

Name \_\_\_\_\_

**RULES FOR THIS TEST:**

- Do not borrow another student's calculator.
  - Circle each final answer.
  - A correct answer will only be given full credit if enough work is shown to justify that answer.
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1. (12 points) Maria invests \$1000 in a bank account which earns interest at 12.5% per year compounded annually.

(a) Assuming that she does not make any more deposits or withdrawals, find a formula for the balance in Maria's account  $t$  years after her initial deposit.

(b) How many years will it take for the balance in her account to reach \$5000?

2. (10 points) Tables for the five functions,  $f(x)$ ,  $g(x)$ ,  $h(x)$ ,  $p(x)$ , and  $q(x)$ , are shown below. To the right of each table, circle one of the words **linear**, **exponential**, or **neither**. You should circle **linear** if the function could be linear, you should circle **exponential** if the function could be exponential, and you should circle **neither** if it is impossible for the function to be either linear or exponential. You do not need to find formulas for any of the functions.

$x$	$f(x)$
0	22.0
4	15.5
8	9.0
12	2.5

**linear**,      **exponential**,      **neither**

$x$	$g(x)$
0	$e$
4	$e^2$
8	$e^4$
12	$e^8$

**linear**,      **exponential**,      **neither**

$x$	$h(x)$
0	0.04
4	0.28
8	1.96
12	13.72

**linear**,      **exponential**,      **neither**

$x$	$p(x)$
0	2.05
4	2.24
8	2.43
12	2.62

**linear**,      **exponential**,      **neither**

$x$	$q(x)$
0	125
4	75
8	45
12	27

**linear**,      **exponential**,      **neither**

3. (12 points) Jack planted a magic seed. By the time he went to bed at midnight, his seed had grown into a little plant which stood 0.5 feet tall. From that point on, the plant's height increased by 2% each minute.

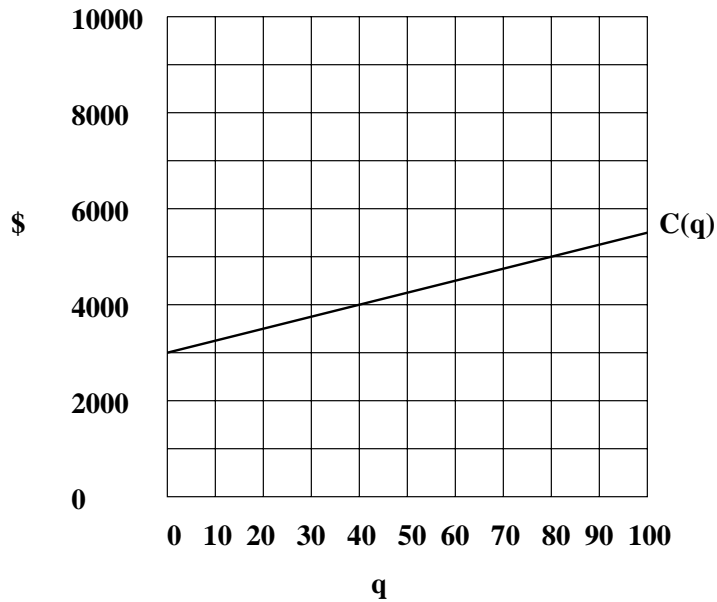
(a) Find a formula for the plant's height (in feet) as a function of the number of minutes since midnight.

(b) During the night, his plant grew into a giant beanstalk. How tall was the beanstalk when Jack awoke at 7:00 A.M. ?

(c) At what time was the beanstalk 20 feet tall?

Give your answer to the nearest minute and write it in the way one would normally write a time of day (*e.g.*, 1:23 AM, 9:42 PM, etc.)

4. (15 points) The cost in dollars for a company to produce  $q$  chemistry sets is given by the linear function  $C(q)$  whose graph is shown below.



