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19/MHS 01/350

MBBS

MATHS 104 ASSIGNMENT

### Question

Examine whether or not these pair of lines are perpendicular to each other. (1)  $y - 3x - 2 = 0$  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  $x = 1, y = 2$ .

### Solutions

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

$3y + x + 9 = 0$

For the lines to be perpendicular then  $m_1 m_2 = -1$

$y - 3x - 2 = 0$

Making  $y$  the subject of the formula:

$y = +3x + 2$

Comparing with  $y = mx + c$

$m_1 = 3$

$3y + x + 9 = 0$

making  $y$  the subject of the formula:

$3y = -x - 9$



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

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

$$y = mx + c$$

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

$$m_1 m_2 = -1$$

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

Since  $m_1 m_2 = -1$ , then the lines  $y - 3x - 2 = 0$  and  $3y + x + 9 = 0$  ARE PERPENDICULAR

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

making  $y$  the subject of the formula in both equations

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

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

$$3y = 2x + 7$$

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

$$y = mx + c$$

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

$$y - 5 = x + 6$$

$$y = x + 6 + 5$$

$$y = x + 11$$

$$y = mx + c$$

$$\therefore m_2 = 1$$



For lines to be perpendicular  $m_1 m_2 = -1$

$$m_1 m_2 = \frac{2}{3} \times 1 = \frac{2}{3}$$

$$m_1 m_2 \neq -1$$

Hence the lines  $3y - 4 = 2x + 3$  and  $y - 5 = x + 6$  are NOT PERPENDICULAR

8.  $x^2 + y^2 + 3xy - 11 = 0$  ( $x=1, y=2$ )

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

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

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

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

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

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

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

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

9) Equation of tangent.

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



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

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

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

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

$7y + 8x - 22 = 0$  is the equation of tangent

b. Equation of normal.

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

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

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

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

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

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

~~$8y - 7x +$~~   $8y - 7x - 9 = 0$  is the equation of normal