RS-2 **SECOND REVISION EXAMINATION – 2025**

STD : XII **MATHEMATICS** MARK : 90 TIME : 3 hrs

PART – A

CHOOSE THE CORRET ANSWER :- 20 X 1 = 20

1) If $P = \begin{bmatrix} 1 & x & 0 \\ 1 & 3 & 0 \\ 2 & 4 & -2 \end{bmatrix}$ is the adjoint of 3×3 matrix A and $|A| = 4$, then x is

(a) 15 (b) 12 (c) 14 (d) 11

2) If $A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$, then adj(adj A) is

(a) $\begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 6 & -6 & 8 \\ 4 & -6 & 8 \\ 0 & -2 & 2 \end{bmatrix}$ (c) $\begin{bmatrix} -3 & 3 & -4 \\ -2 & 3 & -4 \\ 0 & 1 & -1 \end{bmatrix}$ (d) $\begin{bmatrix} 3 & -3 & 4 \\ 0 & -1 & 1 \\ 2 & -3 & 4 \end{bmatrix}$

3) The value of $\left(\frac{1+\sqrt{3}i}{1-\sqrt{3}i}\right)^{10}$ is

(a) $cis\frac{2\pi}{3}$ (b) $cis\frac{4\pi}{3}$ (c) $-cis\frac{2\pi}{3}$ (d) $-cis\frac{4\pi}{3}$

4) A zero of $x^3 + 64$ is

(a) 0 (b) 4 (c) $4i$ (d) -4

5) The equation $\tan^{-1} x - \cot^{-1} x = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$ has

(a) no solution (b) unique solution (c) two solutions (d) infinite number of solutions

6) The circle passing through $(1,-2)$ and touching the axis of x at $(3,0)$ passing through the point

(a) $(-5,2)$ (b) $(2,-5)$ (c) $(5,-2)$ (d) $(-2,5)$

7) If a vector $\vec{\alpha}$ lies in the plane of $\vec{\beta}$ and $\vec{\gamma}$, then

(a) $[\vec{\alpha},\vec{\beta},\vec{\gamma}] = 1$ (b) $[\vec{\alpha},\vec{\beta},\vec{\gamma}] = -1$ (c) $[\vec{\alpha},\vec{\beta},\vec{\gamma}] = 0$ (d) $[\vec{\alpha},\vec{\beta},\vec{\gamma}] = 2$

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

(a) $y = 0$ (b) $y = \pm\sqrt{3}$ (c) $y = \frac{1}{2}$ (d) $y = \pm 3$

9) If $g(x,y) = 3x^2 - 5y + 2y^2, x(t) = e^t$ and $y(t) = \cos t$, then $\frac{dg}{dt}$ is equal to

(a) $6e^{2t} + 5\sin t - 4\cos t \sin t$ (b) $6e^{2t} - 5\sin t + 4\cos t \sin t$

(c) $3e^{2t} + 5\sin t + 4\cos t \sin t$ (d) $3e^{2t} - 5\sin t + 4\cos t \sin t$

10) The value of $\int_0^{2/3} \frac{dx}{\sqrt{4-9x^2}}$ is (a) $\frac{\pi}{6}$ (b) $\frac{\pi}{2}$ (c) $\frac{\pi}{4}$ (d) π

11) The value of $\int_0^1 (\sin^{-1} x)^2 \, dx$ is

(a) $\frac{\pi^2}{4} - 1$ (b) $\frac{\pi^2}{4} + 2$ (c) $\frac{\pi^2}{4} + 1$ (d) $\frac{\pi^2}{4} - 2$

12) The solution of the differential equation $\frac{dy}{dx} = 2xy$ is

(a) $y = Ce^{x^2}$ (b) $y = 2x^2 + C$ (c) $y = Ce^{-x^2} + C$ (d) $y = x^2 + C$

13) Let X have a Bernoulli distribution with mean 0.4, then the variance of $(2X - 3)$ is

(a) 0.24 (b) 0.48 (c) 0.6 (d) 0.96

14) Subtraction is not a binary operation in

(a) $\mathbb{R}$ (b) $\mathbb{Z}$ (c) $\mathbb{N}$ (d) $\mathbb{Q}$

15) The proposition $p \wedge (\neg p \vee q)$ is

(a) a tautology (b) a contradiction (c) logically equivalent to $p \wedge q$ (d) logically equivalent to $p \vee q$

16) If z is a complex number of unit modulus and argument θ, then $arg\left(\frac{1+z}{1+\bar{z}}\right)$ equals

(a) $-\theta$ (b) $\frac{\pi}{2} - \theta$ (c) θ (d) $\pi - \theta$

17) If $x = \sin^{-1}(\sin 10)$ and $y = \cos^{-1}(\cos 10)$, then $y - x$ is

(a) π (b7π (c) 0 (d) 10

18) If $[\vec{a}+\vec{b} \quad \vec{b}+\vec{c} \quad \vec{c}+\vec{a}] = \lambda[\vec{a} \quad \vec{b} \quad \vec{c}]$ then the value of λ is

(a)0 (b 1 (c) 2 (d) 3

19) The point on the curve $y = x^2 - 5x + 5$ at which the tangent is parallel to the line $4x - 2y + 1 = 0$ is

(a) $\left(\frac{1}{4}, \frac{7}{2}\right)$ (b) $\left(\frac{7}{2}, -\frac{1}{4}\right)$ (c) $\left(\frac{1}{8}, \frac{7}{2}\right)$ (d) $\left(\frac{7}{2}, -\frac{1}{8}\right)$

