Math 142 Week In Review
Problem Set #5
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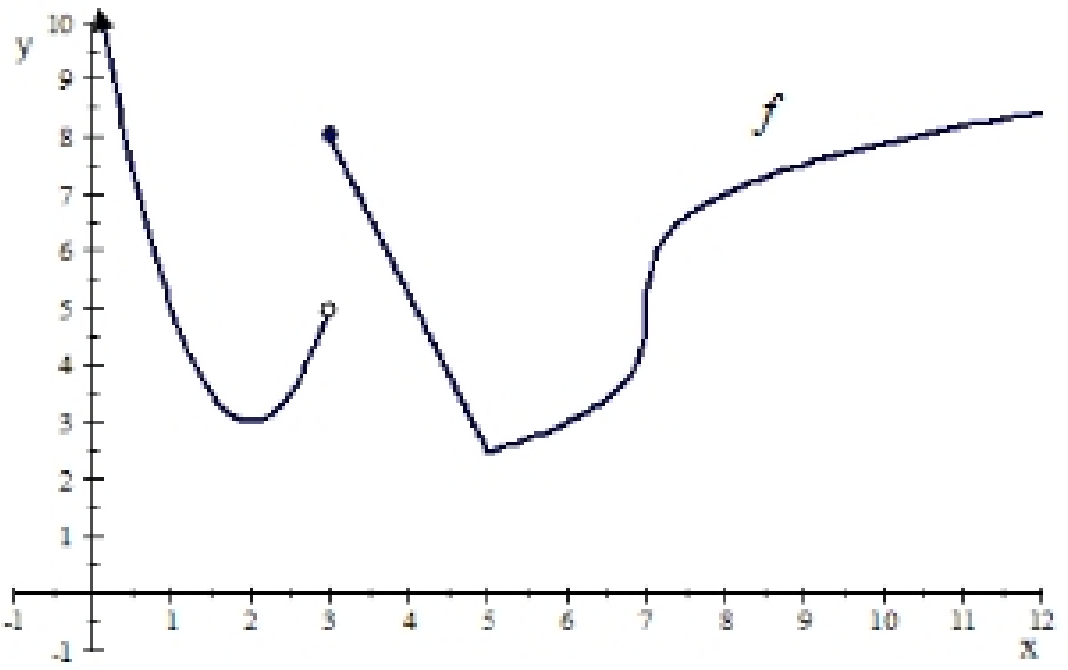
Section 3-4

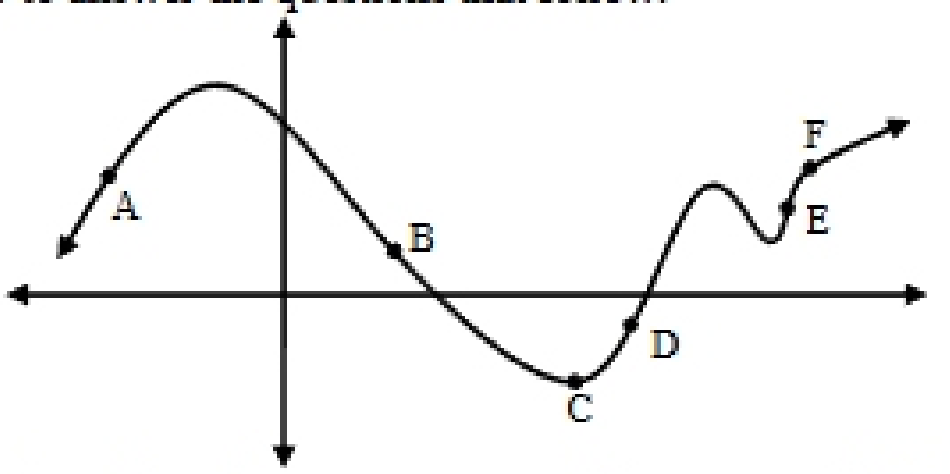
1. For problems a-h below, refer to the graph of the function f shown below. Use the graph to determine whether $f''(x)$, exists at each indicated value of x.



