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Register No. 

## First Revision Examination - 2025

Marks : 90

Time : 3.00 Hrs.

## MATHEMATICS

## PART - I

20 x 1 = 20

i) All questions are compulsory

ii) Choose the most suitable answer from the given four alternatives and write the option code and the corresponding answer.

- The range of the function  $\frac{1}{1-2\sin x}$  is a)  $(-\infty, -1) \cup \left(\frac{1}{3}, \infty\right)$  b)  $\left(-1, \frac{1}{3}\right)$  c)  $\left[-1, \frac{1}{3}\right]$  d)  $(-\infty, -1] \cup \left[\frac{1}{3}, \infty\right)$
- The number of relations on a set containing 3 elements is a) 9 b) 81 c) 512 d) 1024
- The value of  $\log_{\sqrt{2}} 512$  is a) 16 b) 18 c) 9 d) 12
- If a and b are the roots of the equation  $x^2 - kx + 16 = 0$  and satisfy  $a^2 + b^2 = 32$ , then the value of k is.....  
a) 10 b) -8 c)  $\pm 8$  d) 6
- The maximum value of  $4\sin^2 x + 3\cos^2 x + \sin \frac{x}{2} + \cos \frac{x}{2}$  is a)  $4 + \sqrt{2}$  b)  $3 + \sqrt{2}$  c) 9 d) 4
- In a triangle  $\triangle ABC$ ,  $\sin^2 A + \sin^2 B + \sin^2 C = 2$ , then the triangle is  
a) equilateral triangle b) isosceles triangle c) right triangle d) scalene triangle
- The number of parallelograms that can be formed from a set of four parallel lines intersecting another set of three parallel lines.  
a) 6 b) 9 c) 12 d) 18
- The number of rectangles that a chess board has..... a) 81 b)  $9^9$  c) 1296 d) 6561
- The HM of two positive numbers whose AM and GM are 16, 8 respectively is a) 10 b) 6 c) 5 d) 4
- The remainder when  $38^{15}$  is divided by 13 is a) 12 b) 1 c) 11 d) 5
- Which of the following point lie on the locus of  $3x^2 + 3y^2 - 8x - 12y + 17 = 0$  a) (0, 0) b) (-2, 3) c) (1, 2) d) (0, -1)
- The point on the line  $2x - 3y = 5$  is equidistance from (1, 2) and (3, 4) is a) (7, 3) b) (4, 1) c) (1, -1) d) (-2, 3)
- If  $A = \begin{bmatrix} \lambda & 1 \\ 1 & -\lambda \end{bmatrix}$ , then for what value of  $\lambda$ ,  $A^2 = O$ ? a) 0 b)  $\pm 1$  c) -1 d) 1
- If  $A = \begin{bmatrix} -1 & 2 & 4 \\ 3 & 1 & 0 \\ -2 & 4 & 2 \end{bmatrix}$  and  $B = \begin{bmatrix} -2 & 4 & 2 \\ 6 & 2 & 0 \\ -2 & 4 & 8 \end{bmatrix}$ , then B is given by a)  $B = 4A$  b)  $B = -4A$  c)  $B = -A$  d)  $B = 6A$
- If the points whose position vectors  $10\hat{i} + 3\hat{j}$ ,  $12\hat{i} - 5\hat{j}$  and  $a\hat{i} + 11\hat{j}$  are collinear then a is equal to a) 6 b) 3 c) 5 d) 8
- $\lim_{x \rightarrow \infty} \frac{a^x - b^x}{x} =$  a)  $\log ab$  b)  $\log \frac{a}{b}$  c)  $\log \frac{b}{a}$  d)  $\frac{a}{b}$
- $x = \frac{1-t^2}{1+t^2}$ ,  $y = \frac{2t}{1+t^2}$  then  $\frac{dy}{dx}$  is a)  $-\frac{y}{x}$  b)  $\frac{y}{x}$  c)  $-\frac{x}{y}$  d)  $\frac{x}{y}$
- $\int e^{\sqrt{x}} dx$  is a)  $2\sqrt{x}(1 - e^{\sqrt{x}}) + c$  b)  $2\sqrt{x}(e^{\sqrt{x}} - 1) + c$  c)  $2e^{\sqrt{x}}(1 - \sqrt{x}) + c$  d)  $2e^{\sqrt{x}}(\sqrt{x} - 1) + c$
- A bag contains 6 green, 2 white, and 7 black balls. If two balls are drawn simultaneously, then the probability that both are different colours is a)  $\frac{68}{105}$  b)  $\frac{71}{105}$  c)  $\frac{64}{105}$  d)  $\frac{73}{105}$
- If  $y = f(x^2 + 2)$  and  $f(3) = 5$ , then  $\frac{dy}{dx}$  at  $x = 1$  is a) 5 b) 25 c) 15 d) 10

## PART - II

(i) Answer any seven questions. (ii) Question number 30 is compulsory.

