MAT 104 MBBS

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(1)

$y = 3x + 2$

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

$m_1 = 3$

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

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

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

$m_1 m_2 = -1$

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

The lines are perpendicular.

(2)

$3y - 4 = 2x + 3$

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

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

$m_1 = 2/3$

$y = x + 11$

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

$m_1 m_2 \neq -1$

∴ The lines are not perpendicular.

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

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

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

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

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

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

at $x = 1$ and $y = 2$

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

Equation of the tangent

$y_2 - y_1 = m(x - x_1)$

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

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

$7y + 8x - 22 = 0$

Equation of the normal

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

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

$8y - 16 = 7x - 7$

$8y - 7x - 9 = 0$