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MATRIC NUMBER: 19/MHS01/258
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1) $y = 2x^2$ at $(1, 2)$

<u>Soln</u>

$y = 2x^2$

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

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

$m = 4$

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

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

$y - 2 = 4x - 4$

$y - 4x - 2 + 4 = 0$

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

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

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

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

$4y - 8 = -x + 1$

$4y + x - 8 - 1 = 0$

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

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

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

$$\left.\frac{dy}{dx}\right|_{x_1 = 2} = 6x - 2 = 6(2) - 2 = 10$$

$$m = 10$$

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

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

$$y - 8 = 10x - 20$$

$$y - 8 - 10x + 20 = 0$$

$y - 10x + 12 = 0$, the equation to the tangent

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

$$y - 8 = \frac{-1}{10}(x - 2)$$

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

$$10y - 80 = -x + 2$$

$$10y + x - 80 - 2 = 0$$

$10y + x - 82 = 0$; the equation to the normal

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

soln

$y = \frac{x^3}{2}$

Using quotient rule,

$y = \frac{x^3}{2} \frac{— u}{— v}$

$u = x^3 \quad \frac{du}{dx} = 3x^2$

$v = 2 \quad dv/dx = 0$

$dy/dx = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$

$dy/dx = \frac{(2)(3x^2) - (x^3)(0)}{2^2}$

$dy/dx = \frac{6x^2 - 0}{4}$

$\frac{dy}{dx} = \frac{6x^2}{4}$

$\left.\frac{dy}{dx}\right|_{x_1 = -1} = \frac{6(-1)^2}{4} = \frac{6}{4} = \frac{3}{2}$

$m = \frac{3}{2}$

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

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

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

$2y + 1 = 3x + 3$

$2y - 3x + 1 - 3 = 0$

$2y - 3x - 2 = 0$; equation of the ~~normal~~ tangent

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

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

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

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

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

$3y + 2x + \frac{7}{2} = 0$; equation of the normal

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

Soln

$y = 1 + x - x^2$

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

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

$m = 5$

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

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

$y + 5 = 5x + 10$

$y - 5x + 5 - 10 = 0$

$y - 5x - 5 = 0$; the equation to the tangent

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

$y + 5 = \frac{-1}{5}(x + 2)$

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

$5y + 25 = -x - 2$

$5y + x + 25 + 2 = 0$

$5y + x + 27 = 0$; the equation to the normal

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

Soln

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

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

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

$m = -9$

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

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

$y - \frac{1}{3} = -9x + 27$

$y + 9x - \frac{1}{3} - 27 = 0$

$y + 9x - \frac{82}{3} = 0$; equation to the tangent

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

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

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

$9y - 3 = x - 3$

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

$9y - x = 0$; equation to the normal.