1. $y - 3x - 2 = 0 \quad \cdots (1)$

$3y + x + 9 = 0 \quad \cdots (2)$

$y - 3x - 2 = 0$

$y = 3x + 2$

$y = mx + c$

$m = 3$

$3y + x + 9 = 0$

$3y = -9 - x$

$y = \frac{-9}{3} - \frac{x}{3}$

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

$y = 3x + 1$

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

$m_1 m_2 = -1$

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

Lines are Perpendicular

2. $3y - 4 = 2x + 2 \quad \cdots (1)$

$y - 5 = x + 6 \quad \cdots (2)$

$3y = 2x + 2 + 4$

$3y = 2x + 6$

$y = \frac{2x}{3} + \frac{6}{5}$

$y = \frac{2x}{3} + 3$ $\therefore m = 2/3$

$y - 5 = x + 6$

$y = x + 6 + 5$

$y = 8 + 11$ $\therefore m = 1$

Since $m_1 m_2 \neq -1$ is not equal to -1 the lines are not perpendicular.

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

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

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

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

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

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

$m = \frac{-3}{2}$

~~$x = 1, y$~~

$x_1 = 1, y_1 = 2$

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

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

$2(y-2) = -3(x-1)$

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

$2y + 3x - 5 = 0$ [Eqn of tangent

$m_1 m_2 = -1$

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

$-3m_2 = -2$

$m_2 = \frac{+2}{+3}$

$m_2 = \frac{2}{3}$

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

$3(y - 2) = 2(x - 1)$

$3y - 6 = 2x - 2$

$3y - 2x - 8 = 0$ [equation of normal]