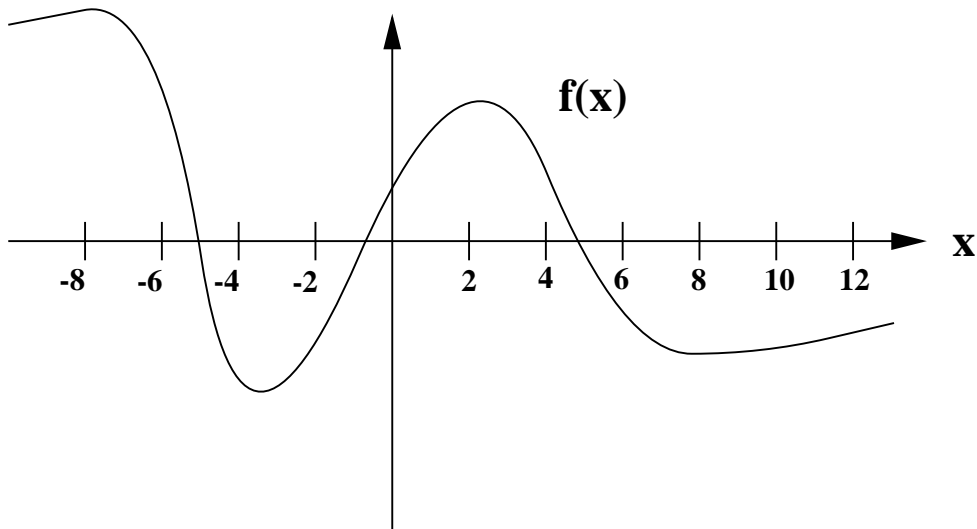
- (a) What are the fixed costs to this company?
- (b) Find a formula for  $C(q)$ .
- (c) When the company sells these chemistry sets, they charge \$100 for each set. Find a formula for the revenue function  $R(q)$  and carefully sketch a graph of this function using the same coordinate axes used for  $C(q)$ .
- (d) How many chemistry sets must this company produce and sell in order to break even?

5. (15 points) The population of a small town is recorded every 10 years from 1930 to 1970.

Year	1930	1940	1950	1960	1970
Population	483	490	498	528	563

- (a) What is the average rate of change of population between 1930 and 1970?
- (b) What is the average rate of change of population between 1960 and 1970?
- (c) If the average rate of change of population continues at the same rate as between 1960 and 1970, then in what year will the population of this town reach 750? Give your answer to the nearest whole number.

6. (12 points) Use the graph of  $f(x)$  given below to answer the following questions.



(a) Of the following six quantities, circle the one that has the largest positive value.

$$f(-8), \quad f(-4), \quad f(0), \quad f(2), \quad f(6), \quad f(10)$$

(b) Of the following six quantities, circle the one that has the largest positive value.

$$f'(-8), \quad f'(-3), \quad f'(-1), \quad f'(2), \quad f'(7), \quad f'(11)$$

(c) Of the following five quantities, circle the one that has the largest positive value.

$$\frac{f(2) - f(-6)}{2 - (-6)}, \quad \frac{f(12) - f(2)}{12 - 2}, \quad \frac{f(4) - f(-3)}{4 - (-3)}, \quad \frac{f(6) - f(-2)}{6 - (-2)}, \quad \frac{f(4) - f(0)}{4 - 0}$$

7. (16 points) A can of soda is taken out of the refrigerator and brought outside on a hot summer day. Suppose that  $f(t) = 90 - 54e^{-0.2t}$  gives the temperature, in degrees Fahrenheit ( $^{\circ}F$ ), of the can of soda  $t$  minutes after it is taken out of the refrigerator.

(a) What is the temperature of the can of soda when it is first taken out of the refrigerator? (*i.e.*, at time  $t = 0$ )

(b) From the time the soda is taken out of the refrigerator, how long does it take before its temperature reaches  $82^{\circ}F$ ? Give your answer to the nearest minute.

(c) During the first 5 minutes that the soda is out of the refrigerator, what is the average rate at which its temperature is increasing?

(d) Precisely 6 minutes after the soda is taken out of the refrigerator, how quickly is its temperature increasing?

8. (8 points) If a substance has a half-life of 10 days, then how long does it take until only 9% of that substance remains? For full credit, be sure that your answer is accurate to at least one place after the decimal point.