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Maths 19/MHS01/306
104 Medicine and Surgery

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 $y - 5 = x + 6$

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 formula

$$y = +3x + 2$$

$$y = 3x + 2$$

By comparison with $y = mx + c$

$$M_1 = 3$$

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

making y the subject of the

formula

$$3y = -x - 9$$

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

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

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$$y = mx + c$$

$$m_2 = -1/3$$

using $m_1, m_2 = -1$ to determine the perpendicularity

$$3 \times -1/3 = -1 \text{ since } m_1, m_2 = -1$$

Then the lines $y - 3x - 2 = 0$ and $3y + x + 9 = 0$ Are perpendicular.

$$\textcircled{1} \quad 3y - 4 = 2x + 3 \quad \text{--- (1)}$$

$$y - 5 = x + 6 \quad \text{--- (2)}$$

Making y the subject of formula in --- (1)

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

$$3y = 2x + 7$$

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

By comparing $y = mx + c$

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

Making y the subject of formula in --- (2)

$$y - 5 = x + 6$$

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$$y = x + 6 + 5$$

$$y = x + 11$$

By comparing with $y = mx + c$

$$m_2 = 1$$

But for the lines to be Perpendicular

$$m_1 m_2 = -1$$

$$m_1 m_2 = 2/3 \times 1 = 2/3$$

$$m_1 m_2 \neq -1$$

Hence the lines $3y - 4 = 2x + 3$ and

$y - 5 = x + 6$ are NOT PERPENDICULAR.

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

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

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

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

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

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

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

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

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

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

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

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

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

a.) Equation of tangent

$$y - y_1 =$$

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

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

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

02 JELADE OLUWAPELUMI DEBORAH

19/MHS01/306

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

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

b) Equation of Normal

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

$$y - 2 = m$$

$$y - 2 = -\frac{1}{-\frac{8}{9}} (x - 1)$$

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

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

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

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

$$8y - 7x - 9 = 0 \text{ is the equation}$$

of normal.