



Total No. of Questions – 24

Regd.

Total No. of Printed Pages – 3

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Part – III

MATHEMATICS, Paper-I(B)

(English Version)

Time : 3 Hours]

[Max. Marks : 75

Note : This question paper consists of **three** sections A, B and C.

SECTION – A

 $10 \times 2 = 20$

I. Very short answer type questions :

- (i) Answer **all** questions.
- (ii) Each question carries **two** marks.

1. Find the equation of the straight line passing through $(-4, 5)$ and cutting off equal and non zero intercepts on the co-ordinate axes.
2. Find the area of the triangle formed by the straight line $x - 4y + 2 = 0$ and the coordinate axes.
3. Find the coordinates of the vertex 'C' of ΔABC if its centroid is origin and the vertices A, B are $(1, 1, 1)$ and $(-2, 4, 1)$ respectively.
4. Find the equation of the plane passing through $(-2, 1, 3)$ and having $(3, -5, 4)$ as d.r.'s of its normal.
5. Compute the limit $\lim_{x \rightarrow 0} \frac{\sin ax}{x \cos x}$.
6. Compute the limit $\lim_{x \rightarrow \infty} \frac{11x^3 - 3x + 4}{13x^3 - 5x^2 - 7}$.
7. Find the derivative of the function $\frac{1 - \cos 2x}{1 + \cos 2x}$.
8. Define the derivative of a function.

9. Find Δy and dy for the function $y = x^2 + 3x + 6$ for the value of $x = 10$ and $\Delta x = 0.01$.
10. State Lagrange's Mean value theorem.

SECTION - B

5 × 4 = 20

II. Short answer type questions :

- (i) Attempt any **five** questions.
- (ii) Each question carries **four** marks.
11. Find the equation of the locus of a point, the difference of whose distances from $(-5, 0)$ and $(5, 0)$ is 8.
12. When the axes are rotated through an angle α , find the transformed equation of $x \cos \alpha + y \sin \alpha = p$.
13. Transform the equation $4x - 3y + 12 = 0$ into
- (i) intercept form and
- (ii) normal form
14. Check the continuity of f given by
- $$f(x) = \frac{x^2 - 9}{x^2 - 2x - 3}, \quad 0 < x < 5 \text{ and } x \neq 3 \text{ at the point } 3$$
- 1.5, if $x = 3$.
15. Find the derivative of $f(x) = \sin 2x$ using the first principle.
16. Find the equations of tangent and normal to the curve $y = x^3 + 4x^2$ at $(-1, 3)$.
17. A container is in the shape of an inverted cone has height 8 m and radius 6 m at the top. If it is filled with water at the rate $2 \text{ m}^3/\text{minute}$, how fast is the height of water changing when the level is 4 m?

III. Long Answer Type questions :

- (i) Attempt any **five** questions.
- (ii) Each question carries **seven** marks.
18. (a) If Q (h, k) is the foot of the perpendicular from p(x_1, y_1) on the straight line $ax + by + c = 0$ then prove that
$$\frac{h - x_1}{a} = \frac{k - y_1}{b} = \frac{-(ax_1 + by_1 + c)}{a^2 + b^2}.$$
- (b) Find the foot of the perpendicular drawn from (4, 1) upon the straight line $3x - 4y + 12 = 0$.
19. (a) Let the equation $ax^2 + 2hxy + by^2 = 0$ represents a pair of straight lines and the angle between them is θ then show that
$$\cos \theta = \frac{|a + b|}{\sqrt{(a - b)^2 + 4h^2}}.$$
- (b) Find the angle between the pair of lines represented by the equation $x^2 - 7xy + 12y^2 = 0$.
20. Show that the lines joining to the origin to the points of intersection of the curve $x^2 - xy + y^2 + 3x + 3y - 2 = 0$ and the straight line $x - y - \sqrt{2} = 0$ are mutually perpendicular.
21. Find the angle between two diagonals of a cube.
22. If $y = \tan^{-1} \left[\frac{\sqrt{1+x^2} + \sqrt{1-x^2}}{\sqrt{1+x^2} - \sqrt{1-x^2}} \right]$ for $0 < |x| < 1$, find $\frac{dy}{dx}$.
23. Find the angle between the curves $y^2 = 4x$; $x^2 + y^2 = 5$.
24. The profit function $p(x)$ of a company, selling x items per day is given $p(x) = (150 - x)x - 1600$.
Find the number of items that the company should sell for maximum profit. Also find the maximum profit.

