

- What is  $\lim_{x \rightarrow 0} \frac{\sqrt{1+x}-1}{x}$  equal to ?  
 (a) 0 (b) 1/2  
 (c) 1 (d) -1/2
- What is  $\lim_{x \rightarrow 0} \frac{2(1-\cos x)}{x^2}$  equal to ?  
 (a) 0 (b) 1/2  
 (c) 1/4 (d) 1
- Consider the following :  
 1.  $\lim_{x \rightarrow 0} \frac{1}{x}$  exists.  
 2.  $\lim_{x \rightarrow 0} \frac{1}{e^x}$  does not exist.  
 Which of the above is/are correct ?  
 (a) 1 only (b) 2 only  
 (c) Both 1 and 2 (d) Neither 1 nor 2
- If  $x^m + y^m = 1$  such that  $\frac{dy}{dx} = -\frac{x}{y}$ , then what should be the value of  $m$  ?  
 (a) 0 (b) 1  
 (c) 2 (d) None of the above
- Which one of the following is correct in respect of the function  $f(x) = \frac{x^+}{|x|}$  for  $x \neq 0$  and  $f(0) = 0$  ?  
 (a)  $f(x)$  is discontinuous every where  
 (b)  $f(x)$  is continuous every where  
 (c)  $f(x)$  is continuous at  $x = 0$  only  
 (d)  $f(x)$  is discontinuous at  $x = 0$  only
- What is  $\lim_{x \rightarrow 2} \frac{x-2}{x^2-4}$  equal to ?  
 (a) 0 (b) 1/4  
 (c) 1/2 (d) 1
- The radius of a circle is uniformly increasing at the rate of 3 cm/s. What is the rate of increase in area, when the radius is 10 cm ?  
 (a)  $6\pi \text{ cm}^2/\text{s}$  (b)  $10\pi \text{ cm}^2/\text{s}$   
 (c)  $30\pi \text{ cm}^2/\text{s}$  (d)  $60\pi \text{ cm}^2/\text{s}$
- Let  $f: \mathbb{R} \rightarrow \mathbb{R}$  be a function whose inverse is  $\frac{x+5}{3}$ .  
 What is  $f(x)$  equal to ?  
 (a)  $f(x) = 3x + 5$  (b)  $f(x) = 3x - 5$   
 (c)  $f(x) = 5x - 3$  (d)  $f(x)$  does not exist
- Consider the following statements :  
 1. If  $y = \ln(\sec x + \tan x)$ , then  $\frac{dy}{dx} = \sec x$   
 2. If  $y = \ln(\operatorname{cosec} x - \cot x)$ , then  $\frac{dy}{dx} = \operatorname{cosec} x$ .  
 Which of the above is/are correct ?  
 (a) 1 only (b) 2 only  
 (c) Both 1 and 2 (d) Neither 1 nor 2
- If  $f(x) = 2^{\sin x}$ , then what is the derivative of  $f(x)$  ?  
 (a)  $2^{\sin x} \ln 2$  (b)  $(\sin x) 2^{\sin x - 1}$   
 (c)  $(\cos x) 2^{\sin x - 1}$  (d) None of these
- The function  $f(x) = x^3 - 3x^2 + 6$  is an increasing function for :  
 (a)  $0 < x < 2$  (b)  $x < 2$   
 (c)  $x > 2$  or  $x < 0$  (d) All  $x$
- Consider the following statements :  
 1. If  $f(x) = x^3$  and  $g(y) = y^3$  then  $f = g$   
 2. Identify function is not always a bijection.  
 Which of the above statements is/are correct ?  
 (a) 1 only (b) 2 only  
 (c) Both 1 and 2 (d) Neither 1 nor 2
- Let  $A = \{x \in \mathbb{R} | x \geq 0\}$ . A function  $f: A \rightarrow A$  is defined by  $f(x) = x^2$ . Which one of the following is correct ?  
 (a) The function does not have inverse  
 (b)  $f$  is its own inverse  
 (c) The function has an inverse but  $f$  is not its own inverse  
 (d) None of the above
- If  $y = \ln(e^{mx} + e^{-mx})$ , then what is  $\frac{dy}{dx}$  at  $x = 0$  equal to ?  
 (a) -1 (b) 0  
 (c) 1 (d) 2
- What is the minimum value of  $|x|$  ?  
 (a) -1 (b) 0  
 (c) 1 (d) 2
- From the point (4,3) a perpendicular is dropped on the x-axis as well as on the y-axis. If the lengths of perpendiculars are p, q respectively, then which one of the