20) The order and degree of the differential equation $\frac{d^2}{dx^2}\left(\frac{d^2y}{dx^2}\right) = 0$

(a) 2 , 2 (b 4 , 4 (c) 2 , 1 (d) 4 , 1

PART – B

ANSWER ANY SEVEN QUESTIONS (Q.NO : 30 IS COMPULSORY) :- 7 X 2 = 14

21. Find the rank of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & 4 \\ 3 & 0 & 5 \end{bmatrix}$

22. Find the square roots of $-6 + 8i$

23. Determine the number of positive and negative roots of the polynomial $x^5 - 19x^4 + 2x^3 + 5x^2 + 11$

24. Find the equation of the parabola with focus $(-\sqrt{2}, 0)$ and directrix $x = \sqrt{2}$.

25. Prove that the function $f(x) = x^2 - 2x - 3$ is strictly increasing in $(2, \infty)$.

26. A circular plate expands uniformly under the influence of heat. If it's radius increases from 10.5cm to 10.75cm, then find an approximate change in the area.

27. Evaluate : $\int_{-\log 2}^{\log 2} e^{-|x|} dx$.

28. A train arrives punctually at a station every half an hour. Everyday in the morning, a student leaves his house to the train station. Let X denote the amount of time, in minutes, that the student waits for the train from the time he reaches the train station. Its known that the pdf of X is $f(x) = \begin{cases} \frac{1}{30}, 0 < x < 30 \\ 0, \text{elsewhere} \end{cases}$

Obtain and interpret the expected value of the random variable X.

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 value of $\tan\left(\cos^{-1}\left(-\frac{2}{7}\right) - \frac{\pi}{2}\right)$.

PART – C

ANSWER ANY SEVEN QUESTIONS (Q.NO : 40 IS COMPULSORY) :- 7 X 3 = 21

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. Simplify $\left(\frac{1+\cos 2\theta + i \sin 2\theta}{1+\cos 2\theta - i \sin 2\theta}\right)^{30}$.

33. Show that $\cot(\sin^{-1} x) = \frac{\sqrt{1-x^2}}{x}, -1 \le x \le 1$ and $x \ne 0$.

34. Find the magnitude and direction cosines of the torque (moment) of a force represented by $3\hat{i} + 4\hat{j} - 5\hat{k}$ about the point with position vector $2\hat{i} - 3\hat{j} + 4\hat{k}$ acting through a point whose position vector is $4\hat{i} + 2\hat{j} - 3\hat{k}$.

35. Expand $\log(1 + x)$ as a Maclaurin's series upto 4 non-zero terms for $-1 < x \le 1$.

36. The time T, taken for a complete oscillation of a single pendulum with length l, is given by the equation $T = 2\pi\sqrt{\frac{l}{g}}$, where g is a constant. Find the approximate percentage error in the calculated value of T corresponding to an error of 2 percent in the value of t.

37. Solve : $\frac{dy}{dx} = e^{x+y} + x^3 e^y$.

38. Suppose a discrete random variable can only take the values 0,1, and 2. The probability mass function is defined by $f(x) = \begin{cases} \frac{x^2+1}{k}, \text{for} x = 0,1,2 \\ 0 \text{otherwise} \end{cases}$ Find (i) the value of k (ii) $P(X \ge 1)$.

39. Establish the equivalence property: $p \to q \equiv \neg p \vee q$.

40. Solve : $\int_{-\frac{1}{\sqrt{2}}}^{x} \frac{dt}{\sqrt{1-t^2}} = \frac{\pi}{2}$.

PART – D

ANSWER ALL THE QUESTIONS :- 7 X 5 = 35

41 a. Investigate the values of λ and μ the system of linear equations $2x + 3y + 5z = 9$, $7x + 3y - 5z = 8$, $2x + 3y + \lambda z = \mu$, have (i) no solution (ii) a unique solution (iii) an infinite number of solutions. *(OR)*

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

42 a. 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.

(OR)

b. Find the area of the region bounded by $2x - y + 1 = 0$, $y = -1$, $y = 3$ and y-axis.

43 a. If $u = \sin^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$, Show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \frac{1}{2}\tan u$. *(OR)*

b. The probability density function of X is given by $f(x) = \begin{cases} k & 1 \le x \le 5 \\ 0 & \text{otherwise} \end{cases}$ then find

(i) the value of k (ii) Distribution function (iii) $P(2 < X < 4)$.

44 a. Find the value of $\sin\left(\tan^{-1}\left(\frac{1}{2}\right) - \cos^{-1}\left(\frac{4}{5}\right)\right)$. *(OR)*

b. 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 $\frac{x-1}{1} = \frac{2y+1}{2} = \frac{z+1}{-1}$.

45 a. If $\vec{a} = \hat{i} - \hat{j}$, $\vec{b} = \hat{i} - \hat{j} - 4\hat{k}$, $\vec{c} = 3\hat{j} - \hat{k}$ and $\vec{d} = 2\hat{i} + 5\hat{j} + \hat{k}$, verify that $(\vec{a} \times \vec{b}) \times (\vec{c} \times \vec{d}) = [\vec{a}, \vec{b}, \vec{d}]\vec{c} - [\vec{a}, \vec{b}, \vec{c}]\vec{d}$. *(OR)*

b. 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?

46 a. For the function $f(x) = 4x^3 + 3x^2 - 6x + 1$ find the intervals of concavity and points of inflection. *(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.

47a. Find the equation of the circle passing through the points (1,1), (2,4), and (5,3). *(OR)*

b. Show that the two curves $y = x^3$ and $x^2 + 6y = 7$ are cut orthogonally.