1. If $\begin{vmatrix} a & b & c \\ l & m & n \\ p & q & r \end{vmatrix} = 2$, then what is the value

   of the determinant $\begin{vmatrix} 6a & 3b & 15c \\ 2l & m & 5n \\ 2p & q & 5r \end{vmatrix}$?

   (a) 10
   (b) 20
   (c) 40
   (d) 60

   Ans = d

2. Let X be the set of all graduates in India. Elements x and y in X are said to be related if they are graduates of the same university. Which one of the following statements is correct ?

   (a) Relation is symmetric and transitive only.
   (b) Relation is reflexive and transitive only.
   (c) Relation is reflexive and symmetric only.
   (d) Relation is reflexive, symmetric and transitive. — *Ans: d*

3. If $x^2 + y^2 = 1$, then what is $\dfrac{1 + x + iy}{1 + x - iy}$

   equal to ?
   (a) $x - iy$ *Ans: a*
   (b) $x + iy$
   (c) $2x$
   (d) $-2iy$

4. Consider the following statements :
   1. For any three vectors $\vec{a}$, $\vec{b}$, $\vec{c}$:
      $\vec{a} \cdot \{(\vec{b} + \vec{c}) \times (\vec{a} + \vec{b} + \vec{c})\} = 0$
   2. For any three coplanar unit vectors
      $\vec{d}$, $\vec{e}$, $\vec{f}$; $(\vec{d} \times \vec{e}) \cdot \vec{f} = 1$

   Which of the statements given above is/are correct ?
   (a) 1 only   *Ans: A*
   (b) 2 only
   (c) Both 1 and 2
   (d) Neither 1 nor 2

Directions : *For the next 3 (three) questions to follow :*

Consider the following lists :

Each item under List I is associated with one or more items under List II.

List I (Function)	List II (Property)
A. sin x	1. Periodic function
B. cos x	2. Non-periodic function
C. tan x	3. Continuous at every point on $(-\infty, \infty)$
	4. Discontinuous function
	5. Differentiable at every point on $(-\infty, \infty)$
	6. Not differentiable at every point on $(-\infty, \infty)$
	7. has period π
	8. has period 2π
	9. increases on $(0, \pi/2)$
	10. decreases on $(0, \pi/2)$
	11. increases on $(\pi/2, \pi)$
	12. decreases on $(\pi/2, \pi)$

A is associated with
(a) 1, 3, 5, 8, 9, 12
(b) 2, 4, 6, 8, 10, 11 — *Ans: D*
(c) 1, 3, 5, 7, 10, 11
(d) None of the above

6. B is associated with
   (a) 2, 3, 5, 8, 9, 12
   (b) 1, 3, 5, 8, 10, 12   *Ans: A*
   (c) 1, 3, 5, 8, 9, 12
   (d) None of the above

7. C is associated with
   (a) 1, 4, 6, 7, 9, 11   *Ans: A*
   (b) 2, 4, 6, 8, 9
   (c) 1, 4, 6, 7, 9
   (d) None of the above

8. If p and q are positive integers, then which one of the following equations has $p - \sqrt{q}$ as one of its roots ?

(a) $x^2 - 2px - (p^2 - q) = 0$

(b) $x^2 - 2px + (p^2 - q) = 0$ Ans: b

(c) $x^2 + 2px - (p^2 - q) = 0$

(d) $x^2 + 2px + (p^2 - q) = 0$

9. Given two squares of sides x and y such that $y = x + x^2$. What is the rate of change of area of the second square with respect to the area of the first square ?

(a) $1 + 3x + 2x^2$ Ans: A

(b) $1 + 2x + 3x^2$

(c) $1 - 2x + 3x^2$

(d) $1 - 2x - 3x^2$

10. The planes $px + 2y + 2z - 3 = 0$ and $2x - y + z + 2 = 0$ intersect at an angle $\pi/4$. What is the value of p^2 ?

(a) 24   Ans: A

(b) 12

(c) 6

(d) 3

11. The growth of a quantity N(t) at any instant t is given by $\dfrac{dN(t)}{dt} = \alpha N(t)$. Given that $N(t) = ce^{kt}$, c is a constant. What is the value of α ?

