

193**III**

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 value of x , if the slope of the line passing through $(2, 5)$ and $(x, 3)$ is 2.
2. Find the sum of the squares of the intercepts of the line $4x - 3y = 12$ on the axes of co-ordinates.
3. Show that the points $(1, 2, 3)$, $(2, 3, 1)$ and $(3, 1, 2)$ form an equilateral triangle.
4. Find the intercepts of the plane $4x + 3y - 2z + 2 = 0$ on the co-ordinate axes.
5. Compute $\lim_{x \rightarrow 0} \frac{e^{3x} - 1}{x}$.
6. Compute $\lim_{x \rightarrow \infty} \frac{11x^3 - 3x + 4}{13x^3 - 5x^2 - 7}$.
7. If $f(x) = \sin(\log x)$, $(x > 0)$ then find $f'(x)$.

8. If $y = x^4 + \tan x$ then find y'' .
9. If the increase in the side of a square is 4% then find the approximate percentage of increase in the area of the square.
10. Verify Rolle's theorem for the function $f(x) = x(x+3)e^{-\frac{x}{2}}$ in $[-3, 0]$.

SECTION - B

5 × 4 = 20

II. Short answer type questions :

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

11. Find the equation of the locus of P, if $A = (2, 3)$, $B = (2, -3)$ and $PA + PB = 8$.
12. When the origin is shifted to $(-1, 2)$ by the translation of axes, find the transformed equation of $x^2 + y^2 + 2x - 4y + 1 = 0$.
13. Show that the lines $2x + y - 3 = 0$, $3x + 2y - 2 = 0$ and $2x - 3y - 23 = 0$ are concurrent and find the point of concurrency.
14. Find the real constants a, b so that the function f given by

$$f(x) = \begin{cases} \sin x, & \text{if } x \leq 0 \\ x^2 + a, & \text{if } 0 < x < 1 \\ bx + 3, & \text{if } 1 \leq x \leq 3 \\ -3, & \text{if } x > 3 \end{cases}$$

is continuous on \mathbb{R} .

15. Find the derivative of the function $\sin 2x$ from the first Principle.

16. A particle is moving along a line according to $S = f(t) = 4t^3 - 3t^2 + 5t - 1$ where S is measured in metres and t is measured in seconds. Find the velocity and acceleration at time t . At what time the acceleration is zero ?
17. At any point t on the curve $x = a(t + \sin t)$; $y = a(1 - \cos t)$, find the lengths of tangent, normal, subtangent and subnormal.

SECTION - C

5 × 7 = 35

III. Long Answer Type questions :

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

18. Find the circumcentre of the triangle whose vertices are $(1, 3)$, $(0, -2)$ and $(-3, 1)$.
19. If the equation $ax^2 + 2hxy + by^2 = 0$ represents a pair of intersecting lines then prove that the combined equation of the pair of bisectors of the angles between these lines is $h(x^2 - y^2) = (a - b)xy$.
20. Find the angle between the straight lines joining the origin to the points of intersection of the curve $7x^2 - 4xy + 8y^2 + 2x - 4y - 8 = 0$ with the straight line $3x - y = 2$.
21. Find the direction cosines of two lines which are connected by the relations $l - 5m + 3n = 0$ and $7l^2 + 5m^2 - 3n^2 = 0$.
22. If $y = x^{\tan x} + (\sin x)^{\cos x}$, find $\frac{dy}{dx}$.
23. Find the angle between the curves $y^2 = 8x$, $4x^2 + y^2 = 32$.
24. Find two positive integers whose sum is 16 and the sum of whose squares is minimum.