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Question 1

$y - 3x - 2 = 0$

$3y + x + 9 = 0$

Solution.

Two lines are said to be perpendicular ie the products of their gradient = -1 ie $m_1 m_2 = -1$

$\therefore$ $y - 3x - 2 = 0$

$y = 3x + 2$

$m_1 = 3$

$3y + x + 9 = 0$

$3y = -x - 9$

$y = -\frac{1}{3}x - 3$

$m_2 = -1/3$

$m_1 m_2 = -1$ $\therefore$ Lines are perpendicular

$3 \times -1/3 = -1$

$\therefore$ The lines $y - 3x - 2 = 0$ and $3y + x + 9 = 0$ are Perpendicular.

Question 2

$3y - 4 = 2x + 3$

$y - 5 = x + 6$

Solution

$3y - 4 = 2x + 3$ —①

$3y = 2x + 7$

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

$y = mx + c$ $\quad M_1 = \frac{2}{3}$

$y - 5 = x + 6$ —②

$y = x + 11$

$M_2 = 1$

If $M_1 M_2 = -1$, then the lines are perpendicular

$2/3 \times 1 = 2/3$

∴ The lines are not Perpendicular.

Question 3

'Find the equations of the tangent and normal to the curve

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

Solution

$m = dy/dx$

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

dy/dx

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

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

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

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

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

$$m = \frac{dy}{dx} = \frac{-2(1) - 3(2)}{2(2) + 3(1)} = \frac{-2 - 6}{4 + 3} = \frac{-8}{7}$$

a Equation of tangent

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

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

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

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

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

$7y + 8x - 22 = 0$ — Equation of the tangent

b) Equation of Normal

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

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

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

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

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

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

$8y - 7x - 9 = 0$ — Equation of normal.