MATH 103 - Test #1 - 2/28/03

Points in [brackets] total 100. ***Show all work for full credit.***

1. Consider a forest with unlimited resources. There are four animal populations in this forest. All four populations are growing but in different ways. The following table gives the current population sizes and the projected growth patterns.

[15]

	Current Population	Annual Growth
a) Rabbits	10,000	150 animals per year
b) Squirrels	5,000	2% per year
c) Turtles	1,000	3% per year
d) Snakes	4,000	200 animals per year

Assume that these growth patterns continue indefinitely into the future. *Write a complete paragraph* explaining which population will have the most animals in the long run, which will have the second most, and so on. Your response should include reference to the *types of growth* involved and also the *specific numbers* given in the table.

2. Use the information about the rabbit population from Question #1.
[15]

a. Write an equation giving the size of the rabbit population P as a function of time t.

b. In how many years will the forest contain 11,650 rabbits?

3. Use the information about the turtle population from Question #1.
[20]

a. Write an equation giving the size of the turtle population P as a function of time t.

b. How many turtles will be present 20 years from now?

c. Draw a graph representing the growth of the turtle population over the next 20 years.

4. At the beginning of the semester you place \$750 in an account in the business office. Ten weeks later there are \$300 dollars in the account.

[20]

a. Assuming the amount in the account decreases in a *linear* fashion, write an equation giving the amount in the account A as a function of time t. (HINT: First determine the *slope*.)

b. In the *context of this problem* explain what the *slope* of your equation represents.

5. You place \$2000 in an account that pays 6% annual interest, *compounded quarterly*. Answer the following using the compound interest formula $A=P_0(1 + {}^{r}/_{k})^{n}$.

[20]

a. Assuming no additional deposits (or withdrawals) are made, how much will you have in your account after <u>ten</u> years?

b. Explain why at the end of the first year you will have more than the expected 6% increase.

6. A town's population is represented by the equation $P = 1200(0.70)^t$, where *t* represents years after 1995.

[10]

a. What was the initial population of the town in 1995?

b. Describe *in detail* what is happening to the population each year.

EXTRA CREDIT: Choose <u>one</u> of the following for 4 extra points.

A. Describe the appropriate model to use when a population begins growing by a certain percent per year but then starts to grow more slowly as the upper limit on population size is approached. In your answer use the *correct technical terminology* and *sketch a graph* to illustrate this type of growth.

B. Use the "Malthusian population model" to answer the following question. A country had 35 million people in 1990. Its annual birth rate is 14 births per 1000 people in the population. Its annual death rate is 11 deaths per 1000 people. Assuming these rates continue (and no immigration is allowed) find the country's population in the year 2020.