Class : 12

Register Number

SECOND REVISION EXAMINATION - 2025

Time Allowed : 3.00 Hours]

MATHEMATICS

[Max. Marks : 90

PART - I

I. **Answer all the questions:** 20x1=20

1. If $(AB)^{-1} = \begin{bmatrix} 12 & -17 \\ -19 & 27 \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} 1 & -1 \\ -2 & 3 \end{bmatrix}$ then B^{-1} = -------

   1) $\begin{bmatrix} 2 & -5 \\ -3 & 8 \end{bmatrix}$ 2) $\begin{bmatrix} 8 & 5 \\ 3 & 2 \end{bmatrix}$ 3) $\begin{bmatrix} 3 & 1 \\ 2 & 1 \end{bmatrix}$ 4) $\begin{bmatrix} 8 & -5 \\ -3 & 2 \end{bmatrix}$

2. The tangent to the curve $y^2 - xy + 9 = 0$ is vertical when

   1) $y = 0$ 2) $y = \pm\sqrt{3}$ 3) $y = ½$ 4) $y = \pm 3$

3. If ρ represents the rank and A and B are n x n matrices, then -----------

   1) $\rho(A + B) = \rho(A) + \rho(B)$ 2) $\rho(AB) = \rho(A) . \rho(B)$
   3) $\rho(A - B) = \rho(A) - \rho(B)$ 4) $\rho(A+B) \leq n$

4. 'L' Hôpital 's rule is not applicable for the limit tends to ------------

   1) 0/0 2) $\infty - \infty$ 3) ∞/∞ 4) 1^0

5. If $|z_1| = 1$, $|z_2| = 2$ $|z_3| = 3$ and $|9z_1z_2 + 4z_1z_3 + z_2z_3| = 12$, then the value of $|z_1 + z_2 + z_3|$ is ———

   1) 1 2) 2 3) 3 4) 4

6. $\sin^{-1}\left(\frac{3}{5}\right) - \cos^{-1}\left(\frac{12}{13}\right) + \sec^{-1}\left(\frac{5}{3}\right) - \text{cosec}^{-1}\left(\frac{13}{12}\right)$ is equal to ----------

   1) 2π 2) π 3) 0 4) $\tan^{-1}\frac{12}{65}$

7. If sinx is the integrating factor of the linear differential equation $dy/dy + py = Q$ then 'P' is

   1) logsinx 2) cosx 3) tanx 4) cotx

8. Which of the following are correct?

   i) $\arg(z_1 + z_2) = \arg z_1 + \arg z_2$ ii) $\arg(z_1 - z_2) = \arg z_1 - \arg z_2$
   iii) $\arg(z_1 z_2) = \arg z_1 \times \arg z_2$ iv) $\arg\left(\frac{z_1}{z_2}\right) = \arg z_1 - \arg z_2$

   1) i) ii) and iv) 2) all 3) iii) and iv) 4) i) and ii)

9. The solution of $\frac{dy}{dx} + P(x)y = 0$ is --------------

   1) $y = ce^{\int pdx}$ 2) $y = ce^{-\int pdx}$ 3) $x = ce^{-\int pdy}$ 4) $x = ce^{\int pdx}$

10. 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) ∞

11. The circle $x^2 + y^2 = 4x + 8y + 5$ intersects the line $3x - 4y = m$ at two distinct point if ---------

    1) $15 < m < 65$ 2) $35 < m < 85$ 3) $-85 < m < -35$ 4) $-35 < m < 15$

12. A random variable x has binomial distribution with n = 25 and p = 0.8 then standard deviation of x is

    1) 6 2) 4 c) 3 4) 2

13. If y = mx + c is a tangent to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ then -------------

1) $c^2 = a^2 m^2 + b^2$ 2) $b^2 = c^2 + a^2 m^2$ 3) $c^2 = a^2 m^2 + m^2$ 4) $c^2 = a^2 m^2 - b2$

14. If $I_{m,n} = \int_0^{\pi/2} \sin^m x \cos^n x \, dx$ then $I_{m,n}$ = .(here n ≥ 2).

1) $\frac{n-1}{m+n} I_{m,n-2}$ 2) $\frac{n+1}{m+n} I_{m,n-2}$ 3) $\frac{n-1}{m+n} I_{m,n-2}$ 4) $\frac{n}{m+n} I_{m,n-2}$

