



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

I. Very Short Answer Type Questions.

10x2=20

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

1. Find the value of y , if the line joining the points $(3, y)$ and $(2, 7)$ is parallel to the line joining the points $(-1, 4)$ and $(0, 6)$.

2. Find the image of the point $(1, 2)$ w.r.t. straight line $3x + 4y - 1 = 0$.

3. Find the distance between the mid-point of the line segment $\overline{AB}$ and the point $(3, -1, 2)$ where $A = (6, 3, -4)$ and $B = (-2, -1, 2)$.

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 $\lim_{x \rightarrow 0} \frac{\sin ax}{x \cos x}$.



6. Evaluate $\lim_{x \rightarrow \infty} \frac{11x^3 - 3x + 4}{13x^3 - 5x^2 - 7}$.

7. If $f(x) = x e^x \sin x$, then find $f'(x)$.

8. If $y = ae^{nx} + be^{-nx}$ then prove that $y'' = n^2 y$.

9. Find Δy and dy for the function $y = e^x + x$, at $x = 5$ and $\Delta x = 0.02$.



10. Verify Rolle's theorem for the function $f(x) = x(x+3) e^{-x/2}$ in $[-3, 0]$.





SECTION - B

II. Short Answer Type Questions.

5x4=20

(i) Answer *any five* questions.(ii) Each question carries *four marks*.11. Find the equation of the locus of P, if $A=(4, 0)$, $B=(-4, 0)$ and $|PA-PB|=4$.12. When the axes are rotated through an angle 45° , the transformed equation of a curve is $17x^2 - 16xy + 17y^2 = 225$. Find the original equation of the curve.13. A straight line through $P(3, 4)$ makes an angle of 60° with the positive direction of the X-axis. Find the coordinates of the points on the line which are 5 units away from P.14. Find real constants a, b so that the function f given by

$$f(x) = \begin{cases} \sin x & \text{if } x \leq 0 \\ x^2 + a & \text{if } 0 < x < 1 \\ bx + 3 & \text{if } 1 \leq x \leq 3 \\ -3 & \text{if } x > 3 \end{cases} \text{ is continuous on } \mathbb{R}.$$

15. Find the derivative of the function $\cos ax$ from the first principle.16. Find the value of k , so that the length of the subnormal at any point on the curve $y = a^{1-k} x^k$ is a constant.

17. The volume of a cube is increasing at a rate of 9 cubic centimetres per second. How fast is the surface area increasing when the length of the edge is 10 centimetres?

SECTION - C

III. Long Answer Type Questions.

5x7=35

(i) Attempt *any five* questions.(ii) Each question carries *seven marks*.18. Find the orthocenter of the triangle whose vertices are $(5, -2)$, $(-1, 2)$ and $(1, 4)$.19. If the second degree equation $S = ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ in the two variables x and y represents a pair of straight lines, then prove that(i) $abc + 2fgh - af^2 - bg^2 - ch^2 = 0$ and(ii) $h^2 \geq ab$, $g^2 \geq ac$ and $f^2 \geq bc$.



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. Show that the lines whose d.c.'s are given by $l + m + n = 0$, $2mn + 3nl - 5lm = 0$ are perpendicular to each other.
22. Find the derivative of the function $(\sin x)^{\log x} + x^{\sin x}$.
23. If the tangent at any point P on the curve $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$ intersects the coordinate axes in A and B , then show that the length AB is a constant.
24. From a rectangular sheet of dimensions $30 \text{ cm} \times 80 \text{ cm}$, four equal squares of side $x \text{ cm}$, are removed at the corners, and the sides are then turned up so as to form an open rectangular box. Find the value of x , so that the volume of the box is the greatest.



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