Time:09:00A.M to 12:00P.M **MATHS-IB** **Max. Marks :75**

Section-A

I. Very Short Answer Questions. Answer all Questions.
Each Question carries' Two' marks **10x2=20M**

1. Find the equation of straight line passing through the points $\left(at^2{}_1, 2at_1\right) \& \left(at_2{}^2, 2at_2\right)$
2. Find the angle between the planes $\sqrt{3}x + y + 1 = 0$ and x+1=0
3. If (3,2,-1), (4,1,1) and (6,2,5) are three vertices and (4,2,2) is the centroid of a tetrahedron, find the fourth vertex
4. Find the intercepts of the plane $4x + 3y - 2z + 2 = 0$ on the coordinate axes
5. Evaluate $\lim_{x\to 1} \frac{\sin(x-1)}{x^3-1}$
6. Evaluate $\lim_{x\to 0}\left(\frac{e^x-1}{\sqrt{1+x}-1}\right)$
7. Find $\frac{dy}{dx}$, if $x = a\cos^3\theta,\ y = a\sin^3\theta$
8. Find the derivative of $Tan^{-1}\sqrt{\frac{1+\cos x}{1-\cos x}}$ with respect to x
9. If the increase in the side of a square is 2% then find the approximate percentage of increase in its area
10. Verify Rolle's theorem for the function $f(x) = \log\left(x^2+2\right) - \log 3 \ on [-1,1]$

Section-B

II. Short Answer Questions. Answer any 'Five' Questions.
Each Question carries 'Four' marks. **5 x4 =20 M**

11. Find the equation of locus of P, if the line segment joining $(2,3)$ and $(-1,5)$ subtends a right angle at P.
12. Show that the axes are to be rotated through an angle of $\frac{1}{2}Tan^{-1}\left(\frac{2h}{a-b}\right)$ so as to remove the xy term from the equation $ax^2 + 2hxy + by^2 = 0$ if $a \neq b$ and through the angle $\frac{\pi}{4}$ if a=b
13. Transform the equation $3x + 4y + 12 = 0$ into
    a) Slope-intercept form(1M)
    b) Intercept form(1M)

c) Normal form (2M)

14. Find real constants a,b so that the function f given by

$f(x) = \sin x \quad if\ x \le 0$

$= x^2 + a \quad if\ 0 < x < 1$

$= bx + 3 \quad if\ 1 \le x \le 3$

$= -3 \quad if \quad x > 3$ is continuous R.

15. Find the derivative of $Cos^2 x$ from the first principle.

16. The volume of a cube is increasing at a rate of 9 c.cm/sec. How fast is the surface area increasing when the length of the edge is 10cm

17. Find the length of normal and subnormal at a point on the curve $y = \frac{a}{2}\left(e^{x/a} + e^{-x/a}\right)$

Section-C

III. Long Answer Questions. Answer any 'Five' Questions.
Each Question carries 'Seven' marks. 5 x7 =35 M

18. Find the circumcentre of the triangle whose sides equations are $3x - y - 5 = 0 : x + 2y - 4 = 0$ and $5x + 3y + 1 = 0$

19. If $S = ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ represents a pair of parallel lines then

i) $h^2 = ab$ and

ii) $af^2 = bg^2$. Also the distances between them is $2\sqrt{\frac{g^2 - ac}{a(a+b)}}\ (or)\ 2\sqrt{\frac{f^2 - bc}{b(a+b)}}$

20. Find the value of "k" if the lines joining the origin to the points of intersection of the curve $2x^2 - 2xy + 3y^2 + 2x - y - 1 = 0$ and the line $x + 2y - k = 0$ are mutually perpendicular

21. Find the angle between the lines whose direction cosines are given by the equations $3l + m + 5n = 0$ and $6mn - 2ln + 5lm = 0$

22. Find the derivative of $Tan^{-1}\left[\frac{\sqrt{1+x^2} + \sqrt{1-x^2}}{\sqrt{1+x^2} - \sqrt{1-x^2}}\right]$ with respect to x

23. If the tangent at any point "P" on the curve $x^m y^n = a^{m+n}$ $(mn \neq 0)$ meets the coordinate axes in A and B then Show that AP:PB is a constant.

24. A wire of length "*l*" is cut into two parts which are bent respectively in the form of a square and a circle. What are the lengths of pieces of the wire so that the sum of the areas is the least?