# FIRST REVISION TEST - 2025

Time: 3.00 hrs. | Standard - XII | Reg No | Marks: 90

## MATHEMATICS

PART - A

I. Answer all the questions: $20 \times 1 = 20$

1. If A is a $3 \times 3$ non - singular matrix such that $AA^T = A^TA$ and $B = A^{-1}A^T$, then $BB^T =$
   a) A  b) B  c) $I_3$  d) $B^T$

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2. The rank of the matrix $\begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 4 & 6 & 8 \\ -1 & -2 & -3 & -4 \end{bmatrix}$ is
   a) 1  b) 2  c) 3  d) 4
3. If z is a complex number such that $z \in C \setminus R$ and $z + \frac{1}{z} \in R$, then $|z|$ is
   a) 0  b) 1  c) 2  d) 3
4. If $\alpha$, $\beta$ and $\gamma$ are the roots of $x^3 + px^2 + qx + r = 0$ then $\sum \frac{1}{\alpha}$ is
   a) $\frac{-q}{r}$  b) $\frac{-p}{r}$  c) $\frac{q}{r}$  d) $-\frac{q}{p}$
5. The domain of the function which is defined by $f(x) = \sin^{-1}\sqrt{x-1}$ is
   a) [1, 2]  b) [-1, 1]  c) [0, 1]  d) [-1, 0]
6. If $\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{a} \times \vec{b}) \times \vec{c}$, where $\vec{a}, \vec{b}, \vec{c}$ are any three vectors such that $\vec{b}.\vec{c} \neq 0$ and $\vec{a}.\vec{b} \neq 0$ then $\vec{a}$ and $\vec{c}$ are
   a) perpendicular  b) parallel  c) inclined at angle $\pi/3$  d) inclined at an angle $\pi/6$
7. $\lim_{x \to 0}\left(\cot x - \frac{1}{x}\right)$ is
   a) 0  b) 1  c) 2  d) $\infty$
8. If $u(x, y) = e^{x^2+y^2}$ then $\frac{\partial u}{\partial x}$ is equal to
   a) $e^{x^2+y^2}$  b) 2xu  c) $x^2u$  d) $y^2u$
9. The approximate change in the volume v of a cube of side x metres caused by increasing the side by 1% is
   a) $0.3\, x\, dx\, m^3$  b) $0.03\, x\, m^3$  c) $0.03\, x^2\, m^3$  d) $0.03\, x^3\, m^3$
10. The solution of the differential equation $\frac{dy}{dx} + \frac{1}{\sqrt{1-x^2}} = 0$ is
    a) $y + \sin^{-1}x = c$  b) $x + \sin^{-1}y = 0$  c) $y^2 + 2\sin^{-1}x = c$  d) $x^2 + 2\sin^{-1}y = 0$
11. A random variable x has binomial distribution with n = 25 and p = 0.8 then standard deviation is
    a) 6  b) 4  c) 3  d) 2

12. In the set Q define $a * b = a + b + ab$ then the value of y in $3 * (y * 5) = 7$ is

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

13. If P represents the rank and A and B are n × n matrices, then
a) $P(A + B) = P(A) + P(B)$ b) $P(AB) = P(A)\,P(B)$ c) $P(A - B) = P(A) - P(B)$ d) $P(A+B) \ldots$

14. Identify the incorrect statement

a) $|Z|^2 = 1 \Rightarrow \frac{1}{z} = \bar{z}$ b) $Re(z) \le |z|$ c) $||Z_1| - |Z_2|| \ge ||Z_1 + Z_2|$ d) $|z^n| = |z|^n$

15. The amplitude and period of $y = a \tan bx$ are respectively.

a) $|a|, \frac{\pi}{b}$ b) $a, \frac{\pi}{b}$ c) not defined, $\frac{\pi}{|b|}$ d) not defined, $\frac{\pi}{b}$

16. Which one is meaningful?

a) $(\vec{a} \times \vec{b}) \times (\vec{b} \cdot \vec{c})$ b) $\vec{a} \times (5 + \vec{b})$ c) $(\vec{a} \cdot \vec{b}) \times (\vec{c} \cdot \vec{d})$ d) $(\vec{a} \times \vec{b}) \cdot (\vec{c} \times \vec{d})$

17. Rolle's constant c for the function $f(x) = |x|$, $x \in [-1, 1]$ is
a) 0 b) 1 c) -1 d) not existing

18. If $f(2a-x) = f(x)$ then $\int_0^{2a} f(x)\,dx =$

a) $2\int_0^a f(x)\,dx$ b) $\int_{-a}^{a} f(x)\,dx$ c) 0 d) $\int_0^a f(x)\,dx$

19. The integrating factor of $\frac{dx}{dy} + px = Q$ is

a) $e^{\int p\,dy}$ b) $e^{\int p\,dx}$ c) $e^{\int Q\,dy}$ d) $e^{\int Q\,dx}$

20. If $x + y = k$ is a normal to the parabola $y^2 = 12x$ then the value of k is
a) 3 b) -1 c) 1 d) 9

## PART - B

**II Answer any 7 questions. ii) Q.No.30 is compulsory.** 7×2=14

21. Find the value of $\left|\frac{2+i}{-1+2i}\right|$

22. Obtain the equation of circle for which (3, 4) and (2, -7) are the ends of a diameter.

23. Find the inverse of $\begin{pmatrix} -2 & 4 \\ 1 & -3 \end{pmatrix}$

24. Evaluate $\int_0^{\pi/2} \sin^{10} x\,dx$

25. Find the value of $\tan^{-1}(-1) + \cos^{-1}(\frac{1}{2})$

26. Find the slope of the tangent to the curve $y = x^4 + 2x^2 - x$ at $x = 1$.

27. Find the acute angle between the planes $\vec{r} \cdot (2\hat{i} + 2\hat{j} + 2\hat{k}) = 11$ and $4x - 2y + 2z = 15$.

