

**Math 142 Week In Review**  
**Problem Set #7**  
**Review for Exam 2 (3.4, 3.5, 3.7, 4.1-4.4, 4.7, 5.1, 5.2)**  
**Instructor: Jenn Whitfield**

- Given the price-demand equation  $p + 0.001x = 50$ ,
  - Express the demand  $x$  as a function of the price  $p$ .
  - Find the elasticity of demand,  $E(p)$ .
  - What is the elasticity of demand when  $p = \$10$ ? If this price is increase by 10%, what is the approximate change in demand?
  - What is the elasticity of demand when  $p = \$25$ ? If this price is increase by 10%, what is the approximate change in demand?
  - What is the elasticity of demand when  $p = \$15$ ? If this price is increase by 10%, what is the approximate change in demand?
- A model for the number of robberies in the United States (see table below) is  $r(t) = 11.3 - 3.6\ln(t)$  where  $t$  is years since 1990. Find the relative rate of change for robberies in 2001.

year	1995	1996	1997	1998	1999	2000	2001	2002
<b>Number of Robbery victims per 1000 population age 12 and over</b>	5.4	5.4	4.3	4.0	3.6	3.2	2.8	2.2

- Find the derivatives of the following functions. (DNS = Do not simplify)

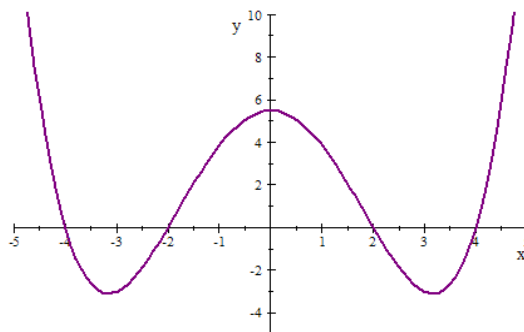
a.  $f(x) = \frac{(4x^3 + 2x^2 + 5)^6}{\sqrt{2x+4}}$

b.  $g(x) = \log_5(\sqrt{4x^2 + 3x - 1}) \cdot 7^{3x+6}$  (DNS)

c.  $h(x) = e^{2x^3+7x} \ln(3x^{2/3} - x^{1/4})$

- Find the intervals where  $f(x) = \frac{1}{4}x^2e^x$  increases and decreases.

- The following graph represents the first derivative of a function. Use the graph to approximate the  $x$  values where the function has relative maximums and minimums and the  $x$  values where the function has point(s) of inflection.



- If  $h(x) = \frac{\ln(x)}{f(x)}$ , and  $f(5) = 4$  and  $f'(5) = -2$ ,

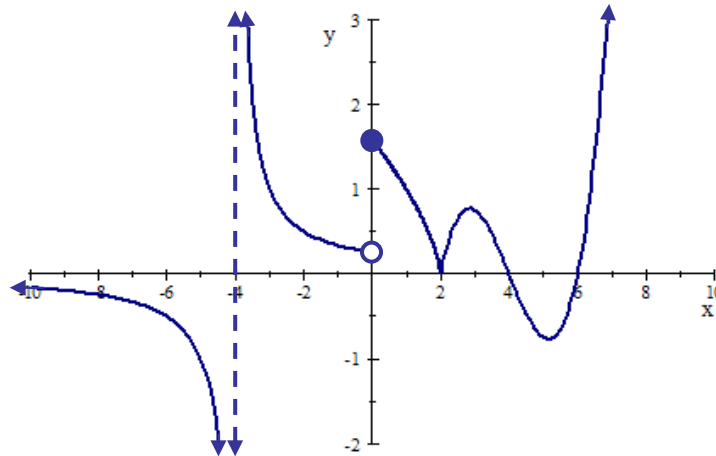
a) Find  $h'(5)$ .

b) Find the equation of the line tangent to  $h(x)$  at  $x = 3$ .

7. Sketch a graph of a function that satisfies the following conditions.

- $f(-2) = 1, f(0) = 2$
- $f'(x) > 0$  on  $(-2, 0)$
- $f'(x) < 0$  on  $(-\infty, -2)$  and  $(0, \infty)$
- $f''(x) > 0$  on  $(-\infty, -1)$  and  $(1, \infty)$
- $f''(x) < 0$  on  $(-1, 1)$
- $\lim_{x \rightarrow \infty} f(x) = 0, \lim_{x \rightarrow -\infty} f(x) = \infty$

8. Use the graph of  $f(x)$  below to answer the questions that follow.



- a. Identify the intervals on which  $f(x)$  is increasing.
- b. Identify the intervals on which  $f(x)$  is decreasing.
- c. Identify the intervals on which  $f'(x) < 0$ .
- d. Identify the intervals on which  $f'(x) > 0$ .
- e. Identify the  $x$  coordinates of the points where  $f'(x)$  does not exist.
- f. Identify the  $x$  coordinates of the point(s) where  $f(x)$  has a local maximum.
- g. Identify the  $x$  coordinates of the point(s) where  $f(x)$  has a local minimum.

9. Suppose the function  $R(x) = 50x - 4x^{3/2}$  represents the revenue function for a company, in thousands of dollars, when selling  $x$  hundred items.

- a. Find the average rate of change in the company's revenue (to the nearest dollar) when sales change from 750 items to 1550 items.
- b. Find the marginal average revenue function.

10. Use the limit definition of the derivative to find the derivative of  $f(x) = \frac{1}{x+1}$ .

11. Given  $f'(x) = 3x^2 - 3$  use derivative techniques to find

- a. the intervals where  $f(x)$  is increasing and decreasing.
- b. relative extrema of  $f(x)$ .
- c. the intervals where  $f(x)$  is concave up and concave down.
- d. all points of inflection.

12. If  $P(x) = 100x - x^2 - 500$  represents the profit function of a company, where  $x$  represents the number of items produced and sold and  $P(x)$  is the profit in hundreds of dollars

- a. Find the marginal profit function.
- b. Find the approximate profit obtained from producing the 31<sup>st</sup> item.
- c. Suppose the company's production level is currently 55 items and they are thinking of increasing the production level to 56 items. Would this be a "wise" move for the company to make? Why or why not?

13. How long will it take money to double if it is invested at 5% interest compounded continuously?

14. In a computer assembly plant a new employee, on average, is able to assemble  $N(t) = 10(1 - e^{-0.4t})$  units after  $t$  days of on-the-job training.

- a. What is the rate of learning after 1 day? After 5 days?
- b. Find the number of days (to the nearest day) after which the rate of learning is less than 0.25 unit per day.