

Total No. of Questions – 24

Total No. of Printed Pages – 3

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No.

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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 × 2 = 20

I. Very Short Answer Type questions :

- (i) Answer all questions.
(ii) Each question carries two marks.

1. Find the slopes of the lines $x + y = 0$ and $x - y = 0$.
2. Transform the equation $x + y + 1 = 0$ into normal form.
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 angle between the planes $2x - y + z = 6$ and $x + y + 2z = 7$.
5. Compute $\lim_{x \rightarrow 0} \frac{e^{7x} - 1}{x}$
6. Compute $\lim_{x \rightarrow \infty} \frac{x^2 + 5x + 2}{2x^2 - 5x + 1}$
7. Find the derivative of $5 \sin x + e^x \log x$.

8. Find the derivative of $\sec^{-1}\left(\frac{1}{2x^2-1}\right)$, $\left(0 < x < \frac{1}{\sqrt{2}}\right)$.
9. Find dy and Δy of $y = f(x) = x^2 + x$ at $x = 10$ when $\Delta x = 0.1$.
10. Verify Rolle's theorem for the function $y = f(x) = x^2 + 4$ in $[-3, 3]$.

SECTION - B

$5 \times 4 = 20$

II. Short Answer Type questions :

- (i) Attempt any **five** questions.
- (ii) Each question carries **four** marks.
11. $A(1, 2)$, $B(2, -3)$ and $C(-2, 3)$ are three points. A point P moves such that $PA^2 + PB^2 = 2PC^2$ then find the equation of locus of P .
12. When the axes are rotated through an angle $\frac{\pi}{4}$, find the transformed equation of $3x^2 + 10xy + 3y^2 = 9$.
13. Find the value of P , if the lines $3x + 4y = 5$, $2x + 3y = 4$, $Px + 4y = 6$ are concurrent.
14. Check the continuity of the following function at 2
- $$f(x) = \begin{cases} \frac{1}{2}(x^2 - 4) & \text{if } 0 < x < 2 \\ 0 & \text{if } x = 2 \\ 2 - 8x^{-3} & \text{if } x > 2 \end{cases}$$
15. Find the derivative of $\cot x$ from the first principle.
16. A particle is moving in a straight line so that after ' t ' seconds its distance is S (in cms) from a fixed point on the line given by $S = f(t) = 8t + t^3$. Find (i) the velocity at time $t = 2$ sec, (ii) the initial velocity and (iii) acceleration at $t = 2$ sec.
17. Find the equations of tangent and normal to the curve $xy = 10$ at $(2, 5)$.

III. Long Answer Type questions :

- (i) Attempt any **five** questions.
- (ii) Each question carries **seven** marks.
18. Find the circumcenter of the triangle whose vertices are $(-2, 3)$, $(2, -1)$ and $(4, 0)$.
19. Show that the area of the triangle formed by the lines $ax^2 + 2hxy + by^2 = 0$, $lx + my + n = 0$ is $\left| \frac{n^2 \sqrt{h^2 - ab}}{am^2 - 2h/m + b/l^2} \right|$.
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 angle between the lines whose direction cosines satisfy the equations $l + m + n = 0$, $l^2 + m^2 - n^2 = 0$.
22. Find $\frac{dy}{dx}$, if $y = (\sin x)^{\log x} + x^{\sin x}$.
23. Find the angle between the curves $xy = 2$, $x^2 + 4y = 0$.
24. A wire of length l is cut into two parts which are bent respectively in the form of a square and a circle. What are the lengths of the pieces of the wire respectively so that the sum of the areas is the least ?