Dharmapuri DT

SECOND REVISION EXAMINATION - 2025

CLASS: 12

MATHEMATICS

Reg.No

Time : 3.00 Hours

MARKS : 90

SECTION – A

Note:

(i) All questions are compulsory.

(ii) Each question carries one mark.

(iii) Choose the most suitable answer from the given four alternatives

20 x 1 = 20

1. If $x^a y^b = e^m, x^c y^d = e^n, \Delta_1 = \begin{vmatrix} m & b \\ n & d \end{vmatrix}, \Delta_2 = \begin{vmatrix} a & m \\ c & n \end{vmatrix}, \Delta_3 = \begin{vmatrix} a & b \\ c & d \end{vmatrix}$, then the values of x and y are respectively,

   (1) $e^{(\Delta_2/\Delta_1)}, e^{(\Delta_3/\Delta_1)}$ (2) $\log(\Delta_1/\Delta_3), \log(\Delta_2/\Delta_3)$

   (3) $\log(\Delta_2/\Delta_1), \log(\Delta_3/\Delta_1)$ (4) $e^{(\Delta_1/\Delta_3)}, e^{(\Delta_2/\Delta_3)}$

2. The principal argument of $\frac{3}{-1+i}$ is

   (1) $\frac{-5\pi}{6}$ (2) $\frac{-2\pi}{3}$ (3) $\frac{-3\pi}{4}$ (4) $\frac{-\pi}{2}$

3. The number of real numbers in $[0,2\pi]$ satisfying $\sin^4 x - 2\sin^2 x + 1$ is

   (1) 2 (2) 4 (3) 1 (4) ∞

4. If $\cot^{-1} 2$ and $\cot^{-1} 3$ are two angles of a triangle, then the third angle is

   (1) $\frac{\pi}{4}$ (2) $\frac{3\pi}{4}$ (3) $\frac{\pi}{6}$ (4) $\frac{\pi}{3}$

5. If $P(x,y)$ be any point on $16x^2 + 25y^2 = 400$ with foci $F_1(3,0)$ and $F_2(-3,0)$ then $PF_1 + PF_2$ is

   (1) 8 (2) 6 (3) 10 (4) 12

6. If the distance of the point $(1,1,1)$ from the origin is half of its distance from the plane $x + y + z + k = 0$, then the values of k are

   (1) ± 3 (2) ± 6 (3) $-3, 9$ (4) $3, -9$

7. The point of inflection of the curve $y = (x-1)^3$ is

   (1) (0,0) (2) (0,1) (3) (1,0) (4) (1,1)

8. Linear approximation for $g(x) = \cos x$ at $x = \frac{\pi}{2}$ is

   (1) $x + \frac{\pi}{2}$ (2) $-x + \frac{\pi}{2}$ (3) $x - \frac{\pi}{2}$ (4) $-x - \frac{\pi}{2}$

9. If $\frac{\Gamma(n+2)}{\Gamma(n)} = 90$ then n is

   (1) 10 (2) 5 (3) 8 (4) 9

10. The integrating factor of the differential equation $\frac{dy}{dx} + y = \frac{1+y}{\lambda}$ is

    (1) $\frac{x}{e^x}$ (2) $\frac{e^x}{x}$ (3) λe^x (4) e^x

11. Let X represent the difference between the number of heads and the number of tails obtained when a coin is tossed n times. Then the possible values of X are

    (1) $i + 2n, i = 0,1,2 \ldots n$ (2) $2i - n, i = 0,1,2 \ldots n$

    (3) $n - i, i = 0,1,2 \ldots n$ (4) $2i + 2n, i = 0,1,2 \ldots n$

12. Which one of the following statements has the truth value T ?
   (i) $\sin x$ is an even function.
   (ii) Every square matrix is non-singular
   (iii) The product of complex number and its conjugate is purely imaginary
   (iv) $\sqrt{5}$ is an irrational number

13. If $f(x) = \int_1^x \frac{e^{\sin u}}{u} du, x > 1$ and $\int_1^3 \frac{e^{\sin x^2}}{x} dx = \frac{1}{2}[f(a) - f(1)]$, then one of the possible value of a is
   (1) 3 (2) 6 (3) 9 (4) 5

14. If the planes $\vec{r} \cdot (2\hat{\imath} - \lambda\hat{\jmath} + \hat{k}) = 3$ and $\vec{r} \cdot (4\hat{\imath} + \hat{\jmath} - \mu\hat{k}) = 5$ are parallel, then the value of λ and μ are
   (1) $\frac{1}{2}, -2$ (2) $-\frac{1}{2}, 2$ (3) $-\frac{1}{2}, -2$ (4) $\frac{1}{2}, 2$

