Assignment

Maths 104

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Name: Victor-Obi Chiagozie Noble
Department: Medicine & Surgery
Matric no: 19/MHS01/432

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

1 $y - 3x - 2 = 0$ and $3y + x + 9 = 0$

Solution

To be perpendicular $M_1M_2 = -1$

$y - 3x - 2 = 0$ make y subject of formula

$y = 3x + 2$

Compare with $y = mx + c$

$m_1 = 3$

$3y + x + 9 = 0$

make y the subject of the formula

$3y = -x - 9$

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

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

$y = mx + c \quad \therefore \quad m_2 = -1/3$

Perpendicularity $= m_1m_2 = -1$

$3 \times -1/3 = -1$

Since $M_1M_2 = -1$ $\therefore$ the Lines are perpendicular

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

Solu

$3y - 4 = 2x + 3$ make y subject of formula

$3y = 2x + 7$

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

$y = mx + c \quad \therefore \quad m_1 = 2/3$

$y - 5 = x + 6$ make y the subject of formula

$y = x + 6 + 5$

$y = x + 6$

$y = mx + c$

$m_2 = 1$

For the lines to be perpendicular

$m_1 m_2 = -1$

$\therefore \quad 2/3 \times 1 = 2/3$

Since $M_1 M_2$ is not -1, it is therefore not perpendicular

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

3) Solution

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

$x^2 + y^2 + 3xy + 1 = 0$

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

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

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

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

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

$m = -8/7$

(a) Equation of tangent:

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

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

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

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

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

(6) Equation of normal

$m_1 m_2 = -1$

$m_2 = -1/m_1 = -1/-8/_1 = 7/8$

$m_2 = 7/8$

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

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

$8y - 16 = 7x - 7$

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

$8y - 7x - 9 = 0$ --- Equation of normal

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