

Total No. of Questions - 24

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Total No. of Printed Pages - 3

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Part - III

MATHEMATICS, Paper - I (B).

(Co-ordinate Geometry and Calculus)

(English Version)

Time : 3 hours

Max. Marks : 75

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

SECTION A

I. Very short answer type questions.

10 × 2 = 20

- i) Attempt **all** questions.
 - ii) Each question carries **two** marks.
1. Slope of the line passing through the points (2, 5) and (x, 3) is 2. Find the value of x.
 2. Find the distance between the parallel lines $5x - 3y - 4 = 0$ and $10x - 6y - 9 = 0$.
 3. Find the midpoint of the line joining the points (1, 2, 3) and (-2, 4, 2).
 4. Find the direction of the cosines of the normal to the plane $x + 2y + 2z - 4 = 0$.

5. Is 'f' defined by $f(x) = \begin{cases} \frac{\sin 2x}{x} & \text{if } x \neq 0 \\ 1 & \text{if } x = 0 \end{cases}$ is continuous at $x = 0$?

6. If $y = \frac{ax+b}{cx+d}$, find $\frac{dy}{dx}$.

7. If $x = a \cos^3 t$, $y = a \sin^3 t$, find $\frac{dy}{dx}$.

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(P.T.O.)

8. Find the derivative of $Tan^{-1}\left(\frac{1+x}{1-x}\right)$.
9. If $y = x^2 + x$, $x = 10$, $\Delta x = 0.1$, then find Δy and dy .
10. Show that at any point (x, y) on the curve $y = b \cdot e^{\frac{x}{a}}$, the length of the subtangent is constant.

SECTION B

II. Short answer type questions.

5 × 4 = 20

- i) Attempt **any five** questions.
- ii) Each question carries **four** marks.
11. Find the equation of the locus 'P' if the line segment joining (2, 3) and (-1, 5) subtends a right angle at 'P'.
12. Find the transformed equation of $17x^2 - 16xy + 17y^2 = 225$ when the axes are rotated through an angle of 45° .
13. Find the equation of the straight line passing through A (-1, 3) and (i) parallel to and (ii) perpendicular to the straight line passing through B (2, -5) and C (4, 6).
14. Find the derivative of $\sqrt{x+1}$ by the first principle.
15. Evaluate $\lim_{x \rightarrow 2} \frac{2x^2 - 7x - 4}{(2x-1)(\sqrt{x}-2)}$
16. A particle moving along a straight line has the relation $s = t^2 + 2t + 3$ connecting the distance 's' described by the particle in time t . Find the velocity and acceleration of the particle at time $t = 3$ seconds.
17. Using Euler's theorem, show that $x \cdot \frac{\partial u}{\partial x} + y \cdot \frac{\partial u}{\partial y} = \frac{1}{2} Tan u$ for the

function $u = Sin^{-1}\left(\frac{x+y}{\sqrt{x} + \sqrt{y}}\right)$

SECTION C

III. Long answer type questions.

5 × 7 = 35

- i) Attempt **any five** questions.
 - ii) Each question carries **seven** marks.
18. Find the orthocenter of the triangle formed by vertices $(-2, -1)$ $(6, -1)$ and $(2, 5)$.
19. Show that the equation $2x^2 - 13xy - 7y^2 + x + 23y - 6 = 0$ represents a pair of straight lines. Also find the angle between them and the co-ordinates of point of intersection of the lines.
20. Show that the lines joining 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 the lines whose direction cosines are given by the equation $3l + m + 5n = 0$ and $6mn - 2nl + 5lm = 0$.
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 $y^2 = 8x$, $4x^2 + y^2 = 32$.
24. A window is in the shape of a rectangle surmounted by a semicircle. If the perimeter of the window be 20ft, find the maximum area.