15. In the case n^{th} roots of unity, identify the correct statements.
   (i) the roots are in G.P
   (ii) sum of the roots is zero
   (iii) Product of the roots is $(-1)^{n+1}$
   (iv) The roots are lying on a unit circle
   (1) (i) and (ii) only (2) (ii) and (iii) only (3) all (4) (i), (ii) and (iii) only

16. If $p+\sqrt{q}$ and $-i\sqrt{q}$ are the roots of a polynomial equation with rational coefficients then the least possible degree of the equation is
   (1) 2 (2) 1 (3) 3 (4) 4

17. The domain of secant function and $\sec^{-1} x$ function are respectively
   (1) $[0,\pi]\backslash\left\{\frac{\pi}{2}\right\}$ and $\mathbb{R}\backslash(-1,1)$ (2) $\mathbb{Z}\backslash(-1,1)$ and $0,\pi\backslash\left\{\frac{\pi}{2}\right\}$
   (3) $[0,\pi]\backslash\left\{\frac{\pi}{2}\right\}$ and $\{-1,1\}$ (4) $\mathbb{Z}\backslash\{-1,1\}$ and $0,\pi\backslash\left\{\frac{\pi}{2}\right\}$

18. The point of contact of the tangent $y = mx + c$ and the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is
   (1) $\left(\frac{a^2m}{c}, \frac{b^2}{c}\right)$ (2) $\left(\frac{a^2m}{c}, \frac{-b^2}{c}\right)$ (3) $\left(-\frac{a^2m}{c}, \frac{b^2}{c}\right)$ (4) $\left(-\frac{a^2m}{c}, -\frac{b^2}{c}\right)$

19. The slant asymptote of $f(x) = \frac{x^2-6x+7}{x+5}$ is
   (1) $x + y + 11 = 0$ (2) $x + y - 11 = 0$ (3) $x = -5$ (4) $y = x - 11$

20. Which of the following is not true ?
   (1) A Boolean matrix is a real matrix whose entries are either 0 or 1
   (2) The product $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ is a Boolean matrix
   (3) All identity matrices I_n are Boolean matrices
   (4) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \vee \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$

SECTION - B

Note: (i) Answer any 7 questions. 7 x 2 = 14

(ii) Question No: 30 is compulsory:

21. If A is symmetric, prove that adj A is also symmetric.
22. Simplify : $i^{59} + \frac{1}{i^{59}}$
23. If α, β, γ are the roots of the equation $x^3 + px^2 + qx + r = 0$, find the value of $\sum \frac{1}{\beta\gamma}$ in terms of the coefficients.
24. If $y = 4x + c$ is a tangent to the circle $x^2 + y^2 = 9$ find c,
25. Prove that the function $f(x) = x^2 - 2x - 3$ is strictly increasing in $(2, \infty)$.
26. The relation between number of words y a person learns in x hours is given by $y = 52\sqrt{x}, 0 \le x \le 9$. What is the approximate number of words learned when x changes from 1 to 1.1 hour?
27. Evaluate : $\int_0^{\frac{\pi}{2}} cos^7 x\, dx$
28. The mean and variance of a binomial variate X are respectively 2 and 1.5. Find $P(X = 1)$
29. Let $*$ be defined on $\mathbb{R}$ by $(a * b) = a + b + ab - 7$. Is $*$ binary on $\mathbb{R}$? If so, find $3 * \left(\frac{-7}{15}\right)$
30. Find the angle between the lines: 4x = -3y, z = 0 and $\vec{r} = \hat{\imath} + t(4\hat{\imath} + \hat{3\jmath})$.

