i}$$

- b. **Geometric Mean (G.M) :** G.M of a set of 'n' observations is the n^{th} root of their product.
G.M. = $(x_1 x_2 \dots x_n)^{1/n}$

If any observation is zero, then G.M. becomes zero.

If any observation is negative, then G.M = imaginary

- c. **Harmonic Mean (H.M):** H.M is a set of 'n' observations is the reciprocal of the A.M., the

reciprocals of given values.
$$\text{H.M} = \frac{n}{\sum \frac{1}{x_i}}$$

Measures of central tendency or inadequate to give us complete idea of the entire distribution.

- d. **Median :** For ungrouped data, if 'n' is odd, $\frac{(n+1)}{2}^{\text{th}}$ observation is the Median and if 'n' is even, then the average of the two middle observations is the Median. For grouped data,

$$\text{Median} = L + \frac{\frac{N}{2} - m}{f} \times c$$

here, L = Lower boundary of the Median class ;

N = Sum of the frequencies.

m = The cumulative frequency before the median class .

f = The frequency of the median class.

c = The length of class .

- e. **Mode** : The observation which occurs most frequently in an ungrouped data is called mode.

$$\text{Mode of a grouped data} = L + \frac{\Delta_1}{\Delta_1 + \Delta_2} \times c$$

here L = Lower boundary of the modal class

$$\Delta_1 = f - f_1; \Delta_2 = f - f_2$$

f = frequency of modal class;

f_1 & f_2 are the frequencies before and after the modal class;

c = Length of the class.

The relation between Mean, Mode, Median :

Mean - Mode = 3(Mean - Median) (or) Mode = 3 Median - 2 Mean

8. **Measure of dispersion** : a) Range, b) Quartile Deviation (Q.D), c) Mean Deviation (M.D), d) Standard Deviation (S.D), e) Variance.

- a. **Range** : Greatest value - Least value

- b. **Quartile Deviation (Q.D)** : The value below which 25% scores will lie is called the first quartile, Q_1

The value below which 75% scores will lie is called the 3rd quartile, Q_3

$$Q_1 = l_1 + \frac{\frac{N}{4} - m_1}{f_1} \times c; Q_3 = l_3 + \frac{\frac{3N}{4} - m_3}{f_3} \times c \text{ and } Q.D = \frac{Q_3 - Q_1}{2}$$

where l_1 & l_3 are the lower boundaries of the respective Quartiles; m_1 & m_3 are the cumulative frequencies to the class above the Quartile class;

f_1 & f_3 are frequencies of the respective Quartile classes.

- c. **Mean Deviation (M.D)**: The average absolute values of the deviations of the measured from central values (Mean, Median, Mode) is called M.D.

$$\text{for ungrouped data, M.D.} = \sum_{i=1} \frac{|x_i - M|}{N}$$

x_i = i^{th} value in given data

M = Central value

N = Number of values

$$\text{for grouped data, M.D.} = \frac{\sum f(x_i - M)}{\sum f} = \frac{\sum |fd|}{\sum f}$$

x_i = Mid value of C.I.

M = Central value $d = (x_i - M)$

d. **Standard Deviation (S.D.):**
$$S.D. = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{N}}$$

here $x_i = i^{\text{th}}$ observation

$\bar{x}$ = Mean

N = Total number of observation

For a symmetric distribution the relationship among Q.D. and S.D. and M.D

$$Q.D. = \frac{2}{3} S.D.; \quad M.D. = \frac{4}{5} S.D. \quad \text{and} \quad Q.D. = \frac{5}{6} M.D.$$

e. **Variance (σ^2):** The mean of the squares of deviations of the values from their A.M. is

called variance.
$$\text{Variance } (\sigma^2) = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{N}$$

9. **Rank-correlation:** It is used to find the relationship between two variables.

10. **Spearman's rank-correlation (ρ)**
$$\rho = 1 - \frac{6 \sum d^2}{n(n^2 - 1)}$$

here n = number of items; d = difference in ranks

The value of ρ lies between -1 and 1

11. The condition for perfect positive correlation $\rho = 1$, and for perfect negative correlation $\rho = -1$

12. For complete absence of correlation, $\rho = 0$.

If $|\rho| < 0.2$, the relationship is negligible.

If $0.2 < |\rho| < 0.4$, the relationship is light.

If $0.4 < |\rho| < 0.7$, the relationship is substantial.

If $0.7 < |\rho| < 1$, the relationship is very high.

13. **Coefficient of Quartile deviation**
$$= \frac{Q_3 - Q_1}{Q_3 + Q_1}$$

14. Coefficient of Mean deviation
$$= \frac{M.D.}{\text{Average}} \quad (15) \quad \text{Coefficient of variation} = \frac{\sigma}{\bar{x}} \times 100.$$

16. **Correlation:** If the change in one variable affects the change in other variable then two variables are said to be correlated.

Correlation coefficient is a numerical measure of linear relationship between x and y and is

defined as
$$\gamma_{(x,y)} = \frac{\text{Cor}(x,y)}{\sigma_x \sigma_y}$$
 or simply ' γ '

Where
$$\text{Cor}(x,y) = \frac{1}{n} \sum x_1 y_1 - \bar{x} \bar{y} \quad \text{or} \quad \frac{1}{n} \sum (x_1 - \bar{x})(y_1 - \bar{y})$$

$$\sigma_x^2 = \frac{1}{n} \sum (x_1 - \bar{x})^2; \quad \sigma_y^2 = \frac{1}{n} \sum (y_1 - \bar{y})^2 \quad -1 \leq \gamma \leq 1. \quad 0 \leq r^2 \leq 1$$

Statistical Ability:

1. The median of the following data is 8, 4, 7, 1, 1, 5, 4, 3, 9, 2, 8, 6, 7

1. 4 2. 7 3. 5 4. 6

Solution: Ascending order 1, 1, 2, 3, 4, 4, 5, 6, 7, 7, 8, 8, 9

Here $n = 13$. So median = the value in the 7th place = 5. **Hence answer is 3.**

2. The arithmetic mean of $1^2, 2^2, 3^2, \dots, 15^2$ is

1. $\frac{248}{3}$ 2. $\frac{248}{15}$ 3. $\frac{496}{15}$ 4. $\frac{246}{3}$

Solution: A.M. = $\frac{1^2 + 2^2 + \dots + 15^2}{15} = \frac{1}{15} \times \frac{15 \times 16 \times 31}{6} = \frac{248}{3}$. **Hence the answer is 1.**

(Note: $1^2 + 2^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$, here $n = 15$.)

3. The standard deviation of 105, 110, 115, 120, 125, 130, 135, is

1. 20 2. 40 3. 30 4. 10

Solution: Shifting the origin is to 100 i.e., less 100 from each item.

Then we get 5, 10, 15, 20, 25, 30, 35. A.M. = $\bar{x} = \frac{5+10+15+20+25+30+35}{7} = \frac{140}{7} = 20$

$$\begin{aligned} \text{S.D.} &= \sqrt{\frac{\sum (x - \bar{x})^2}{N}} = \sqrt{\frac{(5-20)^2 + (10-20)^2 + (15-20)^2 + (20-20)^2 + \dots + (35-20)^2}{7}} \\ &= \sqrt{\frac{225+100+25+0+25+100+225}{7}} = \sqrt{\frac{700}{7}} = \sqrt{100} = 10. \text{ Hence answer is 4.} \end{aligned}$$

4. If the median and mode of 10 observations are 12 and 16 respectively, then the mean of the data is

1. 14 2. 15 3. 10 4. 11

Solution: Mode = 3 median - 2 mean $\Rightarrow 16 = 3(12) - 2 \text{ mean} \Rightarrow 2 \text{ mean} = 36 - 16 = 20$
 $\Rightarrow \text{mean} = 10$. **Hence answer is 3.**

5. If the arithmetic means of two data having 24 and 16 observations are 10 and 15 respectively, then the arithmetic mean of the combined data is

1. 12.5 2. 12 3. 20 4. 13

Solution: $\frac{x_1 + x_2 + \dots + x_{24}}{24} = 10 \Rightarrow x_1 + x_2 + \dots + x_{24} = 240$

$$\frac{y_1 + y_2 + \dots + y_{16}}{16} = 15 \Rightarrow y_1 + y_2 + \dots + y_{16} = 240.$$

So $\frac{x_1 + x_2 + \dots + x_{24} + y_1 + y_2 + \dots + y_{16}}{40} = \frac{240 + 240}{40} = \frac{480}{40} = 12$. **Hence answer is 2.**

6. The median of the first twenty positive integers is
 1. 10 2. 10.5 3. 11 4. 9.5

Solution: Here $n = 20$ is even, so median $= \frac{10+11}{2} = \frac{21}{2} = 10.5$. **Hence answer is 2.**

7. The A.M. of 5 observations is 4.4 and the variance is 8.24. If 3 of the observations are 1, 2 and 6, then the other two are
 1. 8, 5 2. 4, 9 3. 7, 6 4. 2, 11

Solution: Variance $(\sigma^2) = \sum_{i=1}^n \frac{(x_i - \bar{x})^2}{N}$. Here $\bar{x} = 4.4$, $N = 5$.

$$\text{So } \frac{(1-4.4)^2 + (2-4.4)^2 + (6-4.4)^2 + (a-4.4)^2 + (b-4.4)^2}{5} = 8.24$$

$$\Rightarrow 3.4^2 + 2.4^2 + 1.6^2 + (a-4.4)^2 + (b-4.4)^2 = 41.20.$$

$$\Rightarrow (a-4.4)^2 + (b-4.4)^2 = 41.20 - 19.88 = 21.32$$

Using the answers we find $a = 4$, $b = 9$. **Hence answer is 2.**

8. The standard deviation of $x+1, x+2, x+3, x+4, x+8, x+7$ and $x+9$, where x is not equal to zero is,

1. $\sqrt{\frac{29}{6}}$ 2. $\sqrt{\frac{58}{6}}$ 3. $\sqrt{\frac{58x}{6}}$ 4. $\frac{58x}{6}$

Solution: A.M. $= \bar{x} = \frac{x+1+x+2+x+3+x+8+x+7+x+9}{6} = \frac{6x+30}{6} = x+5$

$$\text{S.D.} = \sqrt{\frac{\sum (x - \bar{x})^2}{N}} = \sqrt{\frac{(-4)^2 + (-3)^2 + (-2)^2 + 3^2 + 2^2 + 4^2}{6}}$$

$$= \sqrt{16+9+4+9+4+16} = \sqrt{\frac{58}{6}}. \text{ Hence answer is 2.}$$

9. The variance of the distribution $\{1, 3, 5\}$ is

1. 8 2. $\frac{8}{3}$ 3. $\sqrt{\frac{8}{3}}$ 4. $\sqrt{8}$

Solution: Variance $(\sigma^2) = \sum_{i=1}^n \frac{(x_i - \bar{x})^2}{N}$. Here $\bar{x} = \text{mean} = \frac{1+3+5}{3} = 3$

$$\text{So variance} = \frac{(1-3)^2 + (3-3)^2 + (5-3)^2}{3} = \frac{8}{3}. \text{ Hence the answer is 2.}$$

10. If m is the arithmetic mean of $x_1, x_2, \dots, x_n$ then the arithmetic mean of $ax_1+b, ax_2+b, \dots, ax_n+b$ is

1. m 2. $m+b$ 3. $am+b$ 4. am

Solution: A.M. = $m = \frac{x_1 + x_2 + \dots + x_n}{n}$ A.M. = $\frac{ax_1 + b + ax_2 + b + \dots + ax_n + b}{n}$
 $= \frac{a(x_1 + x_2 + \dots + x_n)}{n} + \frac{nb}{n} = am + b$. **Hence answer is 3.**

11. The arithmetic mean of the first 10 positive integers is

1. 5 2. 6 3. 5.4 4. 5.5

Solution: A.M. = $\frac{1+2+3+\dots+10}{10} = \frac{55}{10} = 5.5$. **Hence answer is 4.**

12. If σ is the standard deviation of $a_1, a_2, \dots, a_n$ then the standard deviation of $k - a_1, k - a_2, \dots, k - a_n$ is

1. $-\sigma$ 2. $k - \sigma$ 3. σ 4. $k + \sigma$

Solution: Shifting of the origin doesn't effect standard deviation (or) standard deviation is translation in variant. **Hence answer is 3.**

13. If Q_k ($k = 1, 2, 3, 4$) is the k^{th} quartile deviation of a distribution then the median of the distribution is

1. Q_1 2. Q_2 3. Q_3 4. Q_4

Answer is 2.

14. For the observations $x_1, x_2, \dots, x_n$ the sum $\sum_{j=1}^n |x_j - c|$ is minimum if c is their

1. mean 2. median 3. mode 4. sum

Answer is 2.

15. The mode of 3, 5, 2, 6, 5, 9, 5, 2, 8, 6 is

1. 6 2. 5 3. 3 4. 2

Solution: 5 is most repeated value. i.e. 3 times. So mode is 5. **Hence answer is 2.**

16. The arithmetic mean of 100 observations is found to be 50. Later it is noticed that two observations are taken as 42 and 4 instead of 142 and 44. The correct mean is

1. 51.4 2. 46.8 3. 41.4 4. 42.2

Solution: A.M. = $\frac{x_1 + x_2 + \dots + x_{98} + 42 + 4}{100} = 50$

$$\frac{x_1 + x_2 + \dots + x_{98} + 142 + 44}{100} = \frac{x_1 + x_2 + \dots + x_{98} + 46}{100} + \frac{140}{100} = 50 + 1.4 = 51.4.$$

Hence answer is 1.

17. The mean of the distribution given below is

x	0-10	10-20	20-30
f	2	3	5
1.	10	2.	18
		3.	21
		4.	23

Solution: Mean = $\frac{\sum fx_i}{\sum f} = \frac{(5 \times 2) + (15 \times 3) + (25 \times 5)}{2 + 3 + 5} = \frac{10 + 45 + 125}{10} = \frac{180}{10} = 18.$

Hence answer is 2. (Note: x_i is mid value of each class)

18. The mean and variance of the observations 6, 7, a, b, 10, 12, 13, are 9 and 9.25 respectively.

Then the ordered pair (a, b) =

1. (7, 3) 2. (8, 6) 3. (8, 4) 4. (9, 5)

Solution: Mean = $\frac{6 + 7 + a + b + 10 + 12 + 12 + 13}{8} = 9$

$\Rightarrow 60 + a + b = 72 \Rightarrow a + b = 12.$ So $a = 8, b = 4.$ **Hence answer is 3.**

19. If the standard deviation of $x_1, x_2, \dots, x_n$ is σ then the standard deviation of $y_1, y_2, \dots, y_n$ where $y_j = 3x_j + 5$ for $j = 1, 2, \dots, n$ is

1. $\sqrt{3}\sigma$ 2. 3σ 3. $3\sigma + 5$ 4. $\sqrt{3}\sigma + 5$

Solution: S.D. of $x_1, x_2, \dots, x_n$ is same as S.D. of $x_1 + k, x_2 + k, \dots, x_n + k$

But S.D. of $kx_1, kx_2, \dots, kx_n$ is k times to S.D. of $x_1, x_2, \dots, x_n.$

Hence answer is 2.

20. The mode of the observations: 19, 9, 8, 7, 6, 3, 7, 2, 7, 6, 9, 7, 8, 7 is

1. 9 2. 8 3. 7 4. 6

Solution: Mode is the value which was repeated more number of times.

So 7 is the mode. **Hence answer is 3.**

21. The mean deviation of the observations 1, 3, 7, 14, 5 about their median is

1. 3 2. 3.4 3. 4 4. 4.2

Solution: Ascending order 1, 3, 5, 7, 14. So median $M = 5.$ Mean deviation = $\frac{1}{n} \sum |x - M|.$

$$= \frac{1}{5} [|1-5| + |3-5| + |5-5| + |7-5| + |14-5|] = \frac{1}{5} [4 + 2 + 0 + 2 + 9] = \frac{17}{5} = 3.4.$$

Hence answer is 2.

22. If m is the arithmetic mean of $a_1, a_2, \dots, a_n$ then the arithmetic mean of $\alpha a_1 + \beta, \alpha a_2 + \beta, \dots, \alpha a_n + \beta$ is

1. m 2. $m + \beta$ 3. $\alpha m + \beta$ 4. αm

Solution: A.M = $\frac{\alpha a_1 + \beta + \alpha a_2 + \beta + \dots + \alpha a_n + \beta}{n} = \frac{\alpha(a_1 + a_2 + \dots + a_n)}{n} + \frac{n\beta}{n} = \alpha m + \beta.$

Hence answer is 3.

23. The median of 65, 42, 59, 70, 82, 25, 92, 49, 30 and 61 is

1. 59 2. 60 3. 61 4. 49

Solution: Ascending order = 25, 30, 42, 49, 59, 61, 65, 70, 82, 92.

Here $n = 10$ even. So median = $\frac{59 + 61}{2} = 60.$ **Hence answer is 2.**

24. If the average of 1, 4, 9, x , 25, 36 and 49 is 20, then $x =$

1. 16 2. 18 3. 22 4. 15

Solution: Average $\frac{1+4+9+x+25+36+49}{7} = 20$

$39 + x + 85 = 140$. $x = 140 - 85 - 39 = 16$. **Hence answer is 1.**

25. If σ is the standard deviation of $x_1, x_2, \dots, x_{100}$ and c is a constant, then the standard deviation of

$x_1 + c, x_2 + c, \dots, x_{100} + c$ is

1. $\sigma + c$ 2. $c\sigma$ 3. σ 4. $(\sigma c)^2$

Solution: Shifting of the origin doesn't effect standard deviation (or) standard deviation is translation in variant. **Hence answer is 3.**

26. The arithmetic mean of the prime numbers less than 10, is

1. 4.5 2. 4 3. 3.6 4. 4.25

Solution: Prime numbers less than 10 are 2, 3, 5, 7.

So arithmetic mean $= \frac{2+3+5+7}{4} = \frac{17}{4} = 4.25$. **Hence answer is 4.**

27. If the median and mode of a distribution are respectively 24.375 and 24.125 then its mean is

1. 24.5 2. 24.25 3. 48.5 4. 24

Solution: Mode $= 3$ median $- 2$ mean $\Rightarrow 24.125 = 3(24.375) - 2$ mean.

So mean $= 24.5$. **Hence answer is 1.**

28. The variance of the observations 6, 7, 5, 4 and 8 is

1. $\sqrt{2}$ 2. $\sqrt{3}$ 3. 2 4. 3

Solution: Variance $(\sigma^2) = \sum_{i=1}^n \frac{(x_i - \bar{x})^2}{N}$. Here $\bar{x}$ = Arithmetic mean $= \frac{6+7+5+4+8}{5} = \frac{30}{5} = 6$

So variance $= \frac{|6-6|^2 + |6-7|^2 + |5-6|^2 + |4-6|^2 + |8-6|^2}{5} = \frac{0+1+1+4+4}{5} = 2$.

Hence answer is 3.

29. The arithmetic mean of the numbers $a, a + 2d, a + 4d, \dots, a + 2nd$, is

1. $a + nd$ 2. $a + (n - 1)d$ 3. $a + (n + 1)d$ 4. $a + \frac{nd}{2}$

Solution: The given series is an arithmetic progression.

Sum of first n terms of A.P. $= s_n = \frac{(2n+1)}{2} [a + a + 2nd] = (2n+1)(a + nd)$

Arithmetic mean $= \frac{s_n}{2n+1} = \frac{(2n+1)(a + nd)}{2n+1} = a + nd$. **Hence answer is 1.**

30. The arithmetic mean of the incomes of 100 workers in a factory is Rs.50 per day and the

arithmetic mean of the incomes of 75 workers of them is Rs.40 per day. Then the arithmetic mean of the incomes of the rest of the workers per day (in rupees) is

1. 60 2. 50 3. 70 4. 80

Solution: Sum of incomes of 100 workers = $100 \times 50 = \text{Rs.}5000$

Sum of incomes of 75 workers = $75 \times 40 = \text{Rs.}3000$

Sum of incomes of 25 workers = $5000 - 3000 = \text{Rs.}2000$.

So average income = $\frac{2000}{25} = 80$. **Hence answer is 4.**

31. The mean deviation of the values 21, 23, 25, 28, 30, 32, 28, 38, 39, 46, 48 from the mean is

1. 7.6 2. 6.7 3. 7.8 4. 8.7

Solution: Shifting the origin to 20. The scores are 1, 3, 5, 8, 10, 12, 18, 19, 26, 28.

$$\text{Mean} = M = \frac{1+3+5+8+10+12+18+19+26+28}{10} = \frac{130}{10} = 13$$

$$\begin{aligned} \text{Mean deviation from mean} &= \sum_{i=1}^n \frac{|x_i - M|}{N} \\ &= \frac{|1-13| + |3-13| + |5-13| + |8-13| + |10-13| + |12-13| + \dots + |28-13|}{10} \\ &= \frac{12+10+8+5+3+1+5+6+13+15}{10} = \frac{78}{10} = 7.8. \text{ Hence answer is 3.} \end{aligned}$$

32. The coefficient of variation is

1. $\frac{\text{M.D}}{\text{Mean}} \times 100$ 2. $\frac{\text{S.D}}{\text{Mean}} \times 100$ 3. $\frac{\text{S.D}}{\text{M.D}} \times 100$ 4. $\frac{\text{M.D}}{\text{S.D}} \times 100$

Answer is 3.

33. The frequency of the inclusive type class 20-25 of the following data is 9, 10, 7, 20, 12, 21, 22, 14, 15, 18, 23, 19, 24, 27, 28, 25, 17, 18, 13, 12, 6, 7, 8, 9, 12

1. 5 2. 6 3. 7 4. 3

Solution: Don't take 25, take 20. The values are 20, 21, 22, 23, 24. **Hence answer is 1.**

34. If the standard deviation of $a_1, a_2, \dots, a_n$ is s , then, the standard deviation of $a_1 + b, a_2 + b, \dots, a_n + b$ is

1. $s + b$ 2. $s - b$ 3. s 4. sb

Solution: Shifting of origin doesn't effect the standard deviation. **Hence answer is 3.**

35. The mode of the distribution for which the arithmetic mean is 4.6 and median is 6.1, is

1. 18.3 2. 9.2 3. 9.1 4. 2.5

Solution: Mode = 3 median - 2 mean = $3(6.1) - 2(4.6) = 18.3 - 9.2 = 9.1$.

Hence answer is 3.

36. Coefficient of Skewness =

1. $\frac{\text{Mode} - \text{Mean}}{\text{S.D}}$ 2. $\frac{\text{Mean} - \text{Mode}}{\text{S.D}}$ 3. $\frac{\text{Mode} - \text{Mean}}{\text{Variance}}$ 4. $\frac{\text{Mean} - \text{Mode}}{\text{Variance}}$

Answer is 2.

37. In a distribution if 6, 4, 8, 3 occur with frequencies 4, 2, 5, 1 respectively, then arithmetic mean is

1. 6.25 2. 6.52 3. 6.30 4. 6.02

Solution: $A.M. = \frac{\sum fx}{\sum f} = \frac{6(4) + 4(2) + 8(5) + 3(1)}{4 + 2 + 5 + 1} = \frac{24 + 8 + 40 + 3}{12} = \frac{75}{12} = 6.25.$

Hence answer is 1.

38. The standard deviation of -3, -2, -1, 0, 1, 2, 3 is

1. 2 2. 4 3. 6 4. 8

Solution: $\bar{x} = A.M. = \frac{(-3) + (-2) + (-1) + (0) + 1 + 2 + 3}{7} = 0$

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$$\begin{aligned} &= \sqrt{\frac{\sum (x - \bar{x})^2}{N}} = \sqrt{\frac{(-3-0)^2 + (-2-0)^2 + (-1-0)^2 + (0-0)^2 + (1-0)^2 + (2-0)^2 + (3-0)^2}{7}} \\ &= \sqrt{\frac{9+4+1+0+1+4+9}{7}} = \sqrt{\frac{28}{7}} = \sqrt{4} = 2. \text{ Hence answer is 1.} \end{aligned}$$

39. If a, g, h are respectively A.M, G.M and H.M of a data then

1. $a \geq g \geq h$ 2. $a \geq g \leq h$ 3. $a \leq g \geq h$ 4. $a \leq g \leq h$

Solution: $A.M = \frac{a+b}{2}$, $G.M = \sqrt{ab}$, $H.M = \frac{2ab}{a+b}$. **Hence answer is 1.**

40. The quartile deviation of 20, 15, 18, 24, 22, 30, 40 is

1. 24 2. 18 3. 12 4. 6

Solution: Ascending order 15, 18, 20, 22, 24, 30, 40.

$Q_1 = \text{value in the } \frac{1}{4}(7+1) \text{ position} = 18.$

$Q_3 = \text{value in the } \frac{3}{4}(7+1) \text{ position} = 30$

$Q.D = \frac{Q_3 - Q_1}{2} = \frac{30 - 18}{2} = \frac{12}{2} = 6. \text{ Hence answer is 4.}$

41. The geometric mean of $2, 2^2, 2^3, 2^4, 2^5, 2^6, 2^7$ is

1. 2 2. 4 3. 8 4. 16

Solution: $G.M = (2^{1+2+3+4+5+6+7})^{1/7} = (2^{28})^{1/7} = 2^4 = 16. \text{ Hence answer is 4.}$

42. The arithmetic mean of $1^3, 2^3, 3^3, \dots, 19^3$ is

1. 36,100 2. 1900 3. 100 4. 10

Solution: A.M = $\frac{1^3 + 2^3 + \dots + 19^3}{19} = \frac{19^2(19+1)^2}{19(4)} = 1900$

Hence the answer is 2.

(Note: $1^3 + 2^3 + 3^3 + \dots + n^3 = \frac{n^2(n+1)^2}{4}$)

43. The mid value of class 33 - 54 is

1. 43.5 2. 43 3. 21 4. 10.5

Solution: Mid value = $\frac{33+54}{2} = \frac{87}{2} = 43.5$

Hence answer is 1.

ICET-2012

44. If σ is the standard deviation of the observations $x_1, x_2, \dots, x_n$ then the standard deviation of $5x_1 + 7, 5x_2 + 7, \dots, 5x_n + 7$ is

1. $5\sigma + 7$ 2. $\sqrt{25\sigma^2 + 7}$ 3. 5σ 4. $5\sigma + \sqrt{7}$

Solution: S.D. of $x_1, x_2, \dots, x_n$ is same as S.D. of $x_1 + k, x_2 + k, \dots, x_n + k$

But S.D. of $kx_1, kx_2, \dots, kx_n$ is k times to S.D. of $x_1, x_2, \dots, x_n$. **Answer is 3.**

45. The variance of the numbers 87, 88, 89, ..., 98 is

1. $\sqrt{\frac{143}{12}}$ 2. $\sqrt{\frac{843}{12}}$ 3. $\frac{143}{12}$ 4. $\frac{843}{12}$

Solution: Variance (σ^2) = $\sum_{i=1}^n \frac{(x_i - \bar{x})^2}{N}$. Ascending order 87, 88, 89, 90, 91, **92, 93**, 94, 95, 96, 97, 98

Here $\bar{x}$ = Arithmetic mean = $\frac{92+93}{2} = 92.5$, $N=12$

So variance = $\frac{|92.5-87|^2 + |92.5-88|^2 + |92.5-89|^2 + |92.5-90|^2 + \dots + |92.5-98|^2}{12}$

= $\frac{2[|5.5|^2 + |4.5|^2 + |3.5|^2 + |2.5|^2 + |1.5|^2 + |0.5|^2]}{12} = \frac{143}{12}$. **Answer is 3.**

46. The mode of the frequency distribution given below is

x	1	2	3	4	5	6	7	8
f	4	9	16	25	22	15	7	3

1. 4.5 2. 4 3. 5 4. 5.5

Solution: 4 is the most number of times repeated. So 4 is the mode. **Answer is 2.**

47. The geometric mean of the observations 2, 4, 16, 32 is

1. 4 2. 6 3. 8 4. 10

Solution: Geometric Mean (GM) : G.M of a set of 'n' observations is the n^{th} root of their product.

$$\text{G.M.} = (x_1 x_2 \dots x_n)^{1/n}.$$

$$\text{G.M.} = (2 \times 4 \times 16 \times 32)^{1/4} = (2 \times 2^2 \times 2^4 \times 2^5)^{1/4} = (2^{12})^{1/4} = (2^3) = 8. \quad \text{Answer is 3.}$$

48. The median of the observations 7, 8, 7, 9, 7, 14, 15, 6, 8, 14, 9, 17, 15, 16 is

1. 7 2. 8 3. 8.5 4. 9

Solution: Ascending order 6, 7, 7, 7, 8, 8, 9, 9, 14, 14, 15, 15, 16, 17.

$$n = 14. \text{ So median} = \frac{9+9}{2} = 9.$$

Answer is 4.

49. If the mean and mode of a data are 45 and 51 respectively then the median of the data is

1. 46 2. 47 3. 48 4. 49

Solution: Mode = 3 median - 2 mean $\Rightarrow 51 = 3(\text{median}) - 2 \times 45 \Rightarrow 3 \text{ median} = 51 + 90 = 141$
 $\Rightarrow \text{median} = 47. \quad \text{Hence answer is 2.}$

50. The quartile deviation of the observations 80, 48, 60, 92, 50, 35, 70 is

1. 10 2. 12 3. 14 4. 16

Solution: Ascending order 35, 48, 50, 60, 70, 80, 92

$$Q_1 = \text{value in the } \frac{1}{4}(7+1) \text{ position} = 48.$$

$$Q_3 = \text{value in the } \frac{3}{4}(7+1) \text{ position} = 80$$

$$Q.D = \frac{Q_3 - Q_1}{2} = \frac{80 - 48}{2} = \frac{32}{2} = 16. \quad \text{Hence answer is 4.}$$

ICET-2011

51. If the Mode and Mean of a data are 44 and 38 respectively, then the Median of the data is

1. 39 2. 40 3. 42 4. 43

Solution: Mode = 3 median - 2 mean $\Rightarrow 44 = 3(\text{median}) - 2 \times 38 \Rightarrow 3 \text{ median} = 44 + 76 = 120$
 $\Rightarrow \text{median} = 40. \quad \text{Hence answer is 2.}$

52. The Median of the observations 108, 343, 721, 39, 74, 192, 48, 10, 123 is

1. 108 2. 123 3. 74 4. 721

Solution: Ascending order 10, 39, 48, 74, 108, 123, 192, 343, 721.

$$n = 9. \text{ So median is value in } \frac{9+1}{2} = 5 \text{ th position is } 108. \quad \text{Answer is 1.}$$

53. The arithmetic mean of the first 71 natural numbers is

1. 72 2. 71 3. 36 4. 35.5

$$\text{Solution: A.M} = \frac{1+2+3+4+\dots+70+71}{71} = \frac{71(71+1)}{2} \cdot \frac{1}{71} = \frac{72}{2} = 36. \quad \text{Answer is 3.}$$

54. The variance of the observations 73, 74, 75,...,84, 85 is

1. 17 2. $\sqrt{14}$ 3. $\sqrt{17}$ 4. 14

Solution: Variance $(\sigma^2) = \sum_{i=1}^n \frac{(x_i - \bar{x})^2}{N}$. Ascending order

73,74,75,76,77,78,79,80,81,82,83,84,85

Here $\bar{x}$ = Arithmetic mean = 79, N=13

$$\text{So variance} = \frac{|73-79|^2 + |74-79|^2 + |75-79|^2 + \dots + |84-79|^2 + |85-79|^2}{13} =$$

$$\frac{2[6^2 + 5^2 + 4^2 + \dots + 3^2 + 2^2 + 1^2 + 0^2]}{13} = \frac{2}{13} \frac{(6)(6+1)(12+1)}{6} = 14. \quad \text{Answer}$$

is 4.

55. For two positive real numbers, arithmetic mean and geometric mean are 13 and 12 respectively, then these two numbers are

1. 12.5, 13.5 2. 12, 14 3. 8, 18 4. 16, 10

Solution: For any two numbers a and b , A.M = $\frac{a+b}{2} = \frac{8+18}{2} = 13$;

$$\text{G.M} = \sqrt{ab} = \sqrt{8 \times 18} = \sqrt{144} = 12. \quad \text{Answer is 3.}$$

ICET-2013 [5 questions were given]

56. The mode of the following distribution is

10,13,16,13,19,24,13,9,24,13,26 is

1. 26 2. 17 3. 13 4. 9 **Answer is 2.**

57. If the standard deviation of a variable x is 12, then the variance of the variable $2x+17$ is

1. 24 2. 288 3. 576 4. 41 **Answer 1 or 3**

58. The mean of 6 observations is calculated as 24 and later it was noted that one of the observations is wrongly taken as 24 instead of -24, then the correct mean is

1. 40 2. 32 3. 24 4. 16 **Answer is 4.**

59. The median of 15 observations is 32. Each of the observations greater than the median are increased by 8 and each of the observations less than median are decreased by 6. Then the median of the new data is

1. 46 2. 18 3. 32 4. 40 **Answer is 4.**

60. If the standard deviation of the n natural numbers is t , then $12t^2 + 1 =$

1. $n^2 - 1$ 2. n^2 3. $n^2 + 1$ 4. $n^2 + 2$ **Answer is 2.**

ICET-2014 [6 questions were given]

61. For a given data, if the mean is 60 and the mode is 66, then the Median of the data is

1. 63 2. 64 3. 60 4. 62

Solution: Mode = 3 median - 2 mean

Answer is 4.

62. The mode of the following data is

6,9,13,10,16,13,13,14,15,11,13,12,14

1. 11 2. 12 3. 13 4. 14 **Answer is 3.**

63. The mean of the first n odd natural numbers is

1. $n-1$ 2. $n+1$ 3. $n+2$ 4. n **Answer is 4.**

64. The variance of the first n even natural numbers is

1. $\frac{n^2-2}{3}$ 2. $\frac{n^2-1}{6}$ 3. $\frac{n^2-1}{12}$ 4. $\frac{n^2+1}{12}$

Solution: Variance $(\sigma^2) = \sum_{i=1}^n \frac{(x_i - \bar{x})}{N}$.

Answer is 3.

65. The mean of the distribution given below is

x	10-20	20-30	30-40	40-50
Frequency	5	10	7	8

1. 30 2. 31 3. 32 4. 33 **Answer is 4.**

66. If σ is the standard deviation of the observations $x_1, x_2, \dots, x_n$ then the standard deviation of $9+3x_1, 9+3x_2, \dots, 9+3x_n$ is

1. $3\sigma-3$ 2. $\sqrt{9\sigma^2+3}$ 3. 3σ 4. $3\sigma+9$

Solution: S.D. of $x_1, x_2, \dots, x_n$ is same as S.D. of $x_1+k, x_2+k, \dots, x_n+k$

But S.D. of $kx_1, kx_2, \dots, kx_n$ is k times to S.D. of $x_1, x_2, \dots, x_n$. **Answer is 3.**

Telangana ICET-2015 [6 questions were given]

67. The correlation coefficient r satisfies the inequality

Answer:3

1. $|r| > 1$ 2. $|r| < 1$ 3. $|r| \leq 1$ 4. $-2 < r < 2$

68. The arithmetic mean of the distribution given below is

x	1	2	3	4	5	6	7
f	1	4	9	16	25	36	49

1. 3.8 2. 4.9 3. 5 4. 5.6

Solution: A.M = $\frac{(1)(1) + (2)(4) + (3)(9) + (4)(16) + (5)(25) + (6)(36) + (7)(49)}{1+4+9+16+25+36+49} =$

$\frac{1+8+27+64+125+216+343}{1+4+9+16+25+36+49} = \frac{784}{140} = 5.6$ **Answer is 4.**

69. The median of the first sixteen even natural numbers is

1. 23 2. 21 3. 19 4. 17

Solution: The ascending order is 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32.

So median = $\frac{16+18}{2} = \frac{34}{2} = 17$.

Answer is 4.

70. The standard deviation of 1, 2, 3, 4, 5, ..., 25 is

1. $13\sqrt{2}$ 2. $2\sqrt{13}$ 3. 52 4. 26

Solution: The standard deviation of first n natural numbers is $\sqrt{\frac{n^2-1}{12}}$. Here $n = 25$. Thus

$$\sqrt{\frac{n^2-1}{12}} = \sqrt{\frac{25^2-1}{12}} = \sqrt{\frac{625-1}{12}} = \sqrt{\frac{624}{12}} = \sqrt{52} = 2\sqrt{13} \quad \text{Answer is 2.}$$

71. For $n \geq 1$, let $a_n = k$, where k is the remainder when n is divided by 5. Then the mode of the observations $a_1, a_3, a_8, a_{12}, a_{13}, a_{17}, a_{23}$ is

1. 1 2. 2 3. 3 4. 4

Solution: The remainders are 1, 3, 3, 2, 3, 2, 3. Thus mode is 3. **Answer is 3.**

72. If σ is the variance of the observations $x_1, x_2, \dots, x_n$ then $9\sigma^2$ is the variance of

1. $4 - 3x_1, 4 - 3x_2, 4 - 3x_3, \dots, 4 - 3x_n$ 2. $4 + 9x_1, 4 + 9x_2, 4 + 9x_3, \dots, 4 + 9x_n$
 3. $4 - 9x_1, 4 - 9x_2, 4 - 9x_3, \dots, 4 - 9x_n$ 4. $4 + 81x_1, 4 + 81x_2, 4 + 81x_3, \dots, 4 + 81x_n$

Answer is 1.

Probability

Random Experiment: An experiment in which all possible outcomes are known and the exact output cannot be predicted in advance, is called a random experiment. Example, tossing a fair coin, drawing a card from a pack of well-shuffled cards.

Sample space: The set of all possible outcomes of an experiment is called a sample space.

Definition of probability: The probability of an event A is defined as the favourable number of

cases of A, by the total number of cases. Thus, $P(A) = \frac{n(A)}{n(S)}$.

Results on probability:

1. $P(S) = 1$
2. $0 \leq P(a) \leq 1$
3. $P(\phi) = 0$
4. $P(\bar{A}) = 1 - P(A)$
5. For any two events A and B, we have $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
6. ${}^nC_r = \frac{n!}{(n-r)!} \times r!$
7. ${}^nC_n = {}^nC_0 = 1$
8. ${}^nC_1 = {}^nC_{n-1} = n$
9. ${}^nP_r = \frac{n!}{(n-r)!}$

Mutually Exclusive Events: If two or more events have no point in common (i.e.) if they cannot occur simultaneously, the events are said to be mutually exclusive.

Note: If A and B are mutually exclusive events then $P(A \cup B) = P(A) + P(B)$.

Independent Events: Two events are said to be independent if the occurrence or non-occurrence of one event does not influence the occurrence or non-occurrence of the other event.

Dependent Events: It implies that occurrence of one event affects the occurrence of the other event.

1. When 3 unbiased coins are tossed, the probability of getting exactly one head is

1. $\frac{1}{3}$
2. $\frac{3}{8}$
3. $\frac{1}{8}$
4. $\frac{1}{2}$

Solution: Total outcomes = 8. They are HHH, HHT, HTH, THH, TTH, THT, HTT, TTT.

The probability of getting exactly one head is $\frac{3}{8}$. **Hence the answer is 2.**

2. If two dice are thrown simultaneously, the probability of getting even numbers on both the dice is

1. $\frac{3}{36}$ 2. $\frac{4}{36}$ 3. $\frac{9}{36}$ 3. $\frac{18}{36}$

Solution: Total outcomes = $6^2 = 36$

Favourable outcomes = 9. (they are (2, 2), (2, 4), (4, 2), (2, 6), (4, 4), (4, 6), (6, 2), (6, 4), (6, 6))

So, the required probability = $\frac{9}{36}$. **Hence the answer is 3.**

3. When two dice are thrown together, the probability that the sum obtained on them is 7, is

1. $\frac{5}{36}$ 2. $\frac{1}{6}$ 3. $\frac{5}{6}$ 4. $\frac{31}{36}$

Solution: Total outcomes = $6^2 = 36$, they are (1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6); (2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6); (3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6); (4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6); (5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6); (6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6).

The probability that the sum obtained on them is 7 = $\frac{6}{36} = \frac{1}{6}$. **Hence the answer is 1.**

4. The probability that a number chosen at random from the set {1, 2, 3, ..., 90} is divisible by 4 or 6 is

1. $\frac{31}{90}$ 2. $\frac{37}{90}$ 3. $\frac{1}{3}$ 4. $\frac{1}{12}$

Solution: Total number of outcomes = 90.

To get no money the possible outcomes = 30.

multiples of 4 = 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, 56, 60, 64, 68, 72, 76, 80, 84, 88

multiples of 6 = 6, 12, 18, 24, 30, 36, 42, 48, 54, 60, 66, 72, 78, 84, 90

Number divisible by 4 or 6 = 4, 6, 8, 12, 16, 18, 20, 24, 28, 30, 32, 36, 40, 42, 44, 48, 52, 54, 56, 60, 64, 66, 68, 72, 76, 78, 80, 84, 88, 90

So, required probability = $\frac{30}{90} = \frac{1}{3}$. **Hence the answer is 3.**

5. If a leap year is selected at random, the probability that there will be 53 Thursdays in that year is

1. $\frac{1}{4}$ 2. $\frac{2}{7}$ 3. $\frac{5}{7}$ 4. $\frac{6}{7}$

Solution: In a leap year, there are 366 days. 366 days = 52 weeks and 2 days.

The remaining two days can be (1) Sunday, Monday (2) Monday, Tuesday (3) Tuesday, Wednesday (4) Wednesday, Thursday (5) Thursday, Friday (6) Friday, Saturday (7) Saturday, Sunday.

Total number of cases = 7 and favourable number of cases = 2.

So required probability = $\frac{2}{7}$. **Hence the answer is 2.**

6. Five coins are tossed at a time. Then the probability of obtaining at least one tail is

1. $\frac{31}{32}$ 2. $\frac{1}{32}$ 3. $\frac{1}{5}$ 4. $\frac{5}{32}$

Solution: Total number outcomes = $2^5 = 32$.

The favourable case is getting atleast one tail (i.e.) 1, 2, 3, 4 or 5 tails or head shouldn't occur in all the five coins simultaneously. So favourable number of cases = 31.

