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II

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

I. Very short answer type questions. **10x2=20**

(i) Attempt *all* questions.

(ii) Each question carries *two marks.*

1. Transform the equation $3x+4y+12=0$ into
(i) slope-intercept form
(ii) intercept form

2. Find the value of p, if the straight lines $x+p=0$, $y+2=0$ and $3x+2y+5=0$ are concurrent.

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 equation of the plane whose intercepts on X, Y, Z-axes are 1, 2, 4 respectively.

5. Compute $\lim_{x\to 0} \frac{e^x - 1}{\sqrt{1+x} - 1}$.

6. Compute $\lim_{x\to\infty} \frac{8|x| + 3x}{3|x| - 2x}$.

7. If $f(x)=\sin(\log x)$, $(x > 0)$ find $f'(x)$.

8. Find the derivative of $\cos(\log x + e^x)$.

9. Find the slope of the normal to the curve $x=a\cos^3\theta$, $y=a\sin^3\theta$ at $\theta = \frac{\pi}{4}$.

10. Find the intervals on which $f(x)=x^2-3x+8$ is increasing or decreasing.

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SECTION - B

II. Short answer type questions. **5x4=20**

(i) Attempt *any five* questions.

(ii) Each question carries *four marks*.

11. If the distance from P to the points (2, 3) and (2, −3) are in the ratio 2 : 3, then find the equation of the locus of P.

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

13. A straight line with slope 1 passes through Q(−3, 5) and meets the straight line $x+y-6=0$ at P. Find the distance PQ.

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14. If f, given by $f(x) = \begin{cases} k^2x - k & \text{if } x \geq 1 \\ 2 & \text{if } x < 1 \end{cases}$ is a continuous function on R, then find the values of k.

15. Find $\frac{dy}{dx}$ for the function $x = \frac{a(1-t^2)}{1+t^2}, y = \frac{2bt}{1+t^2}$.

16. Find the angle between the curve $2y = e^{\frac{x}{2}}$ and Y-axis.

17. Show that $\frac{x}{1+x} < \ln(1+x) < x, \forall x > 0$.

SECTION - C

III. Long answer type questions. **5x7=35**

(i) Attempt *any five* questions.

(ii) Each question carries *seven marks*.

18. If p and q are the lengths of the perpendiculars from the origin to the straight lines $x\sec\alpha + y\operatorname{cosec}\alpha = a$ and $x\cos\alpha - y\sin\alpha = a\cos 2\alpha$, prove that $4p^2 + q^2 = a^2$.

19. Show that the pairs of straight lines $6x^2 - 5xy - 6y^2 = 0$ and $6x^2 - 5xy - 6y^2 + x + 5y - 1 = 0$ form a square.

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 direction cosines of two lines which are connected by the relations $l+m+n=0$ and $mn-2nl-2lm=0$.

22. If $x^y=y^x$ then $\frac{dy}{dx}=\frac{y(x\log y-y)}{x(y\log x-x)}$.

23. Show that the tangent at $P(x_1, y_1)$ on the curve $\sqrt{x}+\sqrt{y}=\sqrt{a}$ is $y y_1^{\frac{-1}{2}}+x x_1^{\frac{-1}{2}}=a^{\frac{1}{2}}$.

24. The profit function $P(x)$ of a company, selling x items per day is given by $P(x)=(150-x)x-1600$. Find the number of items that the company should sell for maximum profit. Also find the maximum profit.

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