15. If $\vec{a}.\vec{b} = \vec{b}.\vec{c} = \vec{c}.\vec{a} = 0$, then the value of $[\vec{a}, \vec{b}, \vec{c}]$ is

1) $|\vec{a}|\,|\vec{b}|\,|\vec{c}|$ 2) $1/3\,|\vec{a}|\,|\vec{b}|\,|\vec{c}|$ 3) 1 4) -1

16. The vector equation $\vec{r} = \hat{i} - 2\hat{j} - \hat{k} + t(6\hat{i} - \hat{k})$ represents a straight line passing through the points.

1) (0, 6, -1) and (1, -2, -1) 2) (0, 6, -1) and (-1, -4, -2)
3) (1, -2, -1) and (1,4, -2) 4) (1, -2, -1) and (0, -6, 1)

17. If $f(x, y) = e^{xy}$, then $\frac{\partial^2 f}{\partial x \partial y}$ is equal to --------------

1) $xy\, e^{xy}$ 2) $(1 + xy)\, e^{xy}$ 3) $(1 + y)\, e^{xy}$ 4) $(1 + x)\, e^{xy}$

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

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

19. Let X have a Bernoulli distribution with mean 0.4 then the variance of (2x - 3) is

1) 0.24 2) 0.48 3) 0.6 4) 0.96

20. Which one of the following statements has truth value of F?

1) Chennai is in India or $\sqrt{2}$ is an integer
2) Chennai is in India or $\sqrt{2}$ is an irrational number
3) Chennai is in China or $\sqrt{2}$ is an integer
4) Chennai is in China or $\sqrt{2}$ is an irrational number.

PART - II

II. Answer any 7 Questions. Question Number 30 is compulsory. **7x2=14**

21. If adj A = $\begin{bmatrix} 0 & -2 & 0 \\ 6 & 2 & -6 \\ -3 & 0 & 6 \end{bmatrix}$ Find A^{-1}

22. Show that $(2 + i\sqrt{3})^{10} + (2 - i\sqrt{3})^{10}$ is real.

23. Find the intercepts cut off by the plane $\vec{r}.(6\hat{i} + 4\hat{j} - 3\hat{k}) = 12$ on the co ordinate axes.

24. Find the intervals of monotonicity and hence find the local extrema for the function $f(x) = x^2 - 4x + 4$

25. Find the value of $\cos[\cos^{-1}(4/5) + \sin^{-1}(4/5)]$

26. Show that the area of the region bounded by
y = sinx, x = 0 and x = π is 2

27. The orbit of Halley's Comet is an ellipse 36. 18 astronomical units long and by 9. 12 astronomical units wide. Find its eccentricity.

28. A pair of fair dice is rolled once. Find the probability mass function to get the number of fours.

29. Find the differential equation of the curve represented by $xy = ae^{x} + be^{-x} + x^2$, Here 'a' and 'b' are orbitrary constants.

30. Let * be defined on 'R' by (a*b) = a+b + ab -7 Is * binary on 'R'? If so, find $3 * (-7/15)$

PART - III

III. Answer any 7 Questions. Question Number 40 is compulsory. **7x3=21**

31. Reduce the matrix $\begin{bmatrix} 0 & 3 & 1 & 6 \\ -1 & 0 & 2 & 5 \\ 4 & 2 & 0 & 0 \end{bmatrix}$ to row echelon form.

32. Prove that $q \rightarrow p \equiv \neg p \rightarrow \neg q$

33. Find the domain of $\cos^{-1}\left(\frac{2 + \sin x}{3}\right)$

34. For any two complex numbers z_1 and z_2, such that $|z_1| = |z_2| = 1$ and $z_1 z_2 \neq -1$, then show that $\frac{z_1 + z_2}{1 + z_1 z_2}$ is real number

35. If α, β, γ and δ are the roots of the polynomial equation $2x^4 + 5x^3 - 7x^2 + 8 = 0$, Find a quadratic equation with integer co efficients whose roots are $\alpha + \beta + \gamma + \delta$ and $\alpha\beta\gamma\delta$

