MAT 104

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

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

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

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

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+B

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

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

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

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

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

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

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

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

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

$\therefore A \neq B$

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

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

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

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

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

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

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

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

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

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

$$m = \frac{-8}{7}$$

Equation of the tangent to 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

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

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

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

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

$8y-16=7x-7$

$8y=7x-7+16$

$7x-8y+9=0$