So required probability = $\frac{31}{32}$. **Hence the answer is 1.**

7. If 4 digit number is formed at random using the digits 1, 3, 5, 7, 9 without repetition, then the probability that it is divisible by 5 is

1. $\frac{4}{5}$ 2. $\frac{3}{5}$ 3. $\frac{1}{5}$ 4. $\frac{2}{3}$

Solution: Without repetitions the 4 digit numbers formed by using 1, 3, 5, 7 and 9 is 5!.

The number formed by using the digits 1, 3, 5, 7 and 9 which is divisible by 5 is 4!. (last digit is fixed by 5).

So required probability = $\frac{4!}{5!} = \frac{1}{5}$. **Hence the answer is 3.**

8. When two dice are rolled, what is the probability that the sum of the numbers appeared on them is 11?

1. $\frac{1}{6}$ 2. $\frac{1}{18}$ 3. $\frac{1}{9}$ 4. 1

Solution: Total number of outcomes = $6^2 = 36$.

Sum of the numbers appeared on them to be 11 is (5, 6); (6, 5) = 2.

So, required probability = $\frac{2}{36} = \frac{1}{18}$. **Hence the answer is 2.**

9. The probability of drawing a red card from a deck of playing cards, is

1. $\frac{2}{13}$ 2. $\frac{1}{13}$ 3. $\frac{1}{4}$ 4. $\frac{1}{2}$

Solution: Total number of card in a deck = 52.

Number of red cards = 26.

So, required probability = $\frac{26}{52} = \frac{1}{2}$. **Hence the answer is 4.**

10. A number n is selected at random from the set $\{1, 2, 3, \dots, 50\}$. The probability that n is a prime is

1. 0.1 2. 0.2 3. 0.3 4. 0.7

Solution: Total number of outcomes = 50.

The number of primes up to 50 = 15 (they are 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47)

So, required probability = $\frac{15}{50} = \frac{3}{10} = 0.3$. **Hence the answer is 3.**

11. The probability of getting a composite number when a 6-faced unbiased die is tossed, is

1. $\frac{1}{4}$ 2. $\frac{1}{3}$ 3. $\frac{1}{2}$ 4. 1

Solution: Total number of outcomes = 6.

Number of getting outcome as a composite number = 2. (they are 4, 6)

So, required probability = $\frac{2}{6} = \frac{1}{3}$. **Hence the answer is 2.**

12. A person gets Rs.10 if a head turns up and loses Rs. 5 if a tail turns up in tossing an unbiased coin. If three unbiased coins are tossed simultaneously the probability getting no money is

1. $\frac{3}{8}$ 2. $\frac{1}{4}$ 3. $\frac{1}{5}$ 4. $\frac{5}{8}$

Solution: Total number of outcomes = $2^3 = 8$.

To get no money the possible outcomes = 3. (they are HTT, THT, TTH)

So, required probability = $\frac{3}{8}$. **Hence the answer is 1.**

13. Two unbiased dice are thrown simultaneously. The probability of getting the sum divisible by 3 is

1. $\frac{11}{36}$ 2. $\frac{12}{36}$ 3. $\frac{13}{36}$ 4. $\frac{17}{36}$

Solution: Total number of outcomes = $6^2 = 36$.

The possible number of outcomes that their sum divisible by 3 = 12. (they are (1, 2); (1, 5); (2, 1); (2, 4); (3, 3); (3, 6); (4, 2); (4, 5); (5, 1); (5, 4); (6, 3); (6, 6).

So, required probability = $\frac{12}{36}$. **Hence the answer is 2.**

14. Let E be the set of all integers with 1 in their units place. The probability that a number n chosen from $\{2, 3, 4, \dots, 50\}$ is an element of E is

1. $\frac{5}{49}$ 2. $\frac{4}{49}$ 3. $\frac{3}{49}$ 4. $\frac{2}{49}$

Solution: Total number of chances = 49.

Number of favourable cases = 4. (they are 11, 21, 31, 41)

So, required probability = $\frac{4}{49}$. **Hence the answer is 2.**

15. A number n is chosen at random from $\{1, 2, \dots, 10\}$. The probability that n satisfies the

equation $(x - 3)(x - 6)(x - 7)(x - 11) = 0$ is

1. $\frac{2}{5}$ 2. $\frac{3}{5}$ 3. $\frac{3}{10}$ 4. $\frac{7}{10}$

Solution: Total number of chances = 10.

Number of favourable cases = 3. (they are 3, 6, 7)

So, required probability = $\frac{3}{10}$. **Hence the answer is 3.**

16. A person gets as many rupees as the number he gets when an unbiased 6-faced die is thrown. If two such dice are thrown the probability of getting Rs.10 is

1. $\frac{1}{12}$ 2. $\frac{5}{12}$ 3. $\frac{5}{36}$ 4. $\frac{9}{36}$

Solution: Total number of chances = $6^2 = 36$.

Number of favourable cases = 3. (they are (4, 6); (5, 5); (6, 4))

So, required probability = $\frac{3}{36} = \frac{1}{12}$. **Hence the answer is 1.**

17. If three unbiased coins are tossed simultaneously then the probability of getting exactly two heads is

1. $\frac{1}{8}$ 2. $\frac{2}{8}$ 3. $\frac{3}{8}$ 4. $\frac{4}{8}$

Solution: Total number of chances = $2^3 = 8$.

Number of favourable cases = 3. (they are HHT, HTH, THH)

So, required probability = $\frac{3}{8}$. **Hence the answer is 3.**

18. If a dice is thrown, then the probability of getting an even number or a number greater than 3, is

1. $\frac{1}{2}$ 2. $\frac{2}{3}$ 3. $\frac{1}{3}$ 4. $\frac{1}{6}$

Solution: Total number of chances = 6.

Number of favourable cases = 4. (they are 2, 4, 5, 6)

So, required probability = $\frac{4}{6} = \frac{2}{3}$. **Hence the answer is 2.**

19. A bag contains 3 red balls, 4 white balls and 7 black balls. The probability of drawing a red or a black ball is

1. $\frac{4}{7}$ 2. $\frac{1}{7}$ 3. $\frac{5}{7}$ 4. $\frac{3}{7}$

Solution: Total number of balls in bag = 14.

The probability of drawing a red or a black ball $= \frac{10_{c_1}}{14_{c_1}} = \frac{10}{14} = \frac{5}{7}$. **Hence the answer is 3.**

20. If two dice are thrown simultaneously, then the probability of having 6 on one die and any number other than 6 on other die, is

1. $\frac{1}{6}$ 2. $\frac{5}{6}$ 3. $\frac{5}{36}$ 4. $\frac{31}{36}$

Solution: Total number of chances $= 6^2 = 36$.

Number of favourable cases $= 5$. (they are (6, 1); (6, 2); (6, 3); (6, 4); (6, 5))

So, required probability $= \frac{5}{36}$. **Hence the answer is 3.**

21. A and B independent events. The probability that both A and B occur is $\frac{1}{6}$ and the probability

that neither of them occurs is $\frac{1}{3}$. Then the probability of occurrence of A is

1. $\frac{5}{6}$ 2. $\frac{1}{2}$ 3. $\frac{1}{12}$ 4. $\frac{1}{18}$

Solution: A, B are independent events.

$$P(A \cap B) = P(A) P(B) = \frac{1}{6} \text{ and } P(\bar{A} \cap \bar{B}) = P(\bar{A})P(\bar{B}) = [1 - P(A)] [1 - P(B)] = \frac{1}{3}.$$

Solving these, we get $P(A) = \frac{1}{3}$ or $\frac{1}{2}$. **Hence the answer is 2.**

22. 8 coins are tossed simultaneously. The probability of getting atleast six heads is

1. $\frac{39}{256}$ 2. $\frac{29}{256}$ 3. $\frac{31}{256}$ 4. $\frac{37}{256}$

Solution: Total number of chances $= 2^8 = 256$.

Number of favourable cases $= 8_{c_6} + 8_{c_7} + 8_{c_8} = 28 + 8 + 1 = 37$.

So, required probability $= \frac{37}{256}$. **Hence the answer is 4.**

23. Three six faced dice are thrown together. The probability that exactly two of the three numbers are equal is

1. $\frac{126}{216}$ 2. $\frac{90}{216}$ 3. $\frac{120}{216}$ 4. $\frac{96}{216}$

Solution: Total number of chances $= 6^3 = 216$.

Number of favourable cases $= 90$.

So, required probability = $\frac{90}{216}$. **Hence the answer is 2.**

24. If two balls are drawn from a bag containing 2 white, 4 red and 6 black balls, the chance for both of them to be red is

1. $\frac{1}{11}$ 2. $\frac{2}{11}$ 3. $\frac{3}{11}$ 4. $\frac{4}{11}$

Solution: If E is the event of drawing two red balls, then

$$n(E) = {}^4C_2 = 6; n(S) = {}^{12}C_2 = 66; P(E) = \frac{6}{66} = \frac{1}{11}. \text{ Hence the answer is 1.}$$

25. 3 mangoes and 3 apples are kept in a box. If two fruits are chosen at random, the probability that one is a mango and the other is an apple is

1. $\frac{2}{6}$ 2. $\frac{2}{5}$ 3. $\frac{3}{5}$ 4. $\frac{3}{6}$

Solution: $n(E) = {}^3C_1 \times {}^3C_1 = 3 \times 3 = 9; n(S) = {}^6C_2 = 15; P(E) = \frac{n(E)}{n(S)} = \frac{9}{15} = \frac{3}{5}$.

Hence the answer is 3.

ICET-2011

26. If two dice are thrown, then the probability that the sum of the two numbers obtained is a prime number is

1. $\frac{7}{12}$ 2. $\frac{5}{12}$ 3. $\frac{1}{4}$ 4. $\frac{3}{4}$ **Answer:2**

27. If a letter is selected at random from the first 15 letters of the English alphabet, then the probability that it is a consonant is

1. $\frac{4}{15}$ 2. $\frac{11}{15}$ 3. $\frac{1}{3}$ 4. $\frac{2}{3}$ **Answer:2**

28. If E, F are two events in a random experiment such that $P(E) = \frac{1}{2}$, $P(F) = \frac{1}{3}$ and

$$P(E \cap F) = \frac{1}{12} \text{ then } P(E \cup F) =$$

1. $\frac{1}{4}$ 2. $\frac{3}{4}$ 3. $\frac{5}{6}$ 4. $\frac{7}{12}$ **Answer:2**

29. If a number is selected at random from the first 120 natural numbers, then the probability that it is divisible by 6 or 8 is

1. $\frac{1}{24}$ 2. $\frac{1}{5}$ 3. $\frac{1}{4}$ 4. $\frac{1}{30}$ **Answer:3**

30. If a leap year is selected at random, then the probability that there will be 53 Sundays in that

year is

1. $\frac{1}{7}$ 2. $\frac{6}{7}$ 3. $\frac{2}{7}$ 4. $\frac{5}{7}$ **Answer:3**

ICET-2012

31. If two unbiased six-faced dice are thrown simultaneously then the probability that the sum is 8 with at least one die showing a prime number is

1. $\frac{1}{9}$ 2. $\frac{1}{8}$ 3. $\frac{1}{7}$ 4. $\frac{1}{6}$ **Answer:1**

32. If A and B are events of a random experiment with $P(A) = \frac{3}{8}$, $P(B) = \frac{1}{3}$ and

$$P(A \cap B) = \frac{1}{4} \text{ then } (\bar{A} \cap \bar{B}) =$$

1. $\frac{5}{12}$ 2. $\frac{11}{24}$ 3. $\frac{13}{24}$ 4. $\frac{17}{24}$ **Answer:3**

33. A group has 12 men and 4 women. If three were selected at random from the group then the probability that they are all men is

1. $\frac{1}{4}$ 2. $\frac{11}{28}$ 3. $\frac{5}{24}$ 4. $\frac{9}{48}$ **Answer:2**

ICET-2013

34. When 2 unbiased dice are thrown, then probability that they show up different numbers is

1. $\frac{1}{6}$ 2. $\frac{11}{36}$ 3. $\frac{5}{6}$ 4. $\frac{25}{36}$ **Answer:3**

35. In a bivariate distribution X_i, Y_i , $i = 1, 2, 3, 4, 5, 6, 7, 8$, if d_i is the deviation between the ranks of

$$X_i \text{ and } Y_i \text{ and } \sum_{i=1}^8 d_i^2 = 21, \text{ then the coefficient of rank correlation between } X_i \text{ and } Y_i \text{ is}$$

1. 0.25 2. 0.50 3. 0.65 4. 0.75 **Answer:4**

36. If 5 boys and 4 girls sit in a row at random, then the probability that boys and girls sit alternately is

1. $\frac{1}{63}$ 2. $\frac{1}{126}$ 3. $\frac{1}{120}$ 4. $\frac{1}{60}$ **Answer:2**

37. If a leap year is selected at random, then the probability that there will be 52 Sundays in that year is

1. $\frac{1}{7}$ 2. $\frac{6}{7}$ 3. $\frac{2}{7}$ 4. $\frac{5}{7}$ **Answer:4**

38. If 3 coins are tossed, then the probability of getting atleast 2 heads is

1. $\frac{1}{2}$ 2. $\frac{1}{8}$ 3. $\frac{1}{4}$ 4. $\frac{3}{8}$ **Answer:1**

ICET-2014

39. Two fair dice are rolled. The probability that the sum of the numbers on the faces shown is 8 is

1. $\frac{5}{36}$ 2. $\frac{1}{6}$ 3. $\frac{7}{36}$ 4. $\frac{1}{9}$ **Answer:2**

40. A number is selected at random from the first 80 natural numbers. The probability that it is divisible by 4 or 6 is

1. $\frac{23}{80}$ 2. $\frac{29}{80}$ 3. $\frac{27}{80}$ 4. $\frac{33}{80}$ **Answer:3**

41. The probability that either of the events A and B to happen is 0.6 and the probability that both of them to happen is 0.2, then $P(A') + P(B') =$

1. 0.4 2. 0.75 3. 0.8 4. 1.2 **Answer:2**

42. Suppose $f(x) = (x-2)(x-5)(x-7)$. If a number α is chosen from $\{1, 3, 4, 5, 6, 7, 8, 9, 10\}$ randomly, the probability that it satisfies the equation $f(\alpha) = 0$, is

1. $\frac{1}{3}$ 2. $\frac{2}{5}$ 3. $\frac{3}{7}$ 4. $\frac{2}{9}$ **Answer:1**

Telangana ICET-2015:

43. A ball is drawn at random from a bag containing 5 green, 6 black and 7 white balls, all of identical size. The probability that the chosen ball is either green or black is

1. $\frac{6}{70}$ 2. $\frac{13}{18}$ 3. $\frac{2}{3}$ 4. $\frac{11}{18}$ **Answer:4**

44. Three numbers are chosen at random from the set $\{1, 2, 3, 4, 5, 6, 7, 8\}$. The probability that they are consecutive numbers is

1. $\frac{9}{28}$ 2. $\frac{7}{28}$ 3. $\frac{5}{28}$ 4. $\frac{3}{28}$ **Answer:4**

45. The probability that a number n is chosen at random from $\{1, 2, 3, 4, \dots, 14\}$ is a prime number solution of the equation $f(x)=0$, where $f(x) = (x-2)(x^2-9)(x-6)(x-8)$ is

1. $\frac{5}{14}$ 2. $\frac{3}{14}$ 3. $\frac{2}{14}$ 4. $\frac{1}{14}$

Solution: Total number of chances = 14.

Number of favourable cases = 2. (they are 2, 3)

So, required probability = $\frac{2}{14}$. **Hence the answer is 3.**

46. If A and B are events of a random experiment with $P(A) = \alpha$, $P(B) = \beta$ and $P(A \cap B) = \gamma$ then $P(\overline{A} \cap \overline{B}) =$

1. $1 + \alpha - \beta + \gamma$ 2. $1 + \alpha + \beta + \gamma$ 3. $1 - \alpha - \beta + \gamma$ 4. $1 + \alpha + \beta - \gamma$ **Answer:3**

Solution: $P(\overline{A} \cap \overline{B}) = P(\overline{A \cup B}) = 1 - P(A \cup B) = 1 - [P(A) + P(B) - P(A \cap B)] = 1 - \alpha - \beta + \gamma$

Section C
COMMUNICATION ABILITY

Introduction: Competence in English Language is very essential for every student, especially professional students to excel in their field of interests.

1. Parts of Speech
Practice Test

1. Identify the parts of speech of the underlined words.

1. The rivers flow during the rainy season.
a) Conjunction b) Verb c) Preposition d) Adjective
2. I have been learning English in Global English Academy.
a) Adjective b) Verb c) Adverb d) Conjunction
3. Radhika said she would join him.
a) Verb b) Interjection c) Preposition d) Adverb
4. I have nine hundred rupees in my purse.
a) Adverb b) Preposition c) Verb d) Adjective
5. It was so nice of you to remember my birthday.
a) Conjunction b) Adjective c) Preposition d) Verb
6. Unless you work hard, you can't speak English.
a) Preposition b) Adverb c) Conjunction d) Verb
7. The Song is Sweet.
a) Verb b) Interjection c) Adverb d) Adjective
8. He is a very honest man.
a) Verb b) Adverb c) Adjective d) Noun
9. Nobody knew the problem.
a) Noun b) Adverb c) Verb d) Pronoun
10. What a terrible nuisance this TV is!
a) Adjective b) Noun c) Interjection d) Verb
11. Though fire is a good servant, it is a bad master.
a) Conjunction b) Preposition c) Verb d) Adverb
12. The sun rose and the fog disappeared.

- a) Preposition b) Adjective c) Conjunction d) Pronoun
13. We have come here for English Coaching.
a) Preposition b) Adverb c) Conjunction d) Adjective
14. How is everybody there?
a) Conjunction b) Interjection c) Adverb d) Verb
15. I was ashamed of having lied to my mother.
a) Verb b) Adverb c) Pronoun d) Adjective
16. He was anxious to atone for his thoughtlessness.
a) Adverb b) Adjective c) Verb d) Noun
17. The 1970s saw the first backlash against the emerging women's movement.
a) Adjective b) Noun c) Conjunction d) Verb
18. The demonetization has made many small companies go bankrupt.
a) Verb b) Adjective c) Preposition d) Noun
19. Who did the catering?
a) Noun b) Adjective c) Verb d) Adverb
20. The detective was watching him closely waiting for a reply.
a) Conjunction b) Adjective c) Adverb d) Pronoun
21. I was sitting to the left of the manager.
a) Adjective b) Preposition c) Conjunction d) Adverb
22. Acting on an anonymous tip-off, police raided the house.
a) Noun b) conjunction c) Pronoun d) Verb
23. In the cold dawn light the fort looked stark and forbidding.
a) Verb b) Adjective c) Adverb d) Noun
24. He is reputed to be extremely wealthy.
a) Adverb b) Verb c) Adjective d) Preposition
25. They died trying to rescue their children from the blaze.
a) Conjunction b) Preposition c) Adjective d) Verb
26. I understand the debilitating effect of economic decline.
a) Adjective b) Verb c) Noun d) Adverb

27. That crossword is too difficult for me.
a) Verb b) Adjective c) Noun d) Adverb
28. He always tries to keep abreast of the latest developments in computing.
a) Noun b) Adverb c) Verb d) Adjective
29. The building looked an absolute shambles.
a) Noun b) Verb c) Adjective d) Adverb
30. They waited in a state of feverish anxiety for their friends to come home.
a) Adjective b) Noun c) Interjection d) Verb
31. He seldom reacts newspapers.
a) Verb b) Adjective c) Verb d) Adverb
32. The man zoomed past on his bike.
a) Preposition b) Verb c) Adverb d) Noun
33. The leaders were bombarded with questions from the press.
a) Adjective b) Adverb c) Preposition d) Verb
34. The nurses are always courteous and helpful.
a) Adverb b) Verb c) Adjective d) Noun
35. I didn't see anyone during the holidays.
a) Preposition b) Conjunction c) Adjective d) Verb
36. I saw him as I was getting off the bus.
a) Adjective b) Preposition c) Conjunction d) Verb
37. His pockets are bulging with some papers.
a) Noun b) Verb c) Adverb d) Adjective
38. He was claiming compensation for unfair dismissal.
a) Adjective b) Verb c) Adverb d) Noun
39. The bird flew away through the window.
a) Conjunction b) Adjective c) Preposition d) Verb
40. This book is written in simple everyday language.
a) Noun b) Adjective c) Preposition d) Verb

KEY									
1. C	2. B	3. A	4. D	5. C	6. C	7. D	8. B	9. D	10. B
11. A	12. C	13. B	14. C	15. D	16. C	17. B	18. B	19. A	20. C
21. B	22. A	23. B	24. C	25. D	26. A	27.	28. B	29. C	30. A
31. D	32. B	33. D	34. C	35. A	36. C	37. B	38. D	39. C	40. B

2. VERBS (Kinds & Usage)

- i) Forms of 'be' are: am, are, was, were, be, and 'is'.
- ii) Linking verbs: appear, became, feel, come, look, remain, seem, sound, stay, stand, read, get, go, grow, fall, run, turn.
- iii) Transitive verbs: Verbs used when something is carried across / passed:
Eg.: He throws the ball.
Boss rings the bell.
- iv) Intransitive verbs: Verbs used where nothing is passed on, there is no transition.
The ball moves.
The bell rings.
- v) Regular and Irregular verbs: Verbs in English have five forms, i) base form ii) past tense form iii) past participle form/third form iv) third person singular v) -ing form

Regular verbs: If the past tense form of a verb and the third form can be predicted from its base form, it is called a *regular verb*. They are formed by adding -d or -ed to the base form.

Eg:

call	called	called
like	liked	liked
try	tried	tried
act	acted	acted
dance	danced	danced
fool	fooled	fooled
joke	joked	joked
list	listed	listed
mail	mailed	mailed
nail	nailed	nailed
occupy	occupied	occupied
park	parked	parked
question	questioned	questioned
rate	rated	rated
show	showed	showed
tamper	tampered	tampered
utter	uttered	uttered
vex	vexed (up)	vexed(up)
wave	waved (at)	waved(at)
xerox	xeroxed	xeroxed
yawn	yawned	yawned
zero	zeroed (on)	zeroed(on)

Irregular verbs: here the other forms of the base form cannot be predicted. Since there is no regularity in forming the other forms, hence the name 'irregular verbs'

LIST OF IRREGULAR VERBS

<i>infinitive</i>	<i>past simple</i>	<i>past participle</i>	<i>infinitive</i>	<i>past simple</i>	<i>past participle</i>
be	was/were	been	let	let	let
beat	beat	beaten	lie	lay	lain
become	became	become	light	lit	lit
begin	began	begun	lose	lost	lost
bite	bit	bitten	make	made	made
blow	blew	blown	mean	meant	meant
break	broke	broken	meet	met	met
bring	brought	brought	pay	paid	paid
build	built	built	put	put	put
buy	bought	bought	read	read	read
catch	caught	caught	ride	rode	ridden
choose	chose	chosen	ring	rang	rung
come	came	come	rise	rose	risen
cost	cost	cost	run	ran	run
cut	cut	cut	say	said	said
do	did	done	see	saw	seen
draw	drew	drawn	sell	sold	sold
drink	drank	drunk	send	sent	sent
drive	drove	driven	shine	shone	shone
eat	ate	eaten	shoot	shot	shot
fall	fell	fallen	show	showed	shown
feel	felt	felt	shut	shut	shut
fight	fought	fought	sing	sang	sung
find	found	found	sit	sat	sat
fly	flew	flown	sleep	slept	slept
forget	forgot	forgotten	speak	spoke	spoken
get	got	got	spend	spent	spent
give	gave	given	stand	stood	stood
go	went	gone	steal	stole	stolen
grow	grew	grown	swim	swam	swum
hang	hung	hung	take	took	taken
have	had	had	teach	taught	taught
hear	heard	hidden	tell	told	told
hide	hid	hidden	tell	told	told
hit	hit	hit	think	thought	thought
hold	held	held	throw	threw	thrown
hurt	hurt	hurt	understand	understood	understood
keep	kept	kept	wake	woke	woken
know	knew	known	wear	wore	worn
leave	left	left	win	won	won
lend	lent	lent	write	wrote	written

- vi) **Helping verbs:** The verbs that help to form not only negatives and questions but also to express a wide variety of meanings. They are *can, could, will, would, shall, should, may, might* and *must*.

MODALS AND THEIR MEANINGS

Can	:	ability / permission / request / possibility
Could	:	ability / request / possibility
Shall	:	futurity / willingness / intention
Should	:	obligation / advisability / necessity / expectation
Will	:	willingness / intention / prediction / insistence / requests in question
Would	:	willingness / habitual action in the past / probability / wishes
May	:	permission / possibility / wishes / purpose /
Might	:	permission / possibility
Must	:	necessity / prohibition / compulsion / obligation / certainty / probability

Others

Must	:	'have to', 'have got to', 'got to'
used to	:	would in the past eg: when i was in delhi, i used to / would go to red fort every day for
going to	:	will / shall
Need	:	be necessary / want / require / ask

- vii) **Phrasal Verbs and Prepositional Verbs:**

Phrasal Verbs: The combination of verbs and prepositions is called 'phrasal verb'. Also called 'two part verbs', and 'composite verbs'.

List of some Phrasal Verbs: back up, (someone), break off (relation), bring about (a change), bring up (children), draw up (a plan), fill out (a form), find out (a secret), turn off (the light).

Prepositional verbs: Prepositions used after a verb may not actually be a part of the verb but are required after the verb and before the noun.

Eg., call on (means visit)

Whereas 'call up' is a phrasal verb which means summon.

List of some prepositional verbs:

Allow for (delays)
Approve of (an action)
Apply for (a job)
Attend to (the matter)
Comment on (something)
Congratulate (someone) on (some achievement)
Live on (small pay)
Object to (something)
Refer to (a thesaurus)

Phrasal - Prepositional verbs:

Combination of phrasal verbs and prepositional verbs.

Eg., come up with (an idea)
 Drop out of(a game)
 Do away with (superstitions)
 Look down on/upon
 Look up to
 Look forward to

Break:

Break away: go away/give up bad habit
Break down: fail/collapse
Break in: interrupt/enter by force
Break off: separate, cancel
Break up: end of a term
Break through: overcome

call:

Call at: visit
Call back: summon to return
Call for: order/demand
Call in: consult
Call off: cancel
Call on: visit a person
Call over: read a list
Call up: telephone

get

Get along: to be compatible/make progress
Get away: escape
Get back: return
Get down to: deal seriously with
Get into: enter
Get off: escape punishment
Get on: progress, agree
Getting on: growing older (he is getting on for thirty)

Approach (it is getting on for evening)
Get out: escape from
Get over: recover from/ overcome an obstacle
Get through: succeed in doing something
Get together: meet together

go:
Go about: move from place to place/pass from person to person
Go after: pursue/hunt/try to win/obtain
Go against: oppose
Go ahead: proceed
Go by: pass/form an opinion
Go down: decrease in price
Go in for: enter for/ have as a hobby
Go off: leave for
Go through: examine/suffer
Go up: increase
Go up to: approach
Go with: match

Eg: The *cause of the* quarrel is.....

Eg.: You have the *choice of* doing either MCA or MBA

Eg.: Good communication skills gives an *impression of* a good human being

Eg.: Their soft skills made a deep impression on the management.(and it referred them for an appraisal)

Eg.: One should have a strong *faith in* self

Eg.: We should have utmost *interest in* the work we choose.

Eg.: They made a *progress in* the most challenging and a difficult project

Eg.: It gives us a great *satisfaction in* helping the helpless.

Eg.: We all must put an *end to* unnecessary avocations.

Eg.: Some who get success without much difficulty, they are an *exception to* us

3. PREPOSITIONS

Prepositions: are words placed before a noun/noun phrase/pronoun. It shows a link between the noun/noun phrase/pronoun.

- **Prepositions of place:** at, away from, above, across, all over, between, by, behind, below, beneath, inside, in front of, on top of, out of, on(to), through, throughout, under, underneath, within, etc.
- **Prepositions of time:** at, after, before, between, by, in, on, since, till, until, upto, etc.
- Some prepositions are also used as adverbs without following a noun / noun phrase / pronoun. Adverbs receive stress.

List of such prepositional phrases.

Aboard, about, above , across, along, alongside, apart, around, before, behind, below, beneath, besides, between, beyond, by, down, in, inside, near, notwithstanding, off, on, opposite, over, outside, past, round, since, through, throughout, to, under, underneath, up, within, without.

Points to be followed in using prepositions:

1. *At:* relates to a small extent of time; *in:* relates to a wider extent.
Eg.: We will start at three o'clock tomorrow.
They usually meet in Shamshabad Airport.
2. They went *into* the restaurant.
3. *Onto:* onto expresses movement and direction.
Eg.: The man jumped onto the cat.
4. *Towards:* These days youngsters are moving towards politics.
5. *Around:* indicates closure proximity.
Eg.: My Professor travelled around the world.
6. *About:* indicates a distributed activity.
Eg.: He has travelled about ten countries.
7. *Among:* is used when the reference is to more than two individuals/groups
Eg.: The land was distributed equally among the sons and daughters.
Note: *amongst* is a literary variant of 'among.'
8. *Between:* is used when the reference is to two / individuals/groups
Eg.: The land was distributed between the son and the daughter.

9. *Besides I beside:*

Eg.: The old man doesn't have any other property beside(s) this plot.

10. *under and in:*

Eg.: Under that much of pressure ,nothing more can be achieved. In such circumstances, nothing more can be done.

Two-word prepositions:

Ahead of, alongside of, because of, inclusive of, exclusive of, instead of, irrespective of, out of, regardless of, short of, according to, as to, contrary to, counter to, due to, next to, owing to, prior to, relative to, subject to, subsequent to, thanks to, up to along with, as for, apart from, away from, up till, from among, from behind, as against, up against, in between.

Three/four –word prepositions:

- i) By means of
By virtue of
By way of
- ii) with respect to with
reference to
- iii) at the cost of
at the instance of at
the risk of
- iv) with the exception of
with the intention of
- v) for fear of for
lack of
- vi) for the benefit of
for the purpose of
for the sake of
- vii) on account of
on behalf of
- viii) on top of

Fill in the blanks with appropriate prepositions:

1. He travelled sixteen miles _____ four hours.
2. She rushed _____ my room and dropped _____ the floor.
3. This painting is the creation _____ a famous artist.
4. She was born _____ a small village _____ India _____ affluent parents.
5. I must start _____ dawn _____ reach _____ time.
6. The couple have been missing _____ two months.
7. _____ rice, they had lentils.
8. Come and sit _____ me.
9. He was killed _____ the wild animal.
10. _____ to a car, he has five bikes.
11. The work was done _____ haste.
12. The river flows _____ the bridge.
13. I have known him _____ a long time.
14. He has not yet fully recovered _____ his illness.
15. I am sorry _____ have kept you waiting.
16. You might spill _____ the milk.
17. I am obliged _____ you _____ your help.
18. He abstains _____ smoking.
19. His colleagues disagreed _____ him _____ the proposal.
20. I prefer tea _____ coffee.
21. The judge was convinced _____ the evidence presented _____ the lawyer.
22. Who is better _____ the two?
23. She insisted _____ going ahead _____ the preparations.
24. I acceded _____ her requests.
25. I prefer reading books _____ watching television.
26. I hope you succeed _____ getting what you want.
27. She decided _____ give up sports so that she could concentrate _____ her studies.
28. I filled the tank, _____ unfortunately I filled it _____ the wrong kind _____ petrol.
29. As I was coming out _____ the room, I collided _____ somebody I knew.
30. Some words are difficult _____ translate _____ one language _____ another.

Answers:

- | | | |
|-----------------|--------------|-------------------|
| 1. In | 11. In | 21. With, by |
| 2. To, on | 12. Under | 22. Of |
| 3. Of | 13. For | 23. On, with |
| 4. In, of, to | 14. From | 24. To |
| 5. At, to, on | 15. To | 25. To |
| 6. For | 16. Over | 26. In |
| 7. With | 17. To, for | 27. To, on |
| 8. With | 18. From | 28. But, with, of |
| 9. By | 19. With, on | 29. Of, with |
| 10. In addition | 20. To | 30. To, from, to |

Exercise

I. Fill in the blanks with appropriate prepositions.

1. Resentment brewing students
2. He was nominated multiple times Prize in literature but never won.
3. The river flows the bridge.
4. Don't cry spilt milk.
5. What are you looking?
6. I will write a letter the incident.
7. She has been like this June.
8. I found this paper the dustbin.
9. Get me something thin.
10. I am tired this work.
11. She is angry..... me.
12. You have to apply the judge for pardon.
13. He never boast his merits.
14. Her conduct does not admit Any excuses.
15. When the child is empowered by the parents, the child transforms a responsible citizen.
16. He has so far interacted with over 40,000 school children the past one year.
17. Indian civilization heritage is built universal spirit.
18. Our nation is endowed natural resources.
19. He was born a middle class family in Mumbai.
20. She is confident winning.
21. Write your number the top of the page.
22. Welcome our country.
23. He got the car and drove away.
24. Some people were taken Hospital after the accident.
25. Are you disappointed your exam results.

II. Fill in the blanks with appropriate Prepositions.

1. He moved the United States to study computer sciences.
a) at b) about c) to d) in
2. This day reminds me My very first day at Microsoft.
a) with b) of c) to d) on
3. She resigned herself Failure.
a) to b) on c) at d) with

4. Do not prevent him working.
a) at b) for c) from d) on
5. They repented Having been idle.
a) for b) to c) from d) of
6. In our early history, our mission was the PC on every desk and home.
a) into b) about c) to d) at
7. There is a passage the two building.
a) between b) into c) in d) with
8. I will return a fortnight.
a) for b) at c) in d) within
9. She studied French The age of ten.
a) in b) since c) from d) between
10. This is in answer your scolding me about my transgression.
a) for b) at c) on d) to
11. his talk, it seems, studies were an ancillary subject.
a) at b) from c) about d) since
12. She is very good English.
a) in b) at c) for d) into
13. The table is the corner of the room.
a) at b) on c) in d) into
14. He's very bad Chemistry.
a) in b) on c) for d) at
15. He is suffering severe depression.
a) from b) at c) in d) for
16. Quickly glance the contents and the headings and subtopics.
a) into b) at c) for d) onto
17. The poor of the world cannot be helped mass production.
a) at b) with c) by d) in
18. He became ill eating undercooked meat.
a) through b) at c) by d) on

19. I will arrange a meeting some time the week.
a) on b) in c) through d) during
20. I have been living with my relatives a few days.
a) since b) for c) in d) around
21. Do you play any other sports football?
a) with b) beside c) besides d) during
22. I smiled the joy of only having to wait one more day.
a) at b) on c) with d) in
23. This is a matter little interest to me.
a) with b) about c) of d) for
24. This rule is not applicable the present case.
a) for b) to c) at d) in
25. He filed a suit his relative.
a) against b) from c) on d) at
26. I haven't eaten Wednesday.
a) from b) on c) through d) since
27. Once they were the border, they knew they would be safe.
a) beside b) from c) across d) in
28. We enjoyed the peace and quiet as we walked the forest.
a) through b) under c) in d) into
29. A lot of mist hung the fields.
a) in b) over c) through d) above
30. You shouldn't open your presents your birthday.
a) besides b) beside c) until d) during

III. Insert appropriate prepositions in the places left blank.

Jupiter's Great Red Spot, the solar system's most famous storm, is almost one-and-a-half times wider than the earth and penetrates 300 km The gas giant's atmosphere, data collected by NASA's Juno spacecraft. Other revelations the mission include that Jupiter has two previously uncharted radiation zones. One

..... the most basic questions Jupiter's Great Spot is: how deep are the roots?"
 said Scott Bolton, Juno's principal investigator The South West Research Institute
 the US. Juno's Microwave Radiometer has the unique capability Peer deep
 Jupiter's clouds. It is proving be an excellent instrument Help us get
 the bottom what makes the Great Red Spot so great. Jupiter's Great Red Spot
 is a giant oval crimson-colored clouds Jupiter's southern hemisphere that
 race counter-clockwise The oval's perimeter winds speed greater than any
 storm the earth.

Keys

I.

- | | | | | | | |
|-----------|------------|----------|----------|----------|----------|----------|
| 1. among | 2. for | 3. under | 4. over | 5. at | 6. about | 7. since |
| 8. behind | 9. like | 10. of | 11. with | 12. to | 13. of | 14. of |
| 15. into | 16. during | 17. on | 18. with | 19. into | 20. of | 21. at |
| 22. to | 23. into | 24. to | 25. with | | | |

II.

- | | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1. C | 2. B | 3. A | 4. C | 5. D | 6. B | 7. A | 8. D | 9. C | 10. D |
| 11. B | 12. B | 13. C | 14. D | 15. A | 16. B | 17. C | 18. A | 19. D | 20. B |
| 21. C | 22. A | 23. C | 24. B | 25. A | 26. D | 27. C | 28. A | 29. B | 30. C |

III.

- | | | | | | |
|----------|---------|-----------------|------------|----------|----------|
| 1. about | 2. into | 3. according to | 4. from | 5. of | 6. about |
| 7. from | 8. in | 9. to | 10. below | 11. to | 12. to |
| 13. to | | | | | |
| 14. of | 15. of | 16. in | 17. around | 18. with | 19. on |

4. ARTICLES

Articles are adjectives

Indefinite Articles: *a, an* (indefinite) and *the* (definite / specific) Their usage depends upon the spoken form (not the written form)

a: is used before a word, beginning with a consonant sound (and is pronounced as first sound in the word above)

Eg: a man, a member of parliament

a: before a word beginning with consonant sound

Eg: a university
a European
a useful thing
a year
a yard
a yellow shirt
a young man
a one-eyed (y sound)

a: is also used in these cases too! Wherever there is a y sound, *a* is used before such word.

Eg: a .young fellow, a ^outh, a .year, a y_ellow paper etc.

an: is used before a word beginning with a vowel sound

Eg: an apple a day keeps ...

an orange a day ...

an umbrella etc

an: before a vowel sound

Eg: an arm
an afternoon
an evening
an office
an orange
an onion
an umbrella
an hour
an Englishman

Note: When *h* is pronounced

A hotel

A horse

A human being

When *h* is silent

An hour

An honestman

An honour

Definite article: *the*: is used to specify and to identify.

1. It is used before a noun after it is introduced.
Eg.: We have a shop in a large building. **The** building belongs to an M.L.A.
2. It is used to denote a person, place or thing.
Eg.: **The** manager of Bank of Baroda is from our colony.
3. It is used before an adjective in the superlative degree. Eg.:
He is **the** most intelligent in the batch.
4. It is used to indicate uniqueness. Eg.:
The sun rises in the east.

Exercise

1. In _____ hour.
2. She is _____ MP.
3. _____ afternoon
4. He is _____ honestman!
5. She always carries _____ umbrella.
6. She goes for _____ evening walk.
7. This is _____ university course.
8. She is _____ European I suppose.
9. I learn 500 words in _____ year.
10. This is _____ unit of BHEL.
11. _____ young fellow was seen outside.
12. He is _____ one-eyed person
13. My father gave me _____ one rupee note.

Exercise

I. Fill in the blanks with appropriate articles.

1.two judge Special Bench was hearing a batch of petitions.
2. Peacock is a majestic bird.
3. He is best batsman of the team.
4. He is colleague of mine.
5. I really need cup of tea.
6. English has become International language.
7. Bangalore is Beautiful city.
8. There is a cold wind blowing from east.
9. We thank our customers for trust and support.
10. He reiterated issues he has raised on the campaign trail.
11. Have you filed complaint?
12. We found dead animal easily.
13. The expedition was welcome change from our daily routine.
14. He was driving the car at 90 Km hour.
15. Mumbai is very expensive city.
16. Hindi is easy language.
17. August is eights month of year.
18. Maldives is island.
19. He is best player.
20. She came after hour.

II. Fill in the blanks with appropriate articles wherever necessary.

The world's newest island formed duringvolcanic eruption in remote pacific three years ago. It may offer clues to how life potentially developed on Mars. Island of Hunga Tonga rose from seabed about 65Km northwest of Tongan capital in late 2014 or early 2015. Scientists initially expected the island was created when vast quantities of rock and dense ash spewed from earth's crust to wash away within few months. But NASA said it had proved more resilient than expected, possibly because warm sea water combined with ash during Volcanic explosion to create concrete like substance known as "tuff". Jim Garvin, chief scientist at NASA's

Goddard Space Flight Center, said it was rare chance to study life cycle of newly created island. Examining how life gained foothold on Tongan island could help scientists pinpoint where to look for evidence of life on Mars. NASA's studies on island were presented at meeting of American Geographical Union in New Orleans.

III. Use the correct article wherever necessary.

1. India faces tough challenge on farm issues.
a) an b) the c) a d) no article
2. Which is nearest station from here?
a) a b) an c) no article d) the
3. My watch is hour late.
a) an b) a c) the d) no article
4. Read second chapter carefully.
a) a b) the c) an d) no article
5. He was icon of the 1980s.
a) a b) the c) an d) no article
6. Who wants ice cream?
a) a b) an c) the d) no article
7. She hasn't faintest idea how to manage people.
a) a b) an c) the d) no article
8. This is room we stayed in last year.
a) an b) the c) a d) no article
9. evening at home watching TV is not my idea of a good time.
a) the b) a c) an d) no article
10. The identification of the crash victims was a long and difficult task.
a) the b) an c) a d) no article
11. She is too much of idealist for this government.
a) an b) a c) the d) no article

12. In ideal world there would be no corruption and poverty.
a) the b) an c) a d) no article
13. She retired early on grounds of ill health.
a) a b) an c) the d) no article
14. He knew that girls used to imitate him and laugh at him behind his back.
a) a b) an c) the d) no article
15. It was impertinent question.
a) the b) a c) an d) no article
16. children were a great consolation to her when her husband died.
a) a b) the c) an d) no article
17. The event was conspicuous success.
a) the b) a c) an d) no article
18. It was luxury if you had TV in those days.
a) a, a b) a, the c) the, a d) no article
19. They were standing in middle of room.
a) the, the b) the, an c) a, the d) no article
20. Everybody knows that migrate birds bring new viruses when they fly into the country.
a) a b) an c) the d) no article

Keys

I.