(a) c

(b) k   Ans: A

(c) $c + k$

(d) $c - k$

12. A circle is drawn with the two foci of an ellipse $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$ at the end of the diameter. What is the equation to the circle ?

(a) $x^2 + y^2 = a^2 + b^2$

(b) $x^2 + y^2 = a^2 - b^2$ Ans: A

(c) $x^2 + y^2 = 2(a^2 + b^2)$

(d) $x^2 + y^2 = 2(a^2 - b^2)$

13. What is the image of the point (1, 2) on the line $3x + 4y - 1 = 0$?

(a) $\left(-\dfrac{7}{5}, \ -\dfrac{6}{5}\right)$

(b) $\left(\dfrac{7}{8}, \ \dfrac{1}{2}\right)$ Ans: A

(c) $\left(\dfrac{7}{8}, \ -\dfrac{1}{2}\right)$

(d) $\left(-\dfrac{7}{5}, \ \dfrac{1}{2}\right)$

14. If the product of the roots of the equation $x^2 - 5x + k = 15$ is -3, then what is the value of k ?

(a) 12   Ans: A

(b) 15

(c) 16

(d) 18

15. Consider the following statements :

1. Every function has a primitive.

2. A primitive of a function is unique.

Which of the statements given above is/are correct ?

(a) 1 only   Ans: B

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

(4 - A)

16. If $A = \{a, b, c, d\}$, then what is the number of proper subsets of A ?

(a) 16

(b) 15   Ans: B

(c) 14

(d) 12

17. What is the number of three-digit odd numbers formed by using the digits 1, 2, 3, 4, 5, 6 if repetition of digits is allowed ?

(a) 60

(b) 108   Ans: B

(c) 120

(d) 216

18. Let $A = \begin{pmatrix} 5 & 6 & 1 \\ 2 & -1 & 5 \end{pmatrix}$. Let there exist a matrix B such that $AB = \begin{pmatrix} 35 & 49 \\ 29 & 13 \end{pmatrix}$. What is B equal to ?

(a) $\begin{pmatrix} 5 & 1 & 4 \\ 2 & 6 & 3 \end{pmatrix}$

    Ans: C

(b) $\begin{pmatrix} 2 & 6 & 3 \\ 5 & 1 & 4 \end{pmatrix}$

(c) $\begin{pmatrix} 5 & 2 \\ 1 & 6 \\ 4 & 3 \end{pmatrix}$

(d) $\begin{pmatrix} 2 & 5 \\ 6 & 1 \\ 3 & 4 \end{pmatrix}$

19. Consider the following statements :

1. The probability that there are 53 Sundays in a leap year is twice the probability that there are 53 Sundays in a non-leap year.

2. The probability that there are 5 Mondays in the month of March is thrice the probability that there are 5 Mondays in the month of April.

Which of the statements given above is/are correct ?

(a) 1 only

(b) 2 only   Ans: A

(c) Both 1 and 2

(d) Neither 1 nor 2

20. Consider the following statements :

1. If $A' = A$, then A is a singular matrix, where A' is the transpose of A.

2. If A is a square matrix such that $A^3 = I$, then A is non-singular.

Which of the statements given above is/are correct ?

(a) 1 only

(b) 2 only   Ans: C

(c) Both 1 and 2

(d) Neither 1 nor 2

21. If p times the pth term of an AP is q times the qth term, then what is the $(p + q)^{th}$ term equal to ?

(a) $p + q$

(b) pq Ans: D

(c) 1

(d) 0

22. A team of 8 players is to be chosen from a group of 12 players. Out of the eight players one is to be elected as captain and another as vice-captain. In how many ways can this be done ?