7 x 2 = 14

- Simplify by rationalizing the denominator  $\frac{7 + \sqrt{6}}{3 - \sqrt{2}}$
- Solve  $3x - 5 \leq x + 1$
- In a  $\triangle ABC$ ,  $a = 3$ ,  $b = 5$  and  $c = 7$ , Find the value of  $\cos A$ .
- Prove that  $10C_2 + 2 \times 10C_3 + 10C_4 = 12C_4$
- Find the middle term in the expansion  $(x + y)^6$
- Find a unit vector along the direction of the vector  $5\hat{i} - 3\hat{j} + 4\hat{k}$

27. If G is the centroid of a triangle ABC prove that  $\vec{GA} + \vec{GB} + \vec{GC} = \vec{0}$
28. Differentiate :  $y = e^{\sin x}$ .
29. A die is rolled. If it shows an odd number, then find the probability of getting 5?
30. Evaluate :  $\int \frac{x+2}{x^2+4x+5} dx$

## PART - III

i) Answer any seven questions. ii) Question number 40 is compulsory.

7 x 3 = 21

31. If  $n(A \cap B) = 3$  and  $n(A \cup B) = 10$ , then find  $n(P(A \Delta B))$
32. Prove  $\log \frac{75}{16} - 2 \log \frac{5}{9} + \log \frac{32}{243} = \log 2$
33. If  $10P_{r-1} = 2 \times 6P_r$ , find r?
34. Write the equation of the lines through the point  $(1, -1)$  parallel to  $x + 3y - 4 = 0$ .
35. Find the value of the product :  $\left| \begin{matrix} \log_3 64 & \log_4 3 \\ \log_3 8 & \log_4 9 \end{matrix} \right| \times \left| \begin{matrix} \log_2 3 & \log_8 3 \\ \log_3 4 & \log_3 4 \end{matrix} \right|$
36. Find the last two digits of the number  $7^{400}$
37. For any two vectors  $\vec{a}$  and  $\vec{b}$ , prove that  $|\vec{a} \times \vec{b}|^2 + (\vec{a} \cdot \vec{b})^2 = |\vec{a}|^2 |\vec{b}|^2$
38. Find the derivative of  $\sin^{-1} \left( \frac{2x}{1+x^2} \right)$  with respect to  $\tan^{-1} x$ .
39. Evaluate :  $\int e^{3x} \cos 2x dx$
40. Nine coins are tossed once, find the probability to get at least two heads

## PART - IV

Answer all the questions.

7 x 5 = 35.

41. a) By the principle of mathematical induction, prove that, for  $n \geq 1$ ,  $1.2 + 2.3 + 3.4 + \dots + n.(n+1) = \frac{n(n+1)(n+2)}{3}$  (OR)
- b) If  $f: \mathbb{R} \rightarrow \mathbb{R}$  is defined by  $f(x) = 3x - 5$ , prove that f is a bijection and find its inverse.
42. a) If  $A + B = 45^\circ$  show that  $(1 + \tan A)(1 + \tan B) = 2$  (OR)
- b) Prove that  $\sqrt{\frac{1-x}{1+x}}$  is approximately equal to  $1 - x + \frac{x^2}{2}$  when x is very small.
43. Resolve into partial fractions  $\frac{2x}{(x^2+1)(x-1)}$  (OR)
- Evaluate :  $\int \frac{x+1}{x^2-3x+1} dx$
44. If  $y = e^{\tan^{-1} x}$  show that  $(1+x^2)y'' + (2x-1)y' = 0$  (OR)
- Show that  $\begin{vmatrix} 1 & 1 & 1 \\ x & y & z \\ x^2 & y^2 & z^2 \end{vmatrix} = (x-y)(y-x)(z-x)$  by using Factor Theorem.
45. Show that the equation  $9x^2 - 24xy + 16y^2 - 12x + 16y - 12 = 0$  represent a pair of parallel lines. Find the distance between them. (OR)
- Find the points of discontinuity of the function f, where  $f(x) = \begin{cases} 4x+5, & \text{if } x \leq 3 \\ 4x-5, & \text{if } x > 3 \end{cases}$
46. The chances of X, Y and Z becoming managers of a certain company are 4 : 2 : 3. The probabilities that bonus scheme will be introduced if X, Y and Z become managers are 0.3, 0.5 and 0.4 respectively. If the bonus scheme has been introduced, what is the probability that Z was appointed as the manager? (OR)
- Find all the values of x for which  $\frac{x^3(x-1)}{(x-2)} > 0$ .
47. Show that the points whose position vectors  $4\hat{i} + 5\hat{j} + \hat{k}$ ,  $-\hat{j} - \hat{k}$ ,  $3\hat{i} + 9\hat{j} + 4\hat{k}$  and  $-4\hat{i} + 4\hat{j} + 4\hat{k}$  are coplanar. (OR)
- If the letters of word IITJEE are permuted in all possible ways and the strings thus formed are arranged in the lexicographic order, find the rank of the word IITJEE.

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