



Total No. of Questions : 24

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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

1. Very short answer type questions.

10x2=20

(i) Attempt *all* questions.(ii) Each question carries *two marks*.1. Transform the equation $3x + 4y + 12 = 0$ into

(i) slope-intercept form

(ii) intercept form

2. Find the value of p , if the straight lines $x + p = 0$, $y + 2 = 0$ and $3x + 2y + 5 = 0$ are concurrent.3. If $(3, 2, -1)$, $(4, 1, 1)$ and $(6, 2, 5)$ are three vertices and $(4, 2, 2)$ is the centroid of a tetrahedron, find the fourth vertex.4. Find the equation of the plane whose intercepts on X , Y , Z -axes are 1, 2, 4 respectively.5. Compute $\lim_{x \rightarrow 0} \frac{e^x - 1}{\sqrt{1+x} - 1}$.6. Compute $\lim_{x \rightarrow \infty} \frac{8|x| + 3x}{3|x| - 2x}$.7. If $f(x) = \sin(\log x)$, ($x > 0$) find $f'(x)$.8. Find the derivative of $\cos(\log x + e^x)$.9. Find the slope of the normal to the curve $x = a \cos^3 \theta$, $y = a \sin^3 \theta$ at $\theta = \frac{\pi}{4}$.10. Find the intervals on which $f(x) = x^2 - 3x + 8$ is increasing or decreasing.

SECTION - B

II. Short answer type questions.

5x4=20

(i) Attempt *any five* questions.

(ii) Each question carries *four marks*.

11. If the distance from P to the points (2, 3) and (2, -3) are in the ratio 2 : 3, then find the equation of the locus of P.

12. A(5, 3) and B(3, -2) are two fixed points. Find the equation of the locus of P, so that the area of triangle PAB is 9.

13. A straight line with slope 1 passes through Q(-3, 5) and meets the straight line $x + y - 6 = 0$ at P. Find the distance PQ.

14. If f , given by $f(x) = \begin{cases} k^2x - k & \text{if } x \geq 1 \\ 2 & \text{if } x < 1 \end{cases}$ is a continuous function on $\mathbb{R}$, then find the values of k .

15. Find $\frac{dy}{dx}$ for the function $x = \frac{a(1-t^2)^{\frac{1}{2}}}{1+t^2}$, $y = \frac{2bt}{1+t^2}$.

16. Find the angle between the curve $2y = e^{\frac{1}{x}}$ and Y-axis.

17. Show that $\frac{x}{1+x} < \ln(1+x) < x, \forall x > 0$.

SECTION - C

III. Long answer type questions.

5x7=35

(i) Attempt *any five* questions.

(ii) Each question carries *seven marks*.

18. If p and q are the lengths of the perpendiculars from the origin to the straight lines $x \sec \alpha + y \csc \alpha = a$ and $x \cos \alpha - y \sin \alpha = a \cos 2\alpha$, prove that $4p^2 + q^2 = a^2$.

19. Show that the pairs of straight lines $6x^2 - 5xy - 6y^2 = 0$ and $6x^2 - 5xy - 6y^2 + x + 5y - 1 = 0$ form a square.



20. Find the values of k if the lines joining the origin to the points of intersection of the curve $2x^2 - 2xy + 3y^2 + 2x - y - 1 = 0$ and the line $x + 2y = k$ are mutually perpendicular.
21. Find the direction cosines of two lines which are connected by the relations $l + m + n = 0$ and $mn - 2nl - 2lm = 0$.
22. If $x^y = y^x$ then $\frac{dy}{dx} = \frac{y(x \log y - y)}{x(y \log x - x)}$.
23. Show that the tangent at $P(x_1, y_1)$ on the curve $\sqrt{x} + \sqrt{y} = \sqrt{a}$ is $y y_1^{-\frac{1}{2}} + x x_1^{-\frac{1}{2}} = a^{\frac{1}{2}}$.
24. The profit function $P(x)$ of a company, selling x items per day is given by $P(x) = (150 - x)x - 1600$. Find the number of items that the company should sell for maximum profit. Also find the maximum profit.