Maths 104

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

solution

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

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

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

$m_1 = \frac{dy}{dx} = \frac{2}{3}$

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

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

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

$M_2 = A \neq B$

i.e product of two slope

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

Two lines are not Perpendicular.

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

Solution

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

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

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

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

$M_1 = \frac{dy}{dx} = 3$

- let $B = 3y + x + 9 = 0$

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

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

$M_2 = \frac{-1}{3}$

The product $= M_1 \cdot M_2$

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

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

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

Soln

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

$\frac{dy}{dx}$

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

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

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

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

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

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

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3a) Equation of the tangent to a curve

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

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

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

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

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

$8x + 7y - 22 = 0$

3b) Equation of the normal to a curve

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

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

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

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

$8y - 16 = 7x - 7$

$8y = 7x - 7 + 16$

$7x - 8y + 9 = 0$

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