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Assignment.

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

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

$$\left.\frac{dy}{dx}\right|_{x=1} = 4(1) = 4$$

$x_1 = 1$, $y_1 = 2$, $m_1 = 4$

a) For tangent:

$$y - y_1 = m_1(x - x_1)$$

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

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

$y - 4x + 2 = 0$ is the equation of the tangent.

b) For Normal:

$$m_1 m_2 = -1$$

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

$$y - y_1 = m_2(x - x_1)$$

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

$$y - 2 = -x/4 + 1/4 \quad \text{(multiply through by 4)}$$

$$4y - 8 = -x + 1$$

$4y + x - 9 = 0$ is the equation of the normal.

2. $y = 3x^2 - 2$ at Point $(2, 8)$

$$\frac{dy}{dx} = 6x \qquad \left.\frac{dy}{dx}\right|_{x=2} = 6(2)$$

$$= 12//$$

$x_1 = 2 \quad y_1 = 8 \quad m_1 = 12$

a) for tangent

$$y - y_1 = m_1(x - x_1)$$

$$y - 8 = 12(x - 2)$$

$$y - 8 = 12x - 24$$

$y - 12x + 16 = 0$ is the equation for the tangent

b) for normal

$$m_1 m_2 = -1$$

$$m_2 = \frac{-1}{12}$$

$$y - y_1 = m_2(x - x_1)$$

$$y - 8 = -\frac{1}{12}(x - 2)$$

$$y - 8 = -\frac{x}{12} + \frac{1}{6} \quad \text{(multiply through by 12)}$$

$$12y - 96 = -x + 2$$

$12y + x - 98 = 0$ is the equation for the normal.

3. $y = \frac{x^3}{2}$ at Point $(-1, -\frac{1}{2})$

$$y = x^3 \times 2^{-1}$$

$$\frac{dy}{dx} = 3x^2 \qquad \left.\frac{dy}{dx}\right|_{x=-1} = 3(-1)^2$$

$$= 3$$

$x_1 = -1, \quad y_1 = -\frac{1}{2}, \quad m_1 = 3$

a) for tangent

$$y - y_1 = m_1(x - x_1)$$

$$y - (-\tfrac{1}{2}) = 3(x - (-1))$$

$$y + \tfrac{1}{2} = 3x + 3 \quad \text{(multiply through by 2)}$$

$$2y + 1 = 6x + 6$$

$2y - 6x - 5 = 0$ is the equation for the tangent.

b. For normal

$m_1 m_2 = -1$

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

$m_2 = \frac{-1}{3}$

$y - y_1 = m_2(x - x_1)$

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

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

$y + 1/2 = -1/3 x - 1/3$ (multiply through by 6)

$6y + 3 = -2x - 2$

$6y + 2x + 5 = 0$ is the equation for the normal.

4. $y = 1 + x - x^2$ at the point $(-2, 5)$

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

$\left.\frac{dy}{dx}\right|_{x=-2} = 1 - 2(-2)$

$= 5$

$x_1 = -2 \quad y_1 = 5 \quad m_1 = 5$

a) For tangent

$y - y_1 = m_1(x - x_1)$

$y - 5 = 5(x - (-2)) \Rightarrow y - 5 = 5(x + 2)$

$y - 5 = 5x + 10$

$y - 5 = 5x + 10$

$y - 5x - 15 = 0$ is the equation of the tangent.

b) For normal

$m_1 m_2 = -1$

$m_2 = \frac{-1}{5}$

$y - y_1 = m_2(x - x_1)$

$y - 5 = \frac{-x}{5} - \frac{2}{5}$ (multiply through by 5)

$5y - 25 = -x - 2$

$5y + x - 23 = 0$ is the equation of the normal.

5. $y = \frac{1}{x}$ at the point $(3, \frac{1}{3})$

$y = x^{-1}$

$\frac{dy}{dx} = -x^{-2}$ $\qquad \frac{dy}{dx}\Big|_{x=3} = -(3)^{-2}$

$= \frac{-1}{3^2} = -\frac{1}{9}$

$x_1 = 3, \; y_1 = \frac{1}{3}, \; m_1 = -\frac{1}{9}$

a) For tangent

$y - y_1 = m_1(x - x_1)$

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

$9y - 3 = -x + 3$

$9y + x - 6 = 0$ is the equation of the tangent.

b) For normal

$y - y_1 = m_2(x - x_1)$

$m_1 m_2 = -1 \quad ; m_2 = \frac{-1}{m_1} = \frac{-1}{-\frac{1}{9}} = 9$

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

$3y - 1 = 9x - 27$

$3y - 1 = 27x - 81$

$3y - 27x + 80 = 0$ is the equation for the normal.