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Course: Mat 6A

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

If  $m_1 \times m_2 = -1$  then they are perpendicular  
 $y = m_1x + c$   
 $y = 3x + 2$   
 $\therefore m_1 = 3$

$3y = -x - 9$  (Divide through by 3)  
 $y = -\frac{1}{3}x - 3$   
 $m_2 = -\frac{1}{3}$

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

$\therefore y - 3x - 2 = 0$  &  $3y + x + 9 = 0$  are perpendicular

2.  $3y - 4 = 2x + 3 \Rightarrow 3y = 2x + 7$   
 $y - 5 = x + 6 \Rightarrow y = x + 11$

If  $m_1 \times m_2 = -1$ , then they are perpendicular

$y = m_1x + c$

$3y = 2x + 7$  (Divide through by 3)

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

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

$y = 2x + 11$

$m_2 = 1$

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

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

$\therefore m_1 \times m_2 \neq -1$  they are not perpendicular



3.  $x^2 + y^2 + 3xy - 11 = 0$ ;  $(1, 2)$ , Find the equations of the tangent and normal.

$$\frac{d}{dx} [2x + 2y \frac{dy}{dx} + 3 \left[ yx + x \frac{dy}{dx} \right] = 0$$

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

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

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

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

$$\left. \frac{dy}{dx} \right|_{x=1, y=2} = \frac{-2(1) - 3(2)}{2(2) + 3(1)} = -\frac{8}{7}$$

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

$$y - y_1 = m_1(x - x_1)$$

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

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

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

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

$$m_1 m_2 = -1$$

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

$$y - y_1 = m_2(x - x_1)$$

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

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

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

$8y - 7x - 9 = 0$  is the equation of the normal.