(a) 27720

(b) 13860   Ans: C

(c) 6930

(d) 495

23. In tossing three coins at a time, what is the probability of getting at most one head ?

(a) $\frac{3}{8}$

(b) $\frac{7}{8}$

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

(d) $\frac{1}{8}$

Ans: C

24. What is the sum of the coefficients of all the terms in the expansion of $(45x - 49)^4$?

(a) -256

(b) -100

(c) 100

(d) 256

Ans: D

25. Two balls are selected from a box containing 2 blue and 7 red balls. What is the probability that at least one ball is blue ?

(a) $\frac{2}{9}$

(b) $\frac{7}{9}$

(c) $\frac{5}{12}$

(d) $\frac{7}{12}$

Ans: C

26. If the equation $x^2 - bx + 1 = 0$ does not possess real roots, then which one of the following is correct ?

(a) $-3 < b < 3$

(b) $-2 < b < 2$

(c) $b > 2$

(d) $b < -2$

Ans: B

27. The probability of guessing a correct answer is $\frac{x}{12}$. If the probability of not guessing the correct answer is $\frac{2}{3}$, then what is x equal to ?

(a) 2

(b) 3

(c) 4

(d) 6

Ans: C

28. If the system of equations $2x + 3y = 7$ and $2ax + (a + b)y = 28$ has infinitely many solutions, then which one of the following is correct ?

(a) $a = 2b$

(b) $b = 2a$

(c) $a = -2b$

(d) $b = -2a$

Ans: B

29. If p and q are the roots of the equation $x^2 - px + q = 0$, then what are the values of p and q respectively ?

(a) $1, 0$

(b) $0, 1$

(c) $-2, 0$

(d) $-2, 1$

Ans: A

30. Consider the following statements related to a variable X having a binomial distribution $b_X(n, p)$:

1. If $p = \frac{1}{2}$, then the distribution is symmetrical.

2. p remaining constant, $P(X = r)$ increases as n increases.

Which of the statements given above is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

Ans: A

31. What is the number of ways of arranging the letters of the word 'BANANA' so that no two N's appear together ?

    (a) 40

    (b) 60   Ans: A

    (c) 80

    (d) 100

32. Consider the equation $(x - p)(x - 6) + 1 = 0$ having integral coefficients. If the equation has integral roots, then what values can p have ?

    (a) 4 or 8

    (b) 5 or 10   Ans: A

    (c) 6 or 12

    (d) 3 or 6

33. What is the equivalent binary number of the decimal number 13·625 ?

    (a) 1101·111

    (b) 1111·101   Ans: C

    (c) 1101·101

    (d) 1111·111

34. What is the value of

$$\left(\frac{i + \sqrt{3}}{-i + \sqrt{3}}\right)^{200} + \left(\frac{i - \sqrt{3}}{i + \sqrt{3}}\right)^{200} + 1 \ ?$$

    (a) −1

    (b) 0   Ans: B

    (c) 1

    (d) 2

35. The order of a set A is 3 and that of a set B is 2. What is the number of relations from A to B ?

    (a) 4

    (b) 6   Ans: D

    (c) 32

    (d) 64

36. What is the value of $\dfrac{\log_{\sqrt{\alpha\beta}}(H)}{\log_{\sqrt{\alpha\beta\gamma}}(H)}$?

    (a) $\log_{\alpha\beta}(\alpha)$

    (b) $\log_{\alpha\beta\gamma}(\alpha\beta)$ Ans: C

    (c) $\log_{\alpha\beta}(\alpha\beta\gamma)$

    (d) $\log_{\alpha\beta}(\beta)$

37. The 59th term of an AP is 449 and the 449th term is 59. Which term is equal to 0 (zero) ?

    (a) 501st term

    (b) 502nd term   Ans: C

    (c) 508th term

    (d) 509th term

38. For a set A, consider the following statements
    1. $A \cup P(A) = P(A)$
    2. $\{A\} \cap P(A) = A$ Ans: D
    3. $P(A) - \{A\} = P(A)$

    where P denotes power set.

