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

$3y + x + 9 = 0$ --- (2)

For two lines $y_1 = m_1x + c_1$ and $y = mx + c$, if they are perpendicular, $mm_1 = -1$

$y = 3x + 2 \quad [m = 3]$

$y = \frac{-x}{3} - \frac{9}{3} = \frac{-x}{3} - 3 \quad \left[m_1 = \frac{-1}{3}\right]$

$mm_1 = 3 \cdot \frac{-1}{3} = -1$

$\therefore$ The lines are perpendicular

2. $3y - 4 = 2x + 3$ --- (1) For (1), $3y = 2x + 7$

$y - 5 = x + 6$ --- (2) $y = \frac{2}{3}x + \frac{7}{3} \quad [m_1 = 2/3]$

For (2):

$y = x + 11 \quad [m = 1] \quad m \cdot m_1 = 1 \cdot \frac{2}{3} = \frac{2}{3} \neq -1$

$\therefore$ The lines are not perpendicular.

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

$2x + 2y\frac{dy}{dx} + 3\left\{y \cdot 1 + x\frac{dy}{dx}\right\} = 0$

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

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

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

For tangent:

$y - y_1 = m(x - x_1)$; $y - 2 = -\frac{8}{7}(x - 1)$ $\therefore$ $7y + 8x = 22$ [equ of tangent]

For normal:

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

$8y-16 = 7x-7$

$8y = 7x+9$ [equ of normal]