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Medicine and Health Sciences

Medicine and Surgery

Serial No: 100

MAT 104 Assignment

### Question

Examine whether or not these pair of lines are perpendicular to each other.

1)  $y - 3x - 2 = 0$  and  $3y + x + 9 = 0$

solution

$y - 3x - 2 = 0$  --- equation 1

$3y + x + 9 = 0$  --- equation 2

From equation 1

$$y - 3x - 2 = 0$$

$$y = 3x + 2$$

$$\frac{dy}{dx} = m = 3$$

from equation 2

$$3y + x + 9 = 0$$

$$3y = -x - 9$$

$$y = \frac{-x - 9}{3}$$

$$\frac{dy}{dx} = m = -\frac{1}{3}$$

$$m_1 \cdot m_2 = -1$$

$\therefore m_1 \cdot m_2 = 3 \times (-\frac{1}{3}) = -1$   $\therefore$  This pair are perpendicular

2)  $3y - 4 = 2x + 3$  and  $y - 5 = x + 6$

solution

$3y - 4 = 2x + 3$  --- equation 1

$y - 5 = x + 6$  --- equation 2

From equation 1

$$3y - 4 = 2x + 3$$

$$3y - 2x - 7 = 0$$

$$3y = 2x + 7$$

$$y = \frac{2x + 7}{3}$$

$$dy/dx = m_1 = 2/3$$

From equation 2

$$y - 5 = x + 6$$

$$y = x + 11$$

$$dy/dx = m_2 = 1$$

$$\text{If } m_1 \times m_2 = -1$$

$$\therefore m_1 \cdot m_2 = 2/3 \times 1 = 2/3$$

Therefore, the two lines are not perpendicular.

$$3) \quad x^2 + y^2 + 3xy - 11 = 0 \quad (x=1, y=2)$$

$$2x + 2y \frac{dy}{dx} + 3[x \frac{dy}{dx} + y] - 0 = 0$$

$$2x + 2y \frac{dy}{dx} + 3x \frac{dy}{dx} + 3y = 0$$

$$2y \frac{dy}{dx} + 3x \frac{dy}{dx} = -2x - 3y$$

$$\frac{dy}{dx} (2y + 3x) = -2x - 3y$$

$$\frac{dy}{dx} = \frac{-2x - 3y}{2y + 3x}$$

m at the point  $x=1$  and  $y=2$

$$m = \left. \frac{dy}{dx} \right|_{x=1, y=2} = \frac{-2(1) - 3(2)}{2(2) + 3(1)} = \frac{-2-6}{4+3}$$

$$m = -\frac{8}{7} \text{ or } -1\frac{1}{7}$$

$$y - y_1 = m(x - x_1)$$

$$y - 2 = -\frac{8}{7}(x + 1)$$

$$7(y - 2) = -8(x + 1)$$

$$7y - 14 = -8x + 8$$

$$7y + 8x - 22 = 0 \quad (\text{Equation of tangent})$$

b) For normal

$$y - y_1 = -1/m(x - x_1)$$

$$y - 2 = -1/8/7(x - 1)$$

$$y - 2 = \frac{7}{8}(x - 1)$$

$$8(y - 2) = 7(x - 1)$$

$$8y - 16 = 7x - 7$$

$$8y - 7x - 9 = 0$$

$$\therefore \text{Equation for normal} = 8y - 7x - 9 = 0$$