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

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

$8(y - 2) = 7(x - 1)$

$8y - 16 = 7x - 7$

$8y - 7x - 16 + 7 = 0$

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

$3y - 2x = 7$

$3y = 7 + 2x$

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

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

$y - 5 = x + 6$

$y - x = 6 + 5$

$y - x = 11$

$y = 11 + x$

$m_2 = 1$

But for the lines to be perpendicular

$m_1 m_2 = -1$

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

$\therefore 3y - 4 = 2x + 3$ and

$y - 5 = x + 6$ are not perpendicular.

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

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

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

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

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

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

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

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

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

$= \frac{-2 - 6}{4 + 3} = -\frac{8}{7}$

Equation of tangent

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

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

$7(y - 2) = -8(x - 1)$

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

$7y + 8x - 14 - 8 = 0$

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

(b) Equation of normal

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

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① $y - 3x - 2 = 0$
$3y + x + 9 = 0$

~~for~~ ~~proof~~

Perpendicular lines $= m_1 m_2 = -1$

$y - 3x - 2 = 0$
$y = 3x + 2$
$m_1 = 3$

$3y + x + 9 = 0$
$3y = -x - 9$
$y = -x/3 - 9/3$
$y = -x/3 - 3$
$m_2 = -1/3$

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

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

② $3y - 4 = 2x + 3 \rightarrow (1)$
$y - 5 = x + 6 \rightarrow (2)$