- following is correct ?  
 (a)  $p = q$  (b)  $3p = 4q$   
 (c)  $4p = 3q$  (d)  $p + q = 5$
17. What is the value of  $\lambda$  if the straight line  $(2x + 3y + 4) + \lambda(6x - y + 12) = 0$  is parallel to  $y$ -axis ?  
 (a) 3 (b) -6  
 (c) 4 (d) -3
18. The line  $y = 0$  divides the line joining the points  $(3, -5)$  and  $(-4, 7)$  in the ratio :  
 (a) 3 : 4 (b) 4 : 5  
 (c) 5 : 7 (d) 7 : 9
19. The sum of the focal distances of a point on the ellipse  $\frac{x^2}{4} + \frac{y^2}{9} = 1$  is :  
 (a) 4 units (b) 6 units  
 (c) 8 units (d) 10 units
20. The eccentricity  $e$  of an ellipse satisfies the condition  
 (a)  $e < 0$  (b)  $0 < e < 1$   
 (c)  $e = 1$  (d)  $e > 1$
21. The equation of a straight line which makes an angle  $45^\circ$  with the  $x$ -axis with  $y$ -intercept 101 units is :  
 (a)  $10x + 101y = 1$  (b)  $101x + y = 1$   
 (c)  $x + y - 101 = 0$  (d)  $x - y + 101 = 0$
22. If the points  $(2, 4)$ ,  $(2, 6)$  and  $(2 + \sqrt{3}, k)$  are the vertices of an equilateral triangle, then what is the value of  $k$  ?  
 (a) 6 (b) 5  
 (c) -3 (d) 1
23. If the distance between the points  $(7, 1, -3)$  and  $(4, 5, \lambda)$  is 13 units, then what is one of the values of  $\lambda$  ?  
 (a) 20 (b) 10  
 (c) 9 (d) 8
24. If a line  $OP$  of length  $r$  (where 'O' is the origin) makes an angle  $\alpha$  with  $x$ -axis and lies in the  $xy$ -plane, then what are the coordinates of  $P$  ?  
 (a)  $(r \cos \alpha, 0, r \sin \alpha)$  (b)  $(0, 0, r \sin \alpha)$   
 (c)  $(r \cos \alpha, 0, 0)$  (d)  $(0, 0, r \cos \alpha)$
25. What is the distances of the point  $(1, 2, 0)$  from  $yz$ -plane is :  
 (a) 1 units (b) 2 units  
 (c) 3 units (d) 4 units
26. What are the direction cosines of a line which is equally inclined to the positive directions of the axes ?  
 (a)  $\left\langle \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}} \right\rangle$  (b)  $\left\langle -\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}} \right\rangle$   
 (c)  $\left\langle -\frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}} \right\rangle$  (d)  $\left\langle \frac{1}{3}, \frac{1}{3}, \frac{1}{3} \right\rangle$
27. What is the angle between the lines  $\frac{x-2}{1} = \frac{y+1}{-2} = \frac{z+2}{1}$  and  $\frac{x-1}{1} = \frac{2y+3}{3} = \frac{z+5}{2}$  ?  
 (a)  $\frac{\pi}{2}$  (b)  $\frac{\pi}{3}$   
 (c)  $\frac{\pi}{6}$  (d) None of these
28. What is the equation to the plane through  $(1, 2, 3)$  parallel to  $3x + 4y - 5z = 0$  ?  
