

Differentiate.

1) $g(x) = \frac{x^2}{x-11}$

(2 Points)

$$g'(x) = \frac{2x(x-11) - 1(x^2)}{(x-11)^2} = \frac{2x^2 - 22x - x^2}{(x-11)^2} = \frac{x^2 - 22x}{(x-11)^2}$$

2) $y = 5x^2 e^{3x}$

(2 Points)

$$y' = 10x e^{3x} + 5x^2 e^{3x} \cdot 3 = 10x e^{3x} + 15x^2 e^{3x} = 5x e^{3x} (2 + 3x)$$

3) $y = \sqrt{4x+2} = (4x+2)^{\frac{1}{2}}$

(2 Points)

$$y' = \frac{1}{2} (4x+2)^{-\frac{1}{2}} (4) = \frac{2}{(4x+2)^{\frac{1}{2}}} = \frac{2}{\sqrt{4x+2}}$$

4) $y = e^{3x^2} + x$

$$y' = e^{3x^2} \cdot 6x + 1 = 6x e^{3x^2} + 1$$

(2 Points)

5) $y = \ln(9+x^2)$

(2 Points)

$$y' = \frac{1}{9+x^2} (2x) = \frac{2x}{9+x^2}$$

6) The total profit (in dollars) from selling x units of cookbooks is $P(x) = (3x-2)(7x-5)$. Find the marginal profit function, Please include Units.

$$P'(x) = 3(7x-5) + 7(3x-2) = 21x - 15 + 21x - 14$$

$$P'(x) = 42x - 29 \frac{\text{Dollars}}{\text{Cookbook}}$$

$$y_1 = f(0) = \frac{-4(0)^2 - 4}{4(0) - 1} = 4 \quad \& \quad x_1 = 0,$$

7) Write an equation of the tangent line to the graph of $f(x) = \frac{-4x^2 - 4}{4x - 1}$ at the

point on the graph where $x = 0$

(2 Points)

$$f'(x) = \frac{-8x(4x-1) - 4(-4x^2-4)}{(4x-1)^2}$$

$$f'(0) = \frac{0+16}{(-1)^2} = 16$$

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

$$y - 4 = 16(x - 0)$$

$$y = 16x + 4$$

8) Find the equation of tangent line to the graph of $f(x) = 3e^{-4x}$ at the point $(0, 3)$.

(2 Points)

$$y' = -12e^{-4x}$$

$$m = -12e^{-4(0)} = -12$$

$$y_1 = 3e^0 = 3$$

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

$$y - 3 = -12(x - 0)$$

$$y = -12x + 3$$

9) The sales in thousands of a new type of product are given by

$S(t) = 230 - 60e^{-0.7t}$, where t represents time in years. Find the rate of change of sales at the time when $t = 4$.

(2 Points)

$$S'(t) = 0 - 60e^{-0.7t}(-0.7) \Rightarrow$$

$$S'(4) = 0 - 60e^{(-0.7 \times 4)} \times (-0.7) = 2.6 \text{ thousands per year}$$

10) Students in a math class took a final exam. They took equivalent forms of the exam in monthly intervals thereafter. The average score $S(t)$, in percent, after t months was found to be given by

$$S(t) = 70 - 16 \ln(t + 1)$$

(2 Points)

$$\text{Find } S'(t) = 0 - 16 \frac{1}{(t+1)} = \frac{-16}{(t+1)} \text{ Percent month}$$