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MATRIC NO.: 19/MH501/041

1.  $y = 2x^2$  at  $(1, 2)$

$$\frac{dy}{dx} = 4x$$

$$\frac{dy}{dx} \text{ at } x=1 = 4 = m_1$$

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

$$y - 2 = 4(x - 1)$$

$$y - 2 = 4x - 4$$

$$y - 4x + 2 = 0 \rightarrow \text{equation at tangent}$$

$$m_2 = -\frac{1}{m_1} = -\frac{1}{4}$$

$$y - 2 = \frac{-1}{4}(x - 1)$$

$$4y - 2 = -1(x - 1)$$

$$4y + x - 9 = 0 \rightarrow \text{equation at normal}$$

$$2. \quad y = 3x^2 - 2x \quad \text{at } (2, 8)$$

$$\therefore \frac{dy}{dx} = 6x - 2$$

$$\frac{dy}{dx} \bigg|_{x=2} = 6(2) - 2 = 10 = m_1$$

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

$$y - 8 = 10(x - 2)$$

$$y - 10x + 12 = 0 \quad \rightarrow \text{equation of tangent}$$

$$m_2 = -1/m_1 = -1/10$$

$$y - 8 = -1/10(x - 2)$$

$$10y - 80 = -1(x - 2)$$

$$10y + x - 82 = 0 \quad \rightarrow \text{equation of normal}$$

$$3. \quad y = x^3/2 \quad \text{at } (-1, -1/2)$$

$$\frac{dy}{dx} = \frac{1}{2} x^3$$

$$\frac{dy}{dx} = \frac{3x^2}{2}, \quad \frac{dy}{dx} \text{ at } x=-1 = \frac{3}{2} (-1)^2 = \frac{3}{2} = m_1$$

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

$$y + 1/2 = \frac{3}{2} (x + 1)$$

$$2y + 1 = 3(x + 1)$$

$$2y - 3x - 2 = 0 \quad \rightarrow \text{equation of tangent}$$

$$m_2 = -1/m_1 = -1/(3/2) = -2/3$$

$$y + 1/2 = -2/3 (x + 1)$$

$$6y + 3 = -4(x + 1)$$

$$6y + 4x + 7 = 0 \quad \rightarrow \text{equation of normal}$$

$$4. \quad y = 1 + x - x^2 \quad \text{at } (-2, -5)$$

$$\frac{dy}{dx} = 1 - 2x,$$

$$\frac{dy}{dx} \text{ at } x = -2 = 1 - 2(-2) = 5 = m,$$

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

$$y + 5 = 5(x + 2)$$

$$y + 5 = 5x + 10$$

$$y - 5x - 5 = 0 \rightarrow \text{equation at tangent.}$$

$$m_2 = -1/m_1 = -1/5$$

$$y + 5 = -1/5(x + 2)$$

$$5y + 25 = -1(x + 2)$$

$$5y + x + 27 = 0 \rightarrow \text{equation at normal}$$

5.  $y = 1/x$  at  $(3, 1/3)$

$$y = x^{-1}$$

$$dy/dx = -x^{-2}$$

$$dy/dx \text{ at } x=3 = -3^{-2} = -1/9 = m,$$

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

$$y - \frac{1}{3} = -\frac{1}{9}(x - 3)$$

$$9y - 3 = -1(x - 3)$$

$$9y + x - 6 = 0 \rightarrow \text{equation of tangent}$$

$$m_2 = -1/m_1 = -1/(-1/9) = 9$$

$$y - \frac{1}{3} = 9(x - 3)$$

$$3y - 1 = 27(x - 3)$$

$$3y - 1 = 27x - 81$$

$$3y - 27x + 80 = 0 \rightarrow \text{equation of normal}$$