 (a)  $3x + 4y + 5z + 4 = 0$  (b)  $3x + 4y - 5z + 14 = 0$   
 (c)  $3x + 4y - 5z + 4 = 0$  (d)  $3x + 4y - 5z + 4 = 0$
29. What are the direction ratios of the line of intersection of the planes  $x = 3z + 4$  and  $y = 2z - 3$  ?  
 (a)  $(1, 2, 3)$  (b)  $(2, 1, 3)$   
 (c)  $(3, 2, 1)$  (d)  $(1, 3, 2)$
30. What is the equation to the straight line passing through  $(a, b, c)$  and parallel to  $z$ -axis ?  
 (a)  $\frac{x-a}{1} = \frac{y-b}{0} = \frac{z-c}{0}$  (b)  $\frac{x-a}{0} = \frac{y-b}{0} = \frac{z-c}{1}$   
 (c)  $\frac{x-a}{0} = \frac{y-b}{1} = \frac{z-c}{0}$  (d)  $\frac{x-a}{0} = \frac{y-b}{1} = \frac{z-c}{1}$
31. If a non-empty set  $A$  contains  $n$  elements, then its power set contains how many elements ?  
 (a)  $n^2$  (b)  $2^n$   
 (c)  $2n$  (d)  $n + 1$
32. Let  $A = \{x, \in W, \text{the set of whole numbers and } x < 3\}$ ,  $B = \{x \in N, \text{the set of natural numbers and } 2 \leq x < 4\}$  and  $C = \{3, 4\}$ , then how many elements will  $(A \cup B) \times C$  contain ?  
 (a) 6 (b) 8  
 (c) 10 (d) 12
33. What is the modulus of  $\frac{\sqrt{2} + i}{\sqrt{2} - i}$  where  $i = \sqrt{-1}$  ?  
 (a) 3 (b)  $1/2$   
 (c) 1 (d) None of these
34. What is the number of diagonals which can be drawn by joining the angular points of a polygon of 100 sides ?  
 (a) 4850 (b) 4950  
 (c) 5000 (d) 10000
35. The angles of a triangle are in AP and the least angle is  $30^\circ$ . What is the greatest angle (in radian) ?  
 (a)  $\frac{\pi}{2}$  (b)  $\frac{\pi}{3}$   
 (c)  $\frac{\pi}{4}$  (d)  $\pi$
36. If each element in a row of a determinant is multiplied by the same factor  $r$ , then the value of the determinant,  
 (a) is multiplied by  $r^3$  (b) is increased by  $3r$   
 (c) remains unchanged (d) is multiplied by  $r$
37. The inverse of a diagonal matrix is a :  
 (a) Symmetric matrix (b) Skew-symmetric matrix  
 (c) Diagonal matrix (d) None of these
38. If  $A = \begin{bmatrix} 3 & 4 \\ 5 & 6 \\ 7 & 8 \end{bmatrix}$  and  $B = \begin{bmatrix} 3 & 5 & 7 \\ 4 & 6 & 8 \end{bmatrix}$ , then which one of the following is correct ?  
 (a)  $B$  is the inverse of  $A$  (b)  $B$  is the ad joint of  $A$   
 (c)  $B$  is the transpose of  $A$  (d) None of these
39. If the sum of matrices  $\begin{bmatrix} x \\ x \\ y \end{bmatrix}$ ,  $\begin{bmatrix} y \\ y \\ z \end{bmatrix}$  and  $\begin{bmatrix} z \\ z \\ 0 \end{bmatrix}$  is the matrix  $\begin{bmatrix} 10 \\ 5 \\ 5 \end{bmatrix}$ , then what is the value of  $y$  ?  
 (a) -5 (b) 0  
 (c) 5 (d) 10

