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III

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

Regd. 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 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 $\lim\limits_{x \to 0} \dfrac{e^{3x} - 1}{x}$.

6. Compute $\lim\limits_{x \to \infty} \dfrac{11x^3 - 3x + 4}{13x^3 - 5x^2 - 7}$.

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

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

is continuous on 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 $5 \times 7 = 35$

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.