a) $x = 1$ b) $x = 2$ c) $x = 3$ d) $x = 4$
e) $x = 5$ f) $x = 6$ g) $x = 7$ h) $x = 9$

2. Given $f(x) = 4 + \frac{4}{x}$, use the four step process to find $f'(x)$ and then find $f'(1)$.

3. Use the graph of $g(x)$ below to answer the questions that follow.



a) Between which two consecutive points is the average rate of change positive?
b) Between which two consecutive points is the average rate of change negative?
c) Between which two consecutive points is the average rate of change largest?
d) Between which two consecutive points is the average rate of change smallest?
e) At which point(s) is the instantaneous rate of change positive?
f) At which point(s) is the instantaneous rate of change negative?
g) At which point(s) is the instantaneous rate of change zero?
h) At which point is the instantaneous rate of change largest?
i) At which point is the instantaneous rate of change smallest?

4. The ozone level (in parts per billion) on a summer day in a metropolitan area is given by $P(t) = 80 + 12t - t^2$ where t is time in hours and $t = 0$ corresponds to 9 a.m.

a) Use the four-step process to find $P'(t)$.
b) Find $P(3)$ and $P'(3)$. Write a brief verbal interpretation of these results.

Section 3.5

5. Find the indicated derivatives.

a) $y = 2t^2 - 3t + 1$ b) $y = \frac{5}{9x^6} + 6\sqrt[3]{x^2}$ c) $y = \pi x^{2\pi} + \frac{5x^8}{\sqrt{x}} + \frac{3e}{\sqrt[6]{x^5}}$

6. If $h(x) = -4f(x) + 5g(x) - 9$, $f'(5) = 8$, and $g'(5) = 4$, find $h'(5)$.

7. If $f(x) = 3x^4 - 6x^2 - 7$ find the equation of the tangent line at $x = 2$.

8. Find the value(s) of x where the line(s) tangent to $h(x) = x^4 - 5x^2 + 4$ are horizontal.

9. Suppose that a person learns y items in x hours, as given by $y = 50\sqrt{x}$ for $0 \le x \le 9$.
   a) Find the rate of learning at the end of 1 hour.
   b) Find the rate of learning at the end of 9 hours.

Section 3.7

10. The total profit (in dollars) from the sale of x skateboards is $P(x) = 30x - 0.3x^2 - 250$ for $0 \le x \le 100$.
   a) Find the exact profit from the sale of the 26^{th} skateboard.
   b) Use the marginal profit to approximate the profit from the sale of the 26^{th} skateboard.

11. The total profit (in dollars) from the sale of x lawn mowers is $P(x) = 30x - 0.03x^3 - 750$ for $0 \le x \le 1000$.
   a) Find the average profit per mower if 50 mowers are produced.
   b) Find the marginal average profit at the production level of 50 mowers, and interpret the results.
   c) Use the results from parts (a) and (b) to estimate the average profit per mower if 51 mowers are produced.

12. The price-demand equation and the cost function for the production of table saws are given, respectively, by

$$p = -\frac{x}{30} + 200 \text{ and } C(x) = 72{,}000 + 60x$$

where x is the number of saws that can be sold at a price of $\$p$ per saw and $C(x)$ is the total cost (in dollars) of producing x saws.
   a) Find the marginal revenue when 1,500 table saws are produced and interpret these quantities.
   b) Find the marginal profit when 1,500 table saws are produced and interpret these quantities.

Section 4.1

13. Recently, Provident Bank offered a 10-year CD that earns 5.51% compounded continuously.
   a) If $10,000 is invested in the CD, how much will it be worth in 10 years?
   b) How long will it take for the account to be worth $15,000?

14. At what nominal rate compounded continuously must money be invested to double in 8 years?

15. A mathematical model for world population growth over short intervals is given by $P = P_0 e^{rt}$ where P_0 is the population at time $t = 0$, r is the continuous compound rate of growth, t is time in years, and P is the population at time t. How long will it take for the U.S. population to double if it continues to grow at a rate of 0.85% per year?