MATHEMATICS PAPER IB.- MARCH 2009
COORDINATE GEOMETRY & CALCULUS

TIME : 3hrs **Max. Marks.75**

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

SECTION A

VERY SHORT ANSWER TYPE QUESTIONS. **10 × 2 =20**

Noe : Attempt all questions. Each question carries 2 marks.

1. If the area of the triangle formed by the straight lines x =0, y =0 and 3x + 4y =a (a >0) is 6. Find the value of 'a'.
2. Find the distance between the parallel straight lines 5x-3y-4= 0, 10x-6y-9=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 angle between the two planes x+2y+2z-5 =0 and 3x+3y+2z-8 =0
5. Complete $\lim_{x \to 0}\left(\frac{e^x - 1}{\sqrt{1+x} - 1}\right)$
6. Find $\lim_{x\to\infty}\left(\sqrt{x^2+x} - x\right)$
7. Show that $f(x) = \begin{cases} \frac{\cos ax - \cos bx}{x^2} & if \;\; x \neq 0 \\ \frac{1}{2}\left(b^2 - a^2\right) & if \;\; x = 0 \end{cases}$ where a and b are real constants, is continuous at 0.
8. IF y = cos (log cot x) find $\frac{dy}{dx}$
9. The diameter of a sphere is measured to be 20cm. If an error of 0.02 cm. occurs in this, find the errors in volume and surface area of the sphere.
10. Find the equation of normal to the curve y = x^2– 4x + 2 at (4,2).

SECTION B

SHORT ANSWER TYPE QUESTIONS. **5X4 =20**

Note : Answer any FIVE questions. Each question carries 4 marks.

11. A (5,3) and B (3, -2) are two fixed points. Find the equation of locus of P, so that the area of triangle PAB is 9 sq. units.
12. When the origin is shifted to the point (2,3) the transformed equation of a curve is x^2 + 3xy -2y^2 + 17x-7y-11=0. Find the original equation of the curve.
13. Find the equations of the straight lines passing through the point (-3, 2) and making an angle of 45^o with the straight line 3x-y +4= 0
14. If $y = Tan^{-1}\left[\frac{\sqrt{1+x^2}+\sqrt{1-x^2}}{\sqrt{1+x^2}-\sqrt{1-x^2}}\right]$ for $0 < |x| < 1$, find $\frac{dy}{dx}$.
15. Find the derivatives of the function COS ax from the first principles.

16. A man 180 cm. high walks at a uniform rate of 12 km. per hour away from a lamp post of 450 cm. high. Find the rate at which the length of his shadow increases.

17. If the function $f = Tan^{-1}\left(\frac{y}{x}\right)$, show that $f_{xx} + f_{yy} = 0$

SECTION C

LONG ANSWER TYPE QUESTIONS. **5X7 =35**

Note: Answer any Five of the following. Each question carries 7 marks.

18. Find the equations of the straight lines passing through the point of intersection of the lines 3x + 2y +4= 0, 2x + 5y =1 and whose distance from (2, -1) is 2.

19. If the equation $ax^2 + 2hxy + by^2 = 0$ represents a pair of distinct (i.e., intersecting) lines, then the combined equation of the pair of bisectors of the angle between these lines is $h\left(x^2 - y^2\right) = \left(a-b\right)xy$

20. Find the angle between the lines joining the origin to the points of intersection of the curve $x^2 + 2xy + y^2 + 2x + 2y - 5 = 0$ and the line 3x – y + 1 = 0

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

22. If $y = x\sqrt{a^2 + x^2} + a^2\log\left(x + \sqrt{a^2 + x^2}\right)$ then show that $\frac{dy}{dx} = 2\sqrt{a^2 + x^2}$

23. Show that the curves $y^2 = 4\left(x+1\right)$ and $y^2 = 36\left(9-x\right)$ intersect orthogonally

24. From a rectangular sheet of dimensions 30 cm x 80 cm. four equal squares of side x cm. are removed at the corners, and the sides are then turned up so as to form an open rectangular box. Find the value of x, so that the volume of the box is the greatest.

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