

1. Suppose the price-demand function for a company is  $p(x) = -10x + 1040$ , where  $x$  is the quantity sold in a given week and  $p(x)$  is the price in dollars.

(a) Find the revenue function,  $R(x)$ .

(b) Suppose the company has to pay a fixed cost of \$6650, plus a variable cost of \$500 per unit. Find the profit function,  $P(x)$ .

(c) How many units must the company sell in order to break even?

(d) Find the vertex of the profit function and interpret each coordinate.

2. Consider the rational function  $f(x) = \frac{-3x^2 - 3x + 36}{5x^2 - 5x - 100}$ .

(a) Write the domain of  $f$  in interval notation.

(b) Identify any horizontal asymptotes.

(c) Identify any vertical asymptotes and holes in the graph of  $y = f(x)$ .

(d) Suppose we define  $g(x)$  to be  $f(x)$  whenever  $x \neq -4$  and  $-\frac{7}{15}$  when  $x = -4$ . Is  $g(x)$  continuous at  $x = -4$ ? Use the definition of continuity to support your answer.

3. Let  $h(x) = \sqrt[3]{2x - 5}$ .

(a) Write the domain of  $h$  in interval notation.

(b) Are there any values for  $x$  in the domain of  $h$  where  $h$  is non-differentiable? Explain.

4. Suppose Andrew invests \$4500 into an account with an annual rate of 3.75%. How much money will be in the account after 16 years if the interest is compounded

(a) Monthly?

(b) Continuously?

5. Let  $g(x) = \frac{4x - 3}{2x + 3}$ . Find the equation of the line tangent to the graph of  $g(x)$  at  $x = -3$ .

6. Let  $g(x) = \sqrt{5x^2 + 3x - 4}$ . Calculate  $\Delta y$  and  $dy$  when  $x = 1$  and  $dx = 0.2$ .

7. The Seas Beginning Company determines that the daily cost function of producing its Rain Forest ultra rain coat can be modeled by

$$C(x) = 1000 + 35x - 0.01x^2 \quad 0 \leq x \leq 300$$

where  $x$  represents the number of rain coats produced each day and  $C(x)$  is the total cost, in dollars, of producing the rain coats. Evaluate and interpret  $MC(200)$ .

8. Find the derivative of the following functions.

(a)  $A(x) = x \ln(x^4)$ .

(b)  $B(x) = \frac{7^x}{x+3}$ .

(c)  $C(x) = \log_6 \sqrt{x}$ .

(d)  $D(x) = e^{x^2-3x+5}$ .

9. Solve  $7^{2x+1} = 5^{x-3}$  for  $x$ .

10. Let  $f(x) = x^4 + 2x^3 - 72x^2 - 216x + 32$ .

(a) Find the interval(s) on which  $f$  is increasing/decreasing.

(b) Find the point(s) at which  $f$  achieves a relative max or min.

(c) Find the interval(s) on which  $f$  is concave up/down.

(d) Find the inflection point(s) of  $f$ .

11. Suppose you want to make an open-top box out of a piece of corrugated cardboard that is 25 by 40 inches. In order to do this, you need to cut out small squares from each corner and fold up the flaps. Determine the dimensions of the box if its volume is to be maximum.

12. Consider the function  $f(x) = \frac{1}{3}x^3 + \frac{3}{2}x^2 - 40x + 2$  on the interval  $[-12, 12]$ . Find the absolute max and absolute min of  $f$  on this interval.

13. Consider the equation  $3x^2 + 2xy = 7y^2 - 8$ .

(a) Determine  $\frac{dy}{dx}$ .

(b) Find the equation of the line tangent to the graph of the curve defined by the given equation at the point  $(2, 2)$ .

14. On a warm and sunny winter day, a snowball that is 48 inches in diameter is melting. It's volume is decreasing at a rate of  $576\pi$  cubic inches per minute. How fast is the radius of the snowball decreasing?

The volume of a sphere is  $V = \frac{4}{3}\pi r^3$ .

15. Determine the indefinite integral  $\int \left( 3\sqrt{x} - 4 + \frac{7}{x^2} \right) dx$ .

16. Evaluate the definite integral  $\int_{-1}^3 (x^2 - 5x + 2) dx$ .

17. Consider the function  $f(x) = x^2 + x - 2$  on the interval  $[-1, 4]$ .

(a) Compute the net area beneath the graph of  $f$ .

(b) Compute the gross area between the graph of  $f$  and the  $x$ -axis.

18. Suppose a rocket is being launched into the air.

(a) The acceleration due to gravity is  $-32$  feet per second, so  $a(t) = -32$ . Suppose that the initial velocity of the rocket is 132 feet per second. Use this information, along with the fact that  $v(t) = \int a(t) dt$ , to recover  $v(t)$ , the velocity function.

(b) Suppose that the rocket is being launched from a platform that is 6 feet high. Use this information, along with the fact that  $s(t) = \int v(t) dt$ , to recover  $s(t)$ , the position function.