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Medicine and Surgery

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MAAT 104 Assignment

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

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

$$m = 4(1)$$

$$m = 4$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$m = 6(2) - 2$$

$$m = 10$$

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

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

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

$y - 10x + 12 = 0$ is the equation of the tangent.

$$b. \begin{aligned} y - y_1 &= \frac{-1}{m}(x - x_1) \\ y - 8 &= \frac{-1}{10}(x - 2) \\ y - 8 &= \frac{-(x - 2)}{10} \end{aligned}$$

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

$10y + x - 82 = 0$ is the equation of the normal.

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

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

$$m = \frac{3(-1)^{1/2}}{2}$$

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

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

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

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

$$6x + 6 = 4y + 2$$

$$4y - 6x - 4 = 0$$

$2y - 3x - 2 = 0$ is the equation of the tangent.

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

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

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

$$-4x - 4 = 6y + 3$$

$$-6y - 3 = 4x - 4 = 0$$

$6y + 4x + 1 = 0$ is the equation of the normal.

$$4a. \quad y = 1 + ax - ax^2 \quad (-2, -5)$$

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

$$m = 1 - 2a(-2)$$

$$m=5$$

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

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

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

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

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

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

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

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

$5y+x+27=0$ is the equation of the normal.

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

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

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

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

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

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

$$-3x+9 = 27y-9$$

$$27y+3x-18=0$$

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

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

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

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

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

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