MAT 104 19/MHS01/284

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

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

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

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

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

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

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

$dy/dx = -1/3$

$K \neq P$

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

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

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

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

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

$dy/dx = 2/3$

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

$dy/dx = -0 = 1 + 0$

$dy/dx = 1$

$\therefore A \neq B$

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

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

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

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

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

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

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

when $x = 1$ and $y = 2$

$$m = -\frac{[2(1)+3(2)]}{2(2)+3(1)}$$

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

$$m = -8/7$$

(a) Equation of the tangent of a curve

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

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

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

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

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

$$8x + 7y - 22 = 0$$

(b) Equation of the normal to a curve

$$y - y_1 = -1/m\,(x - x_1)$$

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

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

$$y - 2 = 7x/8 - 7/8$$

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

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

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