

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.

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