**Practice Integration Problems #1** Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. A faucet was turned on at =0, and  minutes later water was flowing into a barrel at a rate of gallons per minute, .
   1. How much water was added to the barrel during these 5 minutes?
   2. Find the average flow rate for these five minutes.
2. (from 2000 Free Response) Water is pumped into an underground tank at a constant rate of 8

gallons per minute. Water leaks out of the tank at the rate of  gallons per minute, for

. At , the tank contains 30 gallons of water.

1. How many gallons of water leak out of the tank from  to  minutes?
2. How many gallons of water are in the tank at time  minutes?
3. Write an expression for , the total number of gallons of water in the tank at time .
4. At what time , for , is the water in the tank a maximum? Justify your answer.
5. If is the rate of growth of a child in pounds per year, what does  represent?
6. A honeybee population starts with 100 bees and increases at a rate of bees per week. What does  represent?
7. The graph of the function *f* , consisting of three line segments, is shown on the right.   
   Let .

(a) Find . Graph of *f*

(b) Find .

(c) Find the instantaneous rate of change of *g* with respect to *x* at *x* = 2.

(d) Find the absolute maximum value of *g* on the interval . Justify your answer.

(e) The second derivative of *g* is not defined at *x* = 1 and at *x* = 2. Which of these values are *x*-coordinates of points of inflection of the graph of *g*? Justify your answer.

1. Let  where *f* is the continuous function with domain [0, 12] shown on the right.

(a) Find .

(b) On what interval(s) of *x* is *H* increasing? Justify your answer.

(c) On what interval(s) of *x* is *H* concave up? Justify your answer. Graph of *f*

(d) Is  positive or negative? Explain.

(e) For what value of *x* does *H* achieve its maximum value? Explain.

1. If  what is the value of 
2. If 
3. Consider the function *f* that is continuous on the interval  and for which  
    Evaluate:

(a)  (c) 

(b)  (d) 

1. A bowl of soup is placed on the kitchen counter to cool. The temperature of the soup is

given in the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Time *t* (minutes) | 0 | 5 | 8 | 12 |
| Temperature  (°F) | 105 | 99 | 97 | 93 |

(a) Find .

(b) Find the average rate of change of  over the time interval *t* = 5 to *t* = 8 minutes.

1. If  and  are continuous functions such that  for all , then 

(A)  (B)  (C) 

(D)  (E) 