40. If the matrix  $AB$  is a zero matrix, then which one of the following is correct ?  
 (a)  $A$  must be equal to zero matrix or  $B$  must be equal to zero matrix.  
 (b)  $A$  must be equal to zero matrix and  $B$  must be equal to zero matrix.  
 (c) It is not necessary that either  $A$  is zero matrix or  $B$  is zero matrix  
 (d) None of the above

41. If the matrix  $\begin{bmatrix} \alpha & 2 & 2 \\ -3 & 0 & 4 \\ 1 & -1 & 1 \end{bmatrix}$  is not invertible, then :

- (a)  $\alpha = -5$  (b)  $\alpha = 5$   
 (c)  $\alpha = 0$  (d)  $\alpha = 1$

42. The value of the determinant  $\begin{vmatrix} x^2 & 1 & y^2 + z^2 \\ y^2 & 1 & z^2 + x^2 \\ z^2 & 1 & x^2 + y^2 \end{vmatrix}$  is :

- (a) 0 (b)  $x^2 + y^2 + z^2$   
 (c)  $x^2 + y^2 + z^2 + 1$  (d) None of these

43. A square matrix  $[a_{ij}]$  such that  $a_{ij} = 0$  for  $i \neq j$  and  $a_{ii} = k$  where  $k$  is a constant for  $i = j$  is called :

- (a) Diagonal matrix, but not scalar matrix  
 (b) Scalar matrix  
 (c) Unit matrix  
 (d) None of the above

44. What is the value of  $\sin 15^\circ$  ?

- (a)  $\frac{\sqrt{3}-1}{2\sqrt{2}}$  (b)  $\frac{\sqrt{3}+1}{2\sqrt{2}}$   
 (c)  $\frac{\sqrt{3}-1}{\sqrt{3}+1}$  (d)  $\frac{\sqrt{3}+1}{\sqrt{3}-1}$

45. If  $4 \sin^2 \theta = 1$ , where  $0 < \theta < 2\pi$ , how many values does  $\theta$  take ?

- (a) 1 (b) 2  
 (c) 4 (d) None of these

46. The monthly family expenditure (in percentage) on different items are as follows :

Food	Rent	Cloth	Transport	Education	Others
38	19	18	-	9	6

If the total monthly expenditure is Rs.9000, then what is the expenditure on transport ?

- (a) Rs.180 (b) Rs.1000  
 (c) Rs.900 (d) Rs.360

47. If the mean of few observations is 40 and standard deviation is 8, then what is the coefficient of variation ?

- (a) 1% (b) 10%  
 (c) 20% (d) 30%

48. What is the standard deviation of 7, 9, 11, 13, 15 ?

- (a) 2.4 (b) 2.5  
 (c) 2.7 (d) 2.8

49. Which one of the following is a measure of dispersion ?

- (a) Mean (b) Median  
 (c) Mode (d) Standard deviation

50. Let  $\lambda$  and  $r$  be two related variables. The two regression lines are given by  $x - y + 1 = 0$  and  $2x - y + 4 = 0$ . The two

regression lines pass through the point :

- (a)  $(-4, -3)$  (b)  $(-6, -5)$   
 (c)  $(3, -2)$  (d)  $(-3, -2)$

51. If  $P(E)$  denotes the probability of an event  $E$ , then  $E$  is called certain even if :

- (a)  $P(E) = 0$  (b)  $P(E) = 1$   
 (c)  $P(E)$  is either 0 or 1 (d)  $P(E) = 1/2$

52. What is the probability that a leap year selected at random will contain 53 Mondays ?

- (a)  $2/5$  (b)  $2/7$   
 (c)  $1/7$  (d)  $5/7$

53. If  $A$  and  $B$  are two events such that  $P(A \cup B) = \frac{3}{4}$ ,  $P(A \cap B) = \frac{1}{4}$ ,  $P(\bar{A}) = \frac{2}{3}$  where  $\bar{A}$  is the complement of  $A$ , then what is  $P(B)$  equal to ?

- (a)  $1/3$  (b)  $2/3$   
 (c)  $1/9$  (d)  $2/9$

54. Three coins are tossed simultaneously. What is the probability that they will fall two heads and one tail ?

- (a)  $1/3$  (b)  $1/2$   
 (c)  $1/4$  (d)  $3/8$

55. Which one of the following is correct ?

- (a) An event having no sample point is called an elementary event  
 (b) An event having one sample point is called an elementary event  
 (c) An event having two sample point is called an elementary event  
 (d) An event having many sample point is called an elementary event

56. What is the most probable number of successes in 10 trials with probability of success  $2/3$  ?

- (a) 10 (b) 7  
 (c) 5 (d) 4

**FOR THE NEXT TWO (02) QUESTIONS THAT FOLLOW :**

An urn contains one black ball and one green ball. A second urn contains one white and one green ball. One ball is drawn at random from each urn.