1. **a** 2. **the** 3. **the** 4. **a** 5. **a** 6. **an** 7. **a** 8. **the** 9. **the** 10. **the**
11. **a** 12. **the** 13. **a** 14. **an** 15. **a** 16. **an** 17. **the, the** 18. **an** 19. **the** 20. **an**

II.

1. **a** 2. **the** 3. **the** 4. **the** 5. **the** 6. **the** 7. **a** 8. **the** 9. **a** 10. **the**
11. **a** 12. **the** 13. **a** 14. **a** 15. **the** 16. **the** 17. **a** 18. **the**

III.

1. **c** 2. **d** 3. **a** 4. **b** 5. **c** 6. **b** 7. **c** 8. **b** 9. **c** 10. **d**
11. **a** 12. **b** 13. **d** 14. **c** 15. **c** 16. **b** 17. **b** 18. **a** 19. **a** 20. **d**

5. QUESTION TAGS

Exercise

1. Choose the correct answer.

1. Mr Dhanraj opened the shop,?
a) did he b) is he c) didn't he d) does he
2. Will you help me,?
a) won't you b) will you c) do you d) can't you
3. It's not raining,?
a) isn't it b) hasn't it c) has it d) is it
4. He was a great warrior,?
a) is he b) wasn't he c) didn't he d) did he
5. We are not yet ready to call him in,?
a) isn't he b) aren't we c) are we d) won't we
6. Please turn off the TV,?
a) do you b) will you c) can't your d) don't you
7. You are a good sportsman,?
a) don't you b) won't you c) aren't your d) will you
8. Bring me a cup of tea,?
a) will you b) won't you c) can't your d) aren't you
9. They have secured first division,?
a) hasn't they b) are they c) aren't they d) haven't they
10. He was in the market yesterday,?
a) isn't he b) wasn't he c) is he d) was he
11. She can't sing well,?
a) has she b) won't she c) can she d) isn't she
12. Nothing bad happened,?
a) did it b) wasn't it c) didn't it d) isn't it
13. They used to go to the gym?
a) did they b) weren't they c) were they d) didn't they

14. Everbody is searching for the book?
a) aren't they b) do they c) isn't everybody d) is everbody
15. Please, stop this nonsense,?
a) don't you b) won't you c) will you d) can you
16. I'm standing in queue,?
a) aren't I b) am I c) amn't I d) don't I
17. You mother cooks well,?
a) isn't she b) won't she c) can't she d) doesn't she
18. You have a diamond ring,?
a) haven't you b) have you c) don't you d) will you
19. Let's do the work now,?
a) shall we b) should we c) can we d) won't we
20. You haven't got a good dictionary,?
a) do you b) did you c) aren't you d) have you

Keys

1. **C** 2. **A** 3. **D** 4. **B** 5. **C** 6. **B** 7. **C** 8. **A** 9. **D** 10. **B**
11. **C** 12. **A** 13. **D** 14. **B** 15. **C** 16. **A** 17. **D** 18. **C** 19. **A** 20. **D**

6. TYPES OF SENTENCES

Exercise

1. He is a teacher and he wants to serve his pupils.
Change the above sentence into a complex sentence.
 - a) He is a teacher so he wants to serve his pupils
 - b) as he is a teacher, he wants to serve his pupils.
 - c) He is a teacher so that he wants to serve his pupils.
 - d) He wants to serve his pupils because he is a teacher.
 2. He must work hard to make up for the lost time.
Change the above sentence into compound sentence.
 - a) He must work hard and make up for the lost time.
 - b) He must work hard because he lost time.
 - c) If he works hard he can make up his lost time.
 - d) He has to work hard so that he can make for the lost time.
 3. The moment which is lost is lost forever.
Change the above sentence into simple sentence.
 - a) A lost moment will never return.
 - b) As the lost moment is lost, we should not think about it.
 - c) A lost moment is lost forever.
 - d) Everything is lost with a lost moment.
 4. Is this the way to do it?
Change the above sentence into complex sentence.
 - a) This not the way and don't do it.
 - b) Don't do this as it is wrong.
 - c) This is not the way because it should not be done.
 - d) This is not the way how it should be done.
 5. In the event of his being late, he will be punished.
Change the above sentence into compound sentence.
 - a) If he is late, he will be punished.
 - b) He must not be late, or he will be punished.
 - c) He will be punished if he is late again.
 - d) He will not be punished if he is not late.
 6. She said that she was innocent.
Change the above sentence into simple sentence.
 - a) She declared her innocence.
 - b) As she is innocent she declared her innocence.
 - c) She declared her innocence because she was very innocent.
 - d) She was innocent and she declared her innocent.
 7. Search his pockets and you will find the paper.
-

- Change the above sentence into complex sentence.
- Inspite searching his pockets, you did not find the paper.
 - If you search his pockets, you will find the paper.
 - Unless you search his pockets, you can't find the paper.
 - Search his pockets to find the paper.
8. The men who are wise do not talk much.
Change the above sentence into simple sentence.
- They do not talk much because they are wise men.
 - As they are wise men, they do not talk much.
 - Wise men do not talk much.
 - They are wise men and they do not talk much.
9. If you are honest, you will be respected by all.
Change the above sentence into compound sentence.
- Be honest and you will be respected by all.
 - You will be respected by all because of your honesty.
 - Unless you are not you will not be respected by all.
 - In case of honesty you will be respected by all.
10. She speaks like a girl of ten.
Change the above sentence into complex sentence.
- She speaks as if she was a girl of ten.
 - She speaks as if she was a girl of ten.
 - She is speaking like a girl of ten.
 - She speaks as if she were a girl of ten.
11. Taking a piece of paper she started writing on it.
Change the above sentence into compound sentence.
- After taking a piece of paper, she started writing on it.
 - She took a piece of paper and started writing on it.
 - She started writing on it after taking a piece of paper.
 - If she had not taken a piece of paper she would not have written on it.
12. Don't enter the room if you are not permitted.
Change the above sentence into simple sentence.
- You can enter the room if you are permitted.
 - In case you are permitted, you can enter the room.
 - Don't enter the room without permission.
 - Unless you are permitted you don't enter the room.
13. You win or your country will be put to disagree.
Change the above sentence into complex sentence.
- You have to win because your country will be put to disagree.
 - You didn't win so your country will be put to disagree.
 - You have to win because of your country's honour.
 - If you don't win, your country will be put to disagree.

KEYS

- | | | | | | | | | | |
|--------------|--------------|--------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|
| 1. B | 2. A | 3. C | 4. D | 5. B | 6. A | 7. B | 8. C | 9. A | 10. D |
| 11. B | 12. C | 13. D | | | | | | | |

7. TENSES

Simple Present Tense: is used:

1. To express a habitual action; as
He takes milk every morning
I get up every day at five O'clock
My watch knows good time.
2. To express general truth; as
The sun rises in the east
Honey is sweet
Fortune favours the brave.
3. In exclamatory sentences beginning with here and there to express what is actually taking place in the present: as
Here comes the bus;
There she goes;
4. In vivid narrative, as substitute for the simple past; as
Suresh now rushes forward and deals a heavy blow to Praveen. Immediately the sultan hurries to his capital.
5. To indicate a future event that is part of a plan or arrangement, as,
We go to Mumbai next week.
They leave for London by the next mail.
We sail for America next Saturday
When does the college reopens?

Make also the other uses of the Simple Present Tense.

1. It is used to introduce quotations; as,
Keats says, "A thing of beauty is a joy forever."
2. It is used, instead of the simple future tense, in clauses of time and of condition; as,
I shall wait till you finish your lunch.
If it rains we shall get wet.
3. As in broadcast commentaries on sporting events, the simple present is used, instead of the present continuous, to describe activities in progress where there is stress on the succession of happenings rather than on the duration.
4. The simple present is used, instead of the present continuous, with the type of verbs referred. We must say for example. T see an aero plane', not T am seeing an aeroplane.'

Present Continuous Tense: is used

1. For an action going on at the time of speaking; as,
Kusuma is singing (now)
The boys are playing hockey.
2. For a temporary action which may not be actually happening at the time of speaking; as, Eg: He is learning Piano (these days)
3. For an action that is planned or arranged to take place in the near future; as,
I am going to the cinema to night.
My uncle is arriving tomorrow.

It has been pointed out before that the simple present is used for a habitual action. However, when the reference is to particularly a advice or warning - we use present continuous with an adverb like always, continually, constantly.

My dog is very silly; he is always running out into the road.

The following verbs, on account of their meaning, are not normally used in the continuous form:

- 1) Verbs of perception, eg.: see, hear, smell, notice, recognize.
- 2) Verbs of appearing, eg: appear, look, seem
- 3) Verbs of emotion, eg.: want, wish, desire, feel, like love, hate, hope, refuse, prefer
- 4) Verbs of thinking, eg.: think, suppose, believe, agree, consider, trust, remember, forget, know, understand, imagine, mean, mind.
- 5) Have (=possess), own, possess, belong to, contain, consist of be (except when used in passive)

These verbs are used in the simple present. They may, however, be used in the continuous tenses with a change of meaning, as,

I am thinking of ^considering the idea of) going to America.

Mr. Arun Kumar is minding (=looking after) the baby while his wife is out shopping.

Present Perfect Tense: is used

- 1) To indicate completed activities in the immediate past; as
Ranadheer has just gone out,
It has just struck ten.
- 2) To express past actions whose time is not given and not definite; as

Have you read 'Gulliver's Travels'?

I have never known him to be angry?

Mr. Hari has been to Japan.

- 3) To describe past events when we think more of their effect in the present than of the action itself; as,

Prasad has eaten all the biscuits (*i.e.*, there aren't any left for you)

I have cut my finger (and it is bleeding now)

I have finished my work (=now I am free)

- 4) To denote an action beginning at some time in the past and continuing up to the present moment; as,

I have known him for a long time.

Firdous has been ill since last week.

We have lived here for ten years.

We haven't seen Padma for several months.

The following adverbs (or adverb phrases) can be used with the present perfect: just, often, never, ever (in questions only), so far, till now, yet (in negative and questions) already, since, phrases, for-phrases, today, this week, this month, etc.

- * Note that the present perfect is never used with adverbs of past time. We should not say, for example, "He has gone to Calcutta yesterday". In such cases the simple past should be used (he went to Calcutta yesterday.)

Present Perfect Continuous Tense: : is used for an action which began at some time in the past and is still continuing; as,

Dilip has been sleeping for five hours (and is still sleeping).

They have been building the bridge for several months.

They have been playing since four o'clock.

This tense is sometimes used for an action already finished. In such cases the continuity of the activity is emphasized as an explanation of something.

'Why are your clothes so wet?' - T have been watering the garden.

Simple Past Tense:

The simple past is used to indicate an action completed in the past. It often occurs with adverbs or adverb phrases of past time.

The steamer sailed, yesterday.

I received his letter a week ago.

Nalini left school last year.

Sometimes this tense is used without an adverb of time. In such cases the time may be either implied or indicated by the context.

I learnt Hindi in Nagpur.

I didn't sleep well (*i.e.* last night)

Babar defeated Rana Sanga at Kanwaha.

The Simple past is also used for past habits; as,

Jaswanth studied many hours everyday.

Durga always carried an umbrella.

Past Continuous Tense:

The past continuous is used to denote an action going on at some time in the past. The time of the action may or may not be indicated.

We were listening to the radio all evening.

It was getting darker.

The light went out while Anudeep was reading.

When I saw Sandeep, he was playing chess.

This tense is also used, with always, continually etc. for persistent habits in the past.

Rohit was always grumbling.

Past Perfect Tense:

The past perfect describes an action completed before a certain moment in the past; as,

I met him in New Delhi in 1970. I had seen him last five years before.

If two actions happened in the past, it may be necessary to show which action happened earlier than the other. The past perfect is mainly used in such situations. The simple past is used in one clause and the past perfect in the other; as,

When I reached the station the train had started (so I couldn't get into the train)

I had done my exercise when Hari came to see me.

Durga had written the letter before Kusuma arrived.

I had left the class before English Teacher arrived.

Past Perfect Continuous Tense:

The past perfect continuous is used for an action that began before a certain point in the past and continued up to that time; as,

At that time, he had been writing a novel for two months.

When Mr. Mandeep came to the school in 1965, Mr. Anand had already been teaching there for five years.

Simple Future Tense:

The simple future is used for an action that has still to take place; as, I shall see him tomorrow. Tomorrow will be Sunday.

Note that the simple future tense is used. When the future is coloured with intention, the going to + finite construction is preferred , eg., 'He is going to build a new house'.

Future Continuous Tense:

The future continuous represents an action as going on at some time in future time; as,

I shall be reading the paper then.

When I got home, my children will be playing.

This tense also used for future events that are planned; as,

I'll be staying here till Sunday.

Rakesh will be meeting us next week.

Future Perfect tense:

The future perfect is used to indicate the completion of an action by a certain future time; as,

I shall have written my exercise by that time.

Before you go to see him, KhEEzar will have left the place.

Future Perfect Continuous Tense:

The future perfect continuous indicates an action represented as being in progress over a period of time that will end in the future; as,

By next July we shall have been living here for four years.

When he gets his degree, Bharath will have been studying at Oxford for four years.

Exercise

1. The earth _____ round the sun. (*move, moves moved*)
2. My friends _____ the Prime Minister yesterday. (*see, have seen, saw*)
3. I _____ him only one letter up to now. (*sent, have sent, shall send*)
4. I shall telephone you when he _____ back. (*comes, will come, came*)
5. It started to rain while we _____ tennis.
(*are playing, were playing, had played*)
6. Can I have some milk before I _____ to bed? (*go, am going, shall go*)
7. He _____ asleep while he was driving. (*falls, fell, has fallen*)
8. I'm sure I _____ him at the party last night. (*saw, have seen, had seen*)
9. Anayatul _____ a milk in this town. (*have, has, is having*)
10. Suresh Yadav _____ here for the last five years.
(*worked, is working, has been working*)
11. Venu Gopal thanked me for what I _____.
(*have done, had done, have been doing*)
12. I _____ a strange noise. (*hear, am hearing, have been hearing*)
13. I _____ him for long time. (*know, have know, am knowing*)
14. We _____ English for five years, (*study, am studying, have been studying*)
15. Don't disturb me. I _____ my home work. (*do, did, am doing*)
16. Vamshi Krishna _____ to be a doctor. (*wants, wanting, is wanting*)
17. I _____ for next birthday. (*am, shall be, have been*)
18. If you _____ at once you will arrive by 6 o'clock, (*start, started, will star*)
19. Srikanth _____ out five minutes ago. (*has gone, had gone, went*)
20. When he lived in Hyderabad, he _____ to the cinema once a week.
(*goes, went, was going*)

I. Choose the correct verb forms from those in brackets.

1. Bees Honey. (are making/make)
2. Where kiran come from? (does/do)
3. She a car. (has/have)
4. It continuously since 7 o' clock.(is being raining/has been raining)
5. See how the bird in the sky. (is flying/fly)

6. He when the telephone rang. (has been sleeping/was sleeping)
7. They thanked me for what I (do/did)
8. A car in the morning. (has hit/hit)
9. On Friday afternoon, I lunch with my friend. (had/was having)
10. When I went to the shop, the shop Down. (was closed down/had closed down)
11. Tomorrow by this time I exam. (shall write/shall be writing)
12. They about it in near future. (will be knowing/will know)
13. The doctor arrived after the patient (died/had died)
14. I in 1998. (had been married/was married)
15. Who discovered the force of gravitation? (has discovered/discovered)
16. You won't pass until you hard. (work/will work)
17. I to college every day by bus. (go/am going)
18. She jumped off the train while it (ran/was running)
19. They will wait for you until you (reach/reached)
20. He is shortly a new branch. (will open/opening)
21. Each June we To Dubai for a holiday. (will go/go)
22. He 15 films and I think his latest is the best. (had made/has made)
23. When I was a child the violin. (I was playing/I palyed)
24. Sorry we're late, we the wrong turning. (took/had taken)
25. I won't be able to meet you next week, I in Mumbai for a few days. (will stay/will be staying)
26. Next month I kiran for 10 years. (will have known/will have been knowing)
27. He all the doors and windows before he goes to bed. (shuts/will always shut)
28. Science many major advances this century. (made/had made)
29. Just as I into the bath the fire alarm went off. (had got/was getting)
30. They living in Hyderabad for twenty years. (have been/are)

Choose the correct sentence.

31. a) He finished his work when I met him.
b) He was finishing his work when I met him.
c) He had finished his work when I met him.
d) When I met him, he was finishing his work.
32. a) Examinations have been held next month.
b) Examinations will be held next month.
c) Examinations had been held next month
d) Examinations are being held next month
33. a) I understood what you say b) I am understand what are you saying.
c) I had understood what you say d) I understood what you say
34. a) The fair was over five days ago b) The fair had been over five days ago
c) The fair was being over five days ago d) The fair will be over five days ago
35. a) I will meet you when she come back
b) I will meet you when she comes back
c) When she comes back I will be meeting you
d) I will meet you when she came back
36. a) He thanked me for what I have done for him
b) For what I have done, he thanked me
c) He thanked me for what I has done for him
d) He thanked me for what I had done for him
37. a) She went out ten minutes ago b) She had gone out ten minutes ago
c) Ten minutes ago she had gone out d) She will go out ten minutes ago
38. a) If you started at once, you will reach on time
b) You will reach on time if you started at once
c) If you start at once, you will reach on time
d) If you had started at once, you will reach on time
39. a) I am sure I met him at the station yesterday
b) I am sure I had met him at the station yesterday
c) I am sure I will have met him at the station yesterday
d) I am sure I was being met him at the station yesterday
40. a) He did a lot of work today b) He has done a lot of work today
c) A lot of work had been done today d) A lot of work are being done today
41. a) My brother will have arrived tomorrow morning
-

- b) My brother shall have arrived tomorrow morning
 c) Tomorrow morning, my brother will arrive
 d) My brother arrives tomorrow morning
42. a) He was reaching the station after the train was left
 b) He reaches the station after the train had left
 c) He reached the station after the train had left
 d) He had reached the station before the train left
43. a) I'm beginning to realize how difficult it is to be a teacher
 b) I had began to realize how difficult it is to be a teacher
 c) I shall begin to realize how difficult it is to be a teacher
 d) How difficult it is to be a teacher, I had began to realize
44. a) Nothing like this was happened before
 b) Nothing like this have happened before
 c) Nothing like this has happened before
 d) Nothing was like this is happened before
45. a) Since 2000 I have lived in a small house near the station
 b) Since 2000 I lived in a small house near the station
 c) Since 2000 I am living in a small house near the station
 d) Since 2000 I was living in a small house near the station
46. a) Were you ever visited in a cave? b) Have you ever been in a cave?
 c) Have you ever been in cave? d) Had you ever went in a cave?
47. a) I'm reading an interesting novel at the moment
 b) I have read an interesting novel at the movement
 c) I was reading an interesting novel at the moment
 d) I will read an interesting novel at the moment
48. a) What do this word mean? b) What does this word meant?
 c) What does this word means? d) What does this word mean?
49. a) They look after patients for the hospitals
 b) They will looked after the patients in hospitals
 c) They look after patients in hospitals
 d) They are looked after the patients in the hospitals
50. a) It doesn't rain very much in summer
 b) It doesn't rains very much in summer
 c) It's doesn't rain very much in summer
 d) It's don't rain very much in figures

51. a) We are having a nice room in the hotel
b) We have a nice room in the hotel
c) We were having a nice room in the hotel
d) We will be having a nice room in the hotel
52. a) I see the director tomorrow morning
b) Tomorrow morning, I see the direction
c) I have been seeing the director tomorrow morning
d) I'm seeing the director tomorrow morning
53. a) We are having lunch when Sara arrived
b) When Sara arrived, we were had lunch
c) When Sara arrived, we were having lunch
d) We had lunch when Sara arrived
54. a) The children loves having Maryam stay with us
b) The childrens love having Maryam stay with us
c) The children love having Maryam stay with us
d) The children love having Maryam stay with us
55. a) When did you arrive in Hyderabad? b) When did you arrive at Hyderabad?
c) When did you arrived at Hyderabad? d) When did you arrived in Hyderabad?

Keys

- | | | | |
|---------------------|---------------------|----------------------|---------------------|
| 1. make | 2. does | 3. has | 4. has been raining |
| 5. is flying | 6. was sleeping | 7. did | 8. hit |
| 9. had | 10. had closed down | 11. shall be writing | 12. will know |
| 13. had died | 14. was married | 15. discovered | 16. work |
| 17. go | 18. was running | 19. reach | 20. opening |
| 21. go | 22. has made | 23. I played | 24. took |
| 25. will be staying | 26. will have known | 27. shuts | 28. has made |
| 29. was getting | 30. have been | | |

31. C 32. B 33. D 34. A 35. B 36. D 37. A 38. C 39. A 40. B
41. D 42. C 43. A 44. C 45. A 46. B 47. A 48. D 49. C 50. A
51. B 52. D 53. C 54. D 55. A

8. DEGREES OF COMPARISON

Exercise

1. Change the following into comparative degree.
“Very few cities of India are as big as Mumbai.”
 - a) No other city is as big as Mumbai in India
 - b) Mumbai is one of the biggest cities in India
 - c) Mumbai is bigger than many other cities in India
 - d) Mumbai is bigger than any other cities in India
2. Change the following into superlative degree.
“No other playwright is so great as Kalidasa in Sanskrit.”
 - a) Very few playwright, are as great as Kalidasa in Sanskrit
 - b) Kalidasa is the greatest playwright in Sanskrit
 - c) Kalidasa is greater than any other playwright in Sanskrit
 - d) In Sanskrit Kalidasa in greater than many other playwrights
3. Change the following into positive degree.
“Ali is one of the cleverest boys in the class.”
 - a) Ali is cleverer than any other boy in the class
 - b) No other boy is so clever as Ali in the class
 - c) Ali is cleverer than many other boys in the class
 - d) Very few boys in the class are as clever as Ali
4. Change the following into comparative degree.
“No other student in the class writes so fast as Arjun.”
 - a) Arjun writes faster than many other students in the class
 - b) Arjun’s writing is the fastest of all students in the class
 - c) Arjun writes faster than any other student in the class
 - d) Very few students writes faster than Arjun.
5. Change the following into superlative degree.
“Aurangzeb was greater than many other Indian Kings.”
 - a) No other Indian King is so great as Aurangzeb.
 - b) Very few Indian Kings were as great as Aurangzeb
 - c) Aurangzeb is greater than any other Indian Kings
 - d) Aurangzeb was one of the greatest of Indian Kings
6. Change the following into positive degree.
“Radhika is one of the most brilliant girls in the class.”
 - a) Very few girls in the class are as brilliant as Radhika
 - b) Radhika is more brilliant than most other girls in the class
 - c) No other girl in the class are as brilliant as Radhika
 - d) Radhika is more brilliant than any other girl in the class

7. Change the following into comparative degree.
“No other man was so strong as Dara Singh in his youth.”
a) Dara Singh was stronger than many other men in his youth
b) Dara Singh was stronger than any other in his youth
c) Very few men were as strong as Dara Singh in their youth
d) Dara Singh was strongest man in his youth
8. Change the following into superlative degree.
“This market is more fashionable than any other market in the town.”
a) No other market is so fashionable as this market in the town
b) This market is more fashionable than many other markets in the town
c) Very few markets are as fashionable as this market in the town
d) This is the most fashionable market in the town
9. Change the following into positive degree.
“Bilal was the tallest of all the student in his class.”
a) Bilal was taller than any other student in his class
b) Bilal was taller than many other students in his class
c) No other student was as tall as Bilal in his class
d) Very few students in the class were as tall as Bilal

Keys

1. C 2. B 3. D 4. C 5. D 6. A 7. B 8. D 9. C

9. DIRECT AND INDIRECT SPEECH

Reported Speech: Direct and Indirect speech

There are four categories: They are

- (i) No modification of tense / person
- (ii) Modification of person
- (iii) Modification of verb / person / adverbial
- (iv) Modification of structure / pattern in questions / commands / requests / greetings.

Direct: What people actually say.

Indirect: When what someone said is reported.

Case (i): No modification of tense / person:

Direct

Quadeer says, "Swamy has passed."

Indirect

Quadeer says Swamy has passed

Case (ii):

She says, "I am fine today."

She says she is fine today.

He says, "I was fine yesterday."

He says he was fine yesterday.

The pronouns are changed as

I, me, my → he, him, his, she, her

We, us, our → they, them, their

You, your → I, me, my; we, us, our

Case (iii): Modification verb / person and adverbial indirect

Direct

Balu said, T am fine today."

Beena said, "I was fine yesterday."

She said, "My journey would begin".

Indirect

Balu said he was fine that day

Beena said she had been fine the day before

She said her journey would begin

The following changes takes place in tenses:

Present → past

Present perfect → past perfect

Simple past → past perfect

Past perfect → past perfect

In modals:

can, shall, will, may, must → could, should, would, might

In adverbials:

here → there

now → then

next week → the following week

yesterday → the day before

tomorrow → the next day ...

ago → before ^

Case (iv): Modification structure / pattern in questions, commands

Direct

She asked, "What is the time."

Shyam asked, "Are the boys here?"

Sir asked, "Where were you?"

Can you see me tomorrow?" he asked me

'Hello! How are you?" she said.

I said, "Go home".

Indirect

She asked what the time was.

Shyam asked whether the boys were there

Sir asked where I had been.

He asked me whether I could see him the next day.

She greeted me and asked me how I was.

I asked him to go home.

I told him to go home.

Say is used to introduce direct quotation.

Eg.: He said he was going to Sania's match.

Tell is used rarely with direct quotation, (*tell* has an indirect object expressed)

Eg.: tell (someone) something.

tell () about something

tell () where / when / what / who

tell () how something happened

tell () why something happened

tell () to do something

tell () that

Commands:

.....toldto

.....askedto

.....orderedto

Requests:askedto

Questions:asked whether / if.....

Statements:

.....said

.....told

Some reporting verbs:

admit	complain	inform	report
agree	confess	insist	say
allege	combine	maintain	suggest
announce	declare	mention	swear
argue	deny	notify	threaten
ask	disagree	persuade	warn
assure	explain	predict	wonder
boost	hint	promise	
claim	indicate	remind	

Exercise

Directions: In each of the following questions, a sentence has been given in Direct Speech. Out of four alternatives suggested, select the one which best expresses the same sentence in Indirect Speech.

1. **He said, “ I cannot help you at present because I am myself in difficulty”:**
- (A) He said that I cannot help you at present because I am myself in difficulty.
- (B) He said that he could not help you at present because he was himself in difficulty.
- (C) He told that he could not help you at present because he was himself in difficulty.
- (D) He asked that he could not help you at present because he was himself in difficulty.

2. **He says, “I don’t want to play any more”:**
(A) He says that he doesn’t want to play any more.
(B) He says that I don’t want to play any more.
(C) He says that I didn’t want to play any more.
(D) He says that he didn’t want to play any more.
3. **Kazim said. “We shall go to see the Taj in the moonlit night”:**
(A) Kazim said that we shall go to see the Taj in the moonlit night.
(B) Kazim told that we shall go to see the Taj in the moonlit night.
(C) Kazim told that we should go to see the Taj in the moonlit night.
(D) Kazim said that they should go to see the Taj in the moonlit night.
4. **The teacher said, “The Earth moves round the Sun”:**
(A) The teacher said that the Earth moves round the Sun.
(B) The teacher asked that the Earth moves round the Sun.
(C) The teacher told that the Earth moved round the Sun.
(D) The teacher told that the Earth has moved round the Sun.
5. **Rajan said, “The matter shall be decided here and now”:**
(A) Rajan said that the matter should be decided there and then.
(B) Rajan said that the matter shall be decided here and now.
(C) Rajan said that the matter should be decided here and now.
(D) Rajan said that the matter shall be decided there and then,
6. **He said, “I saw her the day before yesterday”:**
(A) He said that he had seen her two days before.
(B) He said that I saw her the day before yesterday.
(C) He said that he saw her the day before yesterday.
(D) He said that he had seen her the day before yesterday.
7. **Richard said, “ Where does she live ?”:**
(A) Richard said that where does she live
(B) Richard asked that where does she live
(C) Richard asked where she lived
(D) Richard asked where did she live
8. **He said, “Will you be there tomorrow?”:**
(A) He asked if she would be there the next day
(B) He asked if she would be there tomorrow
(C) He asked whether she would be there tomorrow
(D) He asked that would you be there the next day
9. **She said, “When shall I know the result of the Test?”:**
(A) She said that when she would know the result of the test
(B) She told when she would know the result of the test
(C) She asked that when she would know the result of the test
(D) She asked when she would know the result of the test
-

10. **Rashid said, “Are these mangoes sweet?”:**
(A) Rashid told that these mangoes were sweet
(B) Rashid told if these mangoes were sweet
(C) Rashid asked if those mangoes were sweet
(D) Rashid asked if these mangoes were sweet
11. **He said, “How can I help in these circumstances?”:**
(A) He told that how could I help in these circumstances
(B) He asked how he could help in those circumstances
(C) He asked how he could help in these circumstances
(D) He told how he could help in those circumstances
12. **He said to Suresh, “Why did you enter my house without taking my permission ?”:**
(A) He told Suresh why you had entered my house without taking my permission
(B) He asked Suresh why you had entered my house without taking my permission
(C) He asked Suresh that why you had entered my house without taking my permission
(D) He asked Suresh why he had entered his house without taking his permission
13. **Manohar said, “What have been searching for all these hours”:**
(A) Manohar told that what you had been searching for all these hours
(B) Manohar said that what you had been searching for all these hours
(C) Manohar asked what I had been searching for all those hours
(D) Manohar asked what I have been searching for all these hours
14. **“Don’t swim out too far, boys,” I said:**
(A) I warned the boys not to swim too far
(B) I said the boys not to swim too far
(C) I proposed the boys not to swim too far
(D) I asked the boys not to swim too far
15. **My father said to me, “Speak the truth and be noble”:**
(A) My father said to me to speak the truth and be noble
(B) My father forbade me to speak the truth and be noble
(C) My father ordered to me to speak the truth and be noble
(D) My father advised me to speak the truth and be noble
16. **He said, “Let us go for the morning walk”:**
(A) He proposed us to go for the morning walk
(B) He ordered us to go for the morning walk
(C) He proposed that they should go for the morning walk
(D) He ordered that they should go for the morning walk
17. **Raju said, “Alas! I am ruined”:**
(A) Raju said that I am ruined
(B) Raju cried with grief that I am ruined

- (C) Raju cried with grief that he was ruined
(D) Raju said with grief that he was ruined
18. **My mother said, “May Heaven bless you!”:**
(A) My mother said that Heaven might bless you
(B) My mother wished that Heaven may bless you
(C) My mother wished that Heaven might bless him
(D) My mother told that Heaven might bless him
19. **He said, “What a dreadful idea !”:**
(A) He exclaimed that what a dreadful idea
(B) He exclaimed that it was a dreadful idea
(C) He exclaimed that it is a dreadful idea
(D) He exclaimed it was a dreadful idea
20. **The Captain said, “Let us play a friendly match”:**
(A) The Captain told us to play a friendly match
(B) The captain asked us to play a friendly match
(C) The captain proposed us to play a friendly match
(D) The Captain proposed that we should play a friendly match

KEY

1.B	2.A	3.D	4.A	5.A	6.A	7.C	8.A	9.D	10.C
11.B	12.d	13.c	14.A	15.D	16.C	17.C	18.C	19.B	20.D

Exercise

- Change the following into indirect speech.
“Can I take your book?” he asked.
a) He said to me that he can take my book
b) He told me that I had taken his book
c) He asked if he could take my book
d) He requested me to take my book
- Change the following into direct speech.
“He asked me what I was doing.”
a) He said to me, “What were you doing.”
b) “What have you been doing?” he asked me
c) He said to me, “what did you do?”
d) He said to me, “What are you doing?”
- Change the following into indirect speech.
She said to him, “Bravo! You have done well.”
a) She applauded him, saying that he had done well.
b) She told him that he did well
c) She confused him, saying that he did well
d) She told him that has done well

4. Change the following into direct speech.
“He asked me whether I was a fool.”
a) He said to me, “were you a fool?”
b) He said to me, “Are you a fool?”
c) He said to me, “Have you been a fool?”
d) He said to me, “Are you not a fool?”
5. Change the following into indirect speech.
“God is everywhere,” Said child Prahlada.
a) Child Prahlada said that God was everywhere
b) Child Prahlada enquired whether God is everywhere
c) Child Prahlada said that God is everwhere
d) Child Prahlada said that God will be everywhere
6. Change the following into direct speech.
“He said that I had to see his brother the following week.”
a) He said to me, “You have seen my brother this week.”
b) He said to me, “Did you see my brother this week?”
c) He said, “I have to see you brother next week.”
d) He said, “You have to see my brother next week.”
7. Change the following into indirect speech.
“You are cute.” Zainab said to me.
a) Zainab asked me whether I was cute b) Zainab told me (that) I was cute
c) Zainab said to me that I am cute d) Zainab told me (that) you were cute
8. Change the following into direct speech.
“She observed that it was a horrible scene.”
a) She said, “What a horrible scene!” b) She said, “It is being a horrible scene.”
c) “It will be a horrible scene.” She said. d) “Is it a horrible scene?” She said.
9. Change the following into indirect speech.
“She said, “Who is your friend?”
a) She asked me who my friend was. b) She asked me who my friend is.
c) She asked me who was my friend. d) She asked me who is my friend
10. Change the following into direct speech.
“He inquired who those people would be ready for lunch.”
a) He inquired, “Are these people ready for lunch?”
b) He asked me “Are people ready for lunch?”
c) He asked me “When were these people ready for lunch?”
d) “When will these people ready for lunch?” he inquired.
11. Change the following into indirect speech.
“She said, “Please give me a glass of water.”

- a) She asked me to give a glass of water
 b) She requested to give her a glass of water
 c) She inquired if I could give her a glass of water.
 d) She asked me if I could give her a glass of water.
12. Change the following into direct speech.
 “He announced that they had selected Adil as their leader.”
 a) He said, “We will select Adil as our leader.”
 b) He announced: “We have selected Adil as our leader.”
 c) He said, “We had selected Adil as our leader.”
 d) He announced: “We select Adil as our leader.”
13. Change the following into indirect speech.
 “She said, I shall definitely help you.”
 a) She said that she would definitely help me
 b) She said that she should definitely help me
 c) She said that she will help me
 d) She said that she has to help me.
14. Change the following into direct speech.
 “Kiran told me that I was not learning English seriously.”
 a) Kiran asked me, “you were not learning English seriously.”
 b) Kiran said to me, “Were you learning English seriously?”
 c) Kiran said to me, “Have you been learning English seriously?”
 d) Kiran said to me, “You are not learning English seriously.”
15. Change the following into indirect speech.
 “I said to him, “Did you go to college yesterday?””
 a) I asked him whether he went to college the previous day.
 b) I asked him whether he would go to college yesterday.
 c) I asked him whether he had gone to college the previous day.
 d) I asked him whether he has gone to college the previous day

Keys

1. **C** 2. **D** 3. **A** 4. **B** 5. **C** 6. **D** 7. **B** 8. **A** 9. **A** 10. **D**
 11. **B** 12. **B** 13. **A** 14. **D** 15. **C**

10. ACTIVE AND PASSIVE VOICE

Actives: Performs an action

Passives: (1) not active
 (2) it doesn't perform an action
 (3) the agent is not mentioned as it is either unknown or is too obvious
 (4) It is not a necessary piece of information.

Present & Past	Active	Passive
Simple present	I repair batteries	Batteries are repaired
	Sandhya prepares slides	The slides are prepared Sandhya.
	No one invites me to the parties	I am never invited to the parties
	How do they prepare laddoos?	How laddoos are prepared?
Simple past	Someone stole my cell phone!	My cell phone was stolen.
	She hid my slides somewhere	My slide was hidden by her.
	When did they build this building?	When was this building built?
Present continuous	The government is building an airport	The airport is being built
	Narne's are making plots near Uppal	Some plots are being made by Name's near Uppal.
Past continuous	When I cam here last year, the were supplying material	When I came here last year, material was being supplied
Present perfect	We have prepared material.	The material has been prepared.
	She has prepared sweets.	Sweets have been prepared by her.
	I have recorded your suggestion	Your suggestions have been recorded.
	But I have not passed them to Sir.	Your suggestions have not been passed to Sir
Past Perfect	You said someone had stolen your clip	You said your clip had been stolen
Other cases	Ramesh would repair the OHP	The OHP would be repaired by Ramesh
	I hope you would invite me to the party	I hope I would be invited to the party
	You can't spoil my car	My car can't be spoilt
	You should not store sweets	Sweets should not be stored
	I am planning to change my vehicle	My vehicle is going to be changed
	She has to warn him	He has to be warned
	We had to take the intelligent to the psychiatrist	The intelligent man had to be taken to the Psychiatrist.

Exercise

Directions: A sentence has been given in Active/Passive Voice. Out of the four alternatives suggested below, select the one which best express the same sense in Passive/Active Voices.

1. **You surprise me:**
(A) I am to be surprised.
(B) You are surprised
(C) I am surprised by you
(D) He is surprised
2. **The boys killed the snake with a stick:**
(A) The snake was killed by the boys with a stick.
(B) A stick was killed by the boys with a stick.
(C) A snake with a stick was killed by the boys.
(D) A snake is killed by the boys with a stick.
3. **He was obliged to resign :**
(A) He was make to resign
(B) To resign was his obligation
(C) Circumstances obliged him to resign
(D) Resignation obliged him
4. **Why did you not agree to my proposal ?**
(A) Why was my proposal not agreed to ?
(B) Why was my proposal not agreed by you ?
(C) Why my proposal was not agreed to by you ?
(D) Why was my proposal not agreed to by you ?
5. **Do you understand what I mean ?**
(A) What I mean is that understood by you ?
(B) Was what I mean understood by you ?
(C) Is what I mean understood by you ?
(D) What I mean is understood by you ?
6. **Whom does he look for ?**
(A) Whom he is looked after for ?
(B) Who is looked after for him ?
(C) Who is looked for by him ?
(D) Whom he is looked after by ?
7. **People speak English all over the world:**
(A) English is spoken all over the world.
(B) English was spoken all over the world.
(C) English was spoken by people.
(D) English is spoken by people.

8. **Who gave you permission to enter ?**
(A) By whom were you given permission to enter ?
(B) By whom was you given permission to enter ?
(C) By whom you were given permission to enter ?
(D) By whom were given you permission to enter ?
9. **The reporter was interviewing the political leaders:**
(A) The political leaders were being interviewed by the reporter.
(B) The political leaders was being interviewed by the reporter.
(C) The political leaders are being interviewed by the reporters.
(D) The political leaders is being interviewed by the reporter.
10. **You should follow all the instructions carefully :**
(A) All the instructions are carefully followed by us.
(B) All the instructions were carefully followed by us.
(C) All the instructions should be carefully followed by you.
(D) All the instructions can be carefully followed by us.
11. **We waste much time on trifles :**
(A) Much time was wasted on trifles.
(B) Much time will be wasted on trifles.
(C) Much time is wasted by us on trifles.
(D) Much time is wasted on trifles.
12. **The boy has rung the bell :**
(A) The bell has been rung by the boy.
(B) The bell was being rung by the boy.
(C) The bell was rung by the boy.
(D) The bell has been being rung by the boy.
13. **The telegraph wires have been cut :**
(A) Someone has been cut the telegraph wires.
(B) No one has cut the telegraph wires.
(C) The telegraph wires have cut someone.
(D) Someone has cut the telegraph wires.
14. **The people elected the Mayor :**
(A) Him was elected Mayor the people.
(B) He was elected Mayor by the people.
(C) Mayor is elected by the people.
(D) He is elected by the people Mayor.
15. **Don't laugh at me :**
(A) Let me be laughed at
(B) Let be me not laughed at
(C) I am laughed at
(D) Let me be not laughed at

- 16. They pick the flowers fresh every morning :**
 (A) The fresh flowers are picked every morning by them
 (B) The flowers are fresh and picked every morning by them
 (C) The flowers are picked fresh every morning by them
 (D) The picked flowers are fresh every morning by them
- 17. Has the price rise affected all the people ?**
 (A) Have all the people been affected by the price rise ?
 (B) Are all the people being affected by the price rise ?
 (C) Had all the people being affected by the price rise ?
 (D) Are all the people affected by the price rise ?
- 18. Cigarette smoking causes two million deaths annually in the industrial states :**
 (A) Cigarette smoking has been causing two million deaths annually in the industrial states
 (B) Two million deaths are caused annually by cigarette smoking in the industrial states
 (C) Two million deaths are being caused by cigarette smoking annually in the industrial states
 (D) Two million deaths have been caused annually by cigarette smoking in the industrial states
- 19. Don't speak until someone speaks to you :**
 (A) Don't speak until you are spoken to
 (B) Don't speak until someone is spoken to
 (C) Don't speak until you have been spoken to
 (D) Don't speak until someone has been spoken to
- 20. The principal kept the staff members waiting :**
 (A) The staff members were kept waiting for the principal
 (B) The staff members were kept waiting by the principal
 (C) The staff members were waiting for the principal
 (D) The staff members were being kept waiting for the principal

KEY

1.C 2.A 3.C 4.B 5.D 6.C 7.A 8.A 9.A 10.C
 11.C 12.A 13.D 14.B 15.D 16.A 17.A 18.B 19.B 20.B

Practice Test

1. “With what were you pleased so much?” The active form of this sentence is
a) What pleases you so much? b) What had pleased you so much?
c) What pleased you so much? d) By what were you pleased so much?
2. “Help the poor.” The passive form of this sentence is
a) The poor had to be helped by you b) The poor should be helped
c) The poor were to be helped by you d) The poor has to be helped
3. “I have been pleased with you honesty.” The active form of this sentence
a) Your honesty have pleased me b) Your honesty had pleased me
c) Your honesty has been pleasing me d) Your honesty has pleased me
4. Which is the passive form?
a) Let not the student be beaten b) Love your mother tongue
c) Let him bring the book d) He cannot carry this heavy bag
5. Which is the active form?
a) She was seen to jump the ditch b) There is no time to be wasted
c) Your brother is known to me d) Does he love books?
6. Choose the correct passive form for “Everyone knows that he is a great scholar.”
a) Everyone is known that he is a great scholar
b) He is known to be a great scholar
c) He is a great scholar to be known by everyone
d) A great scholar is known by everyone
7. Choose the correct active form for “Tools cannot be made by animals.”
a) Animals are not able to make tools b) Animals are able to make tools
c) Animals cannot make tools d) Animals had not made tools
8. Identify the passive form.
a) Who broke the glass? b) Have the door been shut?
c) He refused her admission d) Has the door been shut?
9. Identify the active form.
a) One should keep one’s promises b) Promises should be kept
c) Promises must be kept d) Promises have to be kept
10. “Kites were being flown by some students.” The active form of this sentence is.....
a) Some students were flying kites b) Some students are flying kites
c) Some students have been flying kites d) Some students had been flying kites.