SECTION – C

Note: (i) Answer any Seven Questions. 7 x 3 = 21

(ii) Question No.40 is compulsory

31. If $A = \begin{bmatrix} 3 & 2 \\ 7 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & -3 \\ 5 & 2 \end{bmatrix}$, verify that $(AB)^{-1} = B^{-1}A^{-1}$.
32. Show that the points $1, \frac{-1}{2} + i\frac{\sqrt{3}}{2}$, and $\frac{-1}{2} - i\frac{\sqrt{3}}{2}$ are the vertices of an equilateral triangle.
33. Find a polynomial equation of minimum degree with rational coefficients, having $\sqrt{5} - \sqrt{3}$ as a root.
34. Find the value of $cos^{-1}\left(cos\frac{\pi}{7}cos\frac{\pi}{17} - sin\frac{\pi}{7}sin\frac{\pi}{17}\right)$.
35. With usual notations, in any triangle ABC, prove by vector method that $\frac{a}{sinA} = \frac{b}{sinB} = \frac{c}{sinc}$.
36. Write the Maclaurin series expansion of the functions: $tan^{-1}(x); -1 \le x \le 1$
37. If $w(x, y) = xy + sin(xy)$, then prove that $\frac{\partial^2 w}{\partial y \partial x} = \frac{\partial^2 w}{\partial x \partial y}$.
38. Solve the Linear differential equations: $cos\, x\frac{dy}{dx} + y\, sin\, x = 1$
39. The probability density function of X is given by $f(x) = \begin{cases} kxe^{-2x} & \text{for } x > 0 \\ 0 & \text{for } x \le 0 \end{cases}$. Find the value of k.
40. Evaluate the integrals using properties of integration: $\int_{-5}^{5} sin\left(\frac{e^x - 1}{e^x + 1}\right) dx$

SECTION - D

Answer all questions of the following: $7 \times 5 = 35$

41. a)Find the value of k for which the equations $kx - 2y + z = 1, x - 2ky + z = -2, x - 2y + kz = 1$ have (i) no solution (ii) unique solution (iii) infinitely many solution

(OR)

b) Solve $tan^{-1}\frac{1-x}{1+x} = \frac{1}{2}tan^{-1}x$ for $x > 0$.

42. a)If $2\cos\alpha = x + \frac{1}{x}$ and $2\cos\beta = y + \frac{1}{y}$, show that

(i) $xy - \frac{1}{xy} = 2i\sin(\alpha + \beta)$ (ii) $\frac{x^m}{y^n} - \frac{y^n}{x^m} = 2i\sin(m\alpha - n\beta)$

(OR)

b)If $\vec{a} = 2\hat{\imath} + 3\hat{\jmath} - \hat{k}, \vec{b} = 3\hat{\imath} + 5\hat{\jmath} + 2\hat{k}, \vec{c} = -\hat{\imath} - 2\hat{\jmath} + 3\hat{k}$, verify that $\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{a}.\vec{c})\vec{b} - (\vec{a}.\vec{b})\vec{c}$

43. a)Two coast guard stations are located 600km apart at points $A(0,0)$ and $B(0,600)$. A distress signal from a ship at P is received at slightly different times by two stations. It is determined that the ship is 200km farther from station A than it is from station B. Determine the equation of hyperbola that passes through the location of the ship.

(OR)

b)Evaluate the $\lim_{x \to 0^+} (\cos x)^{\frac{1}{x^2}}$ limits, if necessary use I'Hôpital Rule :

44. a)Find the vertex, focus,equation of directrix and length of the latus rectum of the $x^2 - 2x + 8y + 17 = 0$

(OR)

b)If we blow air into a balloon of spherical shape at a rate of $1000cm^3$ per second. At what rate the radius of the baloon changes when the radius is 7cm? Also compute the rate at which the surface area changes.

45. a)Find the area of the region bounded by x –axis, the curve $y = |\cos x|$, the lines $x = 0$ and $x = \pi$.

(OR)

b)Solve the differential equations: $\frac{dy}{dx} = \frac{y}{x} - \cot\left(\frac{y}{x}\right)\cos\left(\frac{y}{x}\right)$, $y = \frac{\pi}{4}$ when $x = 1$

46. a)Suppose a person deposits ₹10,000 Indian rupees in a bank account at the rate of 5% per annum compounded continuously. How much money will be in his bank account 18 months later?

(OR)

b)To proe that . $p \to (\neg q \vee r) \equiv \neg p \vee (\neg q \vee r)$

47. a)Find the vector parametric, vector non-parametric and Cartesian form of the equation of the plane passing through the points $(-1,2,0), (2,2,-1)$ and parallel to the straight line $\frac{x-1}{1} = \frac{2y+1}{2} = \frac{z+1}{-1}$.

(OR)

b)A six sided die is marked '1' on one face, '2' on two of its faces, and '3' on remaining three faces. The die is rolled twice. If X denotes the total score in two throws,

(i) Find the probability mass function

(ii) Find the cumulative distribution function

(iii) Find $P(3 \leq X < 6)$ (iv) Find $P(X \geq 4)$

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