57. What is the probability that both balls are of same colour ?

- (a)  $1/2$  (b)  $1/3$   
 (c)  $1/4$  (d)  $2/3$

58. What is the probability of getting at least one green ball ?

- (a)  $1/2$  (b)  $1/3$   
 (c)  $2/3$  (d)  $3/4$

**FOR THE NEXT TWO (02) QUESTIONS THAT FOLLOW :**

Two dice each numbered from 1 to 6 are thrown together. Let  $A$  and  $B$  be two events given by

$A$  : Even number on the first die

$B$  : Number on the second die is greater than 4

59. What is  $P(A \cap B)$  equal to ?

- (a)  $1/2$  (b)  $1/4$   
 (c)  $2/3$  (d)  $1/6$

60. What is  $P(A \cup B)$  equal to ?

- (a)  $1/2$  (b)  $1/4$   
 (c)  $2/3$  (d)  $1/6$

61. What is the value of  $\sin 18^\circ \cos 36^\circ$  equal to ?  
 (a) 4 (b) 2  
 (c) 1 (d)  $1/4$
62. What is  $\sin \left[ \sin^{-1} \left( \frac{3}{5} \right) + \sin^{-1} \left( \frac{4}{5} \right) \right]$  equal to ?  
 (a) 0 (b)  $1/2$   
 (c) 1 (d) 2
63. If  $\sec \alpha = \frac{13}{5}$  where  $270^\circ < \alpha < 360^\circ$ , then what is  $\sin \alpha$  equal to ?  
 (a)  $5/13$  (b)  $12/13$   
 (c)  $-12/13$  (d)  $-13/12$
64. What is  $\tan (-585^\circ)$  equal to ?  
 (a) 1 (b) -1  
 (c)  $-\sqrt{2}$  (d)  $-\sqrt{3}$
65. Consider the following statements :  
 1. The value of  $\cos 46^\circ - \sin 46^\circ$  is positive.  
 2. The value of  $\cos 44^\circ - \sin 44^\circ$  is negative.  
 Which of the above statements is/are correct ?  
 (a) 1 only (b) 2 only  
 (c) Both 1 and 2 (d) Neither 1 nor 2
66. The line making an angle  $(-120^\circ)$  with x-axis is situated in the :  
 (a) First quadrant (b) Second quadrant  
 (c) Third quadrant (d) Fourth quadrant
67. The angle subtended at the center of a circle of radius 3 cm by an arc of length 1 cm is :  
 (a)  $\frac{30^\circ}{\pi}$  (b)  $\frac{60^\circ}{\pi}$   
 (c)  $60^\circ$  (d) None of these
68. If  $\sin A = \frac{2}{\sqrt{5}}$  and  $\cos B = \frac{1}{\sqrt{10}}$  where A and B are acute angles, then what is  $A + B$  equal to ?  
 (a)  $135^\circ$  (b)  $90^\circ$   
 (c)  $75^\circ$  (d)  $60^\circ$
69. The top of a hill observed from the top and bottom of a building of height  $h$  is at angles of elevation  $\alpha$  and  $\beta$  respectively. The height of the hill is :  
 (a)  $\frac{h \cot \beta}{\cot \beta - \cot \alpha}$  (b)  $\frac{h \cot \alpha}{\cot \alpha - \cot \beta}$   
 (c)  $\frac{h \tan \alpha}{\tan \alpha - \tan \beta}$  (d) None of these
70. From the top of a lighthouse 70 m high with its base at sea level, the angle of depression of a boat is  $15^\circ$ . The distance of the boat from the foot of the lighthouse is :  
 (a)  $70(2 - \sqrt{3})$  m (b)  $70(2 + \sqrt{3})$  m  
 (c)  $70(3 - \sqrt{3})$  m (d)  $70(3 + \sqrt{3})$  m
71. The locus of a point equidistant from three collinear points is  
 (a) A straight line (b) A pair of points  