36. Prove that $[\vec{a} \times \vec{b}, \vec{b} \times \vec{c}, \vec{c} \times \vec{a}] = [\vec{a}, \vec{b}, \vec{c}]^2$

37. Evaluate : $\lim_{x \to 0}\left(\frac{1}{\sin x} - \frac{1}{x}\right)$

38. Evaluate : $\int_{-1}^{1} \frac{dx}{x^2 + 2x + 5}$

39. If $f(x, y) = \frac{x^2 + y^2 + xy}{x^2 - y^2}$ then show that $x\frac{\partial f}{\partial x} + y\frac{\partial f}{\partial y} = 0$

40. If x is the random variable with distribution function F (x) is given by

$$F(x) = \begin{cases} 0, & x < 0 \\ x & 0 \leq x < 1 \\ 1, & 1 \leq x \end{cases}$$

then find i) The probability density function f(x) ii) $p(0.2 \leq x \leq 0.7)$

PART - IV

IV. Answer all the questions **7x5=35**

41. a) Test the consistency of the following system of a) Linear equations.
$x - y + z = -9$; $2x - y + z = 4$; $3x - y + z = 6$; $4x - y + 2z = 7$ **(OR)**

b) Prove that $g(x,y) = x \log (y/x)$ is homogeneous; What is the degree? Verify Euler's Theorem for g.

42. a) Solve : $(x - 5)(x - 7)(x - 6)(x + 4) = 504$ **(OR)**

b) Show that $\int_0^1 [\tan^{-1}x + \tan^{-1}(1 - x)]\, dx = \frac{\pi}{2} - \log_e 2$

43. a) By vector method, Prove that $\cos(\alpha+\beta) = \cos\alpha \cos\beta - \sin\alpha \sin\beta$

(OR)

b) Solve : $\frac{dy}{dx} + 2y \cot x = 3x^2 \operatorname{cosec}^2 x$

44. a) If $z = x + iy$ and $\arg\left(\frac{z-i}{z+2}\right) = \frac{\pi}{4}$, show that $x^2 + y^2 + 3x - 3y + 2 = 0$

(OR)

b) The cumulative distribution function of a discrete random variable is given by

$$F(x) = \begin{cases} 0, & -\infty < x < -1 \\ 0.15, & -1 \leq x < 0 \\ 0.35, & 0 \leq x < 1 \\ 0.60, & 1 \leq x < 2 \\ 0.85, & 2 \leq x < 3 \\ 1, & 3 \leq x < \infty \end{cases}$$

Find i) The probability mass function ii) $P(x < 1)$ and (iii) $P(x \geq 2)$

45. a) Prove that $\tan^{-1} x + \tan^{-1} y + \tan^{-1} z = \tan^{-1}\left[\frac{x + y + z - xyz}{1 - xy - yz - zx}\right]$

(OR)

b) A Particle moves along a line according to the law $S(t) = 2t^3 - 9t^2 + 12t - 4$, Where $t \geq 0$

i) At what times the particles changes direction?

ii) Find the total distance travelled by the particle in the first 4 seconds.

iii) Find the particle's acceleration each time the velocity is zero.

46. a) A bridge has a parabolic arch that is 10 m height in the centre and 30 m wide at the bottom. Find the height of the arch 6 m from the centre, on either sides.

(OR)

b) Show that the lines $r = (6\hat{i} + \hat{j} + 2\hat{k}) + S(\hat{i} + 2\hat{j} - 3\hat{k})$ and $\vec{r} = (3\hat{i} + 2\hat{j} - 2\hat{k}) + t(2\hat{i} + 4\hat{j} - 5\hat{k})$ are skew lines and hence find the shortest distance between them.

47. a) The farmer plans to fence a rectangular pasture adjacent to a river. The pasture must contain 1,80,000 sq. mtrs. in order to provide enough grass for herds. No fencing is needed along the river. What is the length of the minimum needed fencing material.

(OR)

b) Let A be Q - {1} Define * on A by x * y = x + y - xy Is * a binary on A. If so, Examine the Closure, Commutative, Associative, The existence of identity and existence of inverse properties.