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III

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

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 **10×2=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 $\underset{x\to\infty}{Lt} \dfrac{8|x| + 3x}{3|x| - 2x}$.

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 $\pi/6$.

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 $\underset{x\to 0}{Lt} \frac{\sin(a+bx)-\sin(a-bx)}{x}$

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 $y = \tan^{-1}\left(\dfrac{\sqrt{1+x^2}+\sqrt{1-x^2}}{\sqrt{1+x^2}-\sqrt{1-x^2}}\right)$ for $0 < |x| < 1$, find $\dfrac{dy}{dx}$.

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.