Class : 12

Register Number

SECOND REVISION EXAMINATION - 2025

Time Allowed : 3.00 Hours] **MATHEMATICS** [Max. 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 $A = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$ and $AA^T =$

(1) I (2) $-\sin\theta$ (3) $\cos\theta$ (4) 2

2. If $A = \begin{bmatrix} 1 & \tan\frac{\theta}{2} \\ -\tan\frac{\theta}{2} & 1 \end{bmatrix}$ and $AB = I_2$, then B =

(1) $\left(\cos^2\frac{\theta}{2}\right)A$ (2) $\left(\cos^2\frac{\theta}{2}\right)A^T$ (3) $(\cos^2\theta)I$ (4) $\left(\sin^2\frac{\theta}{2}\right)A$

3. $i^{2021} + i^{2022} + i^{2023} + i^{2024}$ is

(1) 0 (2) 1 (3) -1 (4) i

4. If z is a complex number such that $z \in \mathbb{C}\backslash\mathbb{R}$ and $z + \frac{1}{z} \in \mathbb{R}$ then $|z|$ is

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

5. A zero of $x^3 + 343$ is

(1) -7 (2) 0 (3) $-7i$ (4) 7

6. If $x^3 + 12x^2 + 10ax + 1999$ definitely has positive zero, if and only if

(1) $a \geq 0$ (2) a > 0 (3) a < 0 (4) $a \leq 0$

7. The value of $\cos^{-1}(\cos x), 0 \leq x \leq \pi$ is

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

8.The domain of the function defined by $f(x) = \sin^{-1}\sqrt{x-1}$ is d

(1) [1, 2] (2) [−1, 1] (3) [0, 1] (4) [−1, 0]

9.The radius of the circle $2x^2 + 2y^2 - 6x + 4y + 2 = 0$ is

(1) 1 (2) $\frac{3}{2}$ (3) $\sqrt{3}$ (4) 3

10. Area of the greatest rectangle inscibed in the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is

(1) 2ab (2) ab (3) $\sqrt{ab}$ (4) $\frac{a}{b}$

11.Distance from the origin to the plane $3x - 4y + 12z - 5 = 0$ is

(1) $\frac{5}{13}$ (2) $\frac{5}{12}$ (3) $\frac{4}{13}$ (4) 13

12. If $\vec{a}, \vec{b}, \vec{c}$ are non-coplanar unit vectors such that $\vec{a} \times (\vec{b} \times \vec{c}) = \frac{\vec{b}+\vec{c}}{2}$, then the angle between $\vec{a}$ and $\vec{b}$ is

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

13. The abscissa of the point on the curve $f(x) = \sqrt{8-2x}$ at which the slope of the tangent is -0.25

(1) -8 (2) -4 (3) -2 (4) 0

14. Angle between $y^2 = x$ and $x^2 = y$ at (1,1) is

(1) $\tan^{-1}\left(\frac{3}{4}\right)$ (2) $\tan^{-1}\left(\frac{4}{3}\right)$ (3) $\frac{\pi}{2}$ (4) $\frac{\pi}{4}$

15. The approximate change in the volume V of a cube of side x metres caused by increasing the side by 3% is

(1) $0.9xdx$ m³ (2) $0.09x$ m³ (3) $0.09x^2$ m³ (4) $0.09\,x^3$ m³

16. The value of $\int_{-1}^{2}|x|dx$ is

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

17. The area between $y^2 = 8x$ and its latus rectum is

(1) $\frac{32}{3}$ (2) $\frac{16}{3}$ (3) $\frac{64}{3}$ (4) $\frac{8}{3}$

18. The solution of $\frac{dy}{dx} = 2^{y-x}$ is

(1) $2^x + 2^y = C$ (2) $2^x - 2^y = C$ (3) $\frac{1}{2^x} - \frac{1}{2^y} = C$ (4) $x + y = C$

19. If the function $f(x) = \frac{1}{12}$ for $a < x < b$, represents a probability density function of a continuous random variable X, then which of the following cannot be the value of a and b?

(1)0 and 1 (2)5 and 17 (3)7 and 19 (4)16 and 24

20. In a set $\mathbb{Q}$ define $a \odot b = a + b + ab$. For what value of y, $3 \odot (y \odot 5) = 7$?

(1) $y = \frac{2}{3}$ (2) $y = -\frac{2}{3}$ (3) $y = -\frac{3}{2}$ (4) $y = 4$

SECTION - B

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

(ii) Question No: 30 is compulsory:

21. If $A = \begin{bmatrix} 8 & -4 \\ -5 & 3 \end{bmatrix}$, verify that $A(adjA) = (adjA)A = |A|I$.

22. If $|z| = 3$, show that $7 \leq |z + 6 - 8i| \leq 13$.

23. Show that the equation $x^9 - 5x^5 + 4x^4 + 2x^2 + 1 = 0$ has atleast 6 imaginary solutions.

24. Find the value of $sec^{-1}\left(-\frac{2\sqrt{3}}{3}\right)$.

25. The orbit of Halley's Comet is an ellipse 36.18 astronomical units long and by 9.12 astronomical units wide. Find its eccentricity.

