

**0193****SET -**

Total No. of Questions - 37

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**Part - III**  
**MATHEMATICS, Paper - IB**  
**(English Version)**  
**MODEL QUESTION PAPER**  
**(For the Academic year 2021-22 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 ANY TEN 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. Find the angle which the straight line  $y = \sqrt{3}x - 4$  makes with the Y-axis.
4. Find the length of the perpendicular from  $(0, 0)$  to the straight line  $x - 3y - 4 = 0$ .
5. Show that the points  $(1, 2, 3)$ ,  $(2, 3, 1)$  and  $(3, 1, 2)$  form an equilateral triangle.
6. Find the ratio in which the XZ-plane divides the line joining  $A(-2, 3, 4)$  and  $B(1, 2, 3)$ .
7. Find the coordinates of the vertex 'C' of  $\Delta ABC$  if its centroid is the origin and the vertices A, B are  $(1, 1, 1)$  and  $(-2, 4, 1)$  respectively.
8. Find the equation of the plane whose intercepts on X, Y, Z - axes are 1, 2, 4 respectively.
9. Show that  $\lim_{x \rightarrow 0^+} \left\{ \frac{2|x|}{x} + x + 1 \right\} = 3$
10. Find  $\lim_{x \rightarrow 0} \frac{e^{x+3} - e^3}{x}$

Turn Over

11. Compute :  $\lim_{x \rightarrow 0} \frac{a^x - 1}{b^x - 1}$  ( $a > 0, b > 0, b \neq 1$ )
12. Find the derivative of  $5 \sin x + e^x \log x$ .
13. If  $y = \log [\sin(\log x)]$  then find  $\frac{dy}{dx}$ .
14. Find the approximate value of  $\sqrt[3]{65}$ .
15. Find the slope of the tangent to the curve  $y = 3x^4 - 4x$  at  $x = 4$ .

**Section - B**

**Short answer type questions.**

**5×4=20**

**(i) Answer any FIVE questions.**

**(ii) Each question carries four marks.**

16. 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.
17. Find the equation of the locus of P, if A = (4, 0), B = (-4, 0) and  $|PA - PB| = 4$ .
18. A(1, 2), B(2, -3) and C(-2, 3) are three points. A point P moves Q.  
 $PA^2 + PB^2 = 2 PC^2$ , show that the equation of the locus of P is  $7x - 7y + 4 = 0$ .
19. 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.
20. When the axes are rotated through an angle  $\frac{\pi}{6}$ . Find the transformed equation of  $x^2 + 2\sqrt{3}xy - y^2 = 2a^2$ .
21. Find the points on the line  $3x - 4y - 1 = 0$  which are at a distance of 5 units from the point (3, 2).
22. Find the value of  $p$ , if the following lines are concurrent.  
 $3x + 4y = 5, 2x + 3y = 4, px + 4y = 6$
23. 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.
24. Compute the limit  $\lim_{x \rightarrow 0} \frac{1 - \cos mx}{1 - \cos nx}, n \neq 0$
25. Find the derivative of  $\sin 2x$  from the first principle.

Turn Over

26. If the increase in the side of a square is 4%. Then find the approximate percentage of increase in the area of the square.
27. Show that the tangent at any point  $\theta$  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.**

28. Find the equation of straight lines passing through (1, 2) and making an angle of  $60^\circ$  with the line  $\sqrt{3}x + y + 2 = 0$ .
29. Find the circumcentre of the triangle whose vertices are (1, 0), (-1, 2) and (3, 2).
30. Find the orthocentre of the triangle with the vertices (-2, -1), (6, -1), (2, 5).
31. If the angle between the pair of straight lines  $ax^2 + 2hxy + by^2 = 0$  is  $\theta$ , then show that 
$$\cos \theta = \frac{|a+b|}{\sqrt{(a-b)^2 + 4h^2}}.$$
32. 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.
33. If a ray with d.c's  $l, m, n$  makes angles  $\alpha, \beta, \gamma$  and  $\delta$  with four diagonals of a cube, then show that  $\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma + \cos^2 \delta = \frac{4}{3}$ .
34. Find the derivative of  $\frac{\sin(x+a)}{\cos x}$ .
35. Find the derivative of  $f(x) = \frac{x \cos x}{\sqrt{1+x^2}}$
36. Find the derivative of  $\frac{x(1+x^2)}{\sqrt{1-x^2}}$ .
37. Show that the curves  $y^2 = 4(x+1)$  and  $y^2 = 36(9-x)$  intersect orthogonally.