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The equation of a line is expressed as $y = mx + c$, has gradient m, $y = m_1x + c_1$ and $y = m_2x + c_2$ are perpendicular if $m_1m_2 = -1$

1) $y - 3x - 2 = 0$ and $3y + x + 7 = 0$

$y = 3x + 2$ and $3y = -x - 7$

$m_1 = 3$ $m_2 = -1/3$

$m_1 m_2 = 3 \times -1/3$

$m_1 m_2 = -1$ ∴ The lines are ~~pendicular~~ perpendicular

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

$3y = 2x + 7$ and $y = x + 11$

$y = 2/3x + 7/3$ and $y = x + 11$

$m_1 = 2/3$ and $m_2 = 1$

$m_1 m_2 = 2/3 \times 1$

$m_1 m_2 = 2/3$ ∴ The two lines are not perpendicular

3. $x^2 + y^2 + 3x - 11 = 0$ Find dy/dx (1, 2)

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

$2x + 2y\frac{dy}{dx} + 3[x\,dy/dx + y] = 0$

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

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

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

$\frac{dy}{dx} = -\frac{3y - 2x}{2y + 3x}$; equation of tangent

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

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

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

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

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

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

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

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

$$y - y_1 = {}^{1}/_{m_1}(x - x_1)$$

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

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

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

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

$$8y - 7x - 9 = 0$$ (Equation of the normal)