    Which of the statements given above is/are correct ?

    (a) 1 only

    (b) 2 only

    (c) 3 only

    (d) 1, 2 and 3

39. If the AM and HM of two numbers are 27 and 12 respectively, then what is their GM equal to ?

(a) 12

(b) 18

(c) 24

(d) 27

$\frac{a+b}{2} = 27$

Ans: B aⁿb ⊂ 54

$\frac{1}{a} + \frac{1}{b} = 12$

$\frac{b+a}{ab} =$

40. If $\tan A = \frac{1}{2}$ and $\tan B = \frac{1}{3}$, then what is the value of $(A + B)$?

(a) 0

(b) $\frac{\pi}{4}$

Ans: B

(c) $\frac{\pi}{2}$

(d) π

41. If $(4, 0)$ and $(-4, 0)$ are the foci of an ellipse and the semi-minor axis is 3, then the ellipse passes through which one of the following points ?
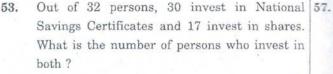
(a) $(2, 0)$

(b) $(0, 5)$ ✓

Ans: D

(c) $(0, 0)$

(d) $(5, 0)$

42. Under what condition do the planes $bx - ay = n$, $cy - bz = l$, $az - cx = m$ intersect in a line ?

(a) $a + b + c = 0$

(b) $a = b = c$

Ans: C

(c) $al + bm + cn = 0$

(d) $l + m + n = 0$

43. What is the maximum point on the curve $x = e^x y$?

(a) $(1, e)$

(b) $(1, e^{-1})$

Ans: B

(c) $(e, 1)$

(d) $(e^{-1}, 1)$

44. The function $f(x) = e^x$, $x \in R$ is

(a) Onto but not one-one

(b) One-one onto

Ans: C

(c) One-one but not onto

(d) Neither one-one nor onto

45. If $y = \sin^{-1}\left(\frac{4x}{1 + 4x^2}\right)$, then what is $\frac{dy}{dx}$ equal to ?

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

Ans: C

(b) $-\frac{1}{1 + 4x^2}$

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

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

53. Out of 32 persons, 30 invest in National Savings Certificates and 17 invest in shares. What is the number of persons who invest in both ?

(a) 13

(b) 15   Ans: B

(c) 17

(d) 19

54. What are the equations of the directrices of the ellipse $25x^2 + 16y^2 = 400$?

(a) $3x \pm 25 = 0$

(b) $3y \pm 25 = 0$ Ans: B

(c) $x \pm 15 = 0$

(d) $y \pm 25 = 0$

55. Let A be an $n \times n$ matrix. If $\det(\lambda A) = \lambda^s \det(A)$, what is the value of s ?

(a) 0

(b) 1   Ans: D

(c) -1

(d) n

56. Let E be the ellipse $\dfrac{x^2}{9} + \dfrac{y^2}{4} = 1$ and C be the circle $x^2 + y^2 = 9$. Let $P = (1, 2)$ and $Q = (2, 1)$. Which one of the following is correct ?

(a) Q lies inside C but outside E

(b) Q lies outside both C and E   Ans:

(c) P lies inside both C and E   D

(d) P lies inside C but outside E

57. What is the geometric interpretation of identity $(\vec{a} - \vec{b}) \times (\vec{a} + \vec{b}) = 2(\vec{a} \times \vec{b}$

1. If the diagonals of a given parallelog are used as sides of a sec parallelogram, then the area of second parallelogram is twice that of given parallelogram.

2. If the semi-diagonals of a g parallelogram are used as sides second parallelogram, then the are the second parallelogram is half th the given parallelogram.

