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MBBS MHS
Mat 104

Assignment

(1) Examine whether or not these pairs of lines are perpendicular to each other

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

Let $y - 3x - 2 = 0$ be m_1 and
$3y + x + 9 = 0$ be m_2

$\therefore$ for m_1

$y - 3x + 2 = 0 \Rightarrow y = 3x + 2$

$dy/dx = 3 + 0$

$dy/dx = 3$

$\therefore m_2$

$3y + x + 9 = 0 \Rightarrow 3y = -x - 9$

$3\,dy/dx = -1 - 0$

$dy/dx = -1/3$

$\therefore m_1 = 3$ and $m_2 = -1/3$

$m_1 m_2 = -1$

$3x - 1/3 = -1$

$\therefore y - 3x - 2 = 0$ is perpendicular to $3y + x + 9 = 0$

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

Let $3y - 4 = 2x + 3$ be m_1 and
$y - 5 = x + 6$ be m_2

$\therefore m_1$

$3y - 4 = 2x + 3$

$3y = 2x + 3 + 4 \Rightarrow 3\,dy/dx = 2$

$dy/dx = 2/3$

$\therefore m_2$

$y - 5 = x + 6$

$y = x + 6 + 5$

$dy/dx = 1$

$m_1 = 2/3$ and $m_2 = 1$

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

$m_1 m_2 \neq -1$

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

(3) Find the equation of the tangent and normal to the curve $x^{square} + y^{square} + 3xy - 11 = 0$ at the point $x = 1, y = 2$

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

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

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

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

$\frac{dy}{dx} = \frac{-3y - 2x}{2y + 5x}$

$m = \left.\frac{dy}{dx}\right|_{x=1 \text{ and } y=2} \Rightarrow \frac{-3(2) - 2(1)}{2(2) + 3(1)} \Rightarrow \frac{-6-2}{4+5} \Rightarrow \frac{-8}{7}$

$m = -8/7$

Equation for tangent $= y - y_1 = m(x - x_1)$

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

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

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

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

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

$8x + 7y - 22 = 0$

Equation for normal : $m_1 m_2 = -1$

$m_2 = \frac{-1}{m_1} \Rightarrow \frac{-1}{-8/7} \Rightarrow \frac{+1 \times 7}{+8} = \frac{7}{8}$

$y - y_1 = m_2(x - x_1)$

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

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

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

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

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

$$\equiv$$