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

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

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

3 Find the equations of the tangent & normal to the curve $x^2 + y^2 + 3xy - 11 = 0$ @ pt $(1, 2)$

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

$y = 3x + 2$

$m_1 = 3$

$3y = -x - 9$

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

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

m_1, m_2 is perpendicular to m_2 when their product equals -1

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

The pair of lines are perpendicular to each other

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

$3y = 2x + 3 + 4$

$3y = 2x + 7$

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

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

$y = x + 6 + 5$

$y = x + 11$

$m_2 = 1$

The lines are perpendicular when $m_1 m_2 = -1$

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

The pair of lines are not perpendicular to each other

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

$$2x + 2y\,dy/dx + 3y + 3x\,dy/dx = 0$$

$$dy/dx\,(2y + 3x) = -2x - 3y$$

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

$$m = dy/dx\,|_{x=1,2} = \frac{-2(1) - 3(2)}{2(2) + 3(1)} = \frac{-2 - 6}{4 + 3} = -8/7$$

Equation of tangent

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

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

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

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

For the normal

$$m = -1 \div -8/7 = 7/8$$

Equation of the normal

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

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

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

$$8y = 7x + 9$$