

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

$$\begin{aligned} 1) & y - 3x - 2 = 0 \quad \dots (i) \\ 2) & 3y + x + 9 = 0 \quad \dots (ii) \end{aligned}$$

For  $M_1$

$$\begin{aligned} y - 3x - 2 &= 0 \\ y &= 3x + 2 \end{aligned}$$

Comparing equation to  $y = mx + c$

$$\begin{aligned} y &= mx + c \\ y &= 3x + 2 \\ m_1 &= 3 \end{aligned}$$

For  $M_2$

$$\begin{aligned} 3y + x + 9 &= 0 \\ 3y &= -x - 9 \end{aligned}$$

divide through by 3

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

comparing to  $y = mx + c$

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

For perpendicular lines  $m_1 \times m_2 = -1$

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

$$= -1$$

Therefore the lines are perpendicular to each other

$$2 \quad 3y - 4 = 2x + 3 \quad \text{--- (1) and } y - 5 = x + 6$$

~~3y~~

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

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

$$3y = 2x + 7$$

divide through by 3

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

$$y = mx + c$$

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

$$y - 5 = x + 6$$

$$y = x + 6 + 5$$

$$y = x + 11$$

Comparing with

$$y = mx + c$$

$$y = x + 11$$

$$m = 1$$

For perpendicular lines  $m_1 \times m_2 = -1$

$$m_1 = \frac{2}{3} \quad m_2 = 1$$

$$\frac{2}{3} \times 1 = \frac{2}{3}$$

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

Therefore the lines are not perpendicular to one another

equation of  
Find the Tangents and and

3 Find the equations of the tangent and normal to the curve

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

at the points  $x=1, y=2$

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

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

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

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

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

$$m = \frac{dy}{dx} \Big|_{\substack{x=x_1 \\ y=y_1}} = \frac{-2(1) - 3(2)}{2(2) + 3(1)} = \frac{-8}{7}$$

Equation of the Tangent

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

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

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

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

multiply through by 7

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

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

$$7y + 8x - 22 = 0$$

Equation of the normal

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

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

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

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

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

multiply through by 8

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

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

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