

Total No. of Questions – 24

Regd.

Total No. of Printed Pages – 3

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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.

10 × 2 = 20

(i) Attempt **all** questions.(ii) Each question carries **two** marks.1. Find the ratio in which the straight line $2x + 3y = 5$ divide the line joining the points $(0, 0)$ and $(-2, 1)$.2. Find the equation of the straight line passing through the points $(at_1^2, 2at_1)$ and $(at_2^2, 2at_2)$.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. Reduce the equation $x + 2y - 3z - 6 = 0$ of the plane to the normal form.5. Find $\lim_{x \rightarrow 0} \left[\frac{\sqrt{1+x} - 1}{x} \right]$ 6. Compute $\lim_{x \rightarrow \infty} \frac{11x^3 - 3x + 4}{13x^3 - 5x^2 - 7}$ 7. If $f(x) = \log(\sec x + \tan x)$, then find $f'(x)$.

8. Find the derivative of $\cos^{-1}(4x^3 - 3x)$.
9. If $y = x^2 + 3x + 6$, $x = 10$ and $\Delta x = 0.01$, then find Δy and dy .
10. Verify Rolle's theorem for the function $x^2 - 1$ on $[-1, 1]$.

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 of P, if the ratio of the distance from P to A(5, -4) and B(7, 6) is 2 : 3.
12. When the axes rotated through an angle α , find the transformed equation of $x \cos \alpha + y \sin \alpha = P$.
13. 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).
14. Check the continuity of f given by

$$f(x) = \begin{cases} (x^2 - 9)/(x^2 - 2x - 3) & \text{if } 0 < x < 5, x \neq 3 \\ 1.5 & \text{if } x = 3 \end{cases}$$
 at the point 3.
15. Find the derivative of $\tan 2x$ from the first principle.
16. Find the angle between the curves given $x + y + 2 = 0$, $x^2 + y^2 - 10y = 0$
17. The volume of a cube is increasing at the rate of $8 \text{ cm}^3/\text{sec}$. How fast is the surface area increasing when the length of an edge is 12 cm ?

SECTION - C

III. Long Answer Type questions :

5 × 7 = 35

- (i) Attempt any **five** questions.
- (ii) Each question carries **seven** marks.

18. Find the circumcentre of the triangle whose sides are given by $x + y + 2 = 0$, $5x - y - 2 = 0$ and $x - 2y + 5 = 0$.

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 line, then show 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 condition for the chord $lx + my = 1$ of the curve circle $x^2 + y^2 = a^2$ (whose centre is the origin) to subtend a right angle at the origin.

21. The vertices of a triangle are A (1, 4, 2), B(-2, 1, 2), C(2, 3, -4). Find $\angle A, \angle B, \angle C$.

22. If $y = x^{\tan x} + (\sin x)^{\cos x}$, find $\frac{dy}{dx}$.

23. If the tangent at any point 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 \times 80 cm, four equal squares of side x cm are removed at the corner, 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.