11. “Why did your father give such a rude reply?” The passive form of this sentence is...
- Why such a rude reply given by your father?
 - Why such a rude reply have been given by your father?
 - Why is such a rude reply given by your father?
 - Why was such a rude reply given by your father?
12. Identify the correct passive form.
- She was refused admission
 - She will have refused admission
 - She will be refusing admission
 - She refused admission by them
13. Identify the correct active form.
- It was not killed by him
 - They are known to me
 - We made them run away
 - By whom have you been asked?
14. Identify the passive form.
- Have you shut the door?
 - I was let go
 - I forgave them their fault
 - He let me go
15. Identify the incorrect passive form.
- Good human beings will be blessed by God
 - Let the order be given
 - Whom was he taught Urdu?
 - Is Kiran helped by him?
16. Identify the incorrect active form.
- Do not defend that man
 - He wants to recognized as a great scholar
 - We were disappointed at his behavior
 - Let her bring the dictionary now
17. “The balcony is being painted by Ahmed.” The active form of this sentence is....
- Ahmed is painting the balcony
 - Ahmed was painting the balcony
 - Ahmed had been painting the balcony
 - Ahmed has been painting the balcony
18. “Arjun gave her a dictionary.” The passive form of this sentence is....
- A dictionary is given to her by Arjun
 - She has been given a dictionary by Arjun
 - She was being given a dictionary by Arjun
 - A dictionary was given to her by Arjun
19. “Paint the doors.” The passive form of this sentence is.....
- Doors should be painted
 - Let the doors be painted
 - Doors have to be painted
 - Doors are to be painted

20. "No one has defeated her in chess so far." The passive form of this sentence is....
 a) She had not been defeated by anyone in chess so far
 b) She was not defeated by any one in chess so far
 c) She was not being defeated by any one in chess so far
 d) She has not been defeated by anyone in chess so far
21. "He was not crowned king by them." Change into active voice.
 a) They don't make him king b) They don't crown him king
 c) They did not crown him king d) They don't consider him king
22. "You must understand that people will frown upon such a thing."
 Change into passive voice.
 a) Such a thing will be frowned upon by people
 b) Such a thing is being frowned upon by people
 c) To understand that such a thing is being frowned upon by people
 d) It must be understood that such a thing will be frowned upon by people
23. Identify the passive form
 a) One should keep one's promises
 b) A clause of compensation is included in the contract
 c) No one has informed me about it d) Your manners have pleased me
24. "Feed the child." Change into passive voice
 a) The child should be feeded b) The child should be fed
 c) The child is being fed by her d) The child must be feeded by you
25. "The house was covered in dirt." Change into active voice.
 a) Dirt covered the house b) Dirt is covering the house
 c) Dirt covers the house d) Dirt will cover the house

Keys

- | | | | | | | | | | |
|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 1. C | 2. B | 3. D | 4. A | 5. D | 6. B | 7. C | 8. D | 9. A | 10. A |
| 11. D | 12. A | 13. C | 14. B | 15. C | 16. B | 17. A | 18. D | 19. B | 20. D |
| 21. C | 22. D | 23. B | 24. C | 25. A | | | | | |

11. CORRECTION OF SENTENCES (Rules & Example),

Correction of nouns: A noun is a naming word. It is the name of a person, thing, animal etc.

Rule 1: there are some nouns which are used only in the plural form.

Eg.: Biceps - doldrums - earnings - gymnastics - outskirts - shorts -spectacles -
scissors - trousers

Rule 2: some are always used in plural

Eg.: cattle - police - people

Rule 3: when the noun is plural, and ends in *s*; the possessive case is formed by adding apostrophe after *s*

Eg.: teachers' association engineers' association

Rule 4: when the noun is plural but does not end in *s*, the possessive case is formed by adding *s*

Eg.: fishermen's co-op societies
Washermen's societies

Rule 5: the possessive case of a compound noun will be formed by adding *s* to the last word.

Eg.: mother - in -law's house
Brother- in-law's house

Correct usage of pronouns: A pronoun is a word used in the place of a noun.

Rule 1:when two singular nouns are joined by 'and' and are preceded by 'each' or 'every' the pronoun must be in singular number.

Eg.: every boy and girl took his or her time.

Rule 2:when a singular noun and a plural noun are combined by 'or'; 'either....or'; 'neither....nor', the singular noun comes first in the sentence and the pronoun must be in the plural.

Eg.: Either the principal or the lecturers failed in their duty in controlling the ragging in the college.

Rule 3: one is used for people in general

Eg.: One must try to do one's duty.

Correct use of adjectives:

Rule 1:Most adjectives form their comparatives by the addition of -r,-er and their superlative by the addition of -st,-est to the positive

Eg.:	positive	comparative	superlative
	Great	greater	greatest
	Brave	braver	bravest

Rule 2: some adjectives form their comparative by using the adverb 'more' with the positive and the superlative by using the adverb 'most' with the positive

positive	comparative	superlative
Beautiful	more beautiful	most beautiful
Interesting	more Interesting	most interesting

Rule 3: superior, senior, junior, inferior, prefer etc are followed by 'to' and not 'than'

Eg.: I prefer coffee than tea(unacceptable)
I prefer coffee to tea (acceptable)

Rule 4: **positive** **comparative** **superlative**

Few	fewer	fewest
Little	less/lesser	least

Correction of adverbs: An adverb is a word which modifies a verb,/adjective/adverb

Rule 1:the word 'only' should be placed before the word it is intended to modify.

Eg.: Only he gave me the notes (he and nobody else) He only told me the truth
(and nothing else) He solved only two problems (incorrect) He only solved
two problems, (correct)

Rule 5: position of adverbs

He 'always' goes to office on foot.
He 'often' visits Mumbai. He never
smokes.

Correct use of the verb:

Rule 1:When two subjects are joined by 'and' the verb is plural.

Eg.: My aunt and her son are in Hyderabad.

Rule 2: If two different singular nouns express 'one idea' the verb should be in the singular form.

Eg.: Bread and jam is good for kids.
Rice and dal is his favourite lunch.

Rule 3: If two singular subjects (combined by and) are preceded by 'each' or 'every' the verb should be in the singular.

Eg.: Every boy and girl was present in the class yesterday.

Correct use of prepositions:

Rule 1: A preposition is placed at the end of a sentence in the following ways Eg.:

- Here is the book that you are looking 'for'.
- This is the person whom I spoke 'about'.
- This is the person you spoke 'to'.
- What are you looking 'at'?
- Do you have a chair to sit 'on'?
- He is known all Hyderabad 'over'.

Rule 2: A preposition is used at the beginning of an interrogative sentence.

Eg.: 'In' which city you live ?
'To' whom are you referring ?

Rule 3: There are some words with prepositions which require gerunds after them.

Eg.: refrain from... abstain from from....
 Addicted to..... in Disqualified from ____
 Expert in..... from..... tired of.....
 Capable of..... of Fond of.....
 Insist on.....

Rule 4: In and within:

- a) 'in' refers to the end of a period of time usually in the future. Eg.:
 He will return in a month, (at the end of one month)
- b) 'within' means before the end of a period of time.
 Eg.: He will return within a month, (he may come after two weeks also)

Rule 5: In and into

- a) 'in' indicates rest/motion inside anything.
 Eg: he is walking in the garden.
 She is watching television in the hall
 He is in the kitchen.
- b) 'into' means motion towards the inside of ...
 Eg.: He walked into the garden.
 Thieves broke into the house of a police officer.

Rule 6: On is used (things at rest)

- i) He sat on a small stone.
- ii) On Saturday / on the 24 of April
- iii) He lives on his parents pension.

Upon is used (things in motion) i)

The man sprang upon the tiger.

Rule 7: Beside and besides

Beside means 'by the side of

Eg.: My house is beside the snow world.

Besides means in addition to /moreover

Eg.: There are ten lecturers in the Department of English besides the Head of the Department.

Rule 8: Between and among

Between is used for two persons/things

Eg.: Parents distribute anything equally between the two children.

Among is used for more than two persons/things.

Eg.: The students were fighting among themselves for the material.

12. VOCABULARY

(Idioms — One word substitutes — Synonyms — Antonyms)

Exercise 1

IMPORTANT ENGLISH IDIOMS

The following list presents a collection of important idioms employed most frequently in written and spoken English today. The list contains only pure idioms *i.e.* fixed expressions whose meanings are quite different from the literal sense of the words semi-idioms, phrasal verbs and proverbs are not included in the list.

A to Z	:	thoroughly and completely
ABC of	:	the basic facts or principles of
Acid test	:	a decisive test of ability, etc.
Add fuel to the flames	:	increase anger on any other
Alice in wonderland	:	very strange
All in all	:	on the whole
Apple of one's eye	:	greatly loved person
At loggerheads	:	quarrelling
At one's wit's end	:	very confused
At the eleventh hour	:	at the last possible moment
Be not cricket	:	not fair or correct
Beat about the bush	:	approach a matter in a roundabout way; speak indirectly
Bed of roses	:	an easy, luxurious life
Bell the cat	:	undertake the dangerous act in a course of action
Below the belt	:	unfair
Between the devil and the deep blue sea	:	between two equally serious evils or dangers
Bite off more than one can chew	:	undertake more than one is able to perform

Black list	:	list of persons or organizations regarded as untrustworthy
Black sheep (of a family)	:	disreputable member
Bolt from the blue	:	sudden, unexpected misfortune
Bone of contention	:	a cause of quarrelling
Blow one's own trumpet	:	praise one's own abilities
Born with a silver spoon in one's mouth	:	have wealthy parents
Break the ice	:	put an end to formality by putting people at ease
Burn the candle at both ends	:	dangerously exhaust one's energies by overworking in two different directions.
Burn one's fingers	:	come to harm by rash meddling in an affair
Burn the midnight oil	:	work very late especially to study
By leaps and bounds	:	very quickly
Call a spade a spade	:	speak plainly and directly
Carrot and the stick	:	reward and punishment
Castles in the air	:	dreams or hopes that are unlikely to become reality
Change horses in midstream	:	change one's opinions in the middle of something.
Chip off the old block	:	a person who is very like one of his parents, especially his father
Cock and bull story	:	an incredible story
Close shave	:	danger just avoided
Cook up	:	prepare scheme to deceive
Cool as a cucumber	:	behave calmly in a dangerous situation.
Cry wolf	:	to give a false warning of danger

Cut corners	:	economize; take a short cut
Cut one's coat according to one's cloth	:	live within one's income
Dead wood	:	something that is no longer useful
Deliver the goods	:	achieve desired results
Dog in the manger	:	a person who stops others from doing or enjoying something that he does not use himself
Doubting Thomas	:	a person noted for his disbelief
Down and out	:	without a job or other means of support
Drag one's feet	:	act very slowly
Drop in the ocean	:	very small amount
Dutch treat	:	dinner or entertainment at which person pays for himself
Eat one's cake and have it	:	have the advantages of something without the disadvantages that go with it
Eat one's words	:	take back a statement
Every Tom, Dick and Harry	:	everyone and anyone
Face the music	:	face difficulties arising from something one has done
Feather one's nest	:	to make profit in a dishonest way
Fiddle while Rome burns	:	behave frivolously in a situation which calls for concern
Fish in troubled waters	:	try to gain an advantage from a confused state of affairs
Fight tooth and nail	:	fight with great determination
Fish out of water	:	a person situated uncomfortably outside his usual environment
Fool's paradise	:	imaginary joy without reason

Fly a kite	:	spread stories, suggestions to find out opinions
Flash in the pan	:	something that only lasts for a very short time
Free lance	:	person who acts independently
Get cold feet	:	become nervous
Gift of the gab	:	facility in speaking
Give the cold shoulder	:	ignore / shun
Give the green light	:	give permission
Give chapter and verse	:	cite and precise reference for a statement
Give the devil his due	:	do justice to a person one dislikes by admitting a point in his favour
Go through fire and water	:	endure extreme difficulties, danger
Grass roots	:	the basic level
Guinea pig	:	person used as a subject in medical or other experiments
Hand in glove with	:	in close relation with
Hard nut to crack	:	a difficult problem to solve
Hat trick	:	triple success
Have one's tongue in one's cheek	:	say one thing and mean another
Have a thick skin	:	be insensitive
Have the last laugh	:	be victorious at the end of an argument
Have at one's fingers ends	:	be thoroughly expert in a subject far superior
Head and shoulders above	:	work requiring great effort
Herculean task Hit the jackpot	:	to win a lot of money or to have great success

Hit below the belt	:	behave / fight unfairly
Hit the nail on the head	:	say the exact thing
Hold the fort	:	look after a business while the person who is unusually in charge is absent.
Hob son's choice	:	no choice at all
Hold out an olive branch	:	show that one is ready to make peace
Hold water	:	be reliable when tested
Hornet's nest	:	lot of trouble
Hot water (be in / bet into)	:	Trouble
In a nut shell	:	in a few words
In black and white	:	in writing
In cold storage	:	stored safely until needed
In the red	:	in debt
In the long run	:	Finally
In the soup	:	in trouble
In the doldrums	:	Depressed
Ins and outs	:	intricacies and complications
Ivory tower	:	cut off from realities of life
Jack of all trades	:	a person who has the ability to do different kinds of work but none of it very well
Jaundiced eye	:	prejudiced outlook
Jekyll and Hyde	:	a person who shows two completely different natures
Jet set	:	rich and fashionable group of people interested only in enjoyment
Jump from the frying pan into the fire	:	in trying to escape from one difficulty find oneself in a worse one

Jump the queue	:	obtain something before one's proper turn is due
Keep abreast of	:	be up to date in knowledge
Keep at arm's length	:	not become too friendly
Keep one's fingers crossed	:	hope that nothing will go wrong
Kick the goose that lays the golden eggs	:	destroy the source of benefit
Kill two birds with one stone	:	with one action accomplish two different purposes
Know one's onions	:	be experienced
Labour of love	:	a job done with pleasure with no expectation of reward
Late for one's own funeral	:	always late
Laughing stock	:	a person who is regarded with scornful laughter
Law of the jungle	:	situation of violence or fierce competition in which no civilized laws are observed
Lead by the nose	:	control completely
Leave no stone unturned	:	spare no effort
Lionize	:	treat as a celebrity
Lion's share	:	the largest part
Live from hand to mouth	:	live from day to day
Live wire	:	an active, lively person
Loaves and fishes	:	material benefits that are an inducement in a person's career
Lock the stable after the horses has bolted	:	take special care to avoid harm after a misfortune has already taken place
Lock, stock and barrel	:	Completely

Lose heart	:	become discouraged
Lose face	:	feel humiliated
Lotus eaters	:	lazy dreamy people
Maintain a low profile	:	be unassertive
Make a clean breast of	:	admit and confess fully
Make a clean sweep	:	to make complete victory / change
Make a mountain out a mole-hill	:	make a small problem seem like a large one
Make both ends meet	:	live with in one's income
Make short work of	:	deal with quickly
Meet one's Waterloo	:	to suffer a ruinous defeat
Miss the bus	:	lose an opportunity
Move heaven and earth	:	do everything possible
Much ado about nothing	:	make great fuss about a trifle
Neck and neck	:	in close competition
Neither fish, flesh nor good red haring	:	difficult to classify
Nuts and bolts	:	basic practical details
Nine teams out of ten	:	almost always
Nip in the bud	:	end in early stage
Nothing to write home about	:	a person or thing that is not at all special
Old school tie	:	system of preferring those who have been to the same public schools
On the rocks	:	in danger of being ruined
On the spur of the moment	:	Suddenly
On top of the world	:	happy and healthy
On velvet	:	in a fortunate position

Once in a blue moon	:	very rarely
Open book	:	nothing secret or mysterious
Out of the question	:	Impossible
Out of the blue	:	Unexpectedly
Out of turn	:	out of the correct order
Pain in the neck	:	an irritating person
Paper tiger	:	a person or that has the outer appearance of being powerful but is in fact ineffective
Part of the furniture	:	a person who is taken for granted or ignored
Pass the buck	:	avoid blame or responsibility
Pay through the nose	:	pay for more than the value
Pie in the sky	:	better conditions of life
Play to the gallery	:	act in order to win popularity
Play fast and loose	:	deceive take advantage of
Play the game	:	behave in a fair manner
Plough a lovely furrow	:	work alone without friends or helpers
Poles apart	:	widely divided in opinion or characteristics
Pour oil on troubled waters	:	attempt to end a quarrel by gentle words
Pull some one's leg	:	make fun of a person in a friendly way
Pull the wool over someone's eye	:	deceive someone
Put all one's eggs in one basket	:	risk everything in one venture
Put the cart before the horse	:	do things in the wrong order
Put out the red carpet	:	give an officials / enthusiastic welcome
Put in the shade	:	Excel
Put in a good word for	:	to speak well of someone

Put a spoke in some one's wheel	:	prevent someone from carrying out his plans
Queer fish	:	a strange person
Rank and file	:	ordinary members
Red-letter day	:	a very important day
Red tape	:	too many formalities / regulations
Ride a tiger	:	take a dangerous course of action
Rubber stamp	:	a person who only makes official decisions made already by another
Scapegoat	:	some one blamed / punished for another's mistakes
Second thoughts	:	after reconsideration
See eye to eye	:	agree with completely
Separate the sheep from the goats	:	separate the good from the wicked
Set one's heart on something	:	desire strongly
Set one's house in order	:	arrange one's affairs properly
Set the world on fire	:	have great success by doing something new
Sit on the fence	:	not take sides
Ships that pass in the night	:	person who meet by chance and who are unlikely ever to meet again
Sixth sense	:	special sensitivity
Sitting duck	:	someone who can easily be hit or attacked
Skeleton in the cupboard	:	shameful secret
Sow one's wild oats	:	enjoy oneself in a wild manner while young
Sour grapes	:	treat something as worthless because one is unable to get it
Sisyphean task	:	endless or fruitless task

Smell a rat	:	become suspicious
Snake in the grass	:	hidden enemy
Something up one's sleeve	:	have a secret idea / plan
Spade work	:	hard work done at the beginning of an activity
Spread like wild fire	:	spread very quickly
Speak volume	:	to express a lot of meaning without speaking
Square peg in a round hole	:	someone or something that does not fit into a particular situation or position.
Stick out one's neck	:	take a risk
Stand head and shoulders above	:	to be much better than
Strike while the iron is hot	:	act at the most favourable moment
Step into someone's shoes	:	take over the duties of someone else
Stand on one's own two feet	:	become confident / independent
Storm in a tea cup	:	a lot of fuss over a trivial affair
Stone's throw	:	a short distance
Stand a chance	:	have the possibility
Steal the limelight	:	attract the most attention
Sugar the pill	:	make something unpleasant seem attractive
Take pot luck	:	take a chance
Take root	:	become established
Take a leaf out of a person's book	:	follow person's example
Take the bull by the horns	:	boldly facing and tackling a difficulty
Take the one's heels	:	run away
Take one's hat off	:	admire / respect

Teething troubles	:	Difficulties that arise during the early stage
Thorn in the flesh	:	continual annoyance
Through thick and thin	:	through good times and bad times
Throw up one's hands	:	give up hope
Throw cold water	:	Discourage
Throw one's weight about / around	:	to impress other people
Tighten one's belt	:	Economize
Time of one's life	:	a very enjoyable time
Talk shop	:	talk about one's work
Turn over a new leaf	:	make a new and better start
Turn a deaf ear	:	refuse to listen
Turn the tables	:	change a situation to one's advantage over one's away
Under a cloud	:	out of favour
Up in arms	:	protesting angrily
Up to one's ears	:	have too much work to do
Wash one's dirty linen in public	:	reveal or talk about one's hidden faults in public
Waste one's breath	:	speak uselessly
Wet blanket	:	one who by criticism discourages a person
Weather the storm	:	survive a crisis
White elephant	:	an expensive and useless possession
With flying colors	:	very successfully
Wild goose chase	:	a hopeless enterprise
Wolf in sheep's clothing	:	a person who has evil intentions but who
Wool gathering	:	appears to be harmless

Worlds apart	:	day-dreaming
Writing on the wall	:	very different warning of future

Exercise 2 ONE WORD SUBSTITUTIONS

Omnipresent	:	one who is present everywhere
Omnipotent	:	one who is all powerful
Omniscient	:	one who has all knowledge
Philanthropist	:	one who loves mankind
Misanthrope	:	one who hates mankind
Altruist	:	one who loves others selflessly
Optimist	:	one who thinks positively
Pessimist	:	one who thinks negatively
Atheist	:	one who does not believe in God/existence of god
Fastidious	:	one who is very selective in his taste/interests
Fanatic	:	excessive and mistaken enthusiasm in religious matters
Lexicographer	:	one who compiles a dictionary
Anthropologist	:	one who studies the evolution of mankind
Carnivorous	:	one who lives on flesh
Cannibal	:	one who feeds on human flesh
Insolvent	:	a person who is unable to pay his debts
Incorrigible	:	something that cannot be corrected.
Numismatics	:	the study of (currency) coins
Irrevocable	:	a decision which cannot be revoked

Infallible	:	one who is free from mistakes.
Teetotaller	:	one who abstains from alcohol
Indelible	:	that cannot be erased
Plagiarism	:	literary theft from the original book
Polyandry	:	the practice of marrying more than one wife/husband.
Polygamy	:	the practice of many marriages
Misogynist	:	one who hates women
Bibliophile	:	one who loves reading books
Stoic	:	one who is indifferent to pleasure and pain
Loquacious	:	one who talks continuously
Anarchist	:	one who destroys government law and order
Plutocracy	:	government by the rich
Bureaucracy	:	government by the officials
Iconoclast	:	one who breaks idols
Ambidextrous	:	one who can use either hand skilfully
Somnambulist	:	one who walks in sleep
Somniloquist	:	one who speaks on sleep
Emigrant	:	one who leaves his own country to live in another
Immigrant	:	one who comes to one country from another to settle there.
Alimony	:	allowance paid to wife after divorce
Misogamist	:	one who hates marriage
Panacea	:	remedy for all ailments
Cynosure	:	center of attraction
Sinecure	:	a job with high salary but little responsibility.
Connoisseur	:	a critical judge of any art

Polyglot	:	one who speaks many languages
Extempore	:	a speech made without any preparation
Philatelist	:	one who collects postal stamps as a hobby
Egoism	:	a belief that action result from selfishness
Egotism	:	a practice of talking too much about one self
Ornithology	:	study about birds
Cartographer	:	one who draws maps
Lapidist	:	one who cuts precious stones
Calligraphist	:	one who has beautiful hand writing
Omnivorous	:	one who eats everything
Herbivorous	:	one who lives on herbs
Blasphemy	:	the act of speaking disrespectfully about the sacred things
Indefatigable	:	one who does not get tired easily
red-tapism	:	too much of official formalities resulting in delay
cacographist	:	one who is bad at spellings

Exercise 3

SYNONYMS

theist	:	one who believes in god
antidote	:	that can control the effects of poison
celibacy	:	the state of being unmarried
incorrigible	:	that cannot be corrected
flammable	:	capable of catching fire
invincible	:	that cannot be conquered/defeated
meticulous	:	one who is too careful fro details
obsolete	:	which is outdated

pseudonym	:	false / assumed name
soliloquy	:	one who talks to oneself
veteran	:	well experienced
omniscient	:	one who has all the knowledge
omnipotent	:	one who is all powerful
reticent	:	one who does not speak even though s/he is capable of
garrulous	:	one who talks continuously
candid	:	frank/outspoken
chaos	:	utter confusion
lucid	:	clear
frail	:	fragile/weak
enormous	:	huge/vast/immense/colossal/gigantic
extravagance	:	lavish
hallucination	:	illusion / dilution / mirage
appalling	:	horrible / dreadful / frightful
industrious	:	hard working
juvenile	:	youthful / immature / young / undeveloped
meek	:	mild / submissive / modest
mitigate	:	soften
humdrum	:	monotonous / unvaried / tiresome / tedious
outrage	:	insult / abuse
pathetic	:	pitiful / distressing / heartrending / sad
pious	:	religious / holy / reverential
placid	:	calm / serene
reliance	:	confidence / trust / credence

sarcastic	:	cynical / ironic
scrupulous	:	strict / precise / careful / conscientious
strenuous	:	energetic / zealous / persevering

Choose the word which is most closest in meaning from the four options given below:

1. **Vexed –**
(A) Annoying (B) Recurring (C) Dangerous (D) Complex
2. **Candid—**
(A) Irritable (B) Trickly (C) Intriguing (D) Guileless
3. **Acquiesce—**
(A) Accept (B) Agree (C) Acerbate (D) Assert
4. **Bleak—**
(A) Impolite (B) Inconsiderate (C) Dismal (D) Deformed
5. **Convoke—**
(A) Exhort (B) Convene (C) Appeal (D) Transfer
6. **Dereliction—**
(A) Blessing (B) Curse (C) Neglect (D) Abandon
7. **Genesis—**
(A) Learned (B) Prenatal (C) Common (D) Beginning
8. **Fickle—**
(A) Festive (B) False (C) Furious (D) Capricious
9. **Culinary—**
(A) Greasy (B) Pertaining to Kitchen (C) Munical (D) Food
10. **Incongruous—**
(A) Disabled (B) Negligible (C) Inconsistent (D) Penurious
11. **Malicious—**
(A) Benevolent Occasional (B) Rancorous (C) Virile (D)
12. **Overthrow—**
(A) Watch (B) Supervise (C) Upset (D) Oppose
13. **Precarious—**
(A) Vulnerable (B) Accurate (C) Vilifying (D) Careless

- | | | | | |
|------------|-------------------------------------|-------------------|---------------|-----------------|
| 14. | Garnish—
(A) Paint | (B) Garner | (C) Adorn | (D) Abuse |
| 15. | Slander—
(A) Calumniate | (B) Vindicate | (C) Retaliate | (D) Moderate |
| 16. | Torment—
(A) Storm | (B) Ferment | (C) Agony | (D) Twinge |
| 17. | Erudite—
(A) Cognizant | (B) Well educated | (C) Studious | (D) Miserly |
| 18. | Caprice—
(A) Whim | (B) Capacity | (C) Pride | (D) Greed |
| 19. | Wretched—
(A) Dirty | (B) Poor | (C) Difficult | (D) Unfortunate |
| 20. | Sodden—
(A) Grassy | (B) Soggy | (C) Serious | (D) Unhappy |
| 21. | Meandering—
(A) Wandering | (B) Curved | (C) Cunning | (D) Lustful |
| 22. | Swamp—
(A) Surf | (B) Marsh | (C) Plain | (D) Clay |
| 23. | Impromptu—
(A) Offhand | (B) Unreal | (C) Effective | (D) Unimportant |
| 24. | Rabble—
(A) Noise | (B) Mob | (C) Roar | (D) Rubbish |
| 25. | Reticence—
(A) Deserve | (B) Receding | (C) Reserve | (D) Treachery |

KEY

1.D	2.D	3.B	4.C	5.B	6.C	7.D	8.D	9.B	10.C
11.B	12.C	13.A	14.C	15.A	16.C	17.B	18.A	19.D	20.B
21.A	22.B	23.A	24.B	25.C					

Exercise 4 ANTONYMS

Words opposite in meaning / having contrary meaning, highly useful in expressing briefly the opposite of a thought. They are also valuable in defining something.

absurd	×	rational / sensible / judicious / sane
active	×	passive / indolent / idle
abundance	×	scarcity
adversity	×	prosperity / bliss
addicted	×	averse
admire	×	despise
alike	×	distinct
alleviate	×	aggravate / heighten
anger	×	forbearance / patience
ancestor	×	descendant
appetite	×	distaste
awkward	×	graceful / skilful
benevolent	×	malevolent
bleak	×	bright
indifference	×	care
boisterous	×	calm
candid	×	tricky / foxy / evasive
confess	×	deny / renounce
oblivious	×	conscious
cooperate	×	counteract / nullify
contrast	×	comparison

courtesy	×	rudeness
delightful	×	distressful
docile	×	ungovernable
endure	×	perish
fact	×	fiction
harmony	×	conflict
hypocrisy	×	frankness / candour
ignorant	×	informed
obscure	×	important
liberty	×	restraint
loyalty	×	disloyalty
belief	×	disbelief
meek	×	arrogant / proud / domineering / blustering
memory	×	forgetfulness / oblivion
modest	×	immodest / concealed
native	×	foreign
anomalous	×	normal
optimist	×	pessimist
pleasure	×	displeasure
perfect	×	imperfect
transitory	×	permanent
prohibition	×	permission
persuade	×	dissuade
plentiful	×	scarce / meagre / scanty

boorish	×	polite
pride	×	humility / modesty
queer	×	common
savage	×	civilised
smile	×	frown

Choose the word which is most nearly opposite in meaning from the four options given below.

1. **Victor –**
(A) Vanquished (B) Successor (C) Inheritor (D) Grace
2. **Chronic –**
(A) Acute (B) Fleeting (C) Irregular (D) Temporary
3. **Hostile—**
(A) Feverish (B) Friendly (C) Unfriendly (D) Belligerent
4. **Joyous—**
(A) Monotonous (B) Gloomy (C) Dreary (D) Euphonic
5. **Luminous—**
(A) Dull (B) Sneaking (C) Bitter (D) Pungent
6. **Lackadaisical—**
(A) Expressing time (B) Monthly (C) Ambitious (D) Pusillanimous
7. **Chaffing—**
(A) Serious (B) Achieving (C) Sneezing (D) Expensive
8. **Scold—**
(A) Insinuate (B) Disparage (C) Upbraid (D) Praise
9. **Gregarious—**
(A) Antisocial (B) Anticipatory (C) Glorious (D) Horrendous
10. **Chimerical—**
(A) Remarkable (B) Powerful (C) Realistic (D) Underrated
11. **Camaraderie—**
(A) Plunder (B) Harmony (C) Deviation (D) Noise
12. **Discreet—**

- | | | | | |
|--------------------------|-------------------------------|-------------------|-----------------|-----------------|
| | (A) Crude | (B) Joking | (C) Grouped | (D) Antisocial |
| 13. Consonant— | (A) Dissonant | (B) Clear | (C) Simple | (D) Vague |
| | (A) Fastidious —Absurd | (B) Sloppy | (C) Indifferent | (D) Facetious |
| 14. Obsequious— | (A) Bold | (B) Assiduous | (C) Precarious | (D) Restorative |
| 15. Profusion— | (A) Valiant | (B) Ordinance | (C) Scarcity | (D) Travesty |
| 16. Alleviate— | (A) Worsen | (B) Endure | (C) Enlighten | (D) Humiliate |
| 17. Ambiguous— | (A) Auxiliary | (B) Responsible | (C) Clear | (D) Salvageable |
| 18. Baneful— | (A) Poisonous | (B) Non-poisonous | (C) Remorseful | (D) Thankful |
| 19. Dastard— | (A) Coward | (B) Hero | (C) Idol | (D) Warmth |
| 20. Exculpate— | (A) Accumulate | (B) Accuse | (C) Predict | (D) Prevail |
| 21. Intermittent— | (A) Fleeting | (B) Heavy | (C) Fearless | (D) Constant |
| 22. Lethargic— | (A) Enervating | (B) Interrogating | (C) Beautiful | (D) Smart |
| 23. Shoddy— | (A) Exotic | (B) Superior | (C) Garrulous | (D) Inadequate |
| 24. Untenable— | (A) Positive | (B) Tremulous | (C) Tender | (D) Supportable |

KEY

1.A	2.D	3.B	4.B	5.A	6.C	7.A	8.C	9.A	10.C
11.D	12.C	13.A	14. B	15.A	16.C	17.A	18.C	19.B	20.B
21.B	22.D	23.D	24.B	25.D					

Exercise

1. Choose the correct meaning of the word given.

- | | | | | | |
|-----|---------------------|-------------------|----------------|----------------|----------------|
| 1. | Antagonism | a) achievement | b) enmity | c) peculiarity | d) dedication |
| 2. | Convivial | a) sociable | b) shameful | c) calm | d) hardship |
| 3. | Profligate | a) extravagant | b) prohibit | c) analyse | d) end |
| 4. | Acrid | a) unprofessional | b) uncertain | c) ancient | d) harsh |
| 5. | Idiosyncrasy | a) transformation | b) appeasement | c) abnormality | d) inspiration |
| 6. | Illusory | a) absolute | b) hate | c) unreal | d) inspire |
| 7. | Noxious | a) vague | b) negligible | c) cheerful | d) deadly |
| 8. | Anarchy | a) boost | b) escape | c) disorder | d) surprising |
| 9. | Taciturn | a) tightlipped | b) nomadic | c) frustrated | d) peak |
| 10. | Abashed | a) composed | b) degraded | c) hopeless | d) ashamed |
| 11. | Barmy | a) rational | b) foolish | c) ruined | d) deadly |
| 12. | Concede | a) veil | b) reveal | c) accept | d) deny |
| 13. | Debacle | a) success | b) failure | c) poverty | d) excess |
| 14. | Edgy | a) irritable | b) expensive | c) joyful | d) placid |
-

- | | | | | | |
|-----|----------------------|------------------|--------------|----------------|----------------|
| 15. | Fallacy | a) understanding | b) treachery | c) belief | d) untruth |
| 16. | Gargantuan | a) showy | b) chatty | c) huge | d) wordy |
| 17. | Hallucination | a) cheating | b) joy | c) fantasy | d) annoyance |
| 18. | Iconoclasm | a) belief | b) theory | c) concept | d) questioning |
| 19. | Jingoism | a) nationalism | b) curse | c) moderation | d) anxiety |
| 20. | Labyrinthine | a) simple | b) difficult | c) twisting | d) sad |
| 21. | Magniloquent | a) modest | b) lofty | c) temporary | d) skilled |
| 22. | Narcissism | a) generosity | b) worry | c) nationalism | d) self-love |
| 23. | Odium | a) hatred | b) progeny | c) love | d) neglect |
| 24. | Paranoia | a) trust | b) equality | c) anxiety | d) mockery |
| 25. | Quixotic | a) Practical | b) funny | c) active | d) unrealistic |
| 26. | Rapine | a) protection | b) robbery | c) enmity | d) calmness |
| 27. | Sanguinary | a) brutal | b) cheerful | c) merciful | d) clever |
| 28. | Thralldom | a) burglar | b) argument | c) slavery | d) excitement |
| 29. | Vendetta | a) respect | b) welcome | c) scorn | d) enmity |

30. **Whopping**
a) enormous b) curious c) good d) enthusiastic
31. **Abstemious**
a) greedy b) moderate c) boring d) absent
32. **Balderdash**
a) curse b) greed c) rubbish d) dislike
33. **Chum**
a) friend b) glamour c) repulsion d) purity
34. **Debonair**
a) modest b) charming c) poor d) critical
35. **Effrontery**
a) shyness b) fluency c) nobility d) arrogance

II. Fill in the blanks choosing the correct word.

1. In business one should be realistic and
a) entertaining b) enterprising c) risky d) interesting
2. The medal had to be awarded to soldiers widow.
a) immediately b) deliberately c) respectfully d) posthumously
3. Over the last decade, terrorism has a threat to civilized society.
a) evolved b) contributed c) threatened d) emerged
4. Police A cooking oil adulteration racket when they raided a godown in the city.
a) captured b) took c) unearthed d) obtained
5. Due to his corrupt practices, the officer was
a) rewarded b) praised c) demoted d) promoted
6. India and the European Union on Friday plans for holding the 14th bilateral summit to be held in India.
a) firmed up b) to hold c) decided d) considering
7. Troops of India and Pakistan continued exchange of fire the line of control on Sunday.
a) through b) along c) beside d) at

8. They elected him as the leader of the legislative party, the way for him to take the oath of office as Himachal Pradesh Chief Minister.
a) giving b) putting c) offering d) paving
9. The UN Security Council imposed new sanctions on North Korea on Friday.
a) unanimously b) impressively c) anonymously d) indifferently
10. The former President returned to the country for the first time since a coup him in 2012.
a) imposed b) allowed c) deposed d) criticised
11. Many Palestinians in Bethlehem described their own leadership as
a) interesting b) qualified c) official d) feckless
12. The university provides broad-based curriculum underscored by multi-disciplinary courses.
a) legible b) interesting c) comprehensive d) educated
13. Some jewellery shops engage celebrities as ambassadors and make you pay more.
a) clever b) brand c) famous d) reputed
14. The special judge pronounced the in a packed courtroom.
a) verdict b) order c) sentence d) justice
15. At least 33 passengers were killed when a bus Into the Banas river.
a) jumped b) got c) ran d) plunged

KEYS

I.

- | | | | | | | | | | |
|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 1. B | 2. A | 3. A | 4. D | 5. C | 6. C | 7. D | 8. C | 9. A | 10. D |
| 11. B | 12. C | 13. B | 14. A | 15. D | 16. C | 17. C | 18. D | 19. A | 20. C |
| 21. B | 22. D | 23. A | 24. C | 25. D | 26. B | 27. A | 28. C | 29. D | 30. A |
| 31. B | 32. C | 33. A | 34. B | 35. D | | | | | |

II.

- | | | | | | | | | | |
|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|--------------|
| 1. B | 2. C | 3. D | 4. C | 5. C | 6. A | 7. B | 8. D | 9. A | 10. C |
| 11. D | 12. C | 13. B | 14. A | 15. D | | | | | |

13. READING COMPREHENSION

HOW TO COMPREHEND, *THE CORRECT WAY*

Comprehension means the power of understanding. The main aim of comprehension is to test a person's understanding of the passage given. The person's understanding capacity and his intelligence will depend upon his practicing and various methods of approaching and tackling of the questions of this type.

The students should carefully go through the passages given and then answer the questions based on them. Hereunder given a few hints to be followed while attempting to answer the questions.

1. Go through the passage carefully and quickly to get the idea of it.
2. Read again a bit slowly to enable to know the details
3. The idea of a simple, complex and compound sentences to be held together in the mind and follow the right sequence of events to be able to distinguish between the important and unimportant facts.
4. Then the questions have to be answered one by one in your own words in complete and simple sentences.

Passage 1:

In June 2009, apparel manufacturer, Levi Strauss India Pvt. Ltd. (Levi's) offered to sell its well-known Levi's brand of jeans and other Levi's products on Equated Monthly installments (EMI) payable through credit cards. Analysts viewed this as a bid by the company to increase sales against the backdrop of the economic downturn. The company planned to arrest its decline in sales through this innovative offer. Analysts felt that the offer was the first such in the branded apparel industry. On the launch of the scheme, Shumone Chatterjee (Chatterjee), MD, Levi's said, "It is for the first time that a brand is offering this kind of deal in India. EMI has proven good for several industries such as housing and white goods; therefore I feel that it will make a significant difference to the branded apparel industry as well."

The offer, launched as a pilot program in Bangalore, was valid only for consumers who purchased products worth Rs. 1,500 and above. The consumers had to settle the bill in three installments. The EMIs were on zero percent interest. Levi's had entered into a tie-up with ICICI Bank to offer this scheme. In return, the bank received service charges from Levi's for each transaction.

Levi's is the Indian subsidiary of US-based Levi Strauss & Co. It sells denim jeans under the brand Levi's a popular and aspirational brand of jeans in India. As of September 2009, Levi's operated through 230 stores and 500 other points of sale in nearly 200 cities.

1. What makes significant difference to the branded apparel industry, according to passage ? ()
(a) tie up with ICICI Bank (b) controlling the decline in sales
(c) expanding the number of stores
(d) EMI option extended to their customers
2. What is the bid by the company to increase sales, according to the passage? ()
(a) to sell Levi's brand of jeans through debit cards
(b) to sell Levi's brand of jeans on EMI s
(c) to give zero percent interest for the bill amount below Rs.1500
(d) stop selling other products of Levi's
3. The offer, launched as a pilot program in Bangalore, was valid only for consumers ()
(a) the customers of ICICI Bank only
(b) for the consumers who purchased products worth Rs.1500 and below
(c) for consumers who purchased products worth Rs. 1,500 and above
(d) who purchased products in Bangalore
4. Levi's operated through 230 storesin nearly 200 cities. ()
(a) through 200 stores (b) in Bangalore
(c) 500 other points of sale in nearly 200 cities.
(d) . through 230 stores

Passage 2:

When we have worked continuously for some time we need relaxation. To pursue hobbies is the best way of relaxing. My favourite hobbies are gardening, stamp-collection and photography.

I have loved gardening since my boyhood. I enjoy watering my garden every morning and evening. It gives me enough physical exercise and sends me back to my work with renewed zest and vigor. It is vary amusing digging up fresh beds for new plants. I grow flowers as well as vegetables. I beam with satisfaction when I cast my eyes on my luxuriant garden. The sight of the lively garden is increasingly refreshing.

My second hobby is stamp-collection. I have collected hundreds of stamps. I have arranged them in five books. My uncle, who often goes abroad on business, has been helping me to collect rare stamps. He sends me foreign stamps from the places he visits. Whenever I have a little leisure, I sit down at a table with my precious stamp-books, arranging new stamps in them and writing names of countries. Each stamp has a story to tell me of distant lands and strange peoples. Looking through the stamps, I can follow the history of nations.

I also love photography. Whenever I go for a picnic or on an excursion or travel round a strange place, I take my camera with me and snap interesting objects. I have a number of valuable snapshots, some of them highly recreational.

1. Hobbies are not meant for ()
 (a) relaxation (b) pleasure (c) leisure (d) none of these
2. The speaker of the passage get physical energy because ()
 (a) he casts his eye on luxuriant garden (b) he grows flowers
 (c) he waters the garden (d) he often plans picnics
3. He collects stamps because ()
 (a) his uncle goes abroad (b) his uncle has the same hobby
 (c) to follow the history of nations (d) he has leisure
4. Digging up fresh beds for new plants, gives the speaker ()
 (a) surprise (b) interest (c) health (d) vegetables

Passage 3:

India is an agricultural country and most of its people live in villages. A village is a collection of small huts in the midst of fields on which the village farmers work. Some villages are big while others are comparatively small. They are generally cut off from the cities and have a different kind of life.