Select the correct answer using the code g below :

(a) 1 only

(b) 2 only   Ans! B

(c) Both 1 and 2

(d) Neither 1 nor 2

58. What is $\displaystyle\int_{0}^{\pi/2} \dfrac{\sin^3 x}{\sin^3 x + \cos^3 x} \, dx$?

(a) π

(b) $\dfrac{\pi}{2}$ Ans: C

(c) $\dfrac{\pi}{4}$

(d) 0

59. The function $f(x) = \dfrac{x}{x^2 + 1}$ from R to R

(a) One-one as well as onto

(b) Onto but not one-one   Ans: D

(c) Neither one-one nor onto

(d) One-one but not onto

60. If A be a real skew-symmetric matrix c n such that $A^2 + I = 0$, I being the i matrix of the same order as that of A what is the order of A ?

(a) 3

(b) Odd   Ans: C

(c) Prime number

(d) Even

Directions : *For the next 3 (three) questions to follow :*

The table below gives an incomplete frequency distribution with two missing frequencies f_1 and f_2.

Value of X	Frequency
0	f_1
1	f_2
2	4
3	4
4	3

The total frequency is 18 and the arithmetic mean of X is 2.

61. What is the value of f_2 ?

(a) 4

(b) 3   Ans: A

(c) 2

(d) 1

62. What is the standard deviation ?

(a) $\dfrac{\sqrt{5}}{2}$

(b) $\dfrac{\sqrt{5}}{3}$ Ans: C

(c) $\dfrac{4}{3}$

(d) $\dfrac{16}{9}$

63. What is the coefficient of variance ?

(a) $\dfrac{200}{3}$

(b) $\dfrac{50\sqrt{5}}{9}$ Ans: A

(c) $\dfrac{600}{\sqrt{5}}$

(d) 150

64. What is the sum of all natural numbe between 200 and 400 which are divisible 7 ?

(a) 6729

(b) 8712

(c) 8729   Ans: C

(d) 9276

65. The mean and variance of a binom distribution are 8 and 4 respectively. What $P(X = 1)$ equal to ?

(a) $\dfrac{1}{2^{12}}$

(b) $\dfrac{1}{2^{8}}$ Ans: A

(c) $\dfrac{1}{2^{6}}$

(d) $\dfrac{1}{2^{4}}$

66. What is $\displaystyle\int e^{ln\,x} \sin x \, dx$ equal to ?

(a) $e^{ln\,x} (\sin x - \cos x) + c$

(b) $(\sin x - x \cos x) + c$ Ans: B

(c) $(x \sin x + \cos x) + c$

(d) $(\sin x + x \cos x) + c$

where c is a constant of integration.

67. An observed event B can occur after one the three events A_1, A_2, A_3. If $P(A_1) = P(A_2) = 0.4$, $P(A_3) = 0.2$ and $P(B \mid A_1) = 0.25$, $P(B \mid A_2) = 0.4$, $P(B \mid A_3) = 0.125$, what is the probability A_1 after observing B ?

(a) 1/3   Ans: C

(b) 6/19

(c) 20/57

(d) 2/5

68. What is $\int \dfrac{x^4 + 1}{x^2 + 1}\, dx$ equal to ?

(a) $\dfrac{x^3}{3} - x + 4 \tan^{-1} x + c$

(b) $\dfrac{x^3}{3} + x + 4 \tan^{-1} x + c$ Ans: C

(c) $\dfrac{x^3}{3} - x + 2 \tan^{-1} x + c$

(d) $\dfrac{x^3}{3} - x - 4 \tan^{-1} x + c$

where c is a constant of integration.

69. What is the value of $\lim\limits_{x \to \infty} \left(\dfrac{x+6}{x+1} \right)^{x+4}$?

(a) e

(b) e^2 Ans: D

(c) e^4

(d) e^5

70. What is the area of the triangle with vertices $(0, 2, 2)$, $(2, 0, -1)$ and $(3, 4, 0)$?

(a) $15/2$ square units

(b) 15 square units Ans: A

(c) $7/2$ square units

(d) 7 square units

71. If $\dfrac{1}{2 - \sqrt{-2}}$ is one of the roots of

$ax^2 + bx + c = 0$ where a, b, c are real, then what are the values of a, b, c respectively ?

