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Medicine and Surgery
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MAT 104

1) Examine whether or not these pair of lines are perpendicular to each other

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

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

3) Find the equations of the tangent and normal to the curve
$x^2 + y^2 + 3xy - 11 = 0$ at the point $x = 1, y =$

solution

1a) $y - 3x - 2 = 0$

$y = mx + C$

$m_1 = 3$

b) $3y + x + 9 = 0$

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

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

$y = mx + C$

$m_2 = -1/3$

$m_1 m_2 = -1$

$m_2 = \frac{-1}{m_1}$

Therefore they are perpendicular to each other

2a $3y - 4 = 2x + 3$

$3y = 2x + 3 + 4$

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

$y = mx + c$

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

b) $y - 5 = x + 6$

$y = x + 6 + 5$

$y = x + 11$

$y = mx + c$

$m_2 = 1$

∴ They are not perpendicular.

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

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

differentiate with respect to x

$\frac{d}{dx}(x)^2 + \frac{d(y^2)}{dx} + \frac{d}{dx}(3xy) = \frac{d}{dx} 11$

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

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

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

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

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

$x \quad y$
$(1, 2)$

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

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

$$m = \frac{y + x_1}{x - x_1} \qquad m = \frac{y - y_1}{x - x_1}$$

$$-\frac{8}{7} = \frac{2 + y_1}{1 - x_1} \qquad \frac{-8}{7} = \frac{y - 2}{x - 1}$$

$$7(2 + y_1) = -8(1 + x_1) \qquad 7(y - 2) = -8(x - 1)$$

$$14 - 7y_1 =$$

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

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

$$7y + 8x = 22$$

$$m_1 m_2 = -1$$

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

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