The villagers live in the midst of natural surroundings. The charms of nature justify the remark of the famous English poet Gowper, "God made the country and man made the town". As we rise early in the morning, we can listen to the sweet songs of birds. We can enjoy the beauty of rising sun and the sweet breeze of day down. The flowing of the river with a murmuring sound, the beauty of the greenery of fields around are the various pleasures that abound in the country side.

The villagers pass a healthy, peaceful life. There is no smoke and noise of the city factories. They breathe fresh air which promotes their health. They also get pure ghee and milk. There is no hustle and bustle and no worry as in the modern city life. The villagers, therefore, are happy and healthy. They lead a simple life and they have and never dream of those luxuries and comforts that modern science has provided us in such ample measure.

1. One of the reasons for the villagers to have a peaceful life is ()
 (a) they already have luxury (b) because of agricultural hard work
 (c) there is less smoke (d) absence of smoke
2. One of the pleasures of villagers is ()
 (a) simple life (b) plenty of entertainment avenues
 (c) they get pure ghee and milk (d) greenery of agricultural fields
3. According to the passage, villagers have a dream ()
 (a) peaceful life (b) Comforts and luxuries
 (c) modern science (d) nothing

4. Villagers are happy because of
(a) no knowledge of luxuries (b) no hustle bustle
(c) no modern facilities (d) no connection to citie

Passage 4:

By the beginning of the twentieth century, doctors knew that many diseases were caused by living microbes. They knew about immunization and vaccines. Thanks to the efforts of scientists like Jenner, Pasteur, Koch and Ehrlich, Lister, had taught them the **value** of antiseptics. Known chemical disinfectants, such as carbolic acid, would kill germs, but they would also injure cell tissues. How could harmful microbes be destroyed without at the same time injuring body tissues?

In 1900 to a shipping clerk – Alexander Fleming – a career in science seemed like a **distant** dream. Alexander was born on August 6, 1881, the youngest son of an ayrshire Scottish farmer. He was able to complete High School but then his family's funds **ran out**. At sixteen he took a job as a shipping clerk and stayed there for four years. In 1901, Alexander came into a small legacy which enabled him to continue his education and on the advice of one of his brothers, who was doctor, he chose to prepare for a career in medicine.

Alexander did usually well in medical school along with rifle shooting, swimming, water polo and painting. After his graduation his teacher Prof. Wright asked him to join him in bacteriological research, to which he **readily** agreed.

Questions:

- According to passage, what was the main problem being encountered by doctors?
(A) How to eliminate microbes while protecting body cells.
(B) How to use known chemical disinfectants.
(C) How to get fresh carbolic acid in time to treat the patient.
(D) How to convince the patient to get vaccination regularly.
- Which of the following was taught to the doctors at the beginning of twentieth century?
(A) Scientists can help doctors in the use of disinfectants.
(B) The role and importance of antiseptics in medical treatment.
(C) Pursuing a career in medicine is a difficult job.
(D) Good microbes help in developing body cells.
- Why did Fleming take up the job as a shipping clerk?
(A) On the advice of one of his brothers.
(B) His financial position was not good at that time.
(C) It was his cherished dream.
(D) It was a very prospective job with opportunities to go abroad.
- Why was it possible for Alexander to continue his studies?

- (A) The inspiration given by his farmer father.
 (B) His desire to become a scientist at any cost.
 (C) The shipping job gave him enough money.
 (D) The assistance and guidance provided by his brother.
5. Who amongst the following has not been mentioned in the passage as ‘Scientist’?
 (A) Jenner (B) Pasteur (C) Wright (D) Lister
6. Which of the following statements is NOT TRUE in the context of the passage?
 (A) Alexander’s father was a Scottish farmer.
 (B) One of Alexander’s brother was a doctor.
 (C) Alexander’s performance in the medical school was very good.
 (D) Harmful microbes attack and cause diseases to tissues which are injured by chemical disinfectants.

Which of the following is most nearly the same in meaning as the word printed in bold as used in the passage?

7. **Value** –
 (A) Cost (B) Price (C) Importance (D) Respect
8. **Ran out**—
 (A) Left for (B) Retained (C) Increased (D) Dwindled

Which of the following is the most opposite in meaning of the word printed in bold as used in the passage?

9. **Readily**—
 (A) Abruptly (B) Suddenly (C) Lately (D) Reluctantly
10. **Distant**—
 (A) Possible (B) Close (C) Remote (D) Difficult

Passage 5:

Scientist Henry Mosely was born in a reputed family on November 23, 1887. His father – a professor of Anatomy at the University of Oxford had an **untimely** death in 1891. However, his mother had sufficient income from family estates to keep her three children in school and to **allow** young Henry to build and equip a simple private laboratory. Thus as a boy he was most familiar with a variety of neighborhood birds and birds’ nests. He also would search for pre-historic artifacts with his sister and his mother on his weekends and holiday vacation. On one occasion, Henry **found** a beautiful arrow-head on a visit to the Shetland Islands. His pride in this find was so great that he had to show it to two of his friends, Julian Huxley and Charles Darwin. All the three boys were of approximately the same age and were grand children of three famous scientists.

Henry **spent** five years at Eton, after which he entered Trinity College, Oxford, with a scholarship in Natural Science. Before he graduated with honours in Natural

Science, he was already dreaming of a career in pure science. He was greatly inspired to do research by scientist Rutherford, whom he met at Manchester.

Questions:

1. Why did Henry decide to make a career in Science?
(A) He was given a scholarship.
(B) His father was a scientist.
(C) To fulfill his father's dream.
(D) Rutherford advised him accordingly.
2. Which of the following seems to be the probable reason for Henry's developing friendship with Julian and Charles?
(A) They were contemporaries and came from respectable families.
(B) He wanted to become a scientist with their help.
(C) They were interested in setting up a private laboratory.
3. Where did Henry finish his college education?
(A) Eton (B) Shetland (C) Oxford (D) Manchester
4. Why did Henry show the arrowhead to his friends?
(A) It was very beautiful and belonged to his family.
(B) It was very evident and had historical value.
(C) He had received it from his father.
(D) It was developed in his private laboratory.
5. What helped Henry to develop keen interest in natural beauty of surrounding areas?
(A) Not given in the passage.
(B) His inheritance of a large family estate.
(C) His friendship with grand children from scientists' families.
(D) His knowledgeable mother and sister.
6. Where did Henry use to spend his weekends and holidays?
(A) His family estate at Shetland.
(B) At Manchester with Rutherford.
(C) At Oxford with his friends.
(D) In his laboratory at Eton.

Which of the following is most nearly the same in meaning as the word printed in bold as used in the passage?

7. **Found**—
(A) Established (B) Discovered (C) Organised (D) Laid
8. **Untimely**—
(A) Prematurely (B) Quick (C) Timeless (D) Eternal

Which of the following is the most opposite in meaning of the word printed in bold as used in the passage?

9. **Spent** –

- (A) Installed (B) Established (C) Recouped (D) Saved

10. **Allow** –

- (A) Permit (B) Forbid (C) Avoid (D) Recover

Passage 6:

I hope there are not many who **sneer** at the conquest of science as materialistic avenues to the betterment of human conditions. A spiritual civilization is not necessarily one of poverty and disease, man drawn rickshaw and the handcart. It is the thing to say that wisdom is more **precious** than rubies and the wise man is happy whatever befalls him and quite another to hold that poverty and ill-health are necessary for spiritual advance. While poverty is spiritual when it is voluntary, the mass poverty of people is a sign of sloth and failure. Our philosophy of life recognizes the production and increase of wealth among the legitimate aims of human endeavour. Pursuit of wealth does not, itself, spell spiritual ruin. It is a means, in itself ethically colourless, neither good nor evil, but a necessary means for the attainment of higher life for the individual and the mass of mankind. What counts is the purpose for which wealth is striven after. So long as we realize that it is a means to a higher end, we can boldly venture out on the path of the conquest of Nature's secrets and their utilization for man's service. There are so many ills that flesh in heir to which need not be met by fatalism and folded hands. Instead of facing suffering and disease by **apologetic** justification of the ways of God to man, nobler piety demands their reduction and **ultimate** removal.

Questions:

1. What opens materialistic means to the betterment of human conditions?
(A) Industrialization (B) Conquest of Science
(B) ways of doing work
(D) Earning of wealth by hook Scientific or by crook
2. Poverty may be spiritual only when it is –
(A) Imposed
(B) Voluntary
(C) Divinely ordained
(D) Sanctioned by the powers that be
3. What does our philosophy recognize as one of the legitimate means of human endeavour?
(A) Entering into wedlock and producing children
(B) Conquest of Science
(C) Production and increase of wealth
(D) Foreign conquest

4. Pursuit of wealth is always recommended if –
 (A) It enables us to be materially well off
 (B) It raises our self-condition
 (C) It makes us wise
 (D) It becomes a means to a higher end
5. Fatalism and folded hands here mean –
 (A) Wrong faith in providence and inaction
 (B) Believing that man is subject to death and hence leaving everything to the will of God.
 (C) Believing something will turn up and doing nothing
 (D) Both (A) and (B)
6. The suitable title to the above passage may be –
 (A) Pursuit of Wealth and Higher Life
 (B) The Blessing of Poverty
 (C) Suffering and Disease Ordained by God
 (D) The Importance of Wisdom

Pick out the word or expression that is closest in meaning (Synonym) to the given word of the passage.

7. **Sneer** –
 (A) Snuff (B) Nauseate (C) Show contempt (D) Peep
8. **Apologetic** –
 (A) Expressing regret (B) Prayerful (C) Boastful (D) Kind

Pick out the word or expression which is opposite in meaning (Antonym) to the given word of the passage.

9. **Precious** --
 (A) Costly (B) Popular (C) Cheap (D) Significant
10. **Ultimate** –
 (A) Prior (B) Posterior (C) Anterior (D) Last

Passage 7:

Compulsory sport in schools has often provoked bitter controversy and both parents and their children have expressed themselves forcefully on the subject. Their chief arguments have been based on the accepted fact that both mentally and physically youngsters are widely different. A child who through disinclination or through inability to play any game well prefers not to join in school games, should be allowed to follow his own particular bent, preferably by doing extra work on a subject within the school curriculum, or taking part in the activities of one of the school societies. Those who are unsuited to any particular game or physical efforts because of a **frail** physique or bodily defect should be given more sympathetic consideration.

While those pleas from the parents deserve a kindly hearing, the good of the children as a whole must be kept in mind. If we are not careful the logical conclusion will be reached where only those who excel in athletics will take part in school games, and nobody would accept that as **sensible**. This must also be borne in mind that both parents and children are apt to **exaggerate** conditions and the former only too often become over-concerned for the safety and well-being of their offspring. Too many times have those 'excused games' been found involved in adventures requiring far more physical effort and **danger** than the games from which they have been excused. Experts have declared that in games and athletics with the possible exception of the 'tug-of-war', the body will stop functioning long before any physical harm can be caused.

Questions:

1. According to certain people including parents and children, a child not inclined to participate in games –
(A) Must be exempted from games
(B) Should not be considered for exemption from games
(C) Should be allowed to follow any extra- curricular activity in lieu of games
(D) Should be fined and then exempted from games
2. The main point of controversy is –
(A) Mental and physical differences among the youngsters
(B) Financial inability of the parents
(C) Disturbances in education
(D) Feeling of indiscipline
3. Conditions put forth by children and parents for avoiding games are –
(A) Genuine (B) False (C) Exaggerated (D) Imaginary
4. Only those who are proficient in games should take part in them. This argument –
(A) Is not acceptable to anyone
(B) Is acceptable a;most to all
(C) Is not acceptable to sports loving persons
(D) Is not accepted by anybody as sensible
5. The phrase 'excused games' means –
(A) Games for which players generally avail exemption
(B) Games played by those who are exempted from compulsory school games
(C) Games for which no excuse is permissible
(D) Games which are open to children
6. A suitable heading to the above passage may be –
(A) Games in schools
(B) Compulsory sports in schools
(C) Children and games
(D) Importance of games in schools

Pick out the word or expression that is closest in meaning (Synonym) to the given word of the passage.

7. **Frail –**
 (A) Feeble (B) Tough (C) Turgid (D) Cold
8. **Exaggerate –**
 (A) Vociferate (B) Vibrate (C) Expatriate (D) Stretch beyond the truth
Pick out the word or expression which is opposite in meaning (Antonym) to the given word of the passage.
9. **Danger--**
 (A) Risk (B) Peril (C) Security (D) Insecurity
10. **Sensible --**
 (A) Discreet (B) Prudent (C) Defeasible (D) Insensible

KEY

Passage 1:	1. d		2. b		3. c		4. c & d			
Passage 2:	1. d		2. c		3. c		4. b			
Passage 3:	1. d		2. d		. d		4. D			
Passage 4:	1.A	2.B	3.B	4.D	5.C	6.D	7.C	8.D	9.D	10.B
Passage 5:	1.D	2.A	3.C	4.B	5.D	6.A	7.B	8.A	9.D	10.B
Passage 6:	1.B	2.B	3.C	4.D	5.A	6.A	7.C	8.B	9.C	10.A
Passage 7:	1.C	2.A	3.C	4.D	5.B	6.B	7.A	8.D	9.C	10.D

14. QUESTIONS

I. Choose the correct preposition.

1. She was born _____ 2004.
(a) on (b) the (c) in (d) of
 2. They are waiting _____ the bus.
(a) to (b) for (c) in (d) by
 3. Don't forget to bring some flowers _____ you.
(a) to (b) for (c) with (d) many
 4. I haven't smoked _____ ages.
(a) in (b) hardly (c) for (d) to
 5. You can look up the word _____ a dictionary.
(a) in (b) from (c) by (d) in
 6. She is allergic _____ insect stings.
(a) to (b) for (c) from (d) by
 7. I'm looking _____ my keys. Have you found them?
(a) above (b) for (c) at (d) after
 8. The song was written _____ Madonna.
(a) down (b) by (c) for (d) after
 9. He likes to travel _____ Spain in summer.
(a) from (b) after (c) around (d) to
 10. The police car chased the robbers _____ the streets.
(a) through (b) above (c) under (d) past
- 1) c 2) b 3) c 4) c 5) d 6) a 7) b 8) b 9) d 10) a

II. Fill in the blanks with the appropriate phrase/verb/preposition.

1. Kazim Likes _____ have sugar than juice.
(a) no preposition (b) in (c) to (d) too
2. Sridhar has been _____ in Lotkunta since 2000.
(a) to stay (b) stayed (c) stay (d) staying
3. Shabbir is _____ tabla.
(a) learns (b) learnt (c) learning (d) learn
4. They were _____ to BBC news when I entered the house.
(a) listen (b) listening (c) listened (d) heard
5. SBI sees no stress _____ gold loan portfolio.
(a) upon (b) about (c) on (d) in
6. Gross refining merger (GRM) _____ the year was \$9.2/bbl.
(a) from (b) of (c) for (d) off
7. They might _____ form diverse backgrounds but they had one thing in common-music.
(a) have come (b) have came (c) had come (d) had came
8. The Ninja 300 comes _____ a close ratio, 6-speed, 1-down and 5-up shifted gearbox with well-shaped ratios.
(a) of (b) to (c) off (d) with
9. Royal Enfield is set to _____ a new variant of its Bullet Twinspark.
(a) start (b) launch (c) released (d) made

10. The kidney bean or red bean, known as rajma in India, gets its name _____ of its visual resemblance to a kidney.
(a) about (b) from (c) due to (d) because
11. _____ six percent of engineering graduates are deemed employable in the IT industry.
(a) at (b) of (c) from (d) about
12. _____ words in the dictionary whenever you find new words.
(a) look for (b) look up (c) look in (d) look after
13. Do not beat anyone 'below the belt' means adopt _____ means.
(a) unfair (b) secret (c) behind (d) fair
14. Every family has a 'black sheep' means they have _____ person.
(a) undesirable (b) favourite (c) dark complexioned (d) desirable
15. 'Burn the midnight oil' means work_____
(a) hard (b) using oil lamp (c) hardly (d) rarely
16. 'Cut corners' means
(a) design (b) change shape (c) spend economically (d) make round
17. We shall start _____ two o' clock in the morning.
(a) on (b) according to (c) for (d) at
18. India is moving _____ prosperity.
(a) toward (b) two wards (c) two words (d) towards
19. 'Cut one's coat according to one's cloth' means live within one's _____
(a) country (b) income (c) duty (d) premises
20. They travelled _____ the South India.
(a) a round (b) around (c) rounded (d) rounding
21. 'gift of the gab' means skill of _____
(a) gifting (b) filling the gaps (c) famous (d) speaking
22. _____ having Royal Enfield bike that Chief Minister has nothing.
(a) beside (b) besides (c) before side (d) left side
23. _____ the pressure of 'ragging' he preferred to join college near his house.
(a) withstanding (b) bearing (c) without standing (d) notwithstanding
24. 'hard nut to crack' means a _____ person or problem to solve.
(a) difficult (b) easy (c) different (d) diffident
25. _____ they were from English medium background, they say they cannot write Urdu.
(a) since (b) sins (c) scenes (d) seen
- 1) c 2) d 3) c 4) b 5) c 6) c 7) a 8) d 9) b 10) d
11) d 12) a 13) a 14) a 15) a 16) c 17) d 18) d 19) b 20) b
21) d 22) b 23) d 24) a 25) d

VOCABULARY **A BUSY DAY**

III. Fill in the blank choosing the correct word.

1. The total installed generation capacity, including inverter, batteries and other _____ is 200 units.
(a) instruments (b) furniture (c) paraphernalia (d) things
2. Vodafone's 3G services had _____ very well

- (a) took off (b) take off (c) taken of (d) taken off
3. After the request to _____ for the National anthem, everyone was shocked to hear a popular song from a Hindi film.
(a) rise (b) raise (c) rice (d) raised
4. ICICI Bank, HDFC Bank and Axis Bank were named by Cobropost for _____ in money laundering.
(a) involving (b) making (c) meddling (d) indulging
5. Ricin is a lethal poison, with no _____ which is found in castor beans.
(a) antibiotics (b) antidote (c) anti science (d) anti medical
6. Twitter is _____ a feature that lets an advertisers target ads based on words that appear in users' tweets.
(a) introducing (b) introduced (c) introduce (d) investing
7. The mango season has just _____ with the 'rasalu' arriving in the markets.
(a) began (b) begin (c) beginning (d) begun
8. Media should be the last to _____ in a situation where government allows pubs and decides their timings.
(a) raise fingers (b) point fingers (c) show fingers (d) find fingers
9. As the sun started _____, people were forced to use caps, umbrellas and scarves.
(a) beat down (b) beaten down (c) beating down (d) beaten down
10. Twitter has _____ an app that lets people find music they like and tweet songs from iTunes.
(a) launching (b) launch (c) launched (d) lunch

1) c 2) d 3) a 4) d 5) b 6) a 7) d 8) b 9) c 10) c

IV. Identify the correct vocabulary for the underlined words.

1. The brother was always playing pranks on his little sister.
(a) injuries (b) mischievous acts (c) detriments (d) detractions
2. Let us not prate about our virtues.
(a) discard (b) forsake (c) speak foolishly about
(d) restore
3. The little girl prattled endlessly about her dolls.
(a) fondled (b) ravished (c) caressed (d) babbled
4. In the preamble to the constitution, the purpose of the document is set forth.
(a) content (b) context (c) epilogue
(d) introductory statement
5. The expert thinks that this stock is a precarious investment and advises against its purchases.
(a) ascertained (b) uncertain (c) doubtless (d) decisive
6. Born Centuries too late, the scholar was anachronism in modern urban society.
(a) misdated person (b) fop (c) snob (d) chic
7. We cannot condone such knavery in public officials
(a) gentility (b) snobbishness (c) haughtiness (d) rascality
8. It is interesting to note how public opinion oscillates between the extremes of optimisms and pessimism.
(a) stays (b) stagnates (c) sways (d) 420tabilizes

9. These books display the quintessence of wit.
 (a) dregs (b) essence; marrow (c) residue (d) probity
10. In China, most people venerate their ancestors
 (a) revere (b) scorn (c) redress (d) shirk
- 1) b 2) c 3) d 4) d 5) b 6) a 7) d 8) c 9) b 10) a

V. IDIOMS

1. My computer shut down unexpectedly while I was writing that essay, and I had to start again from scratch.
 (a) From where the computer was scratched
 (b) From the beginning
 (c) The cat scratched me
 (d) The computer scratched the cat
2. My name threw a wet blanket on my plans try out for the play.
 (a) Put a wet blanket on my plans (b) Threw a wet blanket at me
 (c) Discouraged me (d) Got angry on me
3. It was raining cats and dogs when I walked to school this morning.
 (a) Raining heavily (b) Cats and dogs falling with the rain
 (c) Animals in my path (d) Dogs and cats are in the rain
4. If I did that my dad would kill me.
 (a) Cause me to die (b) Get really mad at me
 (c) Dad would die (d) Dad will shoot me
5. My music teacher makes me learn my pieces by heart.
 (a) Memorize them (b) Write them on paper hearts
 (c) Use my heart to learn them (d) A piece of my heart
6. My mother and I don't see eye to eye on the way I dress.
 (a) Look each other in the eye (b) Look from one eye to the other
 (c) Stare each other (d) Don't agree with each other
7. I'd get in big trouble if my mom heard me using a four letter word.
 (a) Word with four letter (b) Swear word
 (c) Four words (d) Short word
8. She doesn't care about you. She's just looking out for number one.
 (a) Looking out one of the windows (b) looking out for her own interest
 (c) looking for the first one (d) to be the only one
9. My friend told me to break a leg before I went on stage,
 (a) fracture the bone in my leg (b) break a leg off the table
 (c) wished me good luck (d) fighting with the legs
10. Chelsea was going to try out for the baseball team, but she got cold feet.
 (a) feet were too cold (b) was afraid to try
 (c) put her shoes on instead (d) legs feeling cold
- 1) b 2) c 3) a 4) b 5) a 6) d 7) b 8) b 9) c 10) b

SYNONYMS

VI. Choose the correct word for the underlined word.

1. Carlos was happy when he got his new bike.
(a) glad (b) excited (c) sad (d) joyful
2. The person in the bank service was very ignoble man.
(a) noble (b) sophisticated (c) gentle (d) pious
3. The other company is a rival company to us.
(a) partner (b) competitor (c) claimant (d) enemy
4. The person is very civil in this locality.
(a) formal (b) polite (c) social (d) sophisticated
5. The Border Security Force intercepted yesterday a truck carrying arms and ammunition.
(a) interrupted (b) met (c) stopped (d) found
6. He was punished to rigorous imprisonment for larcency.
(a) stealing (b) forgery (c) dacoity (d) murder
7. He enjoys posturing before an audience.
(a) taking up a position (b) pretending (c) acting
(d) putting oneself into show poses

1) a 2) a 3) b 4) c 5) c 6) a 7) d

ANTONYMS

VII. Choose the correct word.

1. PARALLEL
(a) divergent (b) curved (c) random (d) wavy
2. NOVEL
(a) formal (b) ancient (c) customary (d) traditional
3. MANAGE
(a) direct (b) avail (c) bungle (d) wild
4. ARID
(a) plentiful (b) productive (c) humid (d) agreeable
5. IMPULSIVE
(a) cautious (b) considerate (c) clever (d) cunning
6. ENGULFED
(a) encircled (b) grouped (c) disfigured (d) detached
7. LUXURIANT
(a) barn (b) small (c) ghastly (d) decaying
8. ZEST
(a) restive (b) callous (c) indifference (d) distaste
9. REPEL
(a) attract (b) concentrate (c) attend (d) continue
10. FACTITIOUS
(a) ridiculous (b) genuine (c) engineered (d) magnificent
11. DORSAL
(a) inactive (b) ventral (c) peripheral (d) central
12. EPILOGUE

- | | | | | |
|-----|------------------|--------------|--------------|------------------|
| 13. | (a) conversation | (b) dialogue | (c) dramatic | (d) prologue |
| | DISSIPATE | | | |
| 14. | (a) sustain | (b) conserve | (c) preserve | (d) maintain |
| | ACQUIT | | | |
| 15. | (a) confirm | (b) blame | (c) punish | (d) indict |
| | ABORIGINAL | | | |
| | (a) modern | (b) popular | (c) current | (d) contemporary |
-
- | | | | | | | | | | |
|-----|---|-----|---|-----|---|-----|---|-----|---|
| 1) | a | 2) | d | 3) | c | 4) | c | 5) | a |
| 6) | d | 7) | a | 8) | d | 9) | a | 10) | b |
| 11) | b | 12) | d | 13) | b | 14) | d | 15) | a |

PAST, PRESENT AND FUTURE TENSES

VIII. Fill up the blanks with appropriate tense.

1. First, she frowned and then she _____.
 (a) smiling (b) smiled (c) smile (d) pleased
 2. I _____ the kitchen floor.
 (a) moping (b) mopped (c) mop (d) moaned
 3. Jack and Jill _____ their notes.
 (a) writed (b) writing (c) are writing (d) written
 4. Tomorrow, I _____ a donut.
 (a) buyed (b) will buy (c) buying (d) bought
 5. Sally is _____ behind the tree.
 (a) hide (b) hided (c) hiding (d) hidden
 6. The leaves _____ to fall from the trees
 (a) beginning (b) begun (c) are beginning (d) begun
 7. The court is _____ the prisoner early
 (a) released (b) release (c) releasing (d) released
 8. He _____ on the rug.
 (a) tripped (b) trip (c) tripping (d) topped
- 1) b 2) b 3) c 4) b 5) c 6) c 7) c 8) a

IX. REPORTED SPEECH

1. Tom said, "I went to visit my friends this weekend."
 (a) Tom said he wants to visit his friends that weekend
 (b) Tom said he wanted to visit his friends that weekend
 (c) Tom said he wanted to visit his friends this weekend
 (d) Tom said he wish to visit his friends the weekend
2. Jerry said, "I'm studying English a lot the moment".
 (a) Jerry said he was studying English a lot at that moment
 (b) Jerry said he was studying English a lot at the moment
 (c) Jerry said he wasn't studying English a lot
 (d) Jerry said I was studying English a lot at that moment
3. Jack said, "He must be guilty!"
 (a) Jack said he must have been guilty

- (b) Jack said he must have be guilty
 - (c) Jack said he musn't be guilty
 - (d) Jack said he must has been guilty
4. You said, "I will help you!"
- (a) You said you would help me!
 - (b) You said I would help you
 - (c) You said you would help her
 - (d) You said you will help her

Key 1) b 2) a 3) a 4) a

X. PASSIVE SENTENCE

1. "Burglars broke into the house." The passive voice of this sentence is
 - (a) The house was broken
 - (b) The burglars was broken
 - (c) The house has been broken into
 - (d) The house was broken into
2. "Shut the door", The passive voice form of this sentence is
 - (a) Let the door be shut
 - (b) The door ought to be shut
 - (c) The door may be shut
 - (d) Let the door shut
3. Someone used to send me anonymous letters. The passive voice should be
 - (a) I was used to be sent anonymous letters
 - (b) Anonymous letters used to be sent to me
 - (c) I used to be sent anonymous letters
 - (d) Anonymous letters sent to me
4. She is used to cleaning the floor everyday
 - (a) The floor is used to clean by she everyday
 - (b) The floor is used to being cleaned everyday
 - (c) The floor is used to be clean everyday
 - (d) The cleaning of floor is everyday
5. They oughtn't to give children sweets
 - (a) Children oughtn't to give them sweets
 - (b) Children oughtn't to be given sweets
 - (c) Sweets oughtn't to be given to children
 - (d) Do not give sweets to children
6. He didn't show them the right place
 - (a) The right place wasn't shown
 - (b) He didn't show the right place to them
 - (c) The right place was not shown to them
 - (d) They weren't shown the right place
7. No one could tell her the secret
 - (a) She couldn't be told the secret
 - (b) A secret cannot be told to her
 - (c) The secret couldn't be told to her
 - (d) She could be told the secret

8. Someone taught them the passive voice
 - (a) The passive voice was taught to them
 - (b) They taught the passive voice
 - (c) They were taught the passive voice
 - (d) They had been taught the passive voice
9. They allowed him a second loan this year
 - (a) A second loan was allowed to his this year
 - (b) He was allowed a second loan this year
 - (c) He was allowed this year a second loan
 - (d) A second loan allowed to him

1) d 2) a 3) c 4) b 5) b 6) d 7) a 8) c 9) b

PARTS OF SPEECH

XI. Identify the part of speech of the underlined word in each of the following sentences

1. The clown chased a dog around the ring and then fell flat on her face.
 - (a) verb
 - (b) noun
 - (c) pronoun
 - (d) adverb
2. The geese indolently waddled across the intersection.
 - (a) adverb
 - (b) verb
 - (c) adjective
 - (d) pronoun
3. Yikes! I'm late for class.
 - (a) adjective
 - (b) conjunction
 - (c) interjection
 - (d) preposition
4. Bruno's shabby thesaurus tumbled out of the book bag when the bus suddenly pulled out in traffic.
 - (a) noun
 - (b) pronoun
 - (c) adverb
 - (d) adjective
5. Mr. Frederick angrily stamped out the fire that the local hooligans had started on his verandah.
 - (a) adverb
 - (b) verb
 - (c) pronoun
 - (d) adjective
6. Later that summer, she asked herself, what was I thinking of?
 - (a) noun
 - (b) adjective
 - (c) pronoun
 - (d) preposition
7. She thought that the twenty zucchini plants would not be enough so she planted another ten.
 - (a) adverb
 - (b) pronoun
 - (c) verb
 - (d) preposition
8. Although she gave hundreds of zucchini away, the enormous mound left over frightened her.
 - (a) interjection
 - (b) preposition
 - (c) conjunction
 - (d) adjective
9. Everywhere she went, she talked about the prolific veggies.
 - (a) noun
 - (b) pronoun
 - (c) verb
 - (d) adverb
10. The manager confidently made his presentation to the board of directors.
 - (a) pronoun
 - (b) verb
 - (c) adverb
 - (d) noun
11. Frankenstein is the name of the scientist not the monster.
 - (a) preposition
 - (b) conjunction
 - (c) verb
 - (d) pronoun
12. Everyone in the room cheered when the announcement was made
 - (a) noun
 - (b) interjection
 - (c) preposition
 - (d) pronoun
13. The sun was shining as we set out for our first winter camping trip.
 - (a) verb
 - (b) adverb
 - (c) preposition
 - (d) pronoun
14. Dust covered every surface in the locked bedroom.

- (a) adjective (b) noun (c) pronoun (d) preposition
15. They wondered if there truly was honor among thieves.
(a) adjective (b) pronoun (c) preposition (d) adverb
16. Exciting new products and effective marketing, strategies will guarantee the company's success.
(a) conjunction (b) pronoun (c) preposition (d) verb
17. Her greatest fear is that the world will end before she finds a comfortable pair of earrings.
(a) pronoun (b) preposition (c) conjunction (d) verb
18. That suitcase is her's
(a) noun (b) verb (c) pronoun (d) adjective
19. Small children often insist that they can do it by themselves.
(a) conjunction (b) adjective (c) pronoun (d) adverb
20. The census taker knocked loudly on all the doors but nobody was home.
(a) adverb (b) adjective (c) verb (d) conjunction

- 1) b 2) a 3) c 4) d 5) b 6) c 7) c 8) c 9) b 10) c
11) c 12) d 13) a 14) b 15) c 16) a 17) b 18) c 19) b 20) a

XII. Choose the correct meaning for the word given.

1. ANIMOSITY
(a) unknown (b) hatred (c) loving (d) closeness
2. DESOLATE
(a) mingle (b) social (c) polite (d) solitary
3. FRENZY
(a) angry (b) confused (c) excitable (d) frantic
4. PERTURBED
(a) disturbed (b) related (c) composed (d) passionate
5. HAPLESS
(a) aimless (b) hopeless (c) helpless (d) unfortunate
6. ELATION
(a) ill tempered (b) high spirits (c) dull (d) emotional
7. LACKADAISICAL
(a) cheerful (b) superficial (c) unenthusiastic (d) visionary
8. OBSOLETE
(a) fashionable (b) out dated (c) up to date (d) accurate
9. LUCID
(a) liquid state (b) loose (c) clear (d) lacking
10. CHAOTIC
(a) applicable (b) demanding (c) specific (d) more confusing
11. REVERENTIAL
(a) cunning (b) pious (c) valuable (d) fixed
12. ALLURING
(a) testing (b) acquiring (c) surprising (d) tempting
13. AMICABLE
(a) futuristic (b) friendly (c) suitable (d) useful
14. ANOMALOUS

- | | | | | |
|-----|------------------|-----------------|-------------------|---------------|
| | (a) unusual | (b) familiar | (c) ill timed | (d) factual |
| 15. | AUDACIOUS | | | |
| | (a) bold | (b) audible | (c) financial | (d) healthy |
| 16. | BRAWL | | | |
| | (a) negotiations | (b) talks | (c) consensus | (d) quarrel |
| 17. | CALLOUS | | | |
| | (a) Approachable | (b) insensitive | (c) inevitable | (d) accusing |
| 18. | CLEMENCY | | | |
| | (a) cooperative | (b) commanding | (c) strict | (d) mercy |
| 19. | EULOGY | | | |
| | (a) ecological | (b) laudation | (c) criticize | (d) allege |
| 20. | GARRULOUS | | | |
| | (a) gambling | (b) luxurious | (c) accommodating | (d) talkative |
-
- | | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1) b | 2) d | 3) c | 4) a | 5) d | 6) b | 7) c | 8) b | 9) c | 10) d |
| 11) b | 12) d | 13) b | 14) a | 15) a | 16) d | 17) b | 18) d | 19) b | 20) d |

XIII. Choose the correct answer.

1. **A:** "Do you want to go with them?"
B: "Yes, I wish to."
(a) A doesn't like B to go (b) A wants B to go
(c) B wants to go (d) B requests A to permit
2. **A:** Would you mind explaining grammar basics to me?
B: Yes, I do
(a) B takes it serious (b) B is reluctant
(c) B wants to explain (d) B wants to try
3. **A:** We shall go out provided the weather is fine.
B: That's ok.
(a) A is sure of going out (b) A seeks Bs consent
(c) A is doubtful (d) A is desperate
4. **A:** In the event the meeting is postponed, I'll let you know.
B: I'll be waiting.
(a) A is planning to postpone it (b) A will inform about it
(c) A is determined to conduct meeting (d) A wants to postpone it
5. **A:** Can I come to the office today?..
B: Don't come unless I call you .
(a) B orders A to come (b) B waits for A
(c) B is asking A to come (d) B is not clear about time
6. **A:** I want to talk to you on condition the strike is called off.
B: We want you to talk to us first.
(a) A has no precondition (b) A doesn't want to talk
(c) A puts a condition (d) A supports strike
7. **A:** So long as you are willing to return money on time,I don't mind lending to you.
B: OK, please do it.
(a) A is willing to lend money (b) A is putting condition
(c) A doesn't have money (d) B wants to lend money to A

8. ABC College of Management is _____ a unique specialization “Business Analytics”
 (a) giving (b) allotting (c) offering (d) serves
9. The revenue has said service tax will be _____ on erection of pandals or shamiyana for organizing a function.
 (a) implied (b) imposed (c) imported (d) empowered
10. The smallest of the species _____ slightly more than 5.5 cm and weighs about 2 gm.
 (a) measure (b) measuring (c) will measures (d) measures
- 1) c 2) c 3) c 4) b 5) d 6) c 7) b 8) c 9) b 10) d

ICET - English

Choose the right meaning for the underlined :

1. He will have to forgo the pleasure of attending the lecture as he is unwell.
 (a) Go later (b) Forget (c) Give up (d) Go first
2. My brother decided to put up his flat as collateral security to get a loan.
 (a) Unacceptable (b) Property acceptable (c) Unconditional (d) Cordial
3. She left a measly tip for the waiter.
 (a) Less (b) More (c) Voucher (d) Insulting
4. We enjoyed a leisurely stroll on Sunday morning.
 (a) Skating (b) Jogging (c) Playing a game (d) Leisurely walk
5. Those boys are always bickering when they play cricket.
 (a) Engage in quarrel (b) Cheat (c) Play tricks (d) Assault
6. Kabir did not heed the advice of others because of his obstinacy.
 (a) Intelligence (b) Innocence (c) Unsound mind (d) Stubborn
7. Ali ran up stupendous debts because of his fondness of luxuries.
 (a) Enjoyed (b) Huge (c) Sought (d) Unwanted

Choose the antonyms for the underlined:

1. Some students are less confident than their peers
 (a) Juniors (b) Of equal rank (c) Seniors (d) Of different nationals
2. People who perpetrate violent crime should be punished secretly.
 (a) Responsible for (b) Convict (c) Irresponsible (d) Involved in
3. The storm raged with relentless fury.
 (a) Unsteady (b) Steady & persistent (c) Sturdy (d) Studey
4. I could see the pinnacle of the Himalayas above the clouds.

- (a) Highest point (b) Middle point (c) Invisible point (d) Bottom
5. Firdous became flabby due to lack of physical activity.
(a) Dull (b) Strong (c) Weak (d) Thin
6. India can send men to space but there is a catch.
(a) hasslefree (b) unforeseen drawback (c) a loophole (d) understanding

Words in Pairs as Idioms:

Choose the right meaning for the underlined idioms:

1. The objects in his room are always at sixes and sevens
(a) in disorder (b) in order (c) in circle (d) in square
2. She had sixty servants at her beck and call
(a) dispute (b) disposal (c) dispose (d) depose
3. The thief was beaten black and blue by the villagers
(a) very carefully (b) very slowly (c) very severely (d) very politely
4. He was born and bred in Begum Bazaar
(a) studied (b) worked (c) bread factory
(d) brought up since birth
5. It's very difficult to earn one's bread & butter these days
(a) shop (b) livelihood (c) dairy products (d) sweets
6. It was raining cats & dogs few days ago
(a) rain moderately (b) rain heavily (c) rain rarely (d) rain regularly
7. I do not believe in eye to eye as it leads to bitterness
(a) shy (b) maintaining eye contact
(c) friendly behaviour (d) revengeful attitude
8. We should be fair & square in our dealings
(a) cunning (b) careful (c) honest (d) intelligent
9. Greater chunk of people in our country lead a hand to mouth life on account of their poverty
(a) without provision (b) rich (c) middleclass (d) royal family
10. There are no hard & fast rules
(a) fixed (b) flexible (c) fabulous (d) adjustable
11. She stands head & shoulders above all other students in the class
(a) moderate (b) last (c) average (d) much better
12. Discuss your problems heart to heart with your wives & husbands

- (a) sincerely (b) secretly (c) officially (d) professionally
13. People raised a hue & cry against new tax proposals on 'whatsapp'
 (a) no objection (b) appreciated (c) general alarm (d) supported
14. The railway station was a scene of hustle & bustle
 (a) dull (b) energetic activity (c) peaceful (d) organized
15. They gave the complaint against the officer in black & white
 (a) through a person (b) on telephone (c) orally (d) in written
16. India in olden days was known to be a land of milk & honey
 (a) scarcity (b) abundant food supply
 (c) poverty (d) commerce
17. The Supreme Court declared the provision of the Act null & void as it is against the constitution
 (a) valid (b) acceptable (c) invalid (d) postponed
18. Many Bangladeshis who came to India became part & parcel of the land in due course of time
 (a) citizens (b) friends (c) business people (d) essential part
19. We should think over the pros & cons of a matter before aiming at a decision
 (a) positives (b) negatives (c) points for & against (d) supporting
20. I go for a brisk walk every morning rain or shine
 (a) if it rains (b) whether it rains or not (c) in summer (d) in winter
21. We should do all work shoulder to shoulder for the progress of the project
 (a) no competition . (b) unanimous (c) in close competition (d) busy
22. Time & Tide wait for none.
 (a) something (b) everything (c) few things (d) nothing

Choose the right option from the given:

1. I was informed on phone but no written confirmation _____ so far.
 (a) had been received (b) has been received
 (c) had received (d) has received
2. The city was kept _____ night curfew for several days.
 (a) Over (b) At (c) On (d) Under
3. I cannot bear _____.
 (a) Separation from you (b) Your's separation
 (c) Separation of you (d) Your separation

4. Mr. Latif's property was divided _____ his daughter and son.
(a) Among (b) Amidst (c) Between (d) Into
5. Everyone wants to _____ for one's achievements.
(a) Admire (b) Be admired (c) Be admiring (d) Being admired
6. We hope that we shall win the match.
(a) It was hoped the match would be won by us
(b) It is hoped the match will be won by us
(c) The match is hoped to be won
(d) Winning the match is hoped by us
7. The Chinese surrendered quebec to the English in 1759.
(a) Quebec was surrendered 1759 by the Chinese to the English.
(b) The English were surrendered quebec in 1759 by the Chinese.
(c) Quebec was surrendered by the Chinese to the English in 1759.
(d) Quebec was being surrendered to the English in 1759 by the Chinese.
8. Hindustan Petroleum Co. to make up for the losses _____ on sale of fuel.
(a) Happened (b) Caused (c) Incurred (d) Created
9. There are many challenges to be _____.
(a) Meet (b) Achieved (c) Achieve (d) Met
10. The new unit would be _____ on 75 acres.
Settled up (b) Set up (c) Settling up (d) Set
11. The company plans to introduce more _____ of the kids bicycles.
(a) Variations (b) Variants (c) Varieties (d) Varies
12. Merchant acquiring business in _____ of payment through debit/credit card.
(a) Facilitation (b) Facilitate (c) Felicitation (d) Felicitate
13. Indian companies prepare to _____ with the rising demand
(a) Keep out (b) Keep up (c) Keep down (d) None
14. The project _____ one, two & three BHK apartments.
(a) Comprising (b) Compressed (c) Compassed (d) Comprises
15. Social Networking site Facebook has _____ Helsniki-based fitness tracking app moves.
(a) Acquisition (b) Acquit (c) Acquired (d) Procured
16. The willful bank loan _____ by 500 customers crossed the Rs 70,000 crore mark
(a) Faulters (b) Violators (c) Breakers (d) Default

17. Amazon (global e-commerce retailer & e-reading device maker) has its eyes _____ the education sector in India.
 (a) Settled on (b) Set on (c) Setting on (d) Set
18. National Airlines Air India _____ operating a flight to Bhuj in Gujarat.
 (a) Would (b) Is going to (c) Would be going to (d) Would be
19. The e-commerce portal zaamor.com plans to feature modern diamond jewellery collections _____ by in house artisans of VBJ.
 (a) Handcrafted (b) Handcrafted (c) Handcraft (d) Handcropped
20. Harvard MBA student Ms Amrita Singal won the grand prize in the 'Social Enterprise' _____ for her venture 'Saathi'.
 (a) Branch (b) Category (c) Brand (d) Group
21. The competition, which supports both students and alumni launching new business & social impact _____ is inspired by the belief that 'one simple idea can change everything'.
 (a) Venture (b) Ventures (c) Vents (d) Business
22. The _____ in the social enterprise track was "Tomato Jos", a tomato processing company _____ by MBA students.
 (a) Runner up, found (b) Run up, founded
 (c) Run up, find (d) Runner up, founded
23. 'Tomato Jos' is a vertically integrated tomato processing company that _____ small farmers in Nigeria _____ tomatoes that can be made into paste.
 (a) Helps, grows (b) Helps, grow (c) Help, grow (d) (a) Help, growing

Miscellaneous

Choose the right Prepositions:

1. He was _____ London _____ 2000 _____ two years.
 (a) yet, in ,for (b) in, in ,far (c) in, into ,for (d) in, in ,for
2. I have kept your books _____ shelf. Please get them.
 (a) At (b) into (c) on (d) closer
3. They saw the radio _____ her desk.
 (a) into (b) around (c) at (d) away
4. Ahmad usually comes _____ bike.
 (a) with (b) on (c) by (d) along
5. Is it not desirable to stop the vehicle _____ traffic lights.
 (a) away (b) after (c) at (d) far

6. Nagesh Kuknoor forgot the keys _____ the grass.
(a) a (b) into (c) inside (d) on
7. Azhar always puts his watch _____ his cupboard. (in)
8. We should appreciate and compliment those who come _____ bicycles. (on)
9. The buses generally do not stop _____ the bus stop. (at)
10. My teacher stays _____ the first floor. (on)
11. She left some food _____ the plate. (on)
12. Cipla said it _____ Nexavar(ca) at Rs 6,840 for a monthly dose.
(a) Sell (b) Would have sell (c) Has sell (d) Would sell
13. CBDT stands for
(a) Central bank of direct taxes (b) Central board of direct taxes
(c) Central board of disputes (d) Central bank of direct tribunal
14. Generic drug prices are _____ the reach of millions of sufferers of cancer.
(a) Behind (b) Away (c) Beyond (d) Of
15. Finance Minister had also pointed out _____
(a) time and again (b) time & out of tide (d) again & after(d) time & tide
16. German sportswear maker Adidas said it planned to _____ 1/3 of its 900 Reebok stores in Indi(a)
(a) Shut off (b) Call on (c) Call off (d) Shut down
17. The price of 'Sorinib used for treating kidney cancer _____ cut by 76%.
(a) Has been (b) Have been (c) Had (d) Has
18. Audi, the German luxury car manufacturer plans _____ the production capacity at Aurangabad(MH) by 50%.
(a) To heighten (b) To hike (c) To aggravate (d) To be hiked
19. Brain Cancer drug 'Temposide' _____ available at 65,000/-
(a) Would (b) Will (c) Would be (d) Must
20. Sumsung India is _____ to launch its first Android 4.0 tablet early this month.
(a) Geared (b) Gear down (c) Gearing in (d) Gearing up
21. Audi, a part of the Volkswagen group, _____ the manufacturing facility with Skoda
(a) Will shared (b) Can shared (c) Shares (d) Shall shared
22. The manager is not attending _____ the matter.

