



Total No. of Questions : 24
Total No. of Printed Pages : 4

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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) Attempt **all** the questions.
- (ii) Each question carries **TWO** marks.

1. Find the equation of straight line passing through the point (2, 3) and making intercepts on the axes of co-ordinates, whose sum is zero.
2. Transform the equation $x + y - 2 = 0$ into normal form.
3. Find the centroid of the tetrahedron, whose vertices are (2, 3, -4), (-3, 3, -2), (-1, 4, 2), (3, 5, 1).
4. Transform the equation $4x - 4y + 2z - 5 = 0$ into Intercepts form.
5. Find the value of $\lim_{x \rightarrow \infty} \frac{8|x| + 3x}{3|x| - 2x}$.

6. If $x = a \cos^3 t$, $y = a \sin^3 t$, find $\frac{dy}{dx}$.
7. If $y = \sin^{-1}\left(\frac{2x}{1+x^2}\right)$, find $\frac{dy}{dx}$.
8. If $y = \log(\cosh 2x)$, find $\frac{dy}{dx}$.
9. If the increase in the side of a Square is 1%, find the percentage of change in the area of the square.
10. Show that the length of the sub-tangent at any point on the curve $y = a^x$ ($a > 0$) is a constant.

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 a point P such that the distance of P from the origin is twice the distance of P from A(1, 2).
12. Find the transformed equation of $x^2 + 2\sqrt{3}xy - y^2 = 2a^2$, when the axes are rotated through an angle $\frac{\pi}{6}$.
13. Find the value of k , if the angle between the straight lines $4x - y + 7 = 0$ and $kx - 5y - 9 = 0$ is 45° .
14. Find $\lim_{x \rightarrow 0} \frac{\sin(a + bx) - \sin(a - bx)}{x}$

15. Find the derivative of $\sec 3x$ from the first principle.
16. 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.
17. Using Euler's theorem, show that $x \cdot \frac{\partial u}{\partial x} + y \cdot \frac{\partial u}{\partial y} = \frac{1}{2} \tan u$
for the function $u = \sin^{-1} \left(\frac{x+y}{\sqrt{x} + \sqrt{y}} \right)$.

SECTION - C

5×7=35

III. Long answer type questions.

- (i) Attempt **ANY FIVE** questions.
- (ii) Each question carries **SEVEN** marks.

18. Find the Ortho-centre of the triangle, whose vertices are $(-5, -7)$, $(13, 2)$ and $(-5, 6)$.
19. If the equation $S \equiv ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ represents a pair of parallel straight lines, then
- (i) $h^2 = ab$
- (ii) $af^2 = bg^2$
- (iii) The distance between parallel lines $= 2 \sqrt{\frac{g^2 - ac}{a(a+b)}}$
20. Show that the lines joining the origin to the points of intersection of the curve $x^2 - xy + y^2 + 3x + 3y - 2 = 0$ and the straight line $x - y - \sqrt{2} = 0$ are mutually perpendicular.

21. Find the angle between the lines whose direction cosines satisfy the equations $l + m + n = 0$, $2mn + 3nl - 5lm = 0$.
22. If $y = \tan^{-1} \left(\frac{\sqrt{1+x^2} + \sqrt{1-x^2}}{\sqrt{1+x^2} - \sqrt{1-x^2}} \right)$ for $0 < |x| < 1$, find $\frac{dy}{dx}$.
23. Find the angle between the curves $y^2 = 4x$ and $x^2 + y^2 = 5$.
24. Show that the area of a rectangle inscribed in a circle is maximum when it is a square.
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