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| II |

Total No. of Questions – 24   Regd.
Total No. of Printed Pages – 3   No.

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)   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 $\lim\limits_{x \to 0} \dfrac{e^{7x} - 1}{x}$

  6.   Compute $\lim\limits_{x \to \infty} \dfrac{x^2 + 5x + 2}{2x^2 - 5x + 1}$

  7.   Find the derivative of $5 \sin x + e^x \log x$.

8. Find the derivative of $\sec^{-1}\left(\dfrac{1}{2x^2 - 1}\right)$, $\left(0 < x < \dfrac{1}{\sqrt{2}}\right)$.

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 $\dfrac{\pi}{4}$, 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

$$f(x) = \begin{cases} \dfrac{1}{2}(x^2 - 4) & \text{if } 0 < x < 2 \\ 0 & \text{if } x = 2 \\ 2 - 8x^{-3} & \text{if } x > 2 \end{cases}$$

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 $(2, 5)$.

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SECTION – C $5 \times 7 = 35$

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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 $\left| \dfrac{n^2\sqrt{h^2 - ab}}{am^2 - 2hlm + bl^2} \right|$.

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 $\dfrac{dy}{dx}$, 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 ?

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