- (a) On (b) To (c) Of (d) Off
23. People always comment _____ others without knowing the facts.
(a) On (b) At (c) About (d) Of
24. The CM congratulated Saina Nehwal _____ winning the world Badminton Championship in 2015.
(a) For (b) On (c) At (d) About
25. We shouldn't object _____ this petty pleasures.
(a) To (b) At (c) On (d) Of
26. We all should refer _____ the Roget's Thesaurus for synonyms antonyms
(a) Too (b) With (c) At (d) To
27. We should always come up _____ a new idea to survive in the cut throat competitive world
(a) At (b) For (c) With (d) No preposition
28. Khalid always drops out _____ the game whenever he loses hope of winning
(a) From (b) No prep (c) Off (d) Of
29. A: Can you complete the project in one day?
B : Yes I can
(a) Willingness (b) Intention (c) Ability (d) Purpose
30. A: I want you to take up this job
B: Can you brief me about it
(a) Ability (b) Command (c) Request (d) Possibility
31. A: you must read one/two articles everyday in order to get good grade.
(a) Probability (b) Wishes (c) Necessity (d) Possibility
32. A: Will you help me in completing this work?
B: Yes. Why not?
(a) B wants to to reason (b) B is questioning why not himself
(c) B is willing (d) B doesn't
33. A: you will have to invite the chief guest
B: Should I? A means
(a) Only I should do it (b) Others can also invite
(c) Others are unwilling (d) B wishes to do the job

Popular Tag lines

1. Have it your way.
(a) Burger king (b) Pizza hut (c) Dosa house (d) Almond house

2. Just do it.
(a) Reebok (b) Nike (c) Adidas (d) Bata
3. King of beers.
(a) Budweiser (b) Kingfisher (c) Bagpiper (d) Royal challenge
4. I'm Lovin it!
(a) Alex kitchen (b) KFC (c) Taj (d) McDonalds
5. Think different.
(a) Orange (b) Blackberry (c) Apple (d) Samsung
6. They're Gr-r-r-reat!
(a) Oats (b) Kellogg's Cornflakes
7. Thousands of possibilities, get yours.
(a) Best deal (b) Best sale (c) Best offer (d) Best buy
8. _____ gives you wings
(a) Black bull (b) Brown Bull (c) Red Bull (d) White Bull

Verb + Preposition:

- | | |
|--------------------------------------|------------------------|
| 1. Ask <u>for</u> | 15. Angry about |
| 2. Belong <u>to</u> | 16. Different from |
| 3. Happen <u>to</u> | 17. Fed up with |
| 4. Listen <u>to</u> | 18. Good at |
| 5. Speak <u>to</u> | 19. Bad at |
| 6. Thank <u>for</u> | 20. Interested in |
| 7. Think <u>about</u> | 21. Married to |
| 8. Wait <u>for</u> | 22. Sorry about |
| 9. Look <u>at</u> | 23. Sorry for (doing) |
| 10. Look <u>for</u> | 24. On --holiday |
| 11. Look <u>after</u> (case) | 25. on-television |
| 12. Depend <u>on</u> /bank <u>on</u> | 26. on radio |
| 13. afraid of | 27. on the phone |
| 14. Angry with | 28. On time |

Spot the underlined Part that has error :

1. I started/ teaching /10 years back.
a b c
2. They had been/ conducting/ this course/since 5 years.
a b c d
3. It is/ very difficult/ for guessing/ the paper.
a b c d

4. He usually/ waking up/ by 5 am.
a b c
5. They are/ very bad/ in writing/ application letters.
a b c d
6. I have been/ improving/ my handwriting/ for 2000 January.
a b c d

VERBS

1. He has been studying English _____.
(a) for a long time (b) since 1985 (c) recently (d) since he was a child
2. I have studied French _____.
(a) for a long time (b) since 1987 (c) a&b (d) none
3. I have been studying Spanish _____.
(a) for a long time (b) since 1990 (c) a&b (d) none
4. How long _____ you been studying mathematics when you joined Pharmacy.
(a) have (b) had (c) do (d) none
5. The cell phone _____ ringing for two minutes before it was answered.
(a) had been (b) has been (c) was (d) was been
6. I have been looking for my umbrella all day, but I haven't _____ it.
(a) find (b) found (c) founded (d) been finding
7. You have been talking about grammar, but I _____ listening.
(a) was not (b) weren't (c) haven't been (d) was not been
8. When we got there the movie _____ begun.
(a) Did not (b) Was not (c) Had not (d) Wasn't been
9. The flight _____ arrived when we _____ the airport.
(a) Had not, reach (b) Had not, reached (c) Hasn't reached (d) Haven't reached
10. He was listening. _____?
(a) Didn't he (b) Weren't he (c) Doesn't he (d) Wasn't he
11. We have finished tenses. _____?
(a) Didn't we (b) Don't we (c) Haven't we (d) Did we
12. He wasn't writing the notes. _____?
(a) Wasn't he (b) Was he (c) Weren't he (d) Didn't he
13. They attended the marriage on Sunday at Hitex. _____?

- (a) Did they (b) Didn't they (c) Weren't they (d) Were they
14. As soon as she _____ discovered the truth, she told everyone about it.
(a) Has (b) No need of verb (c) Will have (d) Had
15. He _____ motionless after she _____ disappeared.
(a) Was standing, has (b) Stood, had
(c) Was standing, had (d) Stood, has
16. They have been _____ for 20 years.
(a) Marrying (b) married (c) marriage (d) none
17. By five thirty we _____ worked _____ two hours.
(a) Have, from (b) Had, since (c) Had, for (d) Have, for
18. I _____ mailed the resume by the time she enquired.
(a) No need of verb (b) Have (c) Did (d) Had
19. I _____ her before she _____ me.
(a) Saw, saw (b) Had seen, saw (c) Seen, saw (d) Seen, seen
20. She did not see me till I had seen her _____?
(a) Didn't she (b) Does she (c) Did she (d) Doesn't she
21. We _____ all this morning.
(a) Were shopping (b) Were in the shopping
(c) Have shopping (d) Have been shopping
22. I haven't seen her since morning. _____.
(a) Haven't I (b) Hadn't I (c) Have I (d) Had I
23. It has been a week since I _____.
(a) Had phoned (b) Have phoned (c) Did phoned (d) Phoned
24. We _____ found the solution to this problem.
(a) Already (b) Have a; ready (c) Almost (d) All ready
25. We haven't found the solution yet. _____?
(a) Hadn't we (b) Have we (c) Had we (d) Did we
26. She is an Engineer _____?
(a) Is she (b) Does she (c) Isn't she (d) Doesn't she
27. Aren't we practicing much _____?
(a) Do we (c) Don't we (c) Are we (d) Didn't we
28. You wrote CAT last year too. _____?
(a) Don't you (b) Weren't you (c) Wasn't you (d) Didn't you

29. The thief _____
 (a) Is absconding (b) Has absconded (c) Absconding (d) None
30. It _____ me ten rupees.
 (a) Is costing (b) Costs (c) Costing (d) Cost
31. She _____ her father.
 (a) resembles (b) is resembling (c) resemble (d) resembled

CHOOSE THE CORRECT ANSWER

1. I attended the marriage because it was _____
 (a) an order (b) an obligation (c) official (d) my duty
2. There are many areas in which government can _____ effectively.
 (a) interfere (b) introduce (c) intervene (d) interact
3. What is needed is an arrangement for better coordination _____ them.
 (a) with (b) among (c) in (d) of
4. The CBI did not raise to _____ issue when the charge sheet was filed
 (a) main (b) jurisdiction (c) important (d) jargon
5. The osama series aired each week is an _____ tale of the young couple
 (a) credible (b) creditable (c) incredible (d) chaotic
6. The audience appreciated the _____ of Ashoka schooling in Gurukul.
 (a) delegation (b) denotation (c) direction (d) depiction
7. Hindi is the _____ of Hyderabad.
 (a) official (b) unofficial (c) lingua franca (d) semi official.
8. A student should not be thought more than he can think _____.
 (a) with (b) for (c) about (d) of
9. The coach dived _____ the swimming pool.
 (a) in (b) into (c) onto (d) upon
10. The PM accepted _____ the offer of bilateral talks made by the president of Britain.
 (a) to (b) with (c) for (d) so
11. She works quite hard. You can't accuse her _____ being lazy.
 (a) with (b) on (c) off (d) of
12. The plan of action proposed by the chief minister is in consonance _____ vision 2020.
 (a) any (b) for (c) about (d) with

CHOOSE THE RIGHT WORD

13. The manager _____ his staff on their excellent performance.
(a) complemented (b) supplicated (c) complementary (d) reprimand
14. Who will _____ the children while their mother is in the hospital.
(a) look for (b) look after (c) look at (d) look upon
15. He has a reputation _____ honesty
(a) with (b) at (c) for (d) of
16. The building does not have the basic _____ washing.
(a) aberrations (b) ablutions (c) amenities (d) angularities
17. Don't scold the boy, he'll _____ in time
(a) come round (b) come through (c) come back (d) come over

Fill in the blanks with the correct prepositions:

1. They stay _____ the second floor
(a) In (b) on (c) at (d) inside
2. She looked _____ the baby
(a) later (b) alter (c) after (d) along
3. They entered _____ the house at 5am
(a) into (b) inside (c) in (d) none
4. We called _____ the patient in the hospital
(a) in (b) of (c) off (d) on
5. Please return my book _____
(a) back (b) behind (c) beside (d) none
6. Kindly go _____ the syllabus carefully
(a) by (b) buy (c) bye (d) through

Prepositions:

In	-----the kitchen	On	-----a shelf
	-----the garden		-----a plate
	-----London/Laldarwaja		-----a balcony
	-----the cupboard		-----the floor
At	-----the bus stop		-----the gram
	-----the door		-----the envelope
	-----the traffic light		-----the ceiling
	-----her desk		

Phrasal Verbs:

Get in	<i>Got on</i> the bus
Got in	<i>Put on</i> your coat
Got out	<i>Take off</i> your shoes
Get out	<i>Turn on/off</i> (light/machine/tap etc)
	<i>Switch on/off</i> (light/machine)
	<i>Pick up & put down</i>

1. He stood at the centre of the room and _____ to cry
(a) Begin (b) begun (c) began (d) had began
2. In order to _____ the deadline for the payment of fees, the students went in a procession to the principal's room.
(a) Extend (b) Accelerate (c) Move (d) Forward
3. It is quite dark here. Please _____ the light.
(a) Put (b) Burn (c) Switch (d) Switch on
4. Dr. Salim _____ practicing medicine since 1990
(a) Is (b) Has been (c) Had been (d) Shall
5. The change in climate may _____ your health.
(a) Effect (b) Affect (c) Inflict (d) Reflect

Choose phrases/verbs/prepositions:

1. I will _____ the job in two days.
(a) Finished (b) Finish (c) Completed (d) Concluded
2. They are leaving _____ Mumbai next week by KingFisher Airlines.
(a) To (b) Of (c) With (d) For
3. His health is _____ day by day.
(a) Decreasing (b) Increasing (c) Deteriorating (d) Descending
4. Leaving car during _____ the campus is strictly prohibited.
(a) In (b) Onto (c) On (d) Into
5. The workers _____ the strike after he convinced them.
(a) Call off (b) Call of (c) Called of (d) Called off
6. I have been teaching here _____ 2000 December.
(a) From (b) For (c) By (d) Since

15. BUSINESS TERMINOLOGY

Concepts

Absolute Monopoly: Single producer without substitute and control over output, also known as pure monopoly or perfect monopoly

Administered Prices: Prices decided by government or such agencies instead of demand supply forces

Ad valorem Tax: A duty which is imposed on commodities in proportion to their value

Appreciation: An increase in value of stocks, shares and currency

Account: Record of financial transactions over a period of time

Accepting House: Firm usually a Merchant Bank which accepts bills of exchange at a discount for immediate payment to the issuer

Acid Test Ratio: Ratio of liquid assets to current liabilities giving indication of a company's solvency

Acquirer: A person or company which buys something

Adjourn: To stop a meeting for a period

Ad man: Man who works in advertising

Amortize: To pay off by putting money aside regularly over a period of time.

Actuary: Person employed by an insurance company or other organizations to calculate risk involved in premiums (insurance)

Antedate: To put an earlier date on a document

Arbitrage: Selling and buying of foreign currencies to get profit on difference in exchange rates.

Asset: Thing which belongs to a company or a person and which has a value

Average Due Date: The average date when several payments fall due.

Average Cost: Average cost is cost per unit of output

Average Revenue: AR refers to revenue per unit output

Balanced Budget: When current income equals current expenditure is called balanced budget

Backward Integration: If a firm takes control of its suppliers. Ex. Raw materials

Balance Sheet: It is a list of assets and liabilities of a firm at a point of time

Balance of payments: Transactions of a country with the rest of the world during a given year. It includes exports and imports of goods and services

Balance of trade: It refers to exports and imports of goods between two countries. If exports are more it is 'favourable balance of trade' and if imports it is 'unfavourable balance of trade'

Business: Busy - ness. Any activity carried mainly with the objective of earning profit.

Bad debt: A debt which cannot be recovered

Book-keeping: A systematic recording to business transactions in the books of accounts maintained by a trader

Bank rate: Rate of interest at which RBI finances commercial banks

Blue Chip: The term applies to most reliable industrial shares of reputed companies which have stable growth and least risk.

Boom: Stage of business cycle when production employment and spending are all high

Bank Deposits: The funds deposited in bank accounts

Barter System: A method of exchanging goods to goods without a medium of exchange like money

Bear: A bear is a speculator who sells securities in anticipation of a fall in prices of securities

Bill of Exchange: It is an instrument in writing, containing an unconditional order signed by the banker directing a certain person to pay a certain sum of money to certain person or bearer of the instrument.

Black Market: A market which is established without legal sanction

Blue Chip Rate: Refers tot lowest interest rate payable by borrowers having highest credit rate

Brain Drain: Migration of educated and skilled labour from poorer to richer countries

Brand: A brand is a name, term, sign, symbol or design or a combination of all these to identify a particular seller or the group of sellers which differentiates them from competitors

Break-even Point: A no profit and loss point in business

Broker: One who buys and sells bonds and other financial assets

Budget Deficit: Budget deficit is the difference between total revenues and total expenditure

Bullion Market: Precious metals like gold or silver which are held in bulk

Buyer's Market: A market where goods and services are available in plenty and their supply exceeds demand

'B' Shares: Ordinary shares with special voting rights (Owned by the founder of a company and his family)

Baby bonds: US bonds in small denominations.

Bankrupt: A person who has been declared by a court not to be capable of paying his debts.

Bear: Person who sells shares because he thinks the price will fall and he will be able to buy them again more cheaply later

Bilateral: Between two parties or countries

Blind Testing: Testing a product on consumers without telling them what brand it is

By-Product: Product made as a result of manufacturing a main product

Capital: Money, property and assets used in business

Cargo: Load of goods which are sent in a ship or plane etc.

Capitalist: Person who invests money in business

Cartel: Group of companies which try to fix the price or to regulate supply

Company: A group of people organized to buy, sell or provide a service

Conglomerate: Group of subsidiary companies linked together and forming a group, each making very different types of products.

Consortium: Group of companies which work together on a particular project.

Credit Worthiness: Ability of a customer to pay for goods bought on credit

Crisis: Serious economic situation where decisions have to be taken rapidly

Customs duty: Tax payable on goods exported and imported from a country

Current Assets: The assets which can be converted into cash within a short period of time.

Countervailing Duty: An additional import duty imposed on a commodity to offset a reduction of price as a result of export subsidy in the country of its origin

Current liabilities: The liabilities which are repayable within a short period of time within one year

Cyclical unemployment: When aggregate demand for goods and services in the economy falls below its capacity, a large chunk of labour gets unemployed. This cyclical unemployment

Cash Reserve Ratio: A minimum percentage reserve to be kept against their net demand and time liabilities to be kept with RBI. It ranges from 3 to 15%

Current Ratio: It is also called as "Acid test Ratio" It is the ratio of current assets to current liabilities

Debenture: Agreement to repay a debt with fixed interest using the company's assets as security

Debtor: Person who owes money

Deed: Legal document or written agreement

Deregulate: To remove government controls from an industry

Disinvest: To reduce investment by not replacing capital assets when they wear out

Dog: Product that has low market share and low growth rate and so, is likely to be dropped from the company's product line

Dear Money: When interest rates are high and borrowing is expensive

Deflation: A situation when prices and money incomes are falling

Demand: The quantity of a commodity that will be bought at a particular price

Demand Draft: It is a Bill of Exchange and negotiable instrument

Depression: Prolonged and severe slowing down of economic activity

Devaluation: Fall in the external value of currency

Disinflation: A mild form of deflation when a policy is adopted to check inflation

Dividend: The amount of distributed profit as a percentage of the nominal value of the share capital

Division of Labour: Dividing complex work into components and making individuals responsible for each division

Dumping: The sale of a good in a foreign market at a price below its marginal cost

Duopoly: A form of imperfect competition where there are only two producers

Duopsony: When there are two buyers of a particular good or service. It is duopsony

Depreciation: Reduction in the value of a fixed asset due to wear and tear, passage of time and obsolescence etc.

Direct Taxes: If the burden of tax is borne by the tax payers themselves it is a direct tax
Ex. Income tax, gift tax

Demonetisation: When there is lots of unaccounted money (black money) the government withdraws currency of higher denominations, to unearth black money, it is called demonetisation

Easy Money: Refers to a general state of ease and cheapness of borrowing in the financial system

Economic Growth: The rate of expansion of the national product or total value of production of goods and services of a country

Economics of Scale: Saving of expenditure because of increase in and expansion of operations

Exchange Rate: The rate at which one currency can be exchanged for another foreign currency

Elasticity: The degree of responsiveness of demand or supply to a change in price

Fixed cost: The cost which cannot change with a change in the volume of output

Forward Market: A contract to buy or sell commodities or securities at a fixed future date at a price agreed in the contract

Free Market: A market where there is no intervention of government and the supply, demand operate freely

FIFO: First In First Out

Franchise: License to trade using brand name and paying a royalty for it

Gift-edged: Investment which is very safe. Ex: Government Securities

Excise Duty: It is a tax levied on certain commodities produced in the country

Endorse: To sign a bill or a cheque on the back to show that you accept

Face value: Value written on a currency note, coin, bank not, or a share certificate

Factors of Production: Resources required for production. They are divided broadly into 4: Land, Labour, Capital and Organization

Flat Money: Money which the state declares to be legal tender

Finished Good: Good which is ready for consumption of use

Fiscal Policy: Policy of the government on taxes, expenditure, public debt, etc.

Hot Money: Money that moves across borders in response to interest rate differences is called Hot Money

Inflation: A continuous rise in prices or value of money

Indent: An order of listing the goods required.

Invoice: A detailed list goods supplied and services rendered with their values

Interest: A payment by a borrower for a sum of money for a period of time. The remuneration for capital

Inventory: The raw materials, work in goods and finished good maintained by organization to meet operational needs

Intermediate Good: It is neither raw material nor a finished product

Indemnity: Guarantee of payment after a loss

Goodwill: Good reputation of a business

Guarantor: A person who promises to pay someone's debts

Gross Domestic Product: The total value of goods and services produced during a year within the domestic territory of a nation

Hard Currency: The exchange value of currency is stable due to the strong performance of its economy. Ex: US dollar

Hyper Inflation: A very high rate of inflation generally exceeds 1000 percent per annum

Hierarchy: The line of authority in an organization that runs in order of rank from top management to the lowest level

Issued Capital: The actual amount of capital issued by a company and allotted in shares to investors.

Laissez-faire: Refers to a policy of non interference by the state. **Lease:** An agreement to use others property or assets with a periodic payment. **Liabilities:**

Refers to claims actual or potential or an individual or institution. **LIFO:** Last In First Out

Liquid Assets: Assets in the form of money or which can be quickly converted into money

Liquidation (Winding-up): The process of the existence of the company terminated

Lead Time: The length of time between ordering and supply of something and receiving it.

MODVAT: Modified Value Added Tax

Management: It is an act of getting things done through others by planning, organizing, leading and controlling

Market Price: The price determined by market forces *i.e.* supply and demand

Merger: A Union of two or more firms in transaction by which one absorbs the others

Multinational Corporation: A large corporation with operations and decisions spread over several countries but controlled by central headquarters

Most Favoured Nation: Country which has the best terms of trade

Nationalise: To bring private owned industry into state control

Niche: A special place occupied by one company (a niche company)

NNP: Net National Product, GNP - Depreciation

NPU: Net Present Value. Used in estimating present value of money of future outflows and capital budgeting decision

Net Profit: Gross Profit - (Tax + Depreciation)

Open Economy: An economy when is involved in international trade

Opportunity Cost: The next best alternative use of a factor of production

Open Cheque: A cheque which is not crossed

Open Market Operations: Buying and selling of securities done by RBI. It is a method of controlling inflation and depression

Overhead Costs: Costs which are not chargeable to any unit produced. Ex: salaries, rent, research, etc.

Preference Share: Shares with a fixed rate of dividend as a priority payment than ordinary shareholders

Promoter: One who starts a new business venture. It can be a new company or a firm

P&L Account: It is income statement. A summary of revenue and expenditure of a business

Par Value: Means the nominal or face value of a share or security

Paid-up-capital: That part of the issued capital which is paid by the shareholders.

Penetration Pricing: Practice of charging a lower price in order to capture the major part of the market.

Price Discrimination: Charging different prices for different customers

Price: Refers to value of a commodity expressed in terms of money

Rate of Return: Refers to earning from the investment

Repo Rate: Repo is a short term for repurchase agreement for RBI selling a government security at a competitive rate in the market and absorb excess liquidity

Revenue Expenditure: The expenditure incurred for day to day administration of a business

Royalty: Money paid to an inventor, writer

SDRs: Special Drawing Rights

Securities: Investment in stocks and shares certificates which shows your investment in stocks and shares

Sampling: Testing a product by taking a small amount

Shell Company: A company which will not trade but for namesake listed in the stock exchange

Stagflation: Inflation and stagnation of the economy

Stock Broking: Trade of dealing in shares for clients

Stock holder: Person who holds shares in a company

Sunrise Industries: Companies in the field of electronics and other high-tech areas

Stock Exchange: A highly organized market for dealings in stocks and shares

Sinking Fund: It is a fund created for a specific purpose of redeeming debts on a specific date

Self Currency: The currency that keeps on fluctuating in terms of other currencies

Trade Discount: The discount given by a manufacturer to the dealer and to the retailer from the wholesaler

Tax-evasion: Failing to report income or improperly claiming deductions

Tax Avoidance: Avoiding tax by taking benefit of all available deductions

Takeover: By buying more than 50% of the shares of a business

Turnkey Operation: Where a company takes the responsibility of everything so that it is completely ready for the purchaser to takeover

Turn Around: To make a company change from loss making to profit making

Tycoon: Important Businessman

Turnover: Total sales of a business during a particular period

VAT: Value Added Tax: A tax levied on the value of each of the processes carried out by a business

Variable Costs: Expenses that change directly with a change in output

Wall Street: Street in New York where the stock exchange is situated. The American financial centre

WTO: World Trade Organization: International Organization set up with the aim of reducing restrictions in trade between countries

Wash Sales: It is a transaction in which a speculator sells a security and then buys it at higher price through another broker to create impression on that particular share

Yield: Money earned in on investment

Zero Coupon Bond: Bond which yields no interest but sold at a discount

Zero Based Budgeting: To begin from scratch of each activity without taking into consideration of previous allotments.

Exercise

- | | |
|--|---|
| <p>1. Which company's famously advertised vision statement is 'The Network is the Computer'?</p> <p>(a) Cisco Systems
(b) Lucent Technologies
(c) Sun Microsystems
(d) Nortel Networks</p> <p>2. The software company I-flex Solutions was originally a division of which famous financial services company?</p> <p>(a) Citigroup
(b) ICICI
(c) HSBC
(d) ABN Amro Bank</p> <p>3. Which former advertising personality has recently been named the Undersecretary of the State for 'public diplomacy and public affairs' of the US in an exercise to rebrand the US following the September 11 terrorist strikes?</p> <p>(a) Charlotte Beers
(b) Jay Chiat
(c) Martin Sorrel
(d) George Lois</p> <p>4. Which premium international range of luggage was recently launched in India by BlowPlast?</p> <p>(a) Samsonite
(b) Strolley
(c) American Tourister
(d) Delsey</p> <p>5. This year saw the launch of Yahoo! Amazon.com and the famous launch of the Orange mobile phone service in the UK. Which year was this?</p> <p>(a) 1992 (b) 1994</p> | <p style="text-align: center;">(c) 1995 (d) 1993</p> <p>6. Henry Ford revolutionised the car market with the first mass-produced car, the Ford Model T. In which year was it launched?</p> <p>(a) 1924 (b) 1912
(c) 1908 (d) 1897</p> <p>7. Your firm has decided to localize its products and services to meet local market demands. A good approach to use would be..... segmentation.</p> <p>(a) Geographic (b) Benefit
(c) End-use (d) Customer</p> <p>8. Consumers can show their allegiance to brands, stores, or companies. Marketers can use this information to segment consumers by.....</p> <p>(a) User status
(b) Loyalty
(c) Store Type
(d) Brand preference</p> <p>When the size, purchasing power, and profiles of business market segments can be determined, they are said to possess the requirement of being (a) Measurable (b) Accessible (c) Substantial (d) Actionable</p> <p>10. This group determines a product's position relative to competing products.</p> <p>(a) Manufacturers
(b) Wholesalers
(c) Retailers
(d) Consumers</p> <p>11. A company or store gains a(n) by understanding customer needs better than competitors do</p> |
|--|---|

- (a) Competitive advantage
(b) Positioning advantage
(c) Cost advantage
(d) Efficiency advantage
12. Firms gain this type of advantage through the way they design their distribution coverage, expertise, and performance. Which differentiation is it?
(a) Services differentiation
(b) Channel differentiation
(c) People differentiation
(d) Product differentiation
13. When firms use symbols, colours, or characters to convey their personalities, they are usingdifferentiation?
(a) Image (b) People
(c) Company (d) Reputation
14. When Competitors cannot easily copy this difference to promote, we say we have a(n) difference?
(a) Distinctive (b) Profitable
(c) Preemptive (d) Superior
15. You have just created the 'perfect' ad. It communicates the full mix of benefits upon which the brand is positioned. This full . positioning is called.....
(a) Value proposition
(b) AIDA
(c) Capturing the consumers attention
(d) Value profiling
16. The answer to the customer's question, "Why should I buy your brand?" is found in the
(a) Quality image
(b) Customer services
(c) Value proposition
(d) Encyclopaedia
17. Canara Bank and Oriental Bank of Commerce signed an agreement with HSBC. Which of the following is / are correct in this context?
(a) They joined hands to set up a life insurance venture
(b) The proposed venture would be controlled by Canara Bank with 51% stake
(c) Oriental Bank of Commerce would hold 23% stake and HSBC 26%
(d) All of the above
18. AV Birla group company, Madura Garments owns some of the well-known textile brands in India. These brands are
A) Allen Solly
B) Van Heusen
C) Louis Philippe
Choose the answer from the choices given below
(a) A and C (b) A and B
(c) B and C (d) All of these
19. First Store is the BPO subsidiary of which Indian Bank?
(a) ICICI (b) SBI Bank
(c) HDFC (d) HSBC India
20. Who is the Chairman of the Pension Fund Regulatory and Development Authority (PFRDA)?
(a) D. Swrup
(b) M. Damodaran
(c) Pramod Bajpayee
(d) C. Rangarajan
21. "Smart Money" is a term used for
(a) Internet Banking
(b) Credit Card
(c) Cash with Bank
(d) Cash with Public

22. SBI is going to enter into a JV with which telecom company to enable money transaction from one count to another through mobile?
 (a) Airtel (b) MTNL
 (c) Idea (d) Hutch
23. CSN is the biggest steel company of which country?
 (a) Britain (b) US a (c) Russia (d) Brazil
24. zzzzz Motor Company emphasizes "quality first zzzzz tough" in its truck products. The company has developed a differentiation strategy based on
 (a) People (b) Image
 (c) Products (d) Services
25. We define a as anything that can be offered to a market of attention, acquisition, use, or consumption and that might satisfy a want or need.
 (a) Private brand
 (b) Service variability
 (c) Service
 (d) Product
- 26..... are a form of product that consists of activities, benefits, or satisfactions offered for sale that are essentially intangible and do not result in the ownership of anything.
 (a) Line extensions
 (b) Services
 (c) Brands
 (d) Consumer products
27. Many companies are moving to a new level in creating value for their customers. They are developing and delivering total customer experiences. Whereas products are tangible and services are intangible, experiences are
 (a) Product quality
 (b) Memorable
 (c) Unsought product
 (d) Internal marketing
- 28..... are products and services bought by final consumers for personal consumption. These include convenience products, shopping products, specialty products, and unsought products.
 (a) Services
 (b) Consumer products
 (c) Line extensions
 (d) Industrial products
29. A(n) is a name, term, sign, symbol, design, or a combination of these, that indentifies that maker or seller of a product or service.
 (a) Service
 (b) Brand
 (c) Co-branding
 (d) Internal marketing
30. At the very least, the identifies the product or brand. It might also describe several things about the product.
 (a) Line extension
 (b) Social marketing
 (c) Label
 (d) Specialty product
31. A company can increase its business in four ways. Which is not one of these ways?
 (a) It can add new product lines, thus widening its product mix
 (b) It can lengthen its existing product lines

- (c) It can add more versions of each product and thus deepen its product mix
- (d) The company can discontinue some of its lines
32. Some analysts see as the major enduring asset of a company, outlasting the company's specific products and facilities.
- (a) Brands
- (b) Convenience products
- (c) Specialty products
- (d) Unsought products
33. Marketers need to position their brands clearly in target customer's minds. They can position brands at any of three levels. At the lowest level, they can position the brand on
- (a) Interactive marketing
- (b) Internal marketing
- (c) Product attributes
- (d) Strong beliefs and values
34. Retailers have become concerned that there are already too many brands, with too few differences between them. Thus, Procter & Gamble and other large consumer - product marketers are now pursuing..... strategies weeding out weaker brands and focusing their marketing dollars only on brands that can achieve the number-one or number two market share positions in their categories
- (a) Megabrand
- (b) Service inseparability
- (c) Social marketing
- (d) Unsought product
35. Companies must carefully manage their brands. First, the brand's positioning must be continuously communicated to consumers. Major brand marketers often spend huge amounts on advertising to create brand and to build preference and loyalty
- (a) Extension
- (b) Awareness
- (c) Packaging
- (d) Internal marketing
36. The brand's positioning will not take hold fully unless everyone in the company lives the brand. This suggests that managing a company's brand assets can no longer be left only to
- (a) Product line
- (b) Product mix
- (c) Brand extension
- (d) Brand managers
37. Building a(n) and re-educating customers can be a huge undertaking for a company. It cost tens of millions of dollars just for a special four-week advertising campaign to announce the new name, followed by considerable ongoing advertising expenses to the Verizon Company.
- (a) Product mix
- (b) Service intangibility
- (c) New image
- (d) Internal market
38. Name the worlds largest insurer which said it would offer its first insurance coverage complying with Islamic law, tapping a market that could be worth \$15 billion by 2015. Its unit would offer Islamic insurance coverage or takaful, for areas such as health, motor and property to

- Gulf Arab customers before expanding to Asia
 (a) American International Group
 (b) Allianz Insurance Group
 (c) Aviva Insurance Group
 (d) Maxlife Insurance Group
39. Ten private business houses have signed deals with government for setting up thermal power plants in the state. The plants envisage a total investment of over Rs.46,000 crores to produce 10,920 MW of power. This is the first time that the state government signed so many MoUs for thermal power 44 on a single day.
 (a) Jharkhand (b) Orissa
 (c) Chhattisgarh (d) MP
40. Every product seems to go through a life cycle. Which of the following is not a major challenge presented by the PLC? 45
 (a) All products eventually decline
 (b) A firm must be good at developing new products to replace aging ones
 (c) The firm must be good at adapting its marketing strategies 46
 (d) It is difficult to plot the stages as a product goes through the stages
41. Products may fail because
 (a) The market size may have been overestimated
 (b) The product's design did not meet consumer expectations 47
 (c) They were prices too high
 (d) Any of the above
42. A company can obtain new products through new product development. Which of the following define(s) new products?
 (a) Original products
 (b) Product improvements
 (c) Product modification
 (d) All of the above
43. New product development starts with
 (a) Idea generation
 (b) Idea screening
 (c) Concept development
 (d) Concept testing
44. A is the way consumers perceive an actual or potential product.
 (a) Product idea
 (b) Product concept
 (c) Product image
 (d) Test market
45. The search for new product ideas should be rather than haphazard
 (a) Consistent
 (b) Systematic
 (c) Continual
 (d) Strategically planned
46. The purpose of idea generation is to create a of ideas. The purpose of succeeding stages is to that number.
 (a) Small number, reduce
 (b) Small number, increase
 (c) Large number, increase
 (d) Large number, reduce
47. What do we call a detailed version of a new idea stated in meaningful customer terms?
 (a) Product idea
 (b) Product concept

- (c) Product image
(d) Product proposal
48. When developing new products, it is important for a firm to distinguish between a product concept, a product image, and a product
- (a) Idea
(b) Proposal
(c) Life-cycle
(d) All of the above
49. With what groups do firms conduct concept testing for new products?
- (a) Suppliers
(b) Employees
(c) Target customers
(d) Focus groups
50. Many firms routinely test new product concepts with consumers before attempting to
- (a) Commercialize them
(b) Turn them into actual new product
(c) Price them
(d) Create advertising and promotion

KEY

- | | | | | |
|-------|-------|-------|-------|-------|
| 1) c | 2) a | 3) a | 4) d | 5) b |
| 6) c | 7) a | 8) b | 9) a | 10) d |
| 11) a | 12) b | 13) a | 14) c | 15) a |
| 16) c | 17) d | 18) d | 19) a | 20) a |
| 21) b | 22) a | 23) d | 24) d | 25) d |
| 26) b | 27) b | 28) b | 29) b | 30) c |
| 3D d | 32) a | 33) c | 34) a | 35) b |
| 36) d | 37) c | 38) a | 39) b | 40) d |
| 41) d | 42) d | 43) a | 44) c | 45) b |
| 46) d | 47) b | 48) a | 49) c | 50) b |

16. COMPUTER TERMINOLOGY

Concepts

ASCII: American Standard Code for Information Interchange: It is a seven bit code format used for data communication

ARPANET: Advanced Research Projects Agency Network: Developed by Department of Defence (America)

ALU: Arithmetic Logic Unit: It is a part of CPU, which performs arithmetic and logical operations on integers

Alphanumeric Code: Code that represents numbers, alphabets, special symbols

Artificial Intelligence (AI): It is a branch of Computer Science, which makes computers, to think like human beings

ANSI: American National Standards Institute: which provides standards to display Alphanumeric characters, Punctuation marks and other characters

Assembly Program: A low level program which uses in programming to product machine language

Algorithm: Set of instructions for solving specific problem in a finite number of steps.

ARRAY: A group of logically related elements (Names, Roll No.) identified by a single name.

ATM: Asynchronous Transfer Mode: It is one way of Data Transmission in a network which transfers data in the form of character, (character by character)

ATM: Automatic Teller Machine: It is a bank outlet from which customers can make transactions, like withdraw of money, from their accounts

Application Program: A piece of software that performs specific kinds of tasks

Attachment: A file (ex: audio or video, picture) that is sent with an e-mail message

Bandwidth: In a network connection, band-width is the maximum carrying capacity for data traffic

BASIC: Beginners Ail-Purpose Symbolic Instruction Code: It's a programming language which is easy to learn and easy to use

Batch Processing: A technique in which items to be processed are collected into groups (batched) to permit convenient and efficient processing

BPS: Bits per second: It is data transfer rate (units)

Browse: To move through or surf the internet

Browser: A software tool to surf the internet

Bug: An error in a program

Buffer: Is a small, high speed storage element

BUS: The circuit wires used for transferring data between various components of a computer

Byte: A unit of computer memory made up of 8 bits

Bar Code: A code consisting of a number of magnetic ink lines that are imprinted on a table in varying widths and can be read with a scanning device

B2C: Business to Consumer: Business use the internet to offer their products / services to consumers. It is a form of e-commerce

B2B: Business to Business: Business place order for supplies / services with another business directly on the internet

Boot: Process of starting up of a computer system *i.e.* loading the operating system into the memory

Binary Code: Code using bits (0 and 1) to represent data

BIOS: Basic input / output system: Instructions that control the computer's hardware

CRT: Cathode Ray Tube: A technical name for the picture tube (or screen) of a computer monitor

CPU: Central Processing Unit: Provides the fundamental command and instructions environment for the computer. It consists of 3 parts

- 1) **ALU:** Arithmetic Logic Unit
- 2) **CU:** Control Unit
- 3) **MMU:** Main Memory Unit

CAD: Computer Aided Design: It is widely used in the design of electronic circuits, roads etc.

CAM: Computer Aided Manufacturing

COBOL: Common Business Oriented Language: A high level language capable of performing all the calculations used in business

Computer Network: Several computers connected together for the purpose of having data, and other resources

C: is a high level programming language used for various applications

Client: A computer in the network requesting for services

.com: A website name extension used for commercial organizations on the internet

Cursor: A marker that indicates the position of a letter / digit typed on the screen

Compiler: A software program that converts source code written in high level language into computer understandable machine code

Chip: A device that processes information at the most basic level within a computer

Compressed files: Files that have been temporarily condensed. Ex: ZIP files

CD-ROM: Computer Disc Read Only Memory *i.e.* one type of secondary storage device

Computer: A machine used for processing, storing data according to a set of instructions

C2B: Consumer to Business: These sites permit consumers to specify their requirements of a particular product / service which can be met by the business

C2C: Consumer to Consumer: A website where seller can sell a product / services to another consumer via internet Example: E-Bay

Concurrent Processing: The capacity of an operating system to share memory among several programmes and to execute the instructions during the same time

Cryptography: A technique for conversion of plane text into cyper text (unreadable format)

Data: Characters grouped together in a specific pattern. Information stored in a computer

Database: It is a collection of data put together to serve a particular requirement

DBMS: Data Base Management System: Its a software to control and manage data

Data Entry: Any process of entering data into a computer

DTP: Desk Top Publishing: Software category developed to produce high quality documents

Download: Transfer of files from one computer to another

Domain (or) Domain Name: The address of URL of a particular website

DOS: Disk Operating System: It is a single user operating system where in only one programme can be executed / run at a time

Data Structure: It refers to the logical structuring of data in the memory

Debug: Removing errors (bugs) from the programme

EXE: A file extension denoting an executable programme.