(a) $6, -4, 1$

(b) $4, 6, -1$ Ans: A

(c) $3, -2, 1$

(d) $6, 4, 1$

72. If ω is a complex cube root of unity and $x = \omega^2 - \omega - 2$, then what is the value $x^2 + 4x + 7$?

(a) -2

(b) -1 Ans: C

(c) 0

(d) 1

73. If $\cos x \neq -1$, then what is $\dfrac{\sin x}{1 + \cos x}$ equal to ?

(a) $-\cot \dfrac{x}{2}$

(b) $\cot \dfrac{x}{2}$ Ans: C

(c) $\tan \dfrac{x}{2}$

(d) $-\tan \dfrac{x}{2}$

74. The angle of elevation of the tip of a flag post from a point 5 m away from its base is 7? What is the approximate height of the flag post ?

(a) 15 m

(b) 17 m Ans: C

(c) 19 m

(d) 21 m

75. If $A = P(\{1, 2\})$ where P denotes the power set, then which one of the following is correct ?

(a) $\{1, 2\} \subset A$

(b) $1 \in A$

(c) $\varphi \notin A$ Ans: D

(d) $\{1, 2\} \in A$

76. The geometric mean of three numbers was computed as 6. It was subsequently found that, in this computation, a number 8 was wrongly read as 12. What is the correct geometric mean ?

(a) 4

(b) $\sqrt[3]{5}$ Ans: B

(c) $2\sqrt[3]{18}$

(d) None of the above

77. Let $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} = [a_{ij}]$, where i, j = 1, 2. If its inverse matrix is $[b_{ij}]$, what is b_{22} ?

(a) -2

(b) 1

(c) $\dfrac{3}{2}$ Ans: D

(d) $-\dfrac{1}{2}$

78. The angle A lies in the third quadrant and it satisfies the equation $4(\sin^2 x + \cos x) = 1$. What is the measure of the angle A ?

(a) 225°

(b) 240°   Ans: B

(c) 210°

(d) None of the above

79. What is the area enclosed between the curves $y^2 = 12x$ and the lines x = 0 and y = 6 ?

(a) 2 square units

(b) 4 square units   Ans: C

(c) 6 square units

(d) 8 square units

80. In a triangle ABC, BC = $\sqrt{39}$, AC = 5 an AB = 7. What is the measure of the ang A ?

(a) $\dfrac{\pi}{4}$

(b) $\dfrac{\pi}{3}$ Ans: B

(c) $\dfrac{\pi}{2}$

(d) $\dfrac{\pi}{6}$

81. What is the modulus of $\dfrac{1+2i}{1-(1-i)^2}$?

(a) 1

(b) $\sqrt{5}$ Ans: A

(c) $\sqrt{3}$

(d) 5

82. If the line through the points A (k, 1, −1) a B (2k, 0, 2) is perpendicular to the l through the points B and C (2 + 2k, k, 1), th what is the value of k ?

(a) −1

(b) 1

(c) −3   Ans: D

(d) 3

83. What is $\displaystyle\int \dfrac{1}{1+e^x}\, dx$ equal to ?

(a) $x - \ln x + c$ Ans: C

(b) $x - \ln(\tan x) + c$

(c) $x - \ln(1 + e^x) + c$

(d) $\ln(1 + e^x) + c$

where c is a constant of integration.

84. The function $f(x) = x \csc x$ is
   (a) continuous for all values of x
   (b) discontinuous everywhere
   (c) continuous for all x except at $x = n\pi$, where n is an integer
   (d) continuous for all x except at $x = n\pi/2$, where n is an integer — Ans: C

85. What is the solution of the differential equation $a\left(x\dfrac{dy}{dx} + 2y\right) = xy\dfrac{dy}{dx}$?

   (a) $x^2 = kye^{\frac{y}{a}}$

   (b) $yx^2 = kye^{\frac{y}{a}}$ Ans: B

   (c) $y^2x^2 = kye^{\frac{y^2}{a}}$

   (d) None of the above

   where k is a constant.

