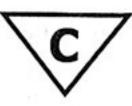
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Total No. of Questions - 24

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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

 $10 \times 2 = 20$

- I. Very short answer type questions:
 - (i) Attempt all questions.
 - (ii) Each question carries two marks.
 - 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), (0, 6).
 - 2. Find the value of 'p', if the straight lines x + p = 0, y + 2 = 0 and 3x + 2y + 5 = 0 are concurrent.
 - 3. Find the fourth vertex of the parallelogram whose consecutive vertices are (2, 4, -1), (3, 6, -1) and (4, 5, 1).
 - 4. Find the angle between the planes x + 2y + 2z 5 = 0 and 3x + 3y + 2z 8 = 0.
 - 5. Compute $\lim_{x\to 0} x^2 \sin\left(\frac{1}{x}\right)$.

- 6. Compute $\lim_{x\to\infty} \frac{8|x|+3x}{3|x|-2x}$.
- 7. If $f(x) = 7^{x^3 + 3x}$ (x > 0), then find f'(x).
- 8. If $x = \tan(e^{-y})$, then show that $\frac{dy}{dx} = \frac{-e^y}{1+x^2}$.
- 9. Find dy and Δy of $y = x^2 + x$ at x = 10 when $\Delta x = 0.1$.
- 10. Verify Rolle's theorem for the function $f: [-3, 8] \to \mathbb{R}$ be defined by $f(x) = x^2 5x + 6$.

SECTION - B

 $5 \times 4 = 20$

- II. Short answer type questions:
 - (i) Attempt any five questions.
 - (ii) Each question carries four marks.
 - A(5, 3) and B(3, -2) are two fixed points. Find the equation of locus of P, so that the area of ΔPAB is 9 sq. units.
 - 12. When the axes are rotated through an angle $\frac{\pi}{4}$, find the transformed equation of $3x^2 + 10xy + 3y^2 = 9$.
- 13. x 3y 5 = 0 is the perpendicular bisector of the line segment joining the points A, B. If A = (-1, -3), find the coordinates of 'B'.

14. Show that
$$f(x) = \begin{cases} \frac{\cos ax - \cos bx}{x^2} & \text{if } x \neq 0 \\ \frac{1}{2}(b^2 - a^2) & \text{if } x = 0 \end{cases}$$

where a and b are real constants, is continuous at x = 0.

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15. If
$$ay^4 = (x + b)^5$$
 then $5yy'' = (y')^2$.

16. Find the lengths of subtangent, subnormal at a point 't' on the curve $x = a(\cos t + t \sin t)$, $y = a(\sin t - t \cos t)$.

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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

 $5 \times 7 = 35$

III. Long answer type questions :

- (i) Attempt any five questions.
- (ii) Each question carries seven marks.
- 18. Find the orthocentre of the triangle whose vertices are (5, -2), (-1, 2) and (1, 4).
- 19. Show that the area of the triangle formed by the lines $ax^2 + 2hxy + by^2 = 0$ and the line lx + my + n = 0 is $\left| \frac{n^2 \sqrt{h^2 ab}}{am^2 2hlm + bl^2} \right|$.
- 20. The condition for the line joining the origin to the point of intersection of the circle $x^2 + y^2 = a^2$ and the line lx + my = 1 to coincide.
- 21. Find the direction cosines of two lines which are connected the relation l + m + n = 0 and mn 2nl 2lm = 0.

- 22. If $\sqrt{1-x^2} + \sqrt{1-y^2} = a(x-y)$ then prove that $\frac{dy}{dx} = \sqrt{\frac{1-y^2}{1-x^2}}$.
- 23. At a point (x_1, y_1) on the curve $x^3 + y^3 = 3axy$, show that the tangent is $(x_1^2 ay_1)x + (y_1^2 ax_1)y = ax_1y_1$.
- 24. A window is in the shape of rectangle surmounted by a semicircle. If the perimeter of the window is 20 ft. find the maximum area.

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