 (c) A point (d) The null set
72. The equation to the locus of a point which is always equidistant from the points (1,0) and (0,-2) is :  
 (a)  $2x + 4y + 3 = 0$  (b)  $4x + 2y + 3 = 0$   
 (c)  $2x + 4y - 3 = 0$  (d)  $4x + 2y - 3 = 0$
73. The points (5,1), (1,-1) and (11,4) are :  
 (a) Collinear  
 (b) Vertices of right angled triangle  
 (c) Vertices of equilateral triangle  
 (d) Vertices of an isosceles triangle
74. What is the perpendicular distance between the parallel lines  $3x + 4y = 9$  and  $9x + 12y + 28 = 0$  ?  
 (a)  $7/3$  Units (b)  $8/3$  Units  
 (c)  $10/3$  Units (d)  $11/3$  Units
75. Let p, q, r, s be the distances from origin of the points (2,6), (3,4), (4,5) and (-2,5) respectively. Which one of the following is a whole number ?  
 (a) P (b) Q  
 (c) R (d) S
76. EFGH is a rhombus such that the angle EFG is  $60^\circ$ . The magnitude of vectors FH and  $\{ m \vec{EG} \}$  are equal where m is a scalar. What is the value of m ?  
 (a) 3 (b)  $1.5$   
 (c)  $\sqrt{2}$  (d)  $\sqrt{3}$
77. If  $\vec{a} \cdot \vec{b} = 0$  and  $\vec{a} \times \vec{b} = \vec{0}$  then which one of the following is correct ?  
 (a)  $\vec{a}$  is parallel to  $\vec{b}$  (b)  $\vec{a}$  is perpendicular to  $\vec{b}$   
 (c)  $\vec{a} = \vec{0}$  or  $\vec{b} = \vec{0}$  (d) None of these
78. The vector  $\vec{a} \times (\vec{b} \times \vec{a})$  is coplanar with :  
 (a)  $\vec{a}$  only (b)  $\vec{b}$  only  
 (c) Both  $\vec{a}$  and  $\vec{b}$  (d) Neither  $\vec{a}$  nor  $\vec{b}$
79. Consider the following :  
 1.  $4\hat{i} \times 3\hat{j} = \vec{0}$       2.  $\frac{4\hat{i}}{3\hat{j}} = \frac{4}{3}$   
 Which of the above is/are correct ?  
 (a) 1 only (b) 2 only  
 (c) Both 1 and 2 (d) Neither 1 nor 2
80. What is the value of  $\lambda$  for which  $(\lambda\hat{i} + \hat{j} - \hat{k}) \times (3\hat{i} - 2\hat{j} + 4\hat{k}) = (2\hat{i} - 11\hat{j} - 7\hat{k})$  ?  
 (a) 2 (b) -2  
 (c) 1 (d) 7
81. The magnitude of the scalar p for which the vector  $p(-3\hat{i} - 2\hat{j} + 13\hat{k})$  is of unit length is :  
 (a)  $1/8$  (b)  $1/64$   
 (c)  $\sqrt{182}$  (d)  $1/\sqrt{182}$
82. The vector  $2\hat{j} - \hat{k}$  lies :  
 (a) in the plane of XY (b) in the plane of YZ  
 (c) in the plane of XZ (d) Along the X-axis
83. ABCD is a parallelogram. If  $\vec{AB} = \vec{a}$ ,  $\vec{BC} = \vec{b}$ , then what is  $\vec{BD}$  equal to ?  
 (a)  $\vec{a} + \vec{b}$  (b)  $\vec{a} - \vec{b}$   
 (c)  $-\vec{a} - \vec{b}$  (d)  $-\vec{a} + \vec{b}$
84. What is the geometric mean of the sequence 1, 2, 4, 8, ..... $2^n$  ?  
 (a)  $2^{n/2}$  (b)  $2^{(n+1)/2}$   
 (c)  $2^{(n-1)}$  (d)  $2^{(n-1)}$
85. The mean of 10 observation is 5. If 2 is added to each observation and then multiplied by 3, then what will be the new mean ?  
 (a) 5 (b) 7  
 (c) 15 (d) 21