86. A vector $\vec{b}$ is collinear with the vector $\vec{a} = (2, 1, -1)$ and satisfies the condition $\vec{a} \cdot \vec{b} = 3$. What is $\vec{b}$ equal to ?

   (a) $(1, 1/2, -1/2)$
   (b) $(2/3, 1/3, -1/3)$ Ans: A
   (c) $(1/2, 1/4, -1/4)$
   (d) $(1, 1, 0)$

87. What is the least positive integer n for which $\left(\dfrac{1+i}{1-i}\right)^n = 1$?

   Ans: D

   (a) 16
   (b) 12
   (c) 8
   (d) 4

88. The vectors $\vec{a} = x\hat{i} + y\hat{j} + z\hat{k}$, $\vec{b} = \hat{}$ $\vec{c}$ are such that they form a right-hand system. What is $\vec{c}$ equal to ?

   (a) $\hat{j}$

   (b) $y\hat{j} - x\hat{k}$ Ans: C

   (c) $y\hat{i} - x\hat{j}$

   (d) $x\hat{i} - y\hat{j}$

89. If $x = t^2$, $y = t^3$, then what is $\dfrac{d^2y}{dx^2}$ equal to ?

   (a) 1

   (b) $\dfrac{3}{2t}$ Ans: C

   (c) $\dfrac{3}{4t}$

   (d) $\dfrac{3}{2}$

90. What is $\displaystyle\int_{-\pi/4}^{\pi/4} \tan^3 x\, dx$ equal to ?

   (a) $\sqrt{3}$ Ans: D

   (b) $\dfrac{1}{3}$

   (c) $\dfrac{1}{2}$

   (d) 0

91. Let O (0, 0, 0), P (3, 4, 5), Q (m, n, r) and R (1, 1, 1) be the vertices of a parallelogram taken in order. What is the value of m + n + r ?

(a) 6

(b) 12

Ans: C

(c) 15

(d) More than 15

92. What is the solution of the differential equation $3 e^x \tan y \, dx + (1 + e^x) \sec^2 y \, dy = 0$?

(a) $(1 + e^x) \tan y = c$

(b) $(1 + e^x)^3 \tan y = c$ **Ans: B**

(c) $(1 + e^x)^2 \tan y = c$

(d) $(1 + e^x) \sec^2 y = c$

where c is a constant of integration.

93. What is the locus of points, the difference of whose distances from two points being constant ?

(a) Pair of straight lines

(b) An ellipse   **Ans: C**

(c) A hyperbola

(d) A parabola

94. What is the differential equation for $y^2 = 4a (x - a)$?

(a) $yy' - 2xyy' + y^2 = 0$ **Ans: A**

(b) $yy' (yy' + 2x) + y^2 = 0$

(c) $yy' (yy' - 2x) + y^2 = 0$

(d) $yy' - 2xyy' + y = 0$

95. If the angle between the vectors $\vec{a}$ and is $\frac{\pi}{3}$, what is the angle between $-5\vec{a}$ $6\vec{b}$?

(a) $\frac{\pi}{6}$

(b) $\frac{2\pi}{3}$ **Ans: B**

(c) $\frac{2\pi}{5}$

(d) $\frac{3\pi}{7}$

96. What is the degree of the differential equa

$$\frac{d^2y}{dx^2} - \sqrt{1 + \left(\frac{dy}{dx}\right)^3} = 0 ?$$

(a) 1

(b) 2   **Ans: B**

(c) 3

(d) 6

97. If $\int x^2 \ln x \, dx = \frac{x^3}{m} \ln x + \frac{x^3}{n} + c,$
what are the values of m and n respective

(a) 1/3, −1/9

(b) 3, − 9   **Ans: B**

(c) 3, 9

(d) 3, 3

where c is a constant of integration.

