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MAT 104 Assignment: Examine whether or not these pair of lines are perpendicular to each other.

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

Comparing the equations to equation of line,

$\therefore y = mx + c$

Equation 1; $y - 3x - 2 = 0$

$y = 3x + 2$

$m_1 = 3$.

Equation 2, $3y + x + 9 = 0$

$3y = -x - 9$

$y = -x/3 - 3$

$m_2 = -1/3$

Recall; $m_1 m_2 = -1$ (for perpendicular lines)

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

$\therefore y - 3x - 2 = 0$ and $3y + x + 9 = 0$ are perpendicular to each other.

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

Comparing the equations to equation of line

Equation of line; $y = mx + c$

Equation 1; $3y - 4 = 2x + 3$

$3y = 2x + 3 + 4$

$3y = 2x + 7$

$y = 2/3x + 7/3$

$\therefore m_1 = 2/3$

Equation 2; $y - 5 = x + 6$

$y = x + 6 + 5$

$y = x + 11$

$\therefore m_2 = 1$

Perpendicular lines; $m_1 m_2 = -1$

$2/3 \times 1 = 2/3 \neq -1$

$\therefore 3y - 4 = 2x + 3$ and $y - 5 = x + 6$ are not perpendicular to each other.

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

Sol

$m = dy/dx = 2x + 2y\, dy/dx + 3[x\, dy/dx + y(1)] = 0$

$= 2x + 2y\, dy/dx + 3x\, dy/dx + 3y = 0$

$2y\, dy/dx + 3x\, dy/dx = -3y - 2x$

$dy/dx(2y + 3x) = -(3y + 2x)$

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

$\frac{dy}{dx} = -\frac{(3(2) + 2(1))}{2(2) + 3(1)} = -\frac{(6 + 2)}{4 + 3} = \frac{-8}{7}$

Equation of the tangent; $y - y_1 = m(x - x_1)$

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

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

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

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

Equation normal; $y - y_1 = -1/m(x - x_1)$

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

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

$8y - 16 = 7x - 7$

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

$8y - 7x - 9 = 0$; equation of normal.