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

Let $A = y - 2x - 2 = 0$

$dy/dx - 2dx/dx - 0 = 0$

$\frac{dy}{dx} - 3 = 0$

$dy/dx = 3$

Let $B = 3y + x + 9 = 0$

$3\,dy/dx + 1 + 0 = 0$

$3\,dy/dx + 1 = 0$

$\frac{dy}{dx} = 1/3$

$\therefore A \perp B$

i.e, $y - 2x - 2 = 0$ is perpendicular to $3y + x + 9 = 0$

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

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

$3\,dy/dx - 0 = 2 + 0$

$3\,dy/dx = 2$

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

Let $G = y - 5 = x + 6$

$dy/dx - 0 = 1 + 0$

$dy/dx = 1$

$\therefore F \not\perp G$

i.e = $3y - 4 = 2x + 3$ is not perpendicular to $y - 5 = x + 6$

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

$$2x + 2y\, dy/dx + 3(x\, dy/dx + y \times 1) - 0 = 0$$

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

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

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

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

when $x = 1$, $y = 2$

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

$$= \frac{-(2+6)}{4+3}$$

$$m = -8/7$$

7) Equation of the tangent to a curve

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

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

$$y - 2 = -8x/7 + 8/7$$

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

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

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

b. Equation of the normal to a curve;

$$y - y_1 = -1/m\,(x - x_1)$$

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

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

$$y - 2 = 7x/8 - 7/8$$

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

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

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