98. What is the principal value of $\csc^{-1}(-\sqrt{2})$?

(a) $\dfrac{\pi}{4}$

(b) $\dfrac{\pi}{2}$

(c) $-\dfrac{\pi}{4}$

(d) 0

Ans: C

99. If $f : R \to R$, $g : R \to R$ and $g(x) = x + 3$ and $(fog)(x) = (x + 3)^2$, then what is the value of $f(-3)$?

(a) -9

(b) 0

(c) 9

(d) 3

$(x + 6)^2$

Ans: C

100. What is the value of $\lim\limits_{x \to 1} \dfrac{(x-1)^2}{|x-1|}$?

(a) 0

(b) 1

(c) -1

(d) The limit does not exist

Ans: B

101. A balloon is pumped at the rate of 4 cm^3 per second. What is the rate at which its surface area increases when its radius is 4 cm ?

(a) 1 cm^2/sec

(b) 2 cm^2/sec

(c) 3 cm^2/sec

(d) 4 cm^2/sec

Ans: B

102. What is the value of $\dfrac{1 + \tan 15°}{1 - \tan 15°}$?

(a) 1

(b) $\dfrac{1}{\sqrt{2}}$

(c) $\dfrac{1}{\sqrt{3}}$

(d) $\sqrt{3}$

Ans: D

103. If $f(x) = kx^3 - 9x^2 + 9x + 3$ is monotonically increasing in every interval, then which one of the following is correct ?

(a) $k < 3$

(b) $k \le 3$

(c) $k > 3$

(d) $k \ge 3$

Ans: D

104. If $\sin^{-1}\dfrac{5}{x} + \sin^{-1}\dfrac{12}{x} = \dfrac{\pi}{2}$, then what is the value of x ?

(a) 1

(b) 7

(c) 13

(d) 17

$\sin^{-1}\frac{5}{x} = \alpha$

$\sin\alpha = \frac{5}{x}$

$x = 5/\sin\alpha$

Ans: C

105. If α, β are the roots of the quadratic equation $x^2 - x + 1 = 0$, then which of the following is correct ?

(a) $(\alpha^4 - \beta^4)$ is real

(b) $2(\alpha^5 + \beta^5) = (\alpha\beta)^5$

(c) $(\alpha^6 - \beta^6) = 0$

(d) $(\alpha^8 + \beta^8) = (\alpha\beta)^8$

Ans: A

106. What is the value of $\sqrt{3}\ \text{cosec}\ 20° - \sec 20°$?

(a) 1/4

(b) 4

Ans: B

(c) 2

(d) 1

107. The probability distribution of random variable X with two missing probabilities p_1 and p_2 is given below :

X	P(X)
1	k
2	p_1
3	4k
4	p_2
5	2k

It is further given that $P(X \le 2) = 0.25$ and $P(X \ge 4) = 0.35$.

Consider the following statements :

1. $p_1 = p_2$

2. $p_1 + p_2 = P(X = 3)$

Which of the statements given above is/are correct ?

(a) 1 only

Ans: A

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

108. If angles A, B, C are in AP, then what is $\sin A + 2 \sin B + \sin C$ equal to ?

(a) $4 \sin B \cos^2 \left(\dfrac{A - C}{2} \right)$

(b) $4 \sin B \cos^2 \left(\dfrac{A - C}{4} \right)$ Ans: B

(c) $4 \sin (2B) \cos^2 \left(\dfrac{A - C}{2} \right)$

(d) $4 \sin (2B) \cos^2 \left(\dfrac{A - C}{4} \right)$

109. *Statement I :* If $-1 \le x < 0$, then $\cos (\sin^{-1} x) = -\sqrt{1 - x^2}$.

Statement II : If $-1 \le x < 0$, then $\sin (\cos^{-1} x) = \sqrt{1 - x^2}$.

Which one of the following is correct in respect of the above statements ?

(a) Both statements I and II independently correct and statement is the correct explanation statement I

(b) Both statements I and II independently correct but statement is not the correct explanation statement I

(c) Statement I is correct but statement is false

(d) Statement I is false but statement correct

Ans: B