1. $y - 3x - 2 = 0$ ——— (1)

$y = 3x + 2$

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

$m_1 = 3$

$3y + x + 9 = 0$ ——— (2)

$3y = -x - 9$

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

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

$m_2 = -1$

If, $m_1 \cdot m_2 = -1$

$\therefore 3 \cdot -1 = -3$

Since eqn (1) $\neq$ eqn (2) $= -3$

$\therefore$ these pair of lines are not perpendicular to each other

2. $3y - 4 = 2x + 3$ ——— (1)

$3y = 2x + 3 + 4$

$y = \frac{2x + 3 + 4}{3}$

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

$m_1 = 2$

$y - 5 = x + 6$ ——— (2)

$y = x + 6 + 5$

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

$m_2 = 1$

If, $m_1 \cdot m_2 = -1$

$\therefore 2 \cdot 1 = 2$

Since eqn (1) $\neq$ eqn (2) $= 2$

$\therefore$ these pair of line are not perpendicular to each other

(1, 2)

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

$x^2 + y\frac{dy}{dx} + 3\left(x\frac{dy}{dx} + y\right) - 11 = 0$

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

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

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

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

$\frac{dy}{dx} = \frac{-2(1) - 3(2)}{2(2) + 3(1)(2)}$

$\frac{dy}{dx} = \frac{-2 - 6}{4 + 6} = \frac{-8}{10}\ 4\ 5$

$\frac{dy}{dx} = \frac{-4}{5}$

$m = -\frac{4}{5}$

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

$y - 2 = -\frac{4}{5}(x - 1)$

$y - 2 = -\frac{4}{5}x + \frac{4}{5}$

$y - 2 + \frac{4}{5}x - \frac{4}{5} = 0$

$5y - 10 + 4x - 4 = 0$

$5y + 4x - 14 = 0$

$\therefore 5y + 4x - 14 = 0$ is the equation of the tangent.

$y - y_1 = \frac{-1}{m}(x - x_1)$

$y - 2 = \frac{-1}{-\frac{4}{5}}(x - 1)$

$-\frac{4}{5}y + \frac{8}{5} = -x + 1$

$-\frac{4}{5}y + \frac{8}{5} + x - 1 = 0$

$-4y + 8 + 5x - 5 = 0$

$-4y + 5x + 3 = 0$

$4y - 5x - 3 = 0$

$\therefore 4y - 5x - 3 = 0$ is the equation to the normal.