



Tangents and Normals Ex 16.2 Q8

The given equations are

$$y^2 = ax^3 + b \quad \text{---(i)}$$

$$y = 4x - 5 \quad \text{---(ii)} \quad P = (2, 3)$$

Differentiating (i) with respect to  $x$ , we get

$$2y \frac{dy}{dx} = 3ax^2$$

$$\therefore \frac{dy}{dx} = \frac{3ax^2}{2y}$$

$$\therefore m_1 = \left( \frac{dy}{dx} \right)_P = \frac{12a}{6} = 2a$$

$$m_2 = \text{slope of (ii)} = 4$$

According to the question

$$m_1 = m_2 \Rightarrow 2a = 4 \Rightarrow a = 2$$

From (i)

$$y^2 = 2 \times 2^3 + b$$

$$\Rightarrow 9 = 16 + b$$

$$\Rightarrow b = -7$$

Thus,

$$a = 2, b = -7$$

Tangents and Normals Ex 16.2 Q9

The given equations are,

$$y = x^2 + 4x - 16 \quad \text{--- (i)}$$

$$3x - y + 1 = 0 \quad \text{--- (ii)}$$

Slope  $m_1$  of (i)

$$m_1 = \frac{dy}{dx} = 2x + 4$$

Slope  $m_2$  of (ii)

$$m_2 = 3$$

As per question

$$m_1 = m_2$$

$$\Rightarrow 2x + 4 = 3$$

$$\Rightarrow x = \frac{-1}{2}$$

From (i)

$$y = \frac{1}{4} - 2 - 16 = -\frac{71}{4}$$

$$\therefore P = \left( \frac{-1}{2}, \frac{-71}{4} \right)$$

Thus, the equation of tangent

$$\left( y + \frac{71}{4} \right) = 3 \left( x + \frac{1}{2} \right)$$

$$\Rightarrow 3x - y = \frac{71}{4} - \frac{3}{2}$$

$$\Rightarrow 3x - y = \frac{65}{4}$$

$$\Rightarrow 12x - 4y - 65 = 0$$

Tangents and Normals Ex 16.2 Q10

The given equation is

$$y = x^3 + 2x + 6 \quad \text{---(i)}$$

$$x + 14y + 4 = 0 \quad \text{---(ii)}$$

Slope  $m_1$  of (i)

$$m_1 = \frac{dy}{dx} = 3x^2 + 2$$

Slope  $m_2$  of (ii)

$$m_2 = \frac{-1}{14}$$

$\therefore$  Slope of normal to (i) is

$$\frac{-1}{m_1} = \frac{-1}{3x^2 + 2}$$

According to the question

$$\frac{-1}{3x^2 + 2} = \frac{-1}{14}$$

$$\Rightarrow 3x^2 + 2 = 14$$

$$\Rightarrow x^2 = 4$$

$$\Rightarrow x = \pm 2$$

From (i)

$$\begin{array}{ll} y = 8 + 4 + 6 & \text{or} \quad -8 - 4 + 6 \\ = 18 & \text{or} \quad -6 \end{array}$$

so,  $P = (2, 18)$  and  $Q = (-2, -6)$

Thus, the equation of normal is

$$(y - 18) = \frac{-1}{14}(x - 2) \Rightarrow x + 14y + 86 = 0$$

$$\text{or} \quad (y + 6) = \frac{-1}{14}(x + 2) \Rightarrow x + 14y - 254 = 0$$

The given equations are,

$$y = 4x^3 - 3x + 5 \quad \text{--- (i)}$$

$$9y + x + 3 = 0 \quad \text{--- (ii)}$$

Slope  $m_1$  of (i)

$$m_1 = \frac{dy}{dx} = 12x^2 - 3$$

Slope  $m_2$  of (ii)

$$m_2 = \frac{-1}{9}$$

According to the question

$$m_1 \times m_2 = -1$$

$$\Rightarrow (12x^2 - 3) \left( -\frac{1}{9} \right) = -1$$

$$\Rightarrow 4x^2 - 1 = 3$$

$$\Rightarrow x^2 = 1$$

$$\Rightarrow x = \pm 1$$

From (i)

$$\begin{aligned} y &= 4 - 3 + 5 & \text{or} & & -4 + 3 + 5 \\ &= 6 & \text{or} & & 4 \end{aligned}$$

$$\therefore P = (1, 6) \text{ or } Q = (-1, 4)$$

Thus, the equation of tangent is

$$(y - 6) = 9(x - 1) \quad \Rightarrow \quad 9x - y - 3 = 0$$

$$(y - 4) = 9(x + 1) \quad \Rightarrow \quad 9x - y + 13 = 0$$

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