E-mail: Electronic Mail: A service provided by a website for exchange of messages

E-Commerce: Business done via internet

FORTTRAN: Formula Translation is one of the oldest high level languages used for scientific purposes

Floppy Disk: A secondary storage device

File: A collection of logically related records

Finger: A software tool used to determine whether another user is logged on to the internet

Flowchart: Pictorial representation of step by step sequence for solving a problem

File Extension: A code usually of 3 letters that appears at the end of a filename after a dot to indicate its format

Format: To alter the appearance of a file

FTP: File Transfer Protocol

Folder: An electronic storage area used to keep related documents / files

Gigabyte: 1024 mega bytes

GUI: Graphic User Interface: An interface which provides visual presentation of information. Example: Windows

Gateway: A special purpose computer system for exchanging information across incompatible networks

Garbage: Collection of data which is no more usable

GIGO: Garbage In Garbage Out

Hacker: A skilled programmer who breaks into secured computer system

Hard Copy: A copy of computer's output printed on a paper

Hard Disk: Main Memory area of a computer which stores bulk amount of data

Hardware: Electronic, magnetic and mechanical devices used in a computer **Home Page:** The first screen / page of a website.

HTML: Hyper Text Markup Language: A language that describes how a page should be formatted

High-level Language: Programming language which is based on functions and procedures

Host: Any computer on a network that provides services to other computers

HTTP: Hyper Text Transfer Protocol: A protocol used for transfer of information on the internet

Instruction: A command that is recognized by the CPU

Interpreter: A program (s/w) that reads each line of a program to check for syntax errors. It converts source code into object code

Intranet: The vast collection of inter-connected networks, using different protocols

Intranet: A private network for internal use only belonging to a company, also known as LAN

ISP: Internet Service Provider: An organization which provides Internet services on a pay-per-use basis

Icon: Pictorial representation of a file or a function (on the display screen) **Import:** To bring an element from another program

Java: A high level object oriented programming language developed by SUN micro systems for internet applications

Joystick: The input device normally used for playing computer games

JPEG: Joint Photographies Experts Group: A compressed format for storing images

JDBC: Java Data Base Connectivity: An application used to connect to the database using java.

Kilobyte: A unit for memory capacity. 1 KB = 1024 bytes

Kernel: A special program in the operating system which performs basic operations of the operating system

LAN: Local Area Connection: A collection of computers and other nodes linked together in a room within a building which share resources. It is also called Intranet

Label: A name attached to an entity for identification

LSI: Large Scale Integration: Technology used to squeeze hundreds of components onto a single chip

Linux: A multiuser and multitasking operating system developed by Linus. It is a free software which is available in the Internet

Laptop: A portable computer

Log on: A term used to denote user connectivity to the network

Log off: A term used to denote used disconnectivity to the network

Megabyte: A unit of memory capacity 1MB = 1024 KB

Memory: Computer capacity for storing information

Modem: Modulator - Demodulator: Modulation is a process of converting digital data in analog data. Demodulation is a process of converting analog data into digital. A device that allows a computer to transmit data to other computer via telephone lines

Motherboard: The main circuit board inside a computer

Mouse: An input device, used to point the cursor to a certain command

MS-DOS: Microsoft Disk Operating System: It is a single user operating system, used by personal computers

Multimedia: A computer system which has ability to present information by integrating text, graphics, sounds and video

Multiprocessing: The simultaneous execution of two or more set of instructions in a single computer

Multiprogramming: A technique for handling two or more independent programs simultaneously

Mainframe Computer: A computer having single processor of limited capacity

Mini Computer: A computer which is known as PC (Personal Computer)

Network: Collection of computers and peripherals devices connected together

Node: Any electronic device connected to other devices in the network

NLP: Natural Language Processing: Is a way to make a computer to understand any natural language. Example: English, Telugu, Hindi

OS: Operating System: The software programme that controls the running of a computer. It is bridge between software and hardware.

On-line: The status of a computer that is actively connected to the internet

Off-line: The status of a computer that is disconnected to the Internet

Output: Information transferred from the internal memory of the computer to some external device

Pixel: Picture Element: At dot on a computer screen

Peripheral: A hardware device that can be connected to PC

Programme: A series of instructions written for execution by a computer user

Port: A physical socket that allows users to connect a peripheral device to a PC

Port: A logical address of a service in the computer

Plugins: Programmes that are needed to open and run certain files such as video clips or second files

Print Preview: On-screen display that shows users exactly how the active document will look when printed

Portal: Web page / site which personalized and portable access to multiple information

Pocket: A unit of information transmitted from one device to another on a network

Parity Bit: A bit which contains the number of ones (Is) in the data. Even parity for even-number of ones and odd parity for odd number of ones

Pascal: A high-level language used for scientific applications

Password: A group of characters by which a user is uniquely identified when logging on to a system

Protocol: A set of rules that computers use while communicating with each other

Package: Collection of programs usually for specific applications

RAM: Random Access Memory: A type of memory in which any location can be accessed

ROM: Read Only Memory: It performs read operation only, the information on ROM is made permanent at the time of hardware production

Records: Set of fields on a related subject

Resolution: A measure of the precision of computer output. It is measured in dots per inch or pixels

Router: A special purpose system that handles the connection between two or more networks

RTOS: Real Time Operating System

Software: Computer programmes that are used in a computer to access the hardware devices

Source Code (or) Source Program: A program written in source language

Search Engine: A special kind of website used to find links for other websites

Scanner: A hardware device used to scan any existing picture or photograph into digital format

Secondary Storage: Storage devices that supplement a computer's primary storage. Example: Floppy, CD, etc.

Simulation: A model of real life situation

Spam: Unwanted mails sent by unidentified users.

Surf: To move through the Internet

SQL: Structured Query Language: It is the standardised query language for requesting information from a database

Spooling: Simultaneous Peripheral Operations Online. It is a processing technique which is used in input / output operations

Syntax: The set of rules governing the construction of valid statements in a language

Single User Operating System: Operating system that allows only one application program at a time. Example: DOS

Soft Copy: Any Computer that operates at very high speeds and is used to process large amounts of data

Swapping: Interchanging of memory location from main memory to secondary storage

Server: A computer which provides services which is connected to a network

System Software: A software that operates the PC

Topology: The organization of a computer network

Template: A format for saving a document

Task Bar: A bar usually situated at the bottom of the screen in windows

TCP / IP: Transmission Control Protocol / Internet Protocol: A Protocol which is used to transfer data in the Internet

Unix: A multitasking operating system

Upload: Sending a file from one computer to a remote computer

URL: Uniform Resource Locator: The standard way to give addresses of any resource on the internet

USB: Universal Serial Bus: A hardware connector that allows users to add different devices

Utilities: Software that assist in certain computer functions

VLSI: Very Large Scale Integration: Design and production technique to place thousands of electronic components within a small integrated chip

Video Conferencing: Conducting a conference among participants at different sites by using computer networks

VDU: Video Display Unit: A computer terminal with monitor and keyboard

VIRUS: Viral Information Resources Under Sieze: A programme designed to replicate and spread on its own usually without the user's knowledge

Voice Mail: A computerised system for receiving / recording and formatting audio messages

Volatile Memory: A type of memory in which data stored is lost when the power is turned off. Example : RAM

Variable: It is named symbol and refers to a storage location in the memory

WAN: Wide Area Network: A network that connects different cities and countries together via leased lines or satellite links.

Web Page: Simple text file that contains text, images and other types of files of particular site in the internet.

Web Server: Web Documents or Pages stored on internet connected computer

Word Processor: A software required to create, edit and store away document. Example: MS-word

WWW: World Wide Web is a composition of millions of linked web pages that can be viewed by using any of the web browser

Worms: Self contained programs that enter a computer and generate their own commands

XML: Extended Markup Language: A tag language which is used to create and manage web pages

Zip File: A file that has been compressed with Win Zip Compression program

EXERCISE

1. 1K is equivalent to
(a) 2^6 (b) 2^8
(c) 2^{10} (d) none of these
2. Binary coded decimal numbers express each decimal digit as
(a) bits (b) bytes
(c) word (d) none of these
3. The basic operations performed by a computer is
(a) Arithmetic operations
(b) Logical operations
(c) Storage and retrieval operations
(d) All the above
4. The earliest calculating device is
(a) Abacus
(b) Clock
(c) Difference engine
(d) None of the above
5. The man who built the first mechanical calculator was
(a) Joseph Marie Jacquard
(b) John Mauchly
(c) Blaise Pascal
(d) Howard Aiken
6. Punched cards were first introduced by
(a) Powers (b) Pascal (c) Jacquard (d) Hollerith
7. The first machine which would be called the prototype of the modern computer was
(a) Automatic loom
(b) Difference engine
(c) Analytic engine
(d) Slide rule
8. Computers built before the first generation of computers were
(a) Mechanical
(b) Electro-mechanical
(c) Electrical
(d) None of the above
9. First generation computers used
(a) Vacuum tubes
(b) Transistors
(c) Integrated circuits
(d) Wires
10. VLSI was first used with the computers of
(a) Second generation
(b) Third generation
(c) Fourth generation
(d) None of the above
11. Second generation computers started appearing in
(a) 1950 (b) 1955
(c) 1960 (d) 1970

12. Word length of a home computer is
 (a) 8 bits (b) 16 bits
 (c) 32 bits (d) 64 bits
13. VAX-11 from DEC is a
 (a) Mini-computer
 (b) Supermini-computer
 (c) Mainframe computer
 (d) None of the above
14. At present, a super computer has the computing capability of
 (a) 4,000 PCs
 (b) 40,000 PCs
 (c) 4 million PCs
 (d) None of the above
15. Cursor is a
 (a) Pixel
 (b) Thin blinking line
 (c) Pointing device
 (d) None of the above
16. Backspace key is a
 (a) Control key
 (b) Function key
 (c) Character key
 (d) None of the above
17. In a high resolution mode, the number of dots in a line is
 (a) 320 (b) 640
 (c) 760 (d) 900
18. Programs stored in ROM are called
 (a) hardware (b) firmware (c) software (d) none of these
19. The unit 'kilo instructions per second' is used to measure the speed of
 (a) processor (b) disk drive (c) printer (d) tape drive
20. Integrated circuits are classified on the basis of
 (a) Manufacturing company
 (b) Type of computer
 (c) Number of translators
 (d) None of the above
21. A binary system has
 (a) Two symbols (a) and (b)
 (b) Two symbols 0 and 1
 (c) At least two symbols
 (d) None of the above
22. The nine's complement of a decimal number is obtained by
 (a) Dividing the given number by 9
 (b) Multiplying the given number by 9
 (c) Subtracting each digit of the number from 9
 (d) Adding each digit of the number to 9
23. A compiler
 (a) Is a computer program
 (b) Translate a high-level language into machine language
 (c) Is a part of software
 (d) None of the above
24. Computer software includes
 (a) Application programs
 (b) Operating system programs
 (c) Packaged programs
 (d) All the above
25. Machine language
 (a) Is the language in which programs were first written
 (b) Is the only language understood by the computer
 (c) Differs from one type of computer to another
 (d) All the above
26. Assembly language

- (a) Uses alphabetic codes in place of binary numbers used in machine language
 (b) Is the easiest language to write programs
 (c) Need not be translated into machine language
 (d) None of the above
27. A source program is
 (a) A program written in a machine language
 (b) A program to be translated into machine language
 (c) A machine language translation of a program written in a high level language
 (d) None of the above
28. Stand-alone programs refer to
 (a) Source program
 (b) Object programs
 (c) Executable programs
 (d) None of the above
29. Algorithm and flowchart help us to
 (a) Know the memory capacity
 (b) Identify the base of a number system
 (c) Direct the output to a printer
 (d) Specify a problem completely and clearly
30. The steps in an algorithm
 (a) Must follow a prescribed order
 (b) Need not follow any order
 (c) Will follow a prescribed order sometimes
 (d) Will follow a random order
31. The octal system has the following symbols
 (a) 0, 1, 2, 3, 4 5, 6, 7, 8, 9
 (b) 0, 1, 2, 3, 4, 5, 6, 7
 (c) 0, 1
 (d) 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, f
32. The decimal equivalent of binary number 101 is
 (a) 5 (b) 6 (c) 8 (d) 10
33. Every piece of information is stored in the computer memory in terms of
 (a) Character
 (b) Digits
 (c) Character and digits
 (d) Zeros and ones
34. BCD stands for
 (a) Binary Coded Decimal
 (b) Bits Coded Decimal
 (c) Bytes Coded Decimal
 (d) Binary Coded Data
35. EBCDIC stands for
 (a) Extended Binary Coded Data Interchange Code
 (b) Extended Binary Coded Decimal Interchange Code
 (c) Extended Binary Coded Digits Interchange Code
 (d) Extended Binary Coded Decimal Information Code
36. The decimal equivalent of an octal number 76 is
 (a) 66 (b) 64
 (c) 62 (d) 58
37. EPROM can be used for
 (a) Erasing the contents of ROM
 (b) Reconstructing the contents of ROM
 (c) Erasing and reconstructing the contents of ROM
 (d) Duplicating ROM

38. Which device can understand the difference between data and program?
 (a) Input devices
 (b) Output devices
 (c) Memory
 (d) microprocessor
39. The decimal equivalent of hexadecimal number 4B3 is
 (a) 1200 (b) 1230
 (c) 1203 (d) 1215
40. The sum of the binary number 101 and 1101 is
 (a) 10110 (b) 10010
 (c) 10101 (d) 10100
41. The symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, f belongs to
 (a) Decimal system
 (b) Octal system
 (c) Hexadecimal system
 (d) None of the above
42. The octal equivalent of a decimal number 65 is
 (a) 111 (b) 101
 (c) 100 (d) 110
43. Memory unit is one part of
 (a) Input device
 (b) Control unit
 (c) Output device
 (d) Central processing unit
44. The programs which are as permanent as hardware and stored in ROM is known as
 (a) hardware (b) software (c) firmware (d) ROM ware
45. The hexadecimal equivalent of a decimal number 740 is
 (a) 2EB (b) 2EC
 (c) 2ED (d) E2D
46. Evaluate $111101_2 - 10010_2$
 (a) 101110_2 (b) 111010_2
 (c) 110101_2 (d) 10101_2
47. The primary units of computer are
 (a) Input, output, CPU, auxiliary storage unit
 (b) Input, output, CPU
 (c) Input, CPU, auxiliary storage unit
 (d) Input, output, memory
48. The octal equivalent of a binary number 01001 is
 (a) 51 (b) 22 (c) 11 (d) 12
49. 1 MB is equivalent to
 (a) 2^{20} bytes (b) 2^{10} bytes
 (c) 2^{40} bytes (d) 2^8 bytes
50. The hexadecimal equivalent of a binary number 10011010 is
 (a) 9A (b) A9
 (c) B9 (d) 9B

KEY

- | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|
| 1) c | 2) a | 3) d | 4) a | 5) c | 6) d | 7) c |
| 8) b | 9) a | 10) c | 11) b | 12) a | 13) b | 14) b |
| 15) b | 16) a | 17) b | 18) b | 19) a | 20) c | 21) b |
| 22) c | 23) b | 24) d | 25) d | 26) a | 27) b | 28) c |
| 29) d | 30) a | 31) b | 32) a | 33) d | 34) a | 35) b |
| 36) c | 37) c | 38) d | 39) c | 40) b | 41) c | 42) b |
| 43) d | 44) c | 45) a | 46) d | 47) a | 48) c | 49) A |
| 50) a | | | | | | |

Communication Ability

ICET-2012 Choose the Correct Answer:

1. A coaxial cable to which a number of computers are connected is known as **Answer:3**
(1) Multistrand wire (2) Jelly filled cable (3) Ethernet (4) LAN
2. The system of transforming data into codes that are meaningless to anyone who does not possess the system for recovering initial data is
Answer:4
(1) Cryogenic (2) Modulation (3) Quantization (4) Cryptography
3. An electronic device that allows a single communication channel to carry simultaneous data from many terminals is called **Answer:1**
(1) multiplexer (2) microprocessor (3) modulator (4) expert system
4. Short term advance provided by a bank to a current account holder is called **Answer:3**
(1) Demand Draft (2) Hand loan (3) Over draft (4) Margin money
5. The organization which enables multilateral trade among countries is called **Answer:2**
(1) World Bank (2) World Trade Organization
(3) United Nations Organization (4) International Court
6. The advent of mass production is ascribed to the period of **Answer:4**
(1) Second World War (2) Internet era (3) Copper age (4) Industrial Revolution
7. Compared with a manual system, in a computer system **Answer:2**
(1) basic internal control objectives change.
(2) the methodologies for implementing control change.
(3) control objectives are more difficult to achieve. (4) internal control principles change.
8. The logical organization of data in a database is called **Answer:2**
(1) structure (2) schema (3) algorithm (4) legacy
9. 10 year Redeemable Bonds means that at the end of the stipulated years the Bond **Answer:2**
(1) is written off (2) amount is paid and settled
(3) gets converted into shares (4) can be pledged in a bank
10. Market value of Mutual Fund is expressed as **Answer:4**
(1) Rupees per share (2) Rupees per script
(3) Gross value in rupees (4) NAV in rupees

ICET-2012 Choose the Correct Answer:

1. The passive form of the sentence "She saw you and him." is **Answer:1**
(1) You and he were seen by her. (2) You and him were seen by her.
(3) You and him had been seen by her. (4) You and him were being seen by her.

2. Kamala: "Look, would you mind very much if I went out for a few minutes to make a

phone call? It is rather important.”

Krishna: “No, you go ahead.”

Answer:2

Krishna’s answer implies that he is

- (1) angry (2) understanding (3) frustrated (4) apologetic

3. A: “Why do you always behave like a dog in the manger?”

Answer:1

B: “I don't know. It's just my nature, I guess.”

‘A’ implies that ‘B’ is

- (1) a spoilsport (2) rude (3) aggressive (4) uncouth

4. A: “Would you like a cup of coffee?”

Answer:1

B: “If you say so.”

‘B’ is

- (1) indifferent (2) eager (3) casual (4) pleased

5. “Brooding over past failures, he decided to commit suicide.”

Answer:4

The sentence implies that

- (1) suicide was dear to him. (2) his failures were broad.
(3) one should erase all memories, good or bad.
(4) the thought of his past failures led to his decision.

6. A: “I saw red when he put the blame on me.”

B: “I understand you weren’t driving the car when the accident happened.”

‘A’ is

- (1) angry (2) annoyed (3) furious (4) resentful

7. “The man was a square peg in a round hole.”

Answer:3

The speaker implies that the man was

- (1) a loner (2) a recluse (3) a misfit (4) a bore

ICET-2012 Fill in the blank with the appropriate phrase / verb / preposition:

1. I _____ five languages.

Answer:1

- (1) know (2) am knowing (3) known (4) knowing

1. He was desperate _____ a job.

Answer:1

- (1) for (2) on (3) at (4) about

1. _____ our advertised programme, we will be showing a film.

Answer:4

- (1) In regard to (2) In spite of (3) On behalf of (4) In place of

1. He has five children _____ on his meagre salary.

Answer:1

- (1) to look after (2) to look at (3) to look to (4) to look for

2. He _____ me at chess yesterday.

Answer:2

- (1) bet (2) beat (3) bait (4) beat-up

1. Their house is hidden _____ the trees. **Answer:2**
 (1) among (2) by (3) with (4) on
1. Live _____ your means. **Answer:2**
 (1) without (2) within (3) from (4) on
5. _____ you change your mind, let us know. **Answer:4**
 (1) Could (2) Might (3) Would (4) Should

ICET-2012 Read the following passage and answer the five questions.

Philosophy in the East is an art of life and way of living. The proper aim of philosophy in according to the Indian mind, is not to obtain knowledge for its own sake but for the sake of making life better. Philosophy in the soil of India is a personal attitude towards life and the universe. To philosophise is not merely to read and know philosophy; it is also to think philosophically. Philosophy begins in wonder, doubt and curiosity. It grows out of our developing awareness of the problems of human existence. Philosophy does not shrink from facing the difficult and unsolved problems of our life. There are certain perennial problems which interest mankind and for which philosophers have sought answers. Philosophy is primarily concerned with the soul, God, immortality, world, knowledge and similar other problems, which again owe their solutions to the proper estimate of life. Many questions, however, have been answered only tentatively, and many problems remain unsolved.

1. What is the meaning of 'perennial' ? **Answer:2**
 (1) momentary (2) everlasting (3) temporary (4) short-lived
2. How can problems be solved ? **Answer:2**
 (1) by proper evaluation (2) by meditating
 (3) by acknowledging them (4) by transcending them
3. How does one become philosophical? **Answer:4**
 (1) through reading (2) through discussion
 (3) through writing (4) through knowledge of the complexities of life
4. Why is the study of philosophy valuable? **Answer:1**
 (1) It adds wisdom to one's life. (2) It deals with spirituality.
 (3) It deals with the problems of life. (4) It provides answers to all problems.
5. What is the aim of philosophy in the East? **Answer:2**
 (1) learning (2) self-realisation
 (3) material gain (4) professional advancement

ICET-2012 Read the following passage and answer questions :

Although languages have come into existence and died away throughout human history, it was only in the 1990s, following the publication of a series of worldwide surveys, that people began to notice that the rate of disappearance was significantly increasing. The thrust of these facts is easy to summarise: of the 6,000 or so languages in the world, it seems probable that about half of these will disappear in the course of the present century. It is a rate of loss unprecedented in recorded history.

The impact of dominant languages on minority languages is a matter of universal concern, and the role of English is specially implicated. The growth of English as a global language is not the sole factor in explaining language endangerment. Although it is English that has been the critical factor in the disappearance of languages in such parts of the world as Australia and North America, this language is of little relevance when we consider the corresponding losses that have taken place in South America or in many parts of Asia, where such languages as Spanish, Portuguese, Russian, Arabic and Chinese have replaced local languages.

Languages die. A language lives on, after the last native speaker dies, only if it has been written down or recorded in some way. At the turn of the millennium, some 2000 languages had still not been documented. When one of these languages disappears, the consequences are truly catastrophic. When people die, they leave signs of their presence in this world, in the form of their dwelling places, burial mounds and artifacts - in a word, their archaeology. But, spoken language leaves no archaeology. When a language dies which has never been documented, it is as if it has never been.

1. Which of the following statements is true?

Answer:2

- (1) A language is not documented by the native speakers.
- (2) A language continues to live if it has been documented.
- (3) Native speakers do not allow other languages to dominate their language.
- (4) English has dominated all languages in the world.

2. What is the disadvantage of spoken language?

Answer:3

- (1) It will certainly die.
- (2) It cannot survive the onslaught of other languages.
- (3) It leaves no trace when it dies.
- (4) Native speakers find it difficult to remember it.

3. What will happen by the end of the present century?

Answer:4

- (1) The number of languages will be 3000.
- (2) The number of languages will be less than 3000.
- (3) The number of languages will be more than 3000.
- (4) The number of languages may be about 3000.

4. What does 'catastrophic' mean?

Answer:1

- (1) Causing a lot of damage
- (2) Causing a lot of anger
- (3) Causing a lot of annoyance
- (4) Causing a lot of disturbance

5. What is the author's view about the languages of the world?

Answer:3

- (1) People are unaware of the dying languages.
- (2) People were unaware of the dying languages.
- (3) People have been aware of the dying languages
- (4) People thought that languages did not die.

ICET-2012 Read the following passage and answer questions :

So now let's talk about how discipline relates to self-esteem. In studies of children, Coopersmith found that power and withholding affection were associated with children who demonstrated low self-esteem, but management techniques were associated with children who exhibited high self-

esteem. So it seems that parents should use physical punishment and withholding of affection with caution, right? Well, most psychologists oppose physical punishment for children under the age of 2, and some psychologists believe that discipline should be achieved without any physical punishment for children of all ages, referencing the fact that discipline means 'to teach' whereas punishment means 'to harm'. Anyway it's generally agreed that reinforcement of good behaviour is more effective than waiting for bad behaviour that requires punishment. But when discipline is necessary, setting limits with negative consequences that are consistently enforced seems to promote healthy development of self-esteem in children, especially when these management techniques are supplemented with approval, attention, and affection. I mean, when parents try to catch their children in the act of doing something right and use that as a basis for positive reinforcement of their behaviour.

1. To 'discipline' one, one has to **Answer:3**
 (1) punish (2) harm (3) teach (4) catch the children doing wrong
2. As against waiting for bad behaviour that requires punishment, one is advised to **Answer:2**
 (1) teach good behaviour (2) reinforce good behaviour
 (3) set limits for negative consequences (4) shower affection
3. Physical punishment for children below the age of two is opposed by **Answer:3**
 (1) all psychologists (2) some psychologists (3) most psychologists (4) all parents
4. To help healthy development of self-esteem in children, **Answer:4**
 (1) discipline is not necessary. (2) punishment is to be avoided totally.
 (3) teaching is enough. (4) use positive reinforcement when they do something right.
5. The study of Coopersmith found that low self-esteem associated with children is due to **Answer:2**
 (1) enforcement of discipline (2) power and withholding of affection
 (3) teaching process (4) management techniques

ICET-2012 Choose the correct meaning for the word given :

1. pecuniary **Answer:1**
 (1) relating to money (2) relating to odd behaviour
 (3) relating to diseases (4) relating to attitude
2. gingerly **Answer:1**
 (1) carefully (2) made of spice (3) lightly (4) quickly
3. expedient **Answer:1**
 (1) appropriate (2) advisable (3) quicken (4) dismiss
4. trill **Answer:4**
 (1) fall (2) run (4) cut (4) sing
5. stalemate **Answer:2**
 (1) movement (2) standstill (3) attitude (4) accustomed

6. haggard **Answer:1**
(1) exhausted (2) worried (3) sad (4) gloomy

ICET-2012 Fill in the blank choosing the correct word :

1. The van and the car _____ head-on in the dark. **Answer:1**
(1) collided (2) colluded (3) collated (4) collocated
2. During the Emergency, the Prime Minister _____ any opposition by implementing martial law. **Answer:2**
(1) postponed (2) pre-empted (3) defied (4) greeted
3. We face the _____ prospect of still higher unemployment. **Answer:2**
(1) grimy (2) grim (3) grilling (4) garish
4. The _____ marathon walk lasted for ten weary hours. **Answer:4**
(1) gory (2) grand (3) gruesome (4) gruelling

ICET - 2011: Choose the correct meaning for the word given ;

1. Contiguous **Answer:2**
(1) Infectious (2) Adjoining (3) Unlawful (4) Prohibitive
2. Homogeneous **Answer:3**
(1) Treated milk (2) Human beings and animal groups
(3) Parts or people of similar type (4) Words spelt similarly but having different meanings
3. Insatiable **Answer:1**
(1) Unable to be satisfied (2) Not complete (3) Fulfilled (4) Covetous
4. Knick-knack **Answer:2**
(1) Game (2) Small ornament (3) Knock (4) Snack
5. Haughty **Answer:2**
(1) Sportive (2) Disdainful (3) Naughty (4) Disconcerted
6. Grandiloquent **Answer:4**
(1) Grand plans (2) Great future (3) Exaggerate (4) Pompous

ICET - 2011: Fill in the blank choosing the correct word :

1. When the accident happened, the car was speeding down the _____ highway. **Answer:4**
(1) depraved (2) deprived (3) dislocated (4) deserted

2. He was _____ from the country when his visa expired. **Answer:3**
(1)repatriated (2) migrated (3)deported (4) exported

3. The three countries have signed a _____ pledging to work together in the health scheme. **Answer:3**
(1)memorial (2) memorabilia (3)memorandum (4) memoir

4. The judge promised to _____ the injustice done to him. **Answer:3**
(1)remove (2) abolish (3) redress (4) compensate

ICET - 2011 Choose the correct answer :

1. A deed is **Answer:3**
(1) any written matter. (2) a draft of annulment. (3) a legal document. (4) a present.

2. The concept of 'gangplank' implies **Answer:3**
(1) doing things through proper channels, (2) decentralising things.
(3) defying established hierarchy. (4) clinging to a tyrannical authority.

3. Job specific tests that are designed to predict the potential of an individual to perform tasks are called **Answer:2**
(1) personality tests. (2) aptitude tests. (3) intelligence tests. (4) verbal ability tests.

4. A section of a Government department in charge of a particular activity **Answer:4**
(1) diocese. (2) compartment. (3) collegium. (4) wing.

5. 'Benchmarking' is **Answer:3**
(1) increasing sales. (2) obtaining a brand mark.
(3) setting a standard for performance. (4) opting out of competition.

6. HTML means **Answer:2**
(1) Hyper Text Modern Language. (2) Hyper Text Markup Language.
(2) Hyper Text Modem Language. (4) Hyper Text Machine Language.

7. The installation wizard in Windows cannot **Answer: 1 OR 2**
(1) perform automatic search. (2) install hardware.
(3) guide through screens. (4) do quick installation.

8. GPS refers to **Answer:2**
(1) Geo-Positioning System (2) Global Positioning System
(3) Geo-Processing System (4) Global Pointing System

9. Which of the following is not an input device ? **Answer:1**
(1) Printer. (2) Light pen (3) Keyboard (4) Scanner

10. The technique of creating a series of graphic frames to give an appearance of continuous movement is called **Answer:2**
(1) booting (2) animation (3) diode (4) graphics

ICET - 2011 Choose the correct answer:

1. A: I'm terribly sorry, John. I forgot your birthday. I don't know how it slipped my mind.
B: That's O.K. I was disappointed though. I know you were very busy last week.

In this conversation, the speaker B is **Answer:4**
(1) apologetic (2) angry (3) disappointed (4) understanding.

2. "Had they built a house of their own, they would not have been on the road today" means **Answer:4**
(1) they have built a house of their own.
(2) they are not on the road today.
(3) they have not built a house of their own but they are not on the road today.
(4) they have not built a house of their own and so they are on the road today.

3. A: Remember to wear your safety belt in the car.

B: Should I? Forget it. B's reply shows that he is **Answer:4**
(1) carefree. (2) full of care. (3) callous. (4) careless.

4. The passive form of the sentence, "Do not beat anybody" is **Answer:1**
(1) Let nobody be beaten by you. (2) You shall not beat anybody.
(3) Do not be beaten by anybody. (4) Nobody is beaten by you.

5. He was pushed to the wall and so he had to resign the membership of the party. **Answer:3**

The sentence implies that he was
(1) in a happy position. (2) pinned to the wall.
(3) in a desperate position. (4) confined to a cell.

6. "Sudheer is the last person I'd trust with a secret" means **Answer:2**
(1) Sudheer is the most suitable person to share a secret with.
(2) Sudheer is the least suitable man to share a secret with.
(3) Sudheer is not an unreliable person.
(4) Sudheer is a troubleshooter.

7. I don't like to play second fiddle to anyone. The speaker does not want to **Answer:1**
(1) play a supporting role. (2) play the lead role.
(3) play others' fiddles. (4) borrow anybody else's fiddles.

ICET - 2011 Fill in the blank with the appropriate phrase/verb/ preposition:

1. It's time you put pen _____ paper and replied to the CEO's letter. **Answer:1**
(1) to (2) on (3) and (4) at

2. Doesn't he _____ his father? **Answer:2**
(1) take back (2) take after (3) take up (4) take in

3. He did not know the answer. _____ . **Answer:1**
(1) Neither did I (2) Either did I (3) Neither have I (4) Either have I
4. I'm sorry he disobeyed instructions. I'll take him _____ when he gets back. **Answer:3**
(1) after (2) amiss (3) apart (4) back
5. Wage increase must be commensurate with the pressures of **Answer:1**
(1) inflation (2) depression (3) deflation (4) bureaucratisation
6. The company is forging _____ with its plans for expansion. **Answer:2**
(1) forward (2) ahead (3) on (4) through
7. In the end, it all _____ a question of trust. **Answer:4**
(1) gets round to (2) adds up to (3) feels up to (4) comes down to
8. Despite our disagreements, we have been able to _____ an accord. **Answer:4**
(1) reach (2) locate (3) find (4) strike

ICET - 2011 Read the following passage and answer questions .

Museums must make their collections accessible. In the past, this simply meant packing them into display cases, often with wordy labels that made little concession to the lay person. Nowadays, accessibility should demand more than this. Displays can be lively and interesting, making the best use of theatrical or architectural techniques to capture the visitor's attention and perhaps stimulate emotional response. But museums should be about more than their displays. They should make their collection accessible to the widest possible community. The provision of loan boxes of objects for class teachers is one known example of this, and recently this principle has been extended by some museums so that similar material is made available for use in treating elderly people who are losing their memory.

Museums concern themselves with 'artifacts and specimens' - not replicas. They exist to facilitate an encounter with authenticity. They present items that actually existed - were used - had meaning - at some historical time. This is a great strength and is what distinguishes them from heritage centres and theme parks, books and C.D. ROMs. Museums which rise to the challenge, which this distinction implies, and provide exciting and accessible displays, catalogues and outreach programmes, will find that their apparent competitors in 'virtual history' are in fact their allies, stimulating an appetite for the 'real thing' that museums are uniquely placed to satisfy.

1. According to the passage, museums must make their collections accessible to **Answer:4**
(1) lay persons. (2) buyers. (3) researchers. (4) general public.
2. "But museums should be about more than their displays". This statement means: **Answer:1**
(1) They should go beyond their visuals.
(2) They should have more space for their collections.
(3) They should have wordy labels.
(4) They should have more displays.

3. Museums are different from heritage centres, theme parks, books and CD-ROMs because they deal with **Answer:3**

- (1) exciting objects. (2) replicas. (3) original objects. (4) modern objects.

4. According to the passage, the “provision of loan boxes of objects” helps museums ____

Answer:4

- (1) become popular (2) serve society
(3) get publicity (4) make objects accessible to more people

5. The “real thing” refers to

Answer:1

- (1) authentic displays. (2) catalogues
(3) outreach programmes. (4) virtual displays.

ICET - 2011 Read the following passage and answer the questions :

A stamp is, to many people, just a slip of paper that takes a letter from one town or country to another. They can't understand why stamp collectors find so much pleasure in collecting them and how we find time to indulge in our hobby. To them it seems a waste of time, effort and money. But, they do not realise that many find the effort worthwhile and many who, if they did not spend their time collecting stamps, would spend it less profitably. In our leisure hours what better occupation is there to keep us out of mischief than that of collecting stamps? An album, a packet of hinges, a new supply of stamps, and the time passes swiftly. Stamp-collecting has no limits and a collection never has an end; countries are always issuing new stamps to celebrate coronations, great events, anniversaries and deaths. And the fascination of collecting is in obtaining these stamps before one's rivals. Every sphere of stamp collecting has its fascination - receiving letters from distant countries and discovering old stamps in the leaves of dusty old books. A stamp itself has a fascination all its own. Gazing at its little picture we are transported to the wilds of Congo, the homes of the Arabs, and the endless tracks of the Sahara desert. There is a history in a stamp. The ancient Roman Empire and the Constitution of America, India's Independence and the Allied Victory, are all conveyed to our mind's eye through stamps. We see famous men - printers, writers, scientists, soldiers, politicians - and famous incidents. Stamps, so small and minute, contain knowledge that is vast and important.

1. Stamps take us through

Answer:2

- (1) albums (2) history (3) old books (4) dusty books

2. Stamp collection profits one to

Answer:2

- (1) kill time (2) keep out of mischief.
(3) get fascinated with pictures. (4) become complacent.

3. A stamp has

Answer:1

- (1) an inherent fascination. (2) only official value.
(3) no fascination at all. (4) no historical value.

4. The journey of a stamp is into

Answer:1

- (1) the past. (2) the world of futile fantasy.

(3) the world of savagery.

(4) the mazes of the future.

5. The passage is a contemplation on

Answer:2

(1) stamps and their ignominious history.

(2) the usefulness of collecting stamps.

(3) the competition in collecting stamps.

(4) stamp vendors.

ICET - 2011 Read the following passage and answer questions :

How do you understand multiple intelligences? In 1983, Howard Gardner, a Harvard University Professor, developed a theory called Multiple Intelligences. In his book Frames of Mind, he outlines seven intelligences that he feels are possessed by everyone: visual/spatial, verbal/linguistic, musical/rhythm, logic/math, body/kinesthetic, interpersonal and intrapersonal. In 1996, he added an eighth intelligence : naturalistic. In short, if you have ever done things that come easily for you, you are probably drawing on one of your intelligences that is well developed. On the other hand, if you have tried to do things that are very difficult to master or understand, you may be dealing with material that calls on one of your less developed intelligences. If playing the Piano by ear comes easily to you, your musical/rhythm intelligence may be very strong. If you have trouble writing or understanding poetry, your verbal/linguistic intelligence may not be as well developed. This does not mean that you will never be able to write poetry : it simply means that you have not fully developed your skills in this area.

1. How many intelligences does Gardner speak about?

Answer:1

(1) Eight

(2) Seven

(3) Multiple

(4) innumerable

2. Inability to perform a certain task indicates lack of

Answer:2

(1) spatial intelligence.

(2) task-related intelligence.

(3) naturalistic intelligence.

(4) interpersonal intelligence.

3. What does “Kinesthetic” mean?

Answer:2

(1) Dynamic

(2) Sensory

(3) Flexible

(4) Musical

4. What type of intelligence do people who can think in pictures have?

Answer:4

(1) Musical

(2) Naturalistic

(3) Linguistic

(4) Visual

5. What does trouble in understanding poetry mean?

Answer:4

(1) You are not a master of vocabulary.

(2) You failed to visualise a picture.

(3) You don't have kinesthetic intelligence.

(4) You have not developed this special skill.

To
The Secretary,
APSCHE,
Huderabad.

Sir

Sub:Submission of certificates of the two not approved cadidates.

Ref:Procds.No.APSCHE/Secy/Approval/EdCET-2012/B.Ed/OU-70;

Dt:02.03.13

I, M.Rama Koti Reddy, principal, Millennium College of Education, Andhra Bank Complex, Main Road, Sangareddy, Medak(Dist), here by submitting the certificates of the two Candidates of our college who were not approved by you stating that the certificates of two candidates certificates were not enclosed for approval of Category 'B' seats at the time of submission for approval.Sir you have approved 23 Candidates of our college .The names of two not approved Candidates are as follows.

1.Name: M.Prabhavathi D/o M. Balaiah --- Bio-Science Methodology.

2.Name:G.Jyothi Laxmi D/o Narayana --- Social Studies Methodology.

I am enclosing the certificates of these two candidates and also the xerox copy of 23 Candidates approved list send by you to our college along with this letter .Kindly do the needful.

Thanking you sir.

Yours faithfully

ICET – 2023
26th May 2023 Shift 1

ANALYTICAL ABILITY

Data Sufficiency

Note: In questions 1 to 20, a question is followed by data in the form of two statements labelled as (I) and (II). You must decide whether the data given in the statements are sufficient to answer the question. Using the data make as appropriate choice from (1) to (4) as per the following guidelines.

- (a) Mark choice (1) if the statement (I) alone is sufficient to answer the question, but (II) does not answer the question*
- (b) Mark choice (2) if the statement (II) alone is sufficient to answer the question, but (I) does not answer the question*
- (c) Mark choice (3) if both the statements (I) and (II) are sufficient to answer the question, but neither statement alone is sufficient.*
- (d) Mark choice (4) if both the statements (I) and (II) together are not sufficient to answer the question, and additional data is required.*

1. What is the third term of that geometric progression?
(I) The fifth term of that geometric progression is 32.
(II) Product of the first five terms of that geometric progression is 1024.
2. What is the value of $\sin \theta$?
(I) $\cos \theta = \frac{4}{5}$
(II) $\tan \theta$ is negative
3. What is the value of x ?
(I) $x + y = 24$.
(II) $x^2 + y^2 = 2^{96}$
4. Is $b > a$?
(I) $x + 3$ is a factor of $x^6 - 27^b$
(II) $x - 2$ is a factor of $x^2 - 4a^b$
5. What is the angle subtended by the sector at the centre of the circle?
(I) Perimeter of the sector is 16 cm
(II) Arc length of the sector is 10 cm
6. What is the median of the integers in set S consisting of six integers?
(I) Range of the set is 40
(II) Arithmetic mean of the integers in S is 15

7. Is $x + y > 0$?
 (I) $2\log_{10} x + 2\log_{10} y = 10$
 (II) $\log_y x = 0$
8. Is x a perfect square of an integer?
 (I) x leaves remainder 2 when divided by 4
 (II) x leaves remainder 1 when divided by 4
9. If a, b, c are real numbers, are the roots of the quadratic equation $ax^2 + bx + c = 0$ ($a \neq 0$) imaginary?
 (I) $a + c > 0$
 (II) $a.c < 0$
10. If A, B are two sets such that $n(A \cup B) = 75$, then what is the number of elements in the set $A \cap B$? (Here $n(S)$ denotes the number of elements in the set S)
 (I) $n(A) = 60$
 (II) $n(B) = 50$
11. What is the average of the real numbers $a + 7, b - 3, c + 14, d - 5$?
 (I) $a - b + c - d = 0$
 (II) $a + b + c + d = 63$
12. What is the ratio of the areas of a circle and a square?
 (I) The radius of the circle is 4 cm
 (II) The circle circumscribes the square
13. What is the rate of simple interest?
 (I) Principal is Rs.1000
 (II) Amount in 3 years Rs.1195
14. What is the profit / loss percent earned / incurred by selling an article for Rs.24000?
 (I) The difference between the cost price and the selling price of the article is Rs.9600
 (II) The ratio of the selling price to the cost price of the article is 5 : 3.
15. If the person M, N, D, P and K are arranged in the decreasing order of their earnings, then who is the last but one among them?
 (I) M earns more than P who earns less than K .
 (II) N earns more than M and P but less than only D
16. How many sons does the person P have?
 (I) S and T are brothers of M .
 (II) The mother of T is P and P has only one daughter?
17. Among six persons A, B, C, D, E, F who is the tallest person?

