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Answers

1. $y - 3x - 2 = 0$
$3y + x + 9 = 0$.

Soln

$y = mx + c$
$y - 3x - 2 = 0$
make y subject of formular
$y = 3x + 2$
$\therefore m_1 = 3$

$3y + x + 9 = 0$
$3y = -x - 9$
Divide by 3
$\frac{3y}{3} = -\frac{x}{3} - \frac{9}{3}$
$y = -\frac{1x}{3} - 3$

$y = mx + c$
$\therefore m_2 = -\frac{1}{3}$

For the lines to be perpendicular;
$m_1 m_2 = -1$
$3x - \frac{1}{3} = -1$

Since $m_1 m_2 = -1$, than lines $y - 3x - 2 = 0$ and $3y + x + 9 = 0$ are perpendicular.

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$3x^2 + y^2 + 3xy - 11 = 0$ at points $(x_1, y_1) = (1, 2)$

soln

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

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

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

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

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

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

$\left.\frac{dy}{dx}\right|_{x=1, y=2} = \frac{-2(1) - 3(2)}{2(2) + 3(1)} = -\frac{2 - 6}{4 + 3} = -\frac{8}{7}$

$\therefore m_1 = -\frac{8}{7}$

(a) Equation of tangent

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

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

$y - 2 = \frac{-8x + 8}{7}$

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

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

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

$7y + 8x - 22 = 0$

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b) Equation of a normal

$m_1 m_2 = -1$

$\frac{-8}{7} m_2 = -1$

$m_2 = -1 \div \frac{-8}{7}$

$m_2 = -1 \times -\frac{7}{8}$

$m_2 = \frac{7}{8}$

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

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

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

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

$8y - 16 = 7x - 7$

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

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

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

Soln

make y the subject of the formular

$3y = 2x + 3 + 4$

$3y = 2x + 7$

Divide through by 3

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

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

$y = mx + c$ (By comparing)

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

$y - 5 = x + 6$

make y the subject of the formular

$y = x + 6 + 5$

$y = x + 11$

By comparing with $y = mx + c$

$\therefore m_2 = 1$

For the lines to be perpendicular

$m_1 m_2 = -1$

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

$\therefore m_1 m_2 \neq -1$

Therefore lines $3y - 4 = 2x + 3$ and $y - 5 = x + 6$ are not perpendicular