

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****10 × 2 = 20****I. Very Short Answer Type questions :**

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

1. Find the angle which the straight line $y = \sqrt{3}x - 4$ makes with the y-axis.
2. Find the distance between the parallel straight lines $3x + 4y - 3 = 0$ and $6x + 8y - 1 = 0$.
3. Find 'x', if the distance between (5, -1, 7) and (x, 5, 1) is 9 units.
4. Write the equation of the plane $4x - 4y + 2z + 5 = 0$ in the intercept form.
5. Compute $\lim_{x \rightarrow 0} \frac{e^{3+x} - e^3}{x}$.
6. Compute $\lim_{x \rightarrow 3} \frac{x^2 + 3x + 2}{x^2 - 6x + 9}$.
7. Find the derivative of the function $\tan^{-1}(\log x)$.

8. If $y = \frac{2x+3}{4x+5}$ then find y'' .

9. Define relative error and percentage error of the variable 'y'.

10. Find the absolute extremum of $f(x) = x^2$ defined on $[-2, 2]$.

SECTION - B

5 × 4 = 20

II. Short Answer Type questions :

(i) Attempt any **five** questions.

(ii) Each question carries **four** marks.

11. A(5, 3) and B(3, -2) are two fixed points. Find the equation of locus of P, so that the area of triangle PAB is 9.

12. When the origin is shifted to the point (3, -4) and transformed equation is $x^2 + y^2 = 4$. Find the original equation.

13. If the straight lines $ax + by + c = 0$, $bx + cy + a = 0$ and $cx + ay + b = 0$ are concurrent, then prove that $a^3 + b^3 + c^3 = 3abc$.

14. Compute $\lim_{x \rightarrow a} \left(\frac{x \sin a - a \sin x}{x - a} \right)$.

15. Find the derivative of the function $\cot x$ from the first principle.

16. Find the approximate value of $\sqrt[3]{999}$.

17. The distance - time formula for the motion of a particle along a straight line is $s = t^3 - 9t^2 + 24t - 18$. Find when and where the velocity is zero.

III. Long Answer Type questions :

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

18. If $Q(h, k)$ is the image of the point $P(x_1, y_1)$ with respect to the straight line

$$ax + by + c = 0 \text{ then prove that } \frac{h - x_1}{a} = \frac{k - y_1}{b} = \frac{-2(ax_1 + by_1 + c)}{a^2 + b^2}.$$

19. If the equation $S \equiv ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ represents a pair of parallel straight lines then show that (i) $h^2 = ab$ (ii) $af^2 = bg^2$ and (iii) the

$$\text{distance between the parallel lines} = \sqrt{\frac{g^2 - ac}{a(a+b)}} = \sqrt{\frac{f^2 - bc}{b(a+b)}}.$$

20. Find the value of k , if the lines joining the origin to the points of intersection of the curves $2x^2 - 2xy + 3y^2 + 2x - y - 1 = 0$ 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. If $y = x\sqrt{a^2 + x^2} + a^2 \log(x + \sqrt{a^2 + x^2})$ then prove that $\frac{dy}{dx} = 2\sqrt{a^2 + x^2}$.

23. Show that the condition for the orthogonality of the curves $ax^2 + by^2 = 1$ and

$$a_1x^2 + b_1y^2 = 1 \text{ is } \frac{1}{a} - \frac{1}{b} = \frac{1}{a_1} - \frac{1}{b_1}.$$

24. Find the points of local extrema and local extrema for the function $f(x) = \cos 4x$

$$\text{defined on } \left(0, \frac{\pi}{2}\right).$$