

Owolabi Oluwanipemu Mopelola

MAT 104

MBBS

19/MHS01/370

Examine whether or not these pairs of lines are perpendicular

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

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

3 Find the eqn of the tangent and normal to the curve $x^2 + y^2 + 3xy - 11 = 0$ at $(1, 2)$

1 $y - 3x - 2 = 0$

$$y = 3x + 2$$

by comparison to $y = mx + c$

$$m_1 = 3$$

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

$$3y = -x - 9$$

$$y = -\frac{1}{3}x - 3$$

by comparison to $y = mx + c$

$$m_2 = -\frac{1}{3}$$

For 2 lines to be perpendicular

$$m_1 m_2 = -1$$

$$\therefore 3 \times -\frac{1}{3} = -1$$

$\Rightarrow y - 3x - 2 = 0$ is perpendicular to $3y + x + 9 = 0$

2) For equation 1

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

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

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

by comparison to $y = mx + c$

$$m_1 = \frac{2}{3}$$

For equation 2

$$y - 5 = x + 6$$

$$y = x + 6 + 5$$

$$y = x + 11$$

by comparison to $y = mx + c$

$$m_2 = 1$$

For 2 lines to be perpendicular

$$m_1 m_2 = -1$$

$$\therefore \frac{2}{3} \times 1 \neq -1$$

$\Rightarrow 3y - 4 = 2x + 3$ is NOT perpendicular to $y - 5 = x + 6$

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

$$dy/dx = m$$

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

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

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

$$m = \frac{-(3 \times 2) - (2 \times 1)}{2(2) + 3(1)}$$

$$= \frac{-6 - 2}{4 + 3}$$

$$= -\frac{8}{7}$$

For equation of tangent.

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

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

multiply through by 7

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

$$7y + 8x - 14 - 8 = 0$$

$7y + 8x - 22 = 0$ is the equation of the tangent

For equation of the normal

$$m_2 = -\frac{1}{m_1}$$

$$= -\frac{1}{-8/7}$$

$$= \frac{7}{8}$$

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

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

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

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

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

$$8y = 7x + 9 \text{ is the}$$

equation of the normal.