86. What is the mean of first  $n$  odd natural numbers ?  
 (a)  $n$  (b)  $(n + 1)/2$   
 (c)  $n(n + 1)/2$  (d)  $n + 1$
87. The arithmetic mean of numbers  $a, b, c, d, e$ , is  $M$ . What is the value of  $(a - M) + (b - M) + (c - M) + (d - M) + (e - M)$  ?  
 (a)  $M$  (b)  $a + b + c + d + e$   
 (c)  $0$  (d)  $5M$
88. The algebraic sum of the deviations of 20 observations measured from 30 is 2. What would be the mean of the observation ?  
 (a) 30 (b) 32  
 (c) 30.2 (d) 30.1
89. The median of 27 observations of a variable is 18. Three more observations are made and the values of these observations are 16, 18 and 50. What is the median of these 30 observations ?  
 (a) 18 (b) 19  
 (c) 25.5  
 (d) Cannot be determined due to insufficient data
90. Frequency curve may be :  
 (a) Symmetrical (b) Positive skew  
 (c) Negative skew (d) All of these
91. What is  $\int a^x e^x dx$  equal to ?  
 (a)  $\frac{a^x e^x}{\ln a} + c$  (b)  $a^x e^x + c$   
 (c)  $\frac{a^x e^x}{\ln (ae)} + c$  (d) None of these  
 Where  $c$  is the constant of integration
92. What is  $\int_{-1}^1 x|x| dx$  equal to ?  
 (a) 2 (b) 1  
 (c) 0 (d) -1
93. What is  $\int_0^1 \frac{\tan^{-1} x}{1+x^2} dx$  equal to ?  
 (a)  $\frac{\pi^2}{8}$  (b)  $\frac{\pi^2}{32}$   
 (c)  $\frac{\pi}{4}$  (d)  $\frac{\pi}{8}$
94. What is  $\int_0^{\pi/2} \sin 2x \ln (\cot x) dx$  equal to ?  
 (a) 0 (b)  $\pi \ln 2$   
 (c)  $-\pi \ln 2$  (d)  $\frac{\pi \ln 2}{2}$
95. What is the area of the portion of the curve  $y = \sin x$ , lying between  $x = 0, y = 0$  and  $x = 2\pi$  ?  
 (a) 1 Square unit (b) 2 Square unit  
 (c) 4 Square unit (d) 8 Square units
96. What is  $\int \frac{\ln x}{x} dx$  equal to ?  
 (a)  $\frac{(\ln x)^2}{2} + c$  (b)  $\frac{(\ln x)}{2} + c$   
 (c)  $(\ln x)^2 + c$  (d) None of these  
 Where  $c$  is the constant of integration
97. What is the area of the region bounded by the lines  $y = x, y = 0$  and  $x = 4$  ?  
 (a) 4 Square units (b) 8 Square units  
 (c) 12 Square units (d) 16 Square units
98. What is  $\int \left( \frac{1}{\cos^2 x} - \frac{1}{\sin^2 x} \right) dx$  equal to ?  
 (a)  $2 \operatorname{cosec} 2x + c$  (b)  $-2 \cot 2x + c$   
 (c)  $2 \sec 2x + c$  (d)  $-2 \tan 2x + c$   
 Where  $c$  is the constant of integration
99. What is the degree of the differential equation  $\frac{d^2 y}{dx^2} + 2 \left( \frac{dy}{dx} \right)^2 - \frac{dy}{dx} + y = 0$  ?  
 (a) 6 (b) 3  
 (c) 2 (d) 1
100. Consider a differential equation of order  $m$  and degree  $n$ . Which one of the following pairs is **not** feasible ?  
 (a) (3,2) (b) (2,3/2)  
 (c) (2,4) (d) (2,2)
101. The differential equation representing the family of curves  $y = a \sin (\lambda x + \alpha)$  is :  
 (a)  $\frac{d^2 y}{dx^2} + \lambda^2 y = 0$  (b)  $\frac{d^2 y}{dx^2} - \lambda^2 y = 0$   
 (c)  $\frac{d^2 y}{dx^2} + \lambda y = 0$  (d) None of these
102. The differential equation  $y \frac{dy}{dx} + x = a$  where 'a' is any constant represents :  
 (a) A set of straight lines (b) A set of ellipses  
 (c) A set of circles (d) None of these
103. For the differential equation  $\left( \frac{dy}{dx} \right)^2 - x \left( \frac{dy}{dx} \right) + y = 0$ , which one of the following is **not** its solution ?  
 (a)  $y = x - 1$  (b)  $4y = x^2$   
 (c)  $y = x$  (d)  $y = -x - 1$
104. What is the general solution of the differential equation  $x^2 dy + y^2 dx = 0$  ?  
 (a)  $x + y = c$  (b)  $xy = c$   
 (c)  $c(x + y) = xy$  (d) None of these
105. What is the general solution of the differential equation  $e^x \tan x dx + (1 - e^x) \sec^2 x dy = 0$   
 (a)  $\sin y = c(1 - e^x)$  (b)  $\cos y = c(1 - e^x)$   
 (c)  $\cot y = c(1 - e^x)$  (d) None of these
106. If the roots of a quadratic equation are  $m + n$  and  $m - n$ , then the quadratic equation will be :  
 (a)  $x^2 + 2mx + m^2 - mn + n^2 = 0$   
 (b)  $x^2 + 2mx + (m - n)^2 = 0$   
 (c)  $x^2 + 2mx + m^2 - n^2 = 0$   
 (d)  $x^2 + 2mx + m^2 - n^2 = 0$
107. If  $\alpha, \beta$  are the roots of  $x^2 + px - q = 0$  and  $\gamma, \delta$  are the roots of  $x^2 - px + r = 0$  then what is  $(\beta + \gamma) (\beta + \delta)$  equal to ?  
 (a)  $p + r$  (b)  $p + q$   
 (c)  $q + r$  (d)  $p - q$
108. Consider the following statements :



