

Maths 104
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Dept: Medicine and Surgery

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Group A

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

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

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

$$y = 3x + 2$$

$$y = mx + c$$

$$m = 3, c = 2$$

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

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

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

$$y = mx + c$$

$$m = -\frac{1}{3}, c = -3$$

Equation of the pair of lines is perpendicular.

$$3y - 4 = 2x + 3 \quad \text{and} \quad y - 6 = x + 6$$

Soln

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

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

$$3y - 2x = 7$$

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

$$y = mx + c$$

$$m = -2/3, c = 7/3$$

$$y - 5 = x + 6$$

$$y - x = 5 + 6$$

$$y - x = 11$$

$$y = x + 11$$

$$y = mx + c$$

$$m = 1, c = 11$$

Equation of the pair of lines is

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

Soln

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

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

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

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

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

At the point $x=1$ and $y=2$

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

$$n = \frac{dy}{dx} \Big|_{x=1, y=2} = \frac{-2(1) - 3(2)}{2(2) + 3(1)} = \frac{-2 - 6}{4 + 3}$$

$$m = -\frac{8}{7} \text{ or } -1\frac{1}{7}$$

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

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

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

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

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

$$7y + 8x = 22$$

$$7y + 8x - 22 = 0 \Rightarrow \text{Equation of normal}$$

$$m = \frac{-1}{m_1} = \frac{-1}{-\frac{8}{7}}$$

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

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

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

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

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

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

$$8y - 7x = 9$$

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