0193

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

Regd. No.

Part - III

MATHEMATICS, Paper - IB

(English Version)

MODEL QUESTION PAPER (FOR IPE 2020-21 ONLY)

***Time :* 3 Hours** ***Max. Marks :* 75**

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. **10×2=20**

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 $\underset{x\to 0+}{Lt}\left\{\frac{2|x|}{x}+x+1\right\}=3$

6. Find $\underset{x\to 0}{Lt}\frac{e^{x+3}-e^{3}}{x}$

7. Find the derivative of $5\sin x+e^{x}\log x$.

8. If $y=\log\left[\sin\left(\log x\right)\right]$ 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.

Turn Over

Section - B

Short answer type questions. **5×4=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 $\underset{x\to 0}{Lt}\frac{1-\cos mx}{1-\cos nx}$, $n\neq 0$

18. Find the derivative of sin2x 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. **5×7=35**

(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 60º 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).

Turn Over

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

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

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.