1. The sum of cubes of first 20 natural numbers is 44400.  
2. The sum of squares of first 20 natural numbers is 2870.  
Which of the above statements, is/are correct ?  
(a) 1 only (b) 2 only  
(c) Both 1 and 2 (d) Neither 1 nor 2
- 109.** Consider the following statements :  
1.  $(\omega^3 + 1)^7 + \omega = 0$   
2.  $(\omega^{105} + 1)^{10} = p^{10}$  for some prime number  $p$   
Where  $\omega \neq 1$  is a cubic root of unity  
Which of the above statements is/are correct ?  
(a) 1 only (b) 2 only  
(c) Both 1 and 2 (d) Neither 1 nor 2
- 110.** What is the sum of first eight terms of the series  
 $1 - \frac{1}{2} + \frac{1}{4} - \frac{1}{8} + \dots$  ?  
(a)  $\frac{89}{128}$  (b)  $\frac{57}{384}$   
(c)  $\frac{85}{128}$  (d) None of these
- 111.** The number of permutations that can be formed from all the letters of the word 'BASEBALL' is :  
(a) 540 (b) 1260  
(c) 3780 (d) 5040
- 112.** The relation 'has the same father as' over the set of children is :  
(a) Only reflexive (b) Only symmetric  
(c) Only transitive (d) An equivalence relation
- 113.** If the roots of the quadratic equation  $3x^2 - 5x + p = 0$  are real and unequal, then which one of the following is correct ?  
(a)  $p > 25/12$  (b)  $p < 25/12$   
(c)  $p > 25/12$  (d)  $p \leq 25/12$
- 114.** The decimal representation of the number  $(1011)_2$  in binary system is :  
(a) 5 (b) 7  
(c) 9 (d) 11
- 115.** The decimal number  $(57.375)_{10}$  when converted to binary number takes the form :  
(a)  $(111001.001)_2$  (b)  $(100111.110)_2$   
(c)  $(110011.101)_2$  (d)  $(111011.011)_2$
- 116.** If  $(\log_3 x)(\log_x 2x)(\log_{2x} y) = \log_x x^2$ , then what is  $y$  equal to ?  
(a) 4.5 (b) 9  
(c) 18 (d) 27
- 117.** Let  $P = \{1, 2, 3\}$  and a relation on set  $P$  is given by the set  $R = \{(1, 2), (1, 3), (2, 1), (1, 1), (2, 2), (3, 3), (2, 3)\}$ . Then  $R$  is :  
(a) Reflexive, transitive but not symmetric  
(b) Symmetric, transitive but not reflexive  
(c) Symmetric, Reflexive, but not transitive  
(d) None of the above
- 118.** The value of the sum  $\sum_{n=1}^{13} (i^n + i^{n+1})$  where  $i = \sqrt{-1}$  is :  
(a)  $i$  (b)  $-i$   
(c) 0 (d)  $i - 1$
- FOR THE NEXT TWO (02) QUESTIONS THAT FOLLOW :**  
The sum of first 10 terms and 20 terms of an AP are 120 and 440 respectively ?
- 119.** What is its first term ?  
(a) 2 (b) 3  
(c) 4 (d) 5
- 120.** What is the common difference ?  
(a) 1 (b) 2  
(c) 3 (d) 4