26. Verify whether the line $\frac{x-3}{-4}=\frac{y-4}{-7}=\frac{z+3}{12}$ lies in the plane $x-y+z=8$.

27. Evaluate : $\lim_{x\to 0}\left(\frac{\sin x}{x^2}\right)$.

28. Find the volume of a right-circular cone of base radius r and height h.

29. Solve $(1+x^2)\frac{dy}{dx}=1+y^2$.

30. Find the inverse the non-singular matrix $A=\begin{bmatrix}0 & -5\\ -1 & -6\end{bmatrix}$, by Gauss-Jordan method.

SECTION - C

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

(ii) Question No.40 is compulsory

31. Find the cube roots of unity.

32. Solve the equation $2x^3+11x^2-9x-18=0$.

33. Prove that $\frac{\pi}{2}\le \sin^{-1}x+2\cos^{-1}x\le\frac{3\pi}{2}$.

34. If the equation $3x^2+(3-p)xy+qy^2-2px-8pq=0$ represents a circle, find p and q. Also determine the centre and radius of the circle.

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

36. Find the points on the curve $y=x^3-6x^2+x+3$ where the normal is parallel to the line $x+y=1729$.

37. If $u(x,y)=\frac{x^2+y^2}{\sqrt{x+y}}$, prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\frac{3}{2}u$.

38. Solve : $\frac{dy}{dx}=(3x+y+4)^2$.

39. A random variable X has the following probability mass function:

X	1	2	3	4	5
$f(x)$	k^2	$2k^2$	$3k^2$	$2k$	$3k$

Find (i) the value of k (ii) $P(2\le X<5)$

40. Verify $(AB)^T=B^TA^T$ with $A=\begin{bmatrix}-4 & 1\\ 1 & 3\end{bmatrix}$, $B=\begin{bmatrix}4 & -3\\ 3 & 0\end{bmatrix}$.

SECTION - D

Answer all questions of the following: **7 x 5 = 35**

41.(a) Find the non-parametric form of vector equation, and Cartesian equation of the plane passing through the point (2,3,6) and parallel to the straight lines $\frac{x-1}{2}=\frac{y+1}{3}=\frac{z-3}{1}$ and $\frac{x+3}{2}=\frac{y-3}{-5}=\frac{z+1}{-3}$. (OR)

(b) If the curves $ax^2 + by^2 = 1$ and $cx^2 + dy^2 = 1$ intersect each other orthogonally if, $\frac{1}{a} - \frac{1}{b} = \frac{1}{c} - \frac{1}{d}$.

42. (a)A rod of length 1.2m moves with its ends always touching the coordinate axes. The locus of a point P on the rod, which is 0.3m from the end in contact with x-axis is an ellipse. Find the eccentricity. (OR)

(b) Find the dimensions of the largest rectangle that can be inscribed in a semi circle of radius r cm.

43. (a) If $a_1, a_2, a_3, \ldots a_n$ is an arithmetic progression with common difference d, then prove that $tan\left[tan^{-1}\left(\frac{d}{1+a_1a_2}\right) + tan^{-1}\left(\frac{d}{1+a_2a_3}\right) + \ldots + tan^{-1}\left(\frac{d}{1+a_na_{n-1}}\right)\right] = \frac{a_n - a_1}{1+a_1a_n}$. (OR)

(b) Investigate for what values of λ and μ the system of linear equations $x + 2y + z = 7$, $x + y + \lambda z = \mu, x + 3y - 5z = 5$ has (i) no solution (ii) a unique solution (iii) an infinite number of solutions.

44. (a) Find a polynomial equation of minimum degree with rational coefficients, having $\sqrt{5} - \sqrt{3}$ as a root. (OR)

(b) If $V(x,y) = e^x(x\cos y - y\sin y)$, then prove that $\frac{\partial^2 V}{\partial x^2} + \frac{\partial^2 V}{\partial y^2} = 0$.

45. (a) Find the area of the region bounded between the parabolas $y^2 = 4x$ and $x^2 = 4y$.(OR)

(b) If μ and σ^2 are the mean and variance of the discrete random variable X, and $E(X + 3) = 10$ and $E(X + 3)^2 = 116$, find μ and σ^2.

46. (a) The rate of increase in the number of bacteria in a certain bacteria culture is proportional to the number present. Given that the number triples in 5 hours, find how many bacteria will be present after 10 hours? (OR)

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

47.(a) By vector method ,prove that $sin(A + B) = sin\,A\,cos\,B + cos\,A\,sin\,B$ (OR)

(b) Verify (i) closure property, (ii) commutative property, (iii) associative property, (iv) existence of identity, and (v) existence of inverse for the operation $+_5$ on $\mathbb{Z}_5$ using table corresponding to addition modulo 5.