NAME: AGHATISE OSAYAMEN STEPHANIE
DEPARTMENT: MEDICINE AND SURGERY
COLLEGE: MEDICAL AND HEALTH SCIENCE
MATRIC NO: 19/MHS01/053
COURSE CODE: MAT 104

Assignment

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

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

$y = 3x + 2$

$3y = -x - 9 \ldots M_2$

Let $M_1 = y = 3x + 2$

$3\frac{dy}{dx} = -1$

$M_1 \ldots \frac{dy}{dx} = 3$

$M_2 \ldots \frac{dy}{dx} = \frac{-1}{3}$

$M_1 \ldots \frac{dy}{dx} = 3$

$M_2 \ldots \frac{dy}{dx} = -1/3$

Perpendicular $= M_1 \times M_2 = -1$

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

$\therefore$ $y - 3x - 2 = 0$ and $3y + x + 9 = 0$ ARE perpendicular

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

$3y = 2x + 3 + 4$ $\qquad$ $y = x + 6 + 5$

$3y = 2x + 7$ $\qquad$ $y = x + 11$

$3\frac{dy}{dx} = 2$ $\qquad$ $\frac{dy}{dx} = 1$

$M_1 \ldots \frac{dy}{dx} = \frac{2}{3}$ $\qquad$ $M_2 \ldots \frac{dy}{dx} = 1$

Perpendicular $= M_1 \times M_2 = -1$

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

$\therefore$ $3y - 4 = 2x + 3$ 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 $x_1 = 1$, $y_1 = 2$

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

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

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

$3x\frac{dy}{dx} =$

~~$x^2 + 3$~~

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

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

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

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

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

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

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

$$= -8/7$$

a) Equation of tangent

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

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

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

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

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

b) Equation of normal

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

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

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

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

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

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

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