193

II

Total No. of Questions : **24**
Total No. of Printed Pages : **3**

Regd. No.

1183681

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

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

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

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

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

$$f(x) = \begin{cases} \sin x & \text{if} \quad x \leq 0 \\ x^2 + a & \text{if} \quad 0 < x < 1 \\ bx + 3 & \text{if} \quad 1 \leq x \leq 3 \\ -3 & \text{if} \quad x > 3 \end{cases}$$ is continuous on 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 $S \equiv ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ 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 cm × 80 cm, four equal squares of side x 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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