28. Show that $x^2 + y^2 = r^2$, where r is a constant is a solution of the differential equation $\frac{dy}{dx} = \frac{-x}{y}$
29. Prove that in an algebraic structure the Identify element (if exists) must be unique
30. If $f(x, y) = \frac{x^2 + y^2 + xy}{x^2 - y^2}$ then S.T. $x \cdot \frac{\partial f}{\partial x} + y \cdot \frac{\partial f}{\partial y} = 0$

## PART - C

**III Answer any 7 questions. ii) Q.No.40 is compulsory.** 7×3=21

31. Solve by Cramer's rule $5x - 2y + 16 = 0$, $x + 3y - 7 = 0$
32. Show that $\left(\frac{19-7i}{9+i}\right)^{12} + \left(\frac{20-5i}{7-6i}\right)^{12}$ is real.
33. Prove that the length of the Latus Rectum of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ is $2\,{b^2}/{a}$
34. Find the magnitude and direction cosines of the torque of a force represented by $2\vec{i} + \vec{j} - \vec{k}$ if it acts about the point (2, 0, -1) and through the origin.
35. If $\lim_{\theta \to 0}\left(\frac{1-\cos m\theta}{1-\cos n\theta}\right) = 1$ then prove that $m = \pm n$.
36. Evaluate $\int_0^{\pi/2} \frac{dx}{1+5\cos^2 x}$
37. Solve : $(1+x^2)\frac{dy}{dx} = 1 + y^2$
38. Suppose that f(x) given below represents probability mass function.

| x | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| f(x) | $c^2$ | $2c^2$ | $3c^2$ | $4c^2$ | c | 2c |

Find i) value of C ii) Mean & variance

39. Construct the truth table for $(p \vee q) \vee (\neg q)$
40. If α & β are the roots of the quadratic equation $2x^2 - 7x + 13 = 0$ then show that $\alpha^2 + \beta^2 + 3\alpha\beta = \frac{75}{4}$

## PART - D

**IV Answer all questions :** 7×5=35

41. a) A boy is walking along the path $y = ax^2 + bx + c$ through the points (-6, 8) (-2, -12) and (3, 8). He wants to meet his friend and (7, 60). Will he meet his friend ? (use Gaussian elimination method).

(OR)

b) If $z_1$, $z_2$ and $z_3$ are three complex numbers such that $|z_1| = 1$, $|z_2| = 2$, $|z_3| = 3$ and

$|z_1 + z_2 + z_3| = 1$ show that $|9z_1z_2 + 4z_1z_3 + z_2z_3| = 6$

42. a) Find all Zeros of the polynomial $x^6 - 3x^5 - 5x^4 + 22x^3 - 39x^2 - 39x + 135$ if its known that $1 + 2i$ and $\sqrt{3}$ are two of its zeros. (OR)

b) Solve: $\tan^{-1}\left[\frac{x-1}{x-2}\right] + \tan^{-1}\left[\frac{x+1}{x+2}\right] = \frac{\pi}{4}$

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

b) By vector method, prove that $\cos(\alpha + \beta) = \cos\alpha \cdot \cos\beta - \sin\alpha \cdot \sin\beta$

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

b) Prove that $f(x, y) = x^3 - 2x^2y + 3xy^2 + y^3$ is homogeneous, what is the degree? Verify Euler's Theorem for f.

45. a) A pot of boiling water at 100°c is removed from a stove at time t = 0 and left to cool in the kitchen. After 5 minutes, The water temperature has decreased to 80°c, and another 5 minutes later it has dropped to 65°c. Determine the temperature of the kitchen. (OR)

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

$$F(x) = \begin{cases} 0 & \text{for } -\infty < x < 0 \\ 1/2 & \text{for } 0 \le x < 1 \\ 3/5 & \text{for } 1 \le x < 2 \\ 4/5 & \text{for } 2 \le x < 3 \\ 9/10 & \text{for } 3 \le x < 4 \\ 1 & \text{for } 4 \le x < \infty \end{cases}$$



Find (i) the probability mass function ii) $p(x < 3)$ and iii) $p(x \ge 2)$

46. a) i) Define an operation $*$ on Q as follows $a * b = \left(\frac{a+b}{2}\right)$ a, b $\in$ Q. Examine the closure commutative, associative properties satisfied by $*$ on Q.

ii) Define an operation $*$ on Q as follows $a * b = \left(\frac{a+b}{2}\right)$ a, b $\in$ Q. Examine the existence of Indentify and the existence of inverse for the operation $*$ on Q. (OR)

b) Find the intervals of increasing, decreasing concavity and point of inflection of the curve $y = x^3 - 3x$.

47. a) Show that the lines $\frac{x-2}{1} = \frac{y-3}{1} = \frac{z-4}{3}$ and $\frac{x-1}{-3} = \frac{y-4}{2} = \frac{z-5}{1}$ are coplanar. Also find the Cartesian equation of the plane containing these lines. (OR)

b) Find the area of the region bounded between the parabolas $y^2 = x$ and $x^2 = y$.

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