

MAT 104 Assignment

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

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

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

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

$$m_1 = 3$$

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

$$\frac{3dy}{dx} + 1 = 0$$

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

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

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

$$m_1 m_2 = -1$$

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

These lines are perpendicular

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

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

$$\frac{3dy}{dx} - 2 = 0$$

$$3\frac{dy}{dx} = 2$$

$$\frac{dy}{dx} = \frac{2}{3}$$

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

$$y - x - 5 - 6 = 0$$

$$y - x - 11 = 0$$

$$\frac{dy}{dx} - 1 = 0$$

$$\frac{dy}{dx} = 1$$

$$m_1 m_2 = -1$$

These pair of lines are not perpendicular to each other

3) $x^2 + y^2 + 3xy - 11 = 0$

Using Implicit Differentiation

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

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

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

Substitute the values for x & y

$$\frac{\partial y}{\partial x} = \frac{-(2(1)+3(2))}{2(2)+3(1)}$$

$$\frac{\partial y}{\partial x} = \frac{-(2+6)}{4+3}$$

$$\frac{\partial y}{\partial x} = -\frac{8}{7}$$

$$m_1 = -\frac{8}{7}$$

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

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

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

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

$7y + 8x - 22 = 0$ (eqn of the tangent)

$$m_2 = \frac{-1}{-\frac{8}{7}}$$

$$m_2 = -1 \times -\frac{7}{8}$$

$$m_2 = \frac{7}{8}$$

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

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

$$7x - 7 = 8y - 2$$

$$7x - 8y - 7 + 2 = 0$$

$7x - 8y - 5 = 0$ (eqn of the normal)