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COURSE: MATHS 104

MATRIC NO: 19/MHS01/385

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

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

where $y = mx + c$ where $m_1 = 3$

$y - 3x - 2 = 0$ ... equ1

$y = 3x + 2$

$3y + x + 9 = 0$ ... equ 2

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

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

$\therefore m_2 = \frac{-1}{3}$

where $m_1 m_2 = -1$ $\boxed{3 \times -\frac{1}{3} = -1}$

$\therefore$ The line $y - 3x - 2 = 0$ and $3y + x + 9 = 0$ are perpendicular

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

$3y - 4 = 2x + 3$ ... equ1

$\frac{3y}{3} = \frac{2x}{3} + \frac{3}{3} + \frac{4}{3}$

$y = \frac{2x}{3} + \frac{4}{3}$ $\therefore m_1 = \frac{2}{3}$

$y - 5 = x + 6$ ... equ 2

$y = x + 6 + 5$ $\therefore y = x + 11$ $\therefore m_2 = 1$

$m_1 m_2 = 1$ [perpendicularity]

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

$\therefore$ The lines $3y - 4 = 2x + 3$ and $y - 5 = x + 3$ are not perpendicular

3. For the equations of the tangent and normal to the curve

$x^2 + y^2 + 3xy - 11 = 0$ at the point $x = 1, y = 2$

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

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

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

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

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

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

where x is equal to 1 and y equal to 2

$m = \left.\frac{dy}{dx}\right|_{x=1, y=2} = \frac{-2(1) - 3(2)}{2(2) + 3(1)} = \frac{-2 - 6}{4 + 3} = \frac{-8}{7} \quad \therefore m_1 = -\frac{8}{7}$

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

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

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

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

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

For the equation of the normal

~~m_2~~ $m_1 m_2 = -1$

$$\frac{-8}{7} m_2 = -1$$

$$\frac{-8m_2}{-8} = \frac{+7}{+8} \qquad \therefore m_2 = \frac{7}{8}$$

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

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

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

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

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