

EXAM 1
Math 106
November 20, 2002

Name _____

You must show all your work. Partial credit will be given.

1. A baby weighing 7 pounds at birth loses 7% of her weight in the 3 days after birth and then, over the next 4 days, returns to her birth weight. During the next month, she steadily gains 0.5 pound per week. Sketch a graph of the baby's weight from birth to 4 weeks. Accurately label both axes. (10 pts)

2. $P(m)$ is the median sale price (in thousands of dollars) of existing one-family homes in metropolitan area m in 1997. Write the following statement in function notation. In Springfield, MA, the median sale price was \$107,000. (5 pts)

3. The average daily profit resulting from telephone marketing calls by an employee of a certain company can be modeled by

$$P(c) = 0.043c^3 - 3.129c^2 + 71.133c - 315.524$$

dollars when c calls are made daily.

- (a) Find $P(25)$ and interpret the answer. (6 pts)

- (b) Find the value of c between 0 and 25 for which $P(c) = 180$. (5 pts)

4. Rewrite the functions $g(x) = \sqrt{7x^2 + 5x - 2}$ and $x(w) = 4e^w$ as $g \circ x(w) = g(x(w))$. (Composition) (6 pts)

5. Find an algebraic formula for the inverse of $s(v) = 31e^v$. (5 pts)

6. The population of Mexico between 1920 and 1990 can be modeled as

$$P(t) = 7.394(1.0269^t)$$

million people t years after 1900.

(a) What was the population in the middle of 1930? (5 pt)

(b) In what year was the population 40 million? (5 pt)

7. Find each of the following limits.

(a) $\lim_{h \rightarrow 4} \frac{h - 4}{h^2 - 4h}$. (5 pts)

(b) $\lim_{x \rightarrow 2} \frac{2x^3 - 2x^2 + x}{4x^2 - x^3}$. (5 pts)

8. Find the end behavior (horizontal asymptotes, or limits at infinity) of $s(t) = \frac{3t^2 - 12t}{t - 4t^2}$. (5pts)

9. The number of radio stations carrying the “Dr. Laura” program between 1994 and 1999 can be modeled by

$$L(x) = 20(1.864^x)$$

Stations x years after July 1994. When were 100 stations carrying the program? (6 pts)

10. The elimination half-life of a certain type of penicillin is 30 minutes. Write a model for the amount of this penicillin left in a person’s body if the initial dose is 250 mg. (5 pts)

11. The personnel manager for a contracting company keeps track of the total number of labor hours spent on a construction job each week during the construction. Partial data appear in the following table.

Weeks after start of the construction project	Cumulative labor hours
1	25
4	158
7	1254
10	5633
13	9280
16	10010
19	10100

Find a logistic model for this data. What is the maximum number of hours the company could spend on this project? (7 pts)

12. The body weight of mice used in a drug experiment is recorded by the researcher. The data are given in the following table.

Age beyond 2 weeks (weeks)	Weight (grams)
1	11
3	20
5	23
7	26
9	27

Find a LN model for the data and estimate the weight of the mice when they are 4 weeks old. Does the end behavior (as $x \rightarrow \pm\infty$) of your model make sense in this context? (10 pts)

13. The following table shows the amounts spent on reducing sizes of first-grade through third-grade public school classes in a certain state.

Year	Amount (millions)
1990	\$3
1992	\$31
1994	\$37
1996	\$42
1998	\$66

Find a model for this data and explain *why* you chose that particular model. Use your model to predict the amounts spent in 1993 and in 2000. Which of these two prediction would you logically expect to be more accurate? (10 pts)