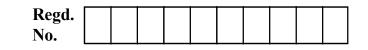
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Total No. of Questions - **30** Total No. of Printed Pages - **4**



Part - III MATHEMATICS, Paper - IB

(English Version)

MODEL QUESTION PAPER (FOR IPE 2020-21 ONLY)

Time : 3 Hours

Max. Marks: 75

 $10 \times 2 = 20$

Note: This question paper consists of three section A, B and C.

Section - A

Very short answer type questions.

- (i) Answer all questions.
- (ii) Each question carries 2 marks.
- 1. Find the value of x, if the slope of the line passing through (2, 5) and (x, 3) is 2.
- 2. Transform the equation x + y + 1 = 0 into normal form.
- 3. Show that the points (1, 2, 3), (2, 3, 1) and (3, 1, 2) form an equilateral triangle.
- 4. Find the equation of the plane whose intersepts on X, Y, Z axes are 1, 2, 4 respectively.

5. Show that
$$\lim_{x \to 0+} \left\{ \frac{2|x|}{x} + x + 1 \right\} = 3$$

6. Find
$$\lim_{x\to 0} \frac{Lt}{x}$$

- 7. Find the derivative of $5\sin x + e^x \log x$.
- 8. If $y = \log[\sin(\log x)]$ then find $\frac{dy}{dx}$.
- 9. Find the approximate value of $\sqrt[3]{65}$.
- 10. Find the slope of the tangent to the curve $y = 3x^4 4x$ at x = 4.

Short answer type questions.

$5 \times 4 = 20$

- (i) Answer any FIVE questions.
- (ii) Each question carries four marks.
- 11. A(2, 3) and B(-3, 4) are two given points. Find the equation of the locus of P, so that the area of the triangle PAB is 8.5 sq.units.
- 12. Find the equation of the locus of P, if A = (4, 0), B = (-4, 0) and |PA PB| = 4.
- 13. When the origin is shifted to point A(2, 3), the transformed equation of the curve is $x^2 + 3xy 2y^2 + 17x 7y 11 = 0$. Find the original equation of the curve.
- 14. When the axes are roted through an angle $\frac{\pi}{6}$. Find the transformed equation of $x^2 + 2\sqrt{3}xy y^2 = 2a^2$.
- 15. Find the points on the line 3x-4y-1=0 which are at a distance of 5 units from the point (3, 2).
- 16. Show that the points O(0, 0, 0), A(2,-3, 3), B(-2, 3, -3) are collinear. Find the ratio in which each point divides the segment joining the other two.

17. Compute the limit
$$\lim_{x\to 0} \frac{1-\cos mx}{1-\cos nx}, n \neq 0$$

18. Find the derivative of $\sin 2x$ from the first principle.

19. Show that the lengths of subtangent and subnormal at a point on the curve $y = b \sin \frac{x}{a}$.

20. Show that the tangent at any point θ on the curve $x = c \sec \theta$, $y = c \tan \theta$ is $y \sin \theta = x - c \cos \theta$.

Section - C

Long Answer type questions.

- (i) Answer any FIVE questions.
- (ii) Each question carries seven marks.
- 21. Find the equation of straight lines passing through (1, 2) and making an angle of 60° with the line $\sqrt{3}x + y + 2 = 0$.
- 22. Find the circumcentre of the triangle whose verteses are (1, 0), (-1, 2) and (3, 2).

5×7=35

23. If the angle between the pair of straight lines $ax^2 + 2hxy + by^2 = 0$ is θ , then show that

$$\cos\theta = \frac{\left|a+b\right|}{\sqrt{\left(a-b\right)^2 + 4h^2}}.$$

- 24. Find the value of k, if the line 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.
- 25. If a ray with d.c's *l*, *m*, *n* makes angles α , β , γ and δ with four diagonals of a cube, then show that $\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma + \cos^2 \delta = \frac{4}{3}$.
- 26. If $x = \frac{3at}{1+t^3}$, $y = \frac{3at^2}{1+t^3}$ then find $\frac{dy}{dx}$.

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

- 28. Show that the curves $y^2 = 4(x+1)$ and $y^2 = 36(9-x)$ intersect orthogonally.
- 29. At any point *t* on the curve $x = a(t + \sin t)$; $y = a(1 \cos t)$ find lengths of tangent and normal.
- 30. A wire of length *l* is cut into two parts which are bent respectively in the form of a square and circle. Find the lengths of the pieces of the wire, so that the sum of the areas is the least.