

SECTION - A**10 × 2 = 20****VERY SHORT ANSWER TYPE QUESTIONS**

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

1. Find the equation of the straight line passing through the point (2, 3) and making non-zero intercepts on the axes of co-ordinates whose sum is zero.
2. If θ is the angle between the lines $\frac{x}{a} + \frac{y}{b} = 1$, $\frac{x}{b} + \frac{y}{a} = 1$, find the value of $\sin \theta$ ($a > b$).
3. For what value of t , the points (2, -1, 3), (3, -5, t), (-1, 11, 9) are collinear?
4. Find the equation of the plane passing through the point (1, 1, 1) and parallel to the plane $x + 2y + 3z - 7 = 0$.
5. Examine the continuity of $f(x) = [x] + x$ at the point $x = 2$.
6. Find $\lim_{x \rightarrow 0} \frac{\sin(a + bx) - \sin(a - bx)}{x}$.
7. Find $\lim_{x \rightarrow \infty} \frac{8|x| + 3x}{3|x| - 2x}$.
8. If $y = \{\cot^{-1}(x^3)\}^2$, find $\frac{dy}{dx}$.
9. Find the approximate value of $\sqrt{82}$.
10. Show that the length of subnormal at any point on the curve $y^2 = 4ax$ is a constant.

SECTION - B**5 × 4 = 20****SHORT ANSWER TYPE QUESTIONS**

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

11. $A(2, 3)$, $B(1, 5)$, $C(-1, 2)$ are given three points. If P is a point such that $PA^2 + PB^2 = 2PC^2$, find the locus of P .
12. When the origin is shifted to the point (2, 3), the transformed equation of a curve $x^2 + 3xy - 2y^2 + 17x - 7y - 11 = 0$. Find the original equation of the curve.

13. Find the equations of the straight line passing through the point of intersection of the lines $3x + 2y + 4 = 0$, $2x + 5y = 1$ and whose distance from $(2, -1)$ is 2 units.
14. Find the derivative of the function $f(x) = x \sin x$, from the first principle rule.
15. Differentiate $f(x) = \tan^{-1} \left(\frac{\sqrt{1+x^2} - 1}{x} \right)$ with respect to $g(x) = \tan^{-1} x$.
16. Sand is poured from a pipe at the rate of 12 c.c./sec. The falling sand forms a cone on the ground in such a way that the height of the cone is always one-sixth of the radius of the base. How fast is the height of the sand cone increasing when the height is 4 cm?
17. If $u^2 = \frac{1}{x^2 + y^2 + z^2}$, show that $\sum \frac{\partial^2 u}{\partial x^2} = 0$.

SECTION - C

5 × 7 = 35

LONG ANSWER TYPE QUESTIONS

Note : Answer any *FIVE* questions. Each question carries 7 marks.

18. If the equations of the sides of a triangle are $7x + y - 10 = 0$, $x - 2y + 5 = 0$ and $x + y + 2 = 0$, find orthocentre of the triangle.
19. If the equation $ax^2 + 2hxy + by^2 = 0$ represents a pair of distinct lines, then prove that the equation of the pair of bisectors of the angles between these lines is $h(x^2 - y^2) = (a - b)xy$.
20. If the equation $mx^2 - 10xy + 12y^2 + 5x - 16y - 3 = 0$ represents a pair of straight lines, find m and also find angle and point of intersection for this value of m .
21. Find the direction cosines of two lines which are connected by the relations $l - 5m + 3n = 0$ and $7l^2 + 5m^2 - 3n^2 = 0$.
22. If $f(x) = (a^2 - b^2)^{-1/2} \cdot \cos^{-1} \left(\frac{a \cos x + b}{a + b \cos x} \right)$ then prove that $f'(x) = (a + b \cos x)^{-1}$, ($a > b > 0$ and $0 < x < \pi$)
23. Find the angle between the curves $2y^2 - 9x = 0$, $3x^2 + 4y = 0$ (In the 4th quadrant)
24. A window is in the shape of a rectangle surmounted by a semi-circle. If the perimeter of the window be 20 ft., find the maximum area of the window.