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MHS/MBBS

MAT 104

1.1 $y - 3x - 2 = 0$ and $3y + x + 9 = 0$

Let $A = y - 3x - 2 = 0$

$= \frac{dy}{dx} - 3 - 0 = 0$

$\frac{dy}{dx} - 3 = 0$

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

(1)

Let $B = 3y + x + 9 = 0$

$3\frac{dy}{dx} + 1 + 0 = 0$

$3\frac{dy}{dx} + 1 = 0$

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

$A \neq B$

i.e $y - 3x - 2 = 0$ is perpendicular to $3y + x + 9 = 0$

2.1 $3y - 4 = 2x + 3$ and $y - 5 = x + 6$

Let $A - 3y - 4 = 2x + 3$

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

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

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

(2)

Let $B = y - 5 = x + 6$

$\frac{dy}{dx} - 0 = 1 + 0$

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

$A \neq B$

i.e $3y - 4 = 2x + 3$ and $y - 5 = x + 6$ is not perpendicular

a) $x^2 + y^2 + 3y - 11 = 0$ at point $(1, 2)$

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

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

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

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

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

When $x = 1$ and $y = 2$

$\therefore m = -\frac{(2+6)}{4+3} = -\frac{8}{7}$ (3)

$\therefore -\frac{4}{3} \quad m = -\frac{8}{7}$

(a) Equation of the tangent to a curve

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

$y - 2 = m(x - 1)$

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

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

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

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

$8x + 7y - 22 = 0$

Equation of the tangent to a curve $\Rightarrow 8x + 7y - 22 = 0$

(b) Equation of the Normal to a curve

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

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

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

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

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

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

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

$8y - 16 = 7x - 7$

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

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

OR

$7x - 8y + 9 = 0$

Equation of the Normal $\Rightarrow 7x - 8y + 9 = 0$