- (I) A is shorter than only two persons. E is taller than F and shorter than C . C is shorter than A and B is shorter than D .
- (II) C is taller than only two persons. B is taller than A and E is taller than F only.
18. What is the value of $\frac{(x+y+z)^2}{x^2+xy+y^2}$?
- (I) $x : y = 3 : 4$
- (II) $y : z = 3 : 4$
19. Five persons A, B, C, D and E are sitting along a circular table facing the centre. Who is sitting to the immediate left of D ?
- (I) C is sitting second to the left of A . B and D are immediate neighbours of each others.
- (II) D is sitting to the immediate left of B . E is not an immediate neighbour of D and B .
20. How is A related to B ?
- (I) C is a brother of B
- (II) A is a daughter of C

Problem Solving

(a) Series

In the question 21-30, each contains two pairs of groups (of letters or letters and numbers). The pattern that appears in one pair should be followed by the other pair also. Observe the pattern carefully and fill in the blanks appropriately.

21. DBCE : QOPR :: JLKI : _____
 (1) WXYV (2) WYVX (3) WYXV (4) YWXU
22. RING : 57 :: PUSH : _____
 (1) 85 (2) 80 (3) 75 (4) 70
23. 624 : 48 :: 736 : _____
 (1) 126 (2) 174 (3) 182 (4) 198
24. $2^2 3^3 : 12 :: 4^3 7^3 : \underline{\hspace{2cm}}$
 (1) 18 (2) 27 (3) 16 (4) 12
25. BC(0503) : DE(0706) :: GH(1009) : JM(_____)
 (1) 1312 (2) 1510 (3) 1512 (4) 1310
26. ENGLISH : 130 :: SANSKRIT : _____
 (1) 125 (2) 137 (3) 148 (4) 151
27. 4DH : 12LP :: _____ : 14NR

- (1) 13DQ (2) 14ER (3) 6FJ (4) 6GI
28. 144 : 20736 :: 288 : _____
 (1) 82941 (2) 82942 (3) 82943 (4) 82944
29. RSab : STcd :: _____ : UVxy
 (1) TUvw (2) VWwx (3) WXxz (4) WXYa
30. 257 : G :: 879 : _____
 (1) J (2) K (3) L (4) M

Note: In the question numbered 31 to 35 pick the odd thing out.

31. 15, 35, 143, 323, 437, 899, 1763
 (1) 143 (2) 323 (3) 437 (4) 899
32. $x^2 - 8x + 15$, $x^2 - 12x + 35$, $x^2 - 18x + 77$, $x^2 - 24x + 143$, $x^2 - 36x + 323$, $x^2 - 60x + 899$, $x^2 - 84x + 1763$
 (1) $x^2 - 84x = 1763$ (2) $x^2 - 36x = 323$ (3) $x^2 - 24x + 143$ (4) $x^2 - 18x + 77$
33. 125, 343, 729, 1331, 2197, 4913, 6859
 (1) 4913 (2) 1331 (3) 729 (4) 125
34. Crowd, Union, Swarm, Team, Flock, Throng
 (1) Crowd (2) Flock (3) Team (4) Swarm
35. 71, 73, 79, 83, 87, 89, 97
 (1) 73 (2) 83 (3) 87 (4) 97

Note: Each of the questions from 36 to 45 follows a definite pattern. Observe the same and fill in the blanks with suitable ones.

36. $66\frac{2}{3}$, 50, 40, $33\frac{2}{6}$, $28\frac{4}{7}$, _____, $22\frac{2}{9}$, 20
 (1) 27 (2) 26 (3) 25 (4) 24
37. 500, $333\frac{1}{3}$, 200, $142\frac{6}{7}$, $90\frac{10}{11}$, $76\frac{12}{13}$, _____
 (1) $67\frac{13}{15}$ (2) $58\frac{14}{17}$ (3) $63\frac{8}{15}$ (4) $55\frac{13}{17}$
38. 0, 4, 18, 48, 100, _____, 294, 448
 (1) 160 (2) 180 (3) 210 (4) 214
39. 1, 5, 14, 30, _____, 91, 140
 (1) 45 (2) 55 (3) 65 (4) 75

40. 1, 6, 20, 56, 144, _____, 832, 1920
 (1) 352 (2) 496 (3) 532 (4) 768
41. $\frac{1}{3}, -\frac{1}{6}, -\frac{2}{3}, -1\frac{1}{6}, -1\frac{2}{3}, \text{_____, } -2\frac{2}{3}, -3\frac{1}{6}$
 (1) $-2\frac{1}{6}$ (2) $-2\frac{1}{4}$ (3) $-2\frac{1}{3}$ (4) $-2\frac{1}{2}$
42. 23, 20, 14, 5, ____, -22, -40
 (1) -7 (2) -9 (3) -19 (4) -12
43. $4\frac{1}{2}, 8\frac{1}{3}, 9\frac{4}{5}, 17\frac{2}{7}, \text{_____, } 22\frac{3}{13}, 21\frac{4}{17}$
 (1) $15\frac{4}{11}$ (2) $18\frac{3}{11}$ (3) $19\frac{5}{11}$ (4) $21\frac{7}{11}$
44. 7, 13, 31, 57, 133, ____, 307
 (1) 183 (2) 227 (3) 251 (4) 279
45. 1, 4, 12, 32, 80, 192, _____
 (1) 264 (2) 324 (3) 448 (4) 542

(b) Data Analysis

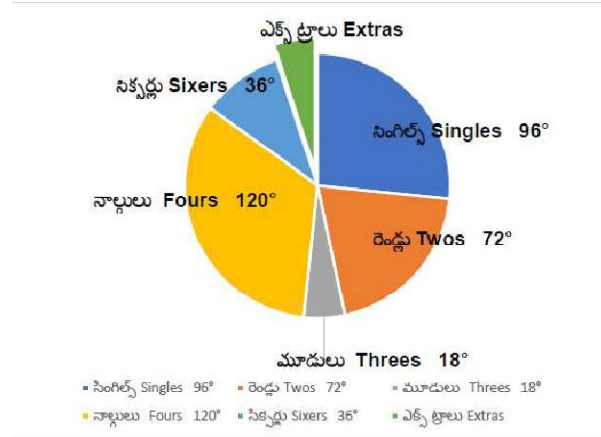
A candidate is expected to calculate the missing value if it is required to answer the question. On the basis of the given information answer to the question from 46 to 48.

Year	State M		State N	
	Number appeared	% of candidates qualified	Number appeared	% of candidates qualified
2018	320	60	640	55
2019	420	-	500	-
2020	350	50	-	65
2021	-	40	550	40
2022	-	55	400	29

46. If the average number of qualified candidates from State M in 2018, 2019, 2020 is 180. What is the average number of qualified candidates from State M. in 2019?
 (1) 173 (2) 169 (3) 177 (4) 167
47. If the representative ratio between the number of qualified candidates from State N in 2018 and 2019 is 11 : 7, what is the number of qualified candidates from State N in 2019?
 (1) 196 (2) 210 (3) 252 (4) 224

48. The number of appeared candidates from State M increased by 100% from 2021 to 2022. If the total number of qualified candidates from State M in 2021 and 2022 together is 405, what is the number of appeared candidates from State M in 2021?
- (1) 360 (2) 330 (3) 270 (4) 250

The given Pie-chart shows the scoring / run pattern of a cricket team in an innings score of 540 runs. Based on the data shown in the chart, answer the questions 49 to 51.



49. The number of extra runs included in the score is
- (1) 24 (2) 26 (3) 27 (4) 36
50. How many sixers are hit in the innings?
- (1) 54 (2) 36 (3) 18 (4) 9
51. The number of twos in the innings is
- (1) 54 (2) 64 (3) 72 (4) 108

Questions Numbers: (52 to 55) In a school of 250 students, 78 play cricket, 83 play hockey, 97 play football, 41 play both cricket and hockey, 53 play hockey and football, 37 play football and cricket and 27 play all the 3 games. Based on the information answer the questions from 52 to 55.

52. The number of students who play a single game is
- (1) 77 (2) 87 (3) 97 (4) 107
53. The number of students who do not play any of the three games is
- (1) 108 (2) 102 (3) 96 (4) 90
54. The number of students who play exactly two games is
- (1) 75 (2) 67 (3) 63 (4) 50
55. The number of students who play hockey or football or both is
- (1) 43 (2) 120 (3) 127 (4) 180

Question Numbers : (56 to 60)

(c) Coding and Decoding Problems

The letters of English alphabet taken in order are arranged around a circle in clock wise direction and are coded as per the following guidelines:

- 1. A vowel is coded as the second vowel from it taken in the anti-clockwise direction*
- 2. A consonant is coded as the fifth consonant from it taken in the anti-clockwise direction*
- 3. For decoding the reverse process is to be followed.*

Using the coding and decoding process answer the questions from 56 to 60.

56. What is the code for ICET?
(1) AXUN (2) EHUO (3) AHUN (4) AWUN
57. The string of letters that is coded as FAIL is
(1) LIRU (2) YOIL (3) LIUR (4) YOFI
58. NEIZB is a code of the word
(1) TOUGH (2) TONES (3) TOURS (4) TOUCH
59. The string of letters that is coded as LOVELY is
(1) RAOBRF (2) RABORF (3) QABOUF (4) RAOUFS
60. DOING WELL is coded in this code language as
(1) YIATM RIFF (2) YEASM QIFF (3) XIATN QOFF (4) XEATM QUFF

Using the coding and decoding process answer the questions from 61 to 65.

61. If PLACEMENT is coded in a language as MIXZBJBKQ, then the word that is coded as JLRPB is
(1) MOULD (2) MOUSE (3) MONEY (4) MOPED
62. If HOCKEY is coded as FMAICW, then the code for PENALTY is
(1) NDMZKSW (2) NCLYJRW (3) MBKXIQV (4) MCLYJRV
63. In a certain code the word CALENDER is coded as MCDQDBMF, then in the same code the word EQUATION is coded as
(1) UJPODPTZ (2) UJPOFRVB (3) SHNMFRVB (4) SHNMDPTZ
64. If QUESTION is coded as UYIWXMSR, then the word what is coded as RYQFIV is
(1) SPACES (2) ANSWER (3) NUMBER (4) TSICET
65. In a certain code language COMPUTER is written as RFUVQNP. Then how is MEDICINE written in the same code language?
(1) EOJDEJFM (2) MFEDJJFN (3) EOJDJEFN (4) MEFDJJOE
66. If 16th March 2023 is Thursday, the day on 24th February 2008 is

- (1) Sunday (2) Monday (3) Wednesday (4) Friday
67. If a clock shows 15 minutes past 5 O'clock, then the angle between the hands of that clock is
 (1) $58\frac{1}{2}^\circ$ (2) 64° (3) $67\frac{1}{2}^\circ$ (4) $72\frac{1}{2}^\circ$
68. At which time between 8 O'clock and 9 O'clock, the hours hand and minutes hand coincide is
 (1) 8 hours $41\frac{9}{11}$ min (2) 8 hours $41\frac{7}{11}$ min (3) 8 hours $41\frac{5}{11}$ min (4) 8 hours $41\frac{3}{11}$ min
69. Seetha's father's mother-in-law's only daughter's son is B. How is Seetha related to B?
 (1) Brother (2) Brother-in-law (3) Nephew (4) Sister
70. The departure of a local train at a station is every 45 minutes. A person A arrives at the station and found that the train left 5 minutes ago and the next train is at 7:45 am. What is the arrival time of A at the station?
 (1) 7.00 am (2) 7.05 am (3) 7.10 am (4) 7.15 am
71. Anil reached a meeting place 32 minutes before 10:20 AM and he is 55 minutes earlier to Sunil who was 38 minutes late to that meeting. Then the scheduled meeting time is
 (1) 10.10 am (2) 10.15 am (3) 10.05 am (4) 10.18 am
72. 6 persons A, B, C, D, E, F sit on one side of a long table B and E are immediate neighbours of A . D is between E and F . B is not at the extreme places. Then the person / persons adjacent to C is / are ____
 (1) A, B (2) B (3) D (4) D, F
73. $a * b = (a + b - 1)^2 - 1 \Rightarrow (1 * 2) * (3 * 3) =$
 (1) 675 (2) 575 (3) 371 (4) 71
74. For $a, b \in \mathbb{R}$, define $a \otimes b = 2a - 3b$ and $a \perp b = 3a + 4b$, then $(5 \otimes 1) \perp (3 \otimes 4) =$
 (1) -3 (2) 3 (3) 24 (4) -24
75. Considers the series $E5!6 \neq I4 < OU7?H \sim BLQ \wedge A2G / 1V + 9W - 3$. How many vowels are there that are immediately preceded by a symbol?
 (1) 4 (2) 2 (3) 1 (4) 3

MATHEMATICAL ABILITY

I. ARITHMETICAL ABILITY

76. If $a^x = b^y = c^z$ and $b^3 = ac^2$, then $9xy - 2xz =$
(1) 2 (2) 3 (3) 4 (4) 6
77. If $2^{m^{n^2}} = (2^m)^{n^2}$, then m in terms of n is
(1) 1 (2) $\sqrt{3}$ (3) $n^{\frac{2}{n^2-1}}$ (4) $m^{\frac{n^2-1}{2}}$
78. In a party the ratio of gents and ladies is 2 : 3. If 3 gents left and 3 more ladies joined the party, then the ratio is 1 : 3, then the number of ladies in the party at the end is
(1) 15 (2) 12 (3) 20 (4) 18
79. Two numbers are in the ratio 3 : 5. If 25 is added to both the numbers, then the ratio between them becomes 2 : 3. The smallest of the two numbers is
(1) 65 (2) 75 (3) 25 (4) 45
80. If $x = \frac{\sqrt{3}+1}{\sqrt{3}-1}$ and $y = \frac{\sqrt{3}-1}{\sqrt{3}+1}$, then $x^3 + y^3 =$
(1) 14 (2) 28 (3) 42 (4) 52
81. $\sqrt{11+2\sqrt{7}+2\sqrt{3}+2\sqrt{21}} =$
(1) $1+\sqrt{5}+\sqrt{11}$ (2) $1+\sqrt{5}+\sqrt{7}$ (3) $1+\sqrt{3}+\sqrt{7}$ (4) $1+\sqrt{3}+\sqrt{5}$
82. The least (positive) remainder obtained when 17^{30} is divided by 5 is
(1) 4 (2) 3 (3) 2 (4) 1
83. What is the least number to be added to 4259 to make it a multiple of 35?
(1) 16 (2) 11 (3) 6 (4) 1
84. The least positive integer to be subtracted from 10000, so that remaining number is exactly divisible by 7, 9, 11 is
(1) 79 (2) 158 (3) 298 (4) 437
85. The largest 4-digit that leaves remainder 7 in each case when divided by 36, 60, 96 is
(1) 8767 (2) 8647 (3) 9217 (4) 9837
86. $\left(1+\frac{1}{2}\right)\left(1-\frac{1}{2}\right)\left(1+\frac{1}{3}\right)\left(1-\frac{1}{3}\right)\left(1+\frac{1}{4}\right)\left(1-\frac{1}{4}\right)\left(1+\frac{1}{5}\right)\left(1-\frac{1}{5}\right) =$
(1) $\frac{3}{5}$ (2) $\frac{5}{8}$ (3) $\frac{8}{11}$ (4) $\frac{11}{14}$

87. If $\frac{1}{24}^{\text{th}}$ of a number is subtracted from $\frac{1}{8}^{\text{th}}$ of the same number, we get 210, then that number is
 (1) 5040 (2) 2520 (3) 1260 (4) 630
88. The difference between the largest and the smallest of the following rational number is
 $\frac{13}{18}, \frac{5}{6}, \frac{19}{36}, \frac{6}{11}$
 (1) $\frac{17}{36}$ (2) $\frac{13}{36}$ (3) $\frac{11}{36}$ (4) $\frac{7}{36}$
89. If $77 < x < 123$ and $45 < y < 62$, then the interval in which $x - y$ lies is
 (1) (32, 61) (2) (32, 78) (3) (15, 61) (4) (15, 78)
90. In an election contested by two candidates A and B. A got 68% of the votes and won by 7200 votes. What is the strength of the electorate?
 (1) 17000 (2) 18000 (3) 19000 (4) 20000
91. The population of a city increases constantly at the rate of 5% every year. If the current population of the city is 8379, then the population of the city two years back was
 (1) 7000 (2) 7300 (3) 7600 (4) 7800
92. If the cost price of 20 articles is equal to selling price of 16 articles, then the percentage of profit is
 (1) 15 (2) 20 (3) 25 (4) 30
93. By allowing a discount of 15% on the marked price of an article a dealer gets 20% profit. Then the ratio of marked price to the cost price of that article is
 (1) $\frac{17}{24}$ (2) $\frac{17}{20}$ (3) $\frac{20}{17}$ (4) $\frac{24}{17}$
94. In a business A invests half as much as B and B invests thrice as much as C. At the end of the year. If C gets 52800 as his share in the year end profit, then A's share in the profit, in rupees, is
 (1) 79200 (2) 105600 (3) 24600 (4) 13200
95. Three persons A, B, C started a partnership business in which A invested $\frac{3}{4}$ of the total investment of B and C; and B invested $\frac{1}{3}$ of the total investment of A and C. If the total profit at the end of the year is Rs.17.5 lakhs, then the share of the profit of C (in lakhs of rupees) is
 (1) 5.8 (2) 5.625 (3) 5.275 (4) 5.0

96. Two taps A, B can fill a tank in 15 min. and 20 min. respectively, while tap C can empty it in 30 min. If all the three Taps are opened simultaneously, the how much time (in minutes) it will take to fill the tank.
 (1) 18 (2) 12 (3) 15 (4) 17
97. A cistern has 3 pipes A, B and C. The pipes A and B can fill it independently in 4 and 5 hours respectively, while C can empty a full tank in 2 hour. If the 3 pipes A, B and C are opened at 5 am, 6 am and 7 am respectively, the time at which the cistern will be empty is
 (1) 6 pm (2) 7 pm (3) 8 pm (4) 9 pm
98. Two persons A, B start from the same point at 7 am and move at the rate of 5 kmph and 8 kmph respectively in the opposite directions. Then the time at which they will be 78 km apart is
 (1) 11 am (2) 12 noon (3) 1 pm (4) 2 pm
99. A car travels $\frac{1}{3}$ rd of the journey at 20 kmph, next $\frac{1}{3}$ rd of journey at 40 kmph and the rest of the journey at 60 kmph. If it takes $7\frac{1}{3}$ hours to complete the journey, then the length of the journey, in kms, is
 (1) 240 (2) 210 (3) 180 (4) 150
100. If 15 men can prepare 40 toys in 8 days by working 9 hours a day, then the number of days required for 12 men to prepare 60 toys working 9 hours per day is
 (1) 15 (2) 12 (3) 9 (4) 18

II. ALGEBRAIC AND GEOMETRICAL ABILITY

101. Persons P and Q together can do a piece of work in 18 days, Q and R together can do that work in 24 days, P and R together can do that work in 36 days. The time taken (in days) by P alone to do that work is
 (1) 51 (2) 48 (3) 45 (4) 42
102. Taking $n = \frac{22}{7}$, the perimeter of the sector of a circle of area $38\frac{1}{2} \text{ cm}^2$, that makes an angle 60° at the centre, in cms, is
 (1) $\frac{16}{3}$ (2) $\frac{24}{3}$ (3) $\frac{32}{3}$ (4) $\frac{48}{3}$
103. A rectangle whose length is 5 times its breadth and a square have same perimeter. Then the ratio of their areas, in that order, is
 (1) 5 : 9 (2) 4 : 9 (3) 9 : 5 (4) 9 : 4
104. If the volume of a cuboid whose length, breadth, height are in the ration 4 : 3 : 2 is 648 cm^3 , then the total surface area of that cuboid (in cm^2), is
 (1) 117 (2) 234 (3) 351 (4) 468

105. If the volume of a sphere and a cube are equal, then the ratio of their respective surface area is
 (1) $\sqrt[3]{11}:1$ (2) $\sqrt[3]{11}:\sqrt{21}$ (3) $\sqrt[3]{11}:\sqrt[3]{21}$ (4) $3:7$
106. A road roller is in the shape of a cylinder (horizontal) of radius 25 cm and height 75 cm. Then the area covered by it in 112 revolutions, in m^2 , is (take $\pi = \frac{22}{7}$)
 (1) 99 (2) 132 (3) 66 (4) 198
107. The total surface area of a solid hemisphere of radius 12 cm (in sq. cm.) is
 (1) 144π (2) 288π (3) 432π (4) 576π
108. If the base radius and the height of a cylinder are increased by 20% each, then the percentage increase in its volume is
 (1) 48.75 (2) 72.8 (3) 113.75 (4) 172.8
109. The remainder when 2^{71} is divided by 13 is
 (1) 7 (2) 8 (3) 9 (4) 10
110. The digit in the units place of the number 13^{131} is
 (1) 1 (2) 3 (3) 5 (4) 7
111. If A is the set of all natural numbers from 1 to 100 both inclusive and B is the set of composite numbers in A, then the number of elements in $A - B$ is
 (1) 23 (2) 24 (3) 25 (4) 26
112. If A has 8 elements, then the number of subsets of A, which have at least two elements is
 (1) 254 (2) 247 (3) 124 (4) 510
113.
$$\frac{(x^2 - y^2)^3 (y^2 - z^2)^3 + (z^2 - x^2)^3}{(x - y)^3 + (y - z)^3 + (z - x)^3} =$$

 (1) $x + y + z$ (2) $x^2 + y^2 + z^2$ (3) $x^3 + y^3 + z^3$
 (4) $(x + y)(y + z)(z + x)$
114. If $ax^3 + bx^3 + 2x^2 + 4$ is exactly divisible by $x^2 - x - 2$, then $a:b =$
 (1) $5:7$ (2) $-5:7$ (3) $-2:3$ (4) $5:-7$
115. If a polynomial in x leaves a remainder -2 and 19 respectively when divided by $x + 3$ and $x - 4$, then the remainder left when it is divided by $x^2 - x - 12$ is
 (1) $3x + 7$ (2) $3x - 7$ (3) $2x + 5$ (4) $2x - 1$
116. A polynomial $p(x)$ leaves remainders 7, 1 when divided by $x + 4$, $x - 2$ respectively. If $f(x)$ is the remainder when $p(x)$ is divided by $x^2 + 2x - 8$, then the remainder when $f(x)$ is divided by $x + 6$ is

- (1) 9 (2) 7 (3) 5 (4) 3
117. r is a fraction such that if 2 is added to its denominator, its value is $\frac{1}{2}$. If 5 is subtracted from its numerator, its value is $\frac{1}{3}$. Then $\frac{1+r}{1-r} =$
- (1) $\frac{13}{24}$ (2) $\frac{18}{25}$ (3) $\frac{37}{11}$ (4) $\frac{26}{11}$
118. If $\frac{6}{x+y} + \frac{1}{x-y} = 1$ and $\frac{24}{x+y} + \frac{6}{x-y} = 5$, then $xy =$
- (1) 24 (2) 30 (3) 32 (4) 35
119. $x^4 + \frac{1}{x^4} = 194 \Rightarrow x^3 + \frac{1}{x^3} =$
- (1) 62 (2) 72 (3) 52 (4) 42
120. If the sum of first 27 terms of an A.P. is 189, then the 14th term of that A.P. is
- (1) 5 (2) 7 (3) 9 (4) 11
121. If the 4th and 7th terms of Geometric Progression are respectively the 5th and 47th terms of the Arithmetic progression whose first term is 12 common difference is 6, then the first term of the Geometric Progression is
- (1) 6 (2) $\frac{9}{2}$ (3) 12 (4) $\frac{15}{2}$
122. $\frac{4\sec 45^\circ \cdot \operatorname{cosec} 60^\circ \cdot \sin^2 30^\circ \cdot \cot 30^\circ}{\sec 60^\circ \cdot \cos^2 45^\circ \cdot \tan^2 60^\circ} =$
- (1) $\frac{2\sqrt{2}}{3}$ (2) $\frac{1}{3}\sqrt{2}$ (3) $\frac{2}{3}$ (4) $2\sqrt{\frac{2}{3}}$
123. If $\frac{\sec^2 30^\circ + \tan^2 60^\circ}{\cos^2 45^\circ + \sin^2 90^\circ} = \frac{p}{q}$ and G.C.D. of p, q is 1, then $\frac{p^2 + q^2}{p^2 - q^2} =$
- (1) $\frac{173}{165}$ (2) $\frac{657}{495}$ (3) $\frac{757}{595}$ (4) $\frac{685}{667}$
124. $7\sin\theta + 24\cos\theta = 25 \Rightarrow 7\operatorname{cosec}\theta - 24\tan\theta =$
- (1) 18 (2) 17 (3) 31 (4) 32
125. If $\sec\theta + \tan\theta = k$, then $\frac{k^2 + 1}{k^2 - 1} =$
- (1) $\cos\theta$ (2) $\operatorname{cosec}\theta$ (3) $\tan\theta$ (4) $\sec\theta$
126. B is the foot of a pole AB. Two points C, D on the ground are such that C, D, B are collinear and the distance between C and D is 20m. If the angles of elevation to the top of

- the pole from C and D are respectively 30° and 45° , then height of the pole AB (in meters) is
 (1) $20(\sqrt{2}+1)$ (2) $10(\sqrt{3}-1)$ (3) $10(\sqrt{3}+1)$ (4) 30
127. D is the midpoint of the side BC of $\triangle ABC$. If $AB = 5$, $AC = 11$ cm, $BC = 6$ cm, then the length of AD (in cm) is
 (1) 6 (2) 7 (3) 8 (4) 9
128. In $\triangle ABC$, if $AB^2 + BC^2 + CA^2 = AB \cdot BC + BC \cdot CA + CA \cdot AB$, then that triangle is
 (1) A scalene triangle (2) An isosceles triangle
 (3) A right angled triangle (4) An equilateral triangle
129. If the perimeter and diagonal of a rectangle are 34 cm and 13 cm respectively, then the area of that rectangle (in sq. cm.) is
 (1) 24 (2) 60 (3) 30 (4) 34
130. If the ratio between the exterior and the interior angles of a regular polygon is 2 : 3, then the number of sides of that polygon is
 (1) 5 (2) 6 (3) 8 (4) 10
131. The number of common tangents that can be drawn to circles when
 (a) they intersect each other
 (b) they do not intersect each other and, then
 (c) they touch each other externally are respectively
 (1) 2, 3, 1 (2) 2, 2, 1 (3) 2, 4, 3 (4) 1, 3, 2
132. $\triangle ABC$ is right angled. A circle with AB as diameter is drawn to intersect the hypotenuse AC in P . If the tangent at P to the circle meets BC in Q .
 (1) 1 : 1 (2) 2 : 1 (3) 2 : 3 (4) 1 : 2
133. If the distance between the points $A(x, 3)$ and $B(7, 9)$ is 10 units, then the sum of the squares of the possible values of x is
 (1) 65 (2) 74 (3) 130 (4) 226
134. If the points $A(2, 1)$, $B(5, x)$ and $C(-4, 5)$ are collinear, then the ratio in which C divides AB is
 (1) 1 : 3 internally (2) 1 : 3 externally (3) 2 : 3 internally (4) 2 : 3 externally
135. The slope of the line passing through the point which divides the line segment joining the points $(3, -8)$ and $(-5, 8)$ in ratio 3 : 1 internally and the point that divides the line segment joining the points $(-2, 7)$ and $(6, -1)$ in the ratio 1 : 3 externally is
 (1) $\frac{7}{3}$ (2) $\frac{-8}{7}$ (3) $\frac{-7}{3}$ (4) $\frac{8}{7}$
136. If θ is the acute angle between the lines $2x + 3y = 0$ and $x = 2y$, then $\tan \theta =$

(1) $\frac{7}{4}$

(2) $\frac{1}{2}$

(3) 7

(4) 2

137. If the line $y = 7x$ is rotated about origin in anti clock wise direction through an angle of 45° , then the equation of the line final position is

(1) $3x - 4y = 0$

(2) $2y - 5x = 0$

(3) $4x + 3y = 0$

(4) $5y + 2x = 0$

138. The equation of the straight line passing through the intersection of the lines $2x - 5y + 1 = 0$, $3x + 2y - 8 = 0$ and making equal intercepts on the coordinate axes is

(1) $y = 2x - 3$

(2) $y = x - 1$

(3) $y = -x + 3$

(4) $y = \frac{2}{3}x - \frac{1}{3}$

139. The equation of the line passing through the point (2, 7) and parallel to the line $3x + 8y - 7 = 0$ is

(1) $3x + 8y - 13 = 0$

(2) $3x + 8y - 62 = 0$

(3) $3x + 8y - 26 = 0$

(4) $3x + 8y - 9 = 0$

140. The equation of the line passing through the points (5, 3) and (2, 1)

(1) $7x + 3y + 3 = 0$

(2) $6x - 8y + 2 = 0$

(3) $2x - 3y - 1 = 0$

(4) $3x + 2y + 5 = 0$

III. STATISTICAL ABILITY

141. The mean of the following data is

x	1	3	5	7	...	19
f	1^2	2^2	3^2	4^2	...	10^2

(1) 55

(2) $\frac{103}{7}$

(3) $\frac{110}{7}$

(4) 100

142. The arithmetic mean of the measures of the angle of pentagon is

(1) 72°

(2) 90°

(3) 108°

(4) 144°

143. If the means of marks, obtained in Mathematics of 3 sections containing 120, 100, 80 students are x , $2x$, $3x$ respectively and if the mean of the 3 sections combined is 112, then $x =$

(1) 30

(2) 40

(3) 50

(4) 60

144. A data consists of the first 20 odd integers with frequencies $1^2, 2^2, \dots, 20^2$ respectively, then the median of the data is

(1) 29

(2) 31

(3) 33

(4) 35

145. The following observations are in descending order.
94, 84, 74, $x + 2$, x , 68, 64, 58

If the median of this data is 72, then the value of $x =$

(1) 68

(2) 69

(3) 71

(4) 73

146. The mode for the following frequency distribution is

Class	52-55	55-58	58-61	61-64
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Frequency	15	20	25	10
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- (1) 56.75 (2) 62.25 (3) 58.75 (4) 68.25
147. If the Mean and Median of a frequency distributions are 20 and 15 respectively, then the Mode is
 (1) 30 (2) 25 (3) 5 (4) 4
148. If three coins are tossed, then the probability of getting at least one head is
 (1) $\frac{1}{8}$ (2) $\frac{3}{8}$ (3) $\frac{5}{8}$ (4) $\frac{7}{8}$
149. If the letters of the word TSICET are arranged at random, then the probability that the T's do not come together is
 (1) $\frac{1}{3}$ (2) $\frac{2}{3}$ (3) $\frac{1}{12}$ (4) $\frac{1}{120}$
150. When a fair coin is tossed 5 times, the probability that head appears at least two times is
 (1) $\frac{13}{16}$ (2) $\frac{5}{16}$ (3) $\frac{3}{16}$ (4) $\frac{17}{32}$

COMMUNICATION ABILITY

Part 1: Meanings (sentences with dashes)

151. Existing everywhere
 (1) omnipresent (2) omnivorous (3) omniscient (4) omnibus
152. Something that has not been included
 (1) commission (2) permission (3) omission (4) remission
153. Relating to an authority
 (1) officious (2) official (3) unofficial (4) private
154. Big and strong or heavy
 (1) hefty (2) lean (3) emaciated (4) tall
155. Accepting different opinions or kinds of behaviour
 (1) conservative (2) revolutionary (3) opinionated (4) liberal

Part 2: Synonyms and Antonyms

156. 'perspective' means
 (1) plucking (2) viewpoint (3) idealism (4) phenomenon
157. 'cosy' means
 (1) comfortable (2) uncomfortable (3) sorrowful (4) distracted

158. Antonym of 'grateful'
 (1) careful (2) careless (3) thankless (4) thankful
159. Give the antonym of 'eager'
 (1) indifferent (2) incoherent (3) inconsistent (4) inappropriate
160. Antonym of 'unique'
 (1) great (2) accomplished (3) common (4) pleasant

Part 3: Verb (Tense & Voice)

161. Ramya _____ ill for three weeks. She is still in hospital.
 (1) had been (2) has been (3) is (4) was
162. Rarely _____ so heavily in the month of March
 (1) did it rained (2) has it rain (3) had it raining (4) does it rain
163. Had they _____ earlier they would have come prepared for the test.
 (1) being told (2) been told (3) told (4) tell
164. The office _____ lists of the eligible candidates and then send them letters for the interviews.
 (1) will prepared (2) has prepare (3) will prepare (4) is prepared
165. As you can see, the guest rooms _____ cleaned and kept ready for the visitors.
 (1) are been (2) has been (3) have being (4) has been

Part 4: Phrasal Verbs & Idioms

166. With practice, typing becomes _____
 (1) first nature (2) second nature (3) second thought (4) second in nature
167. He failed to understand how the leader _____ the crime.
 (1) got over with (2) got up with (3) got under (4) got away with
168. Laxmi is _____ to opt for the job.
 (1) on pressure (2) in pressure (3) under pressure (4) over pressure
169. The car stopped as it _____ fuel.
 (1) ran out of (2) ran out on (3) ran of (4) ran off
170. He had butterflies in his stomach before he began his performance on the state. The underlined idiom means
 (1) He was confident (2) He was irritant (3) He was hungry (4) He was nervous

Part 5: Articles & Prepositions

171. The more he talks, _____ less they understand.
 (1) a (2) an (3) the (4) in

172. 'The Princes; is _____ historical novel.
 (1) an (2) the (3) a (4) of
173. He has taken a fancy _____ growing vegetables.
 (1) on (2) upon (3) to (4) of
174. You are not cut _____ for this job.
 (1) out (2) off (3) in (4) up
175. There has been slight misunderstanding, but we cleared it _____ now.
 (1) of (2) up (3) on (4) upon

Part 6: Computer Terminology

176. A small symbol or picture that represents a program or other things.
 (1) icon (2) GIF (3) logo (4) image
177. What is the full form of e-mail?
 (1) Electric mail (2) Exchange mail (3) Electronic mail (4) Engaging mail
178. Which one of the following is not an operating system (OS)?
 (1) Windows 10 (2) Linux (3) POS (4) Ms Excel
179. A byte is equal to
 (1) 8 bits (2) 16 bits (3) 32 bits (4) 64 bits
180. RAM is a memory of this type
 (1) Volatile (2) Non-volatile (3) Short (4) Long

Part 7: Business Terminology

181. Which of the following is not an element of delegation?
 (1) informal organisation (2) responsibility
 (3) authority (4) accountability
182. Which of the following is correct?
 (1) Sales management subsumes marketing management
 (2) Marketing management subsumes sales management
 (3) Both are independent
 (4) Marketing management has nothing to do with sales management
183. Who is the originator of POSDCORB?
 (1) Henri Fayal (2) Luther Gullick
 (3) Koontz and O'donnell (4) Newman and summer
184. All else belong equal an organization can increase supply by _____
 (1) rise in income of the consumer (2) increase in the income of the producer
 (3) rise in the price of the product (4) improvement in techniques of production

185. Who is known as the father of scientific management?
(1) Max Weber (2) Henry Fayol (3) F. W. Taylor (4) S. George

Part 8: Comprehension

It is said that the strongest chain is no stronger than its weakest link. In the Southern part of our country there are twenty two millions of your brethren who are bound to you by ties which you cannot tear asunder if you would. The most intelligent man in your community has his intelligence darkened by the ignorance of a fellow citizen in the Mississippi bottoms. The wealthiest in your city would be wealthier but for the poverty of a fellow being in the Carolina rice swamps. The most moral and religious among you has his religion and morality modified by the degradation of the man in the South whose religion is a mere matter of form of emotionalism.

The vote in your state that is cast for the highest and purest form of government is largely neutralized by the vote of the man in Louisiana whose ballot is stolen or cast in ignorance. When the South is poor, you are poor, when the South commits crime, you commit crime. My friends, there is no mistake; you must help us to raise the character of our civilization or yours will be lowered.

186. What does the statement “The strongest chain is no stronger than its weakest link” mean in the context of the passage?
- (1) The need for coordination among the races
(2) The need for manufacturing stronger chains
(3) The need to remove weak links in the chain
(4) The need to divide the nation
187. How many people were there in the South part of USA as mentioned in the passage?
- (1) Twenty-two lakhs (2) Twenty-two thousand
(3) Two crore twenty lakhs (4) Twenty-two crores
188. The expression “When the South is poor, you are poor” suggests
- (1) Both the Northern and Southern parts of the country are poor
(2) Without balanced development, the country cannot progress
(3) Northern part is poorer than the South
(4) There is uniform development in the country
189. The phrase “the highest and purest form of government” indicates
- (1) Bureaucracy (2) Dictatorship (3) Democracy (4) Religious state
190. According to the author, the Blacks in the South are
- (1) ignorant (2) well-educated (3) honest (4) intelligent

Today the world is home to a transformative generation of 900 million adolescent girls and women poised to shape the future of work and growth. If this cohort of young women could be equipped with the right resources and opportunities to nurture the 21st century skills, they would become the largest segment of women leaders, change makers, entrepreneurs, and

innovators to history. India, home to one of the largest generations of girls and young women has undertaken wide-ranging initiatives across the critical domains of education, health, digital and financial inclusion to help in the achievement of Sustainable Development Goal 5, which envisions the world to be a more gender equal place by 2030. To unleash the gender dividend and create conditions for female leadership to flourish women at all levels of society must have inclusion in the Information and Communication Technology (ICT), bodily autonomy and safety, shared responsibility within the household and equal participation in decision making spaces. The World Bank notes that over 43% of Indian STEM (Science, Technology, Engineering and Mathematics) graduates are women. However, not all of them are represented in the work force and tech leadership. STEM education appears to have picked up pace but there are prevailing stereotypes that characterise it as a traditionally masculine domain.

191. The passage is about:
(1) 21st century skills (2) STEM
(3) women's failure to keep pace with men (4) female leadership
192. For shaping future growth, what do men need?
(1) Resources and opportunities (2) Domestic responsibilities
(3) Restrictions to work (4) Parental guidance
193. Sustainable Development Goal 5 envisions the world to be a
(1) Peaceful federation (2) Gender equal place
(3) Female dominated world (4) Male-dominated society
194. Critical domains include
(1) Education and financial inclusion (2) Freedom and healthy practices
(3) Liberty in decision-making (4) Becoming champions of change
195. For female leadership to flourish, women need to have inclusion in
(1) Sustainable development (2) STEM
(3) Masculine domain (4) ICT

Interpersonal communication refers to the sharing of information among people. To compare it with other form of communication, such as intrapersonal, organizational, etc. we need to examine how many people are involved, how close they are to one another physically, how many sensory channels are used, and the feedback provided. Interpersonal communication differs from other forms of communication in that there are few participants involved, they in close physical proximity to each other, many sensory channels are used, and feedback is immediate. Also the roles of the sender and receiver keep altering. This form of communication is advantageous because direct and immediate feedback is possible. If a doubt occurs, it can be instantly clarified. No that that non-verbal communication plays a major role in the interpretation of a message in this form of communication due to proximity of the people involved. Interpersonal communication can be formal and informal. For example, your interaction with a sales clerk in a store is different from that with your friends and family members, the interaction between the panel members and the candidate appearing at an interview is different from the conversation between the two candidates waiting outside. Hence, depending on the formality of the situation, interpersonal communication takes on different styles.

196. Inter personal communication is communication between
(1) one to many (2) one to none (3) one to a few (4) one to oneself
197. Intrapersonal communications taken place _____
(1) between one and many
(2) within oneself
(3) between human beings and non-human entities
(4) between a person and an organization
198. Non-verbal communication involves _____
(1) signs and gestures (2) close conversation
(3) distant communication (4) absence of communication
199. Doubles can be clarified instantly in _____
(1) interpersonal communication (2) extrapersonal communication
(3) interpersonal communication (4) non-verbal communication
200. Which of the following involves formal communication?
(1) Conversation with your uncle (2) Interaction with your friend
(3) Interaction with your Bank Manager (4) Interaction with your fiancée



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KEY

1. 2	2. 3	3. 4	4. 3	5. 3	6. 4	7. 2	8. 1	9. 2	10. 3
11. 2	12. 3	13. 3	14. 2	15. 4	16. 3	17. 1	18. 3	19. 3	20. 3
21. 3	22. 1	23. 1	24. 3	25. 3	26. 4	27. 3	28. 4	29. 1	30. 3
31. 3	32. 4	33. 3	34. 3	35. 3	36. 3	37. 2	38. 2	39. 2	40. 1
41. 1	42. 1	43. 1	44. 1	45. 3	46. 1	47. 4	48. 3	49. 3	50. 4
51. 1	52. 1	53. 3	54. 4	55. 3	56. 4	57. 3	58. 1	59. 2	60. 4
61. 2	62. 2	63. 3	64. 3	65. 3	66. 1	67. 3	68. 2	69. 1	70. 2
71. 3	72. 2	73. 1	74. 1	75. 4	76. 2	77. 3	78. 1	79. 2	80. 4
81. 3	82. 1	83. 2	84. 3	85. 2	86. 1	87. 2	88. 3	89. 4	90. 4
91. 3	92. 3	93. 4	94. 1	95. 2	96. 2	97. 4	98. 3	99. 1	100. 1
101. 2	102. 3	103. 1	104. 4	105. 3	106. 2	107. 3	108. 2	109. 1	110. 4
111. 4	112. 2	113. 4	114. 2	115. 1	116. 1	117. 3	118. 4	119. 3	120. 2
121. 2	122. 1	123. 3	124. 1	125. 2	126. 3	127. 3	128. 4	129. 2	130. 1
131. 3	132. 4	133. 4	134. 4	135. 3	136. 1	137. 3	138. 3	139. 2	140. 3
141. 2	142. 3	143. 4	144. 2	145. 3	146. 3	147. 3	148. 4	149. 2	150. 1
151. 1	152. 2	153. 2	154. 1	155. 4	156. 2	157. 1	158. 3	159. 1	160. 3
161. 2	162. 4	163. 2	164. 3	165. 4	166. 4	167. 2	168. 3	169. 1	170. 4
171. 3	172. 3	173. 3	174. 1	175. 2	176. 1	177. 3	178. 4	179. 1	180. 3
181. 1	182. 2	183. 2	184. 4	185. 3	186. 1	187. 3	188. 2	189. 3	190. 1
191. 4	192. 1	193. 2	194. 1	195. 4	196. 3	197. 2	198. 1	199. 3	200. 3