

Show all work for full credit and give complete answers (in full sentences) when requested.
Points in [brackets] total 100.

1. Consider the following exponential growth functions, representing the populations of Towns A, B and C. The variable t represents years from the year 2000.

[15]

$$A = 5000(1.5)^t$$

$$B = 3000(2)^{3t}$$

$$C = 1000(2)^t$$

- a. Which of these populations is growing the slowest? Which is growing the fastest?
Explain your answers!
- b. What is the initial population of Town A?
- c. Assuming these growth patterns continue indefinitely Which town will be larger in the long run — Town A or Town C? **Explain!**
- d. By what percent is Town A growing each year?
2. Exponential growth assumes the quantity of interest increases in size indefinitely.

[10]

- a. Give a specific example where this assumption may not be very realistic.
- b. Draw a graph of a logistic model used to represent a population which begins at 10,000 and has an upper limit of 50,000.

3. Consider the following two cities.
[25]

<u>City</u>	<u>Population in 1995</u>	<u>Growth Pattern</u>
Q	10,000	15 percent growth per year
R	20,000	2500 people added per year

- a. Write an equation representing each city's population as a function of years t since 1990.

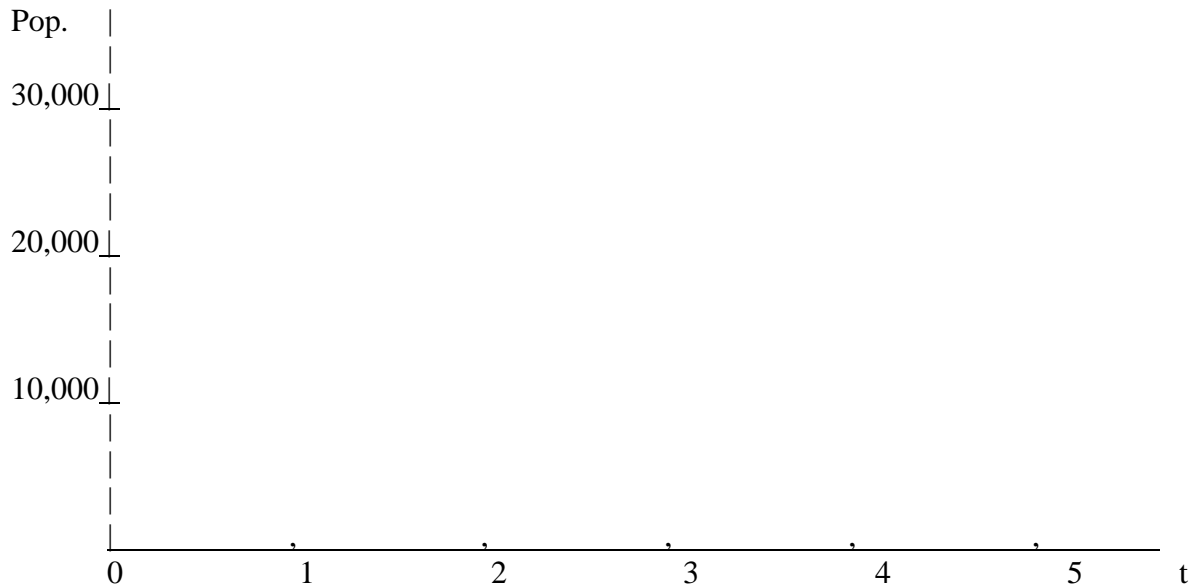
$$Q =$$

$$R =$$

- b. Compute the populations for Cities Q and R, for each year from 1995 through 2000.

<u>Year</u>	<u>t</u>	<u>Q</u>	<u>R</u>
1995	0	10,000	20,000
1996			
1997			
1998			
1999			
2000			

- c. Use the axes below to draw graphs for these two populations.



- d. Which town will have the larger population eventually? **Explain your answer!**

4. You are given the following equation describing your weight y (in pounds) as a function of years x from 1990.

[15]
$$y = 130 + 2x$$

- a. What does the number 130 represent **in the context of this situation**?

- b. What does the number 2 represent **in the context of this situation**?

- c. According to this equation what is your weight now (in 2000)?

5. A water tank is being filled at a constant rate. Initially there were 500 gallons in the tank. Four hours after the inlet hose was opened there are 1500 gallons in the tank.

[15]

- a. How much water is being added per hour?

- b. Write an equation describing the amount in the tank y as a function of hours x that the hose has been running.

$$y =$$

6. Consider the following headline: “Teenage crime increasing exponentially — absentee parents to blame.” Critique the way in which the term “exponential” is being used. For example, what is being suggested to the reader? Is this consistent with the technical definition of “exponential?” **Answer in a full paragraph!**

[10]

7. Match the following terms to their definitions given below.

[10]

- a. exponential growth b. linear growth c. carrying capacity
d. slope e. base f. logistic growth

- _____ Amount added is the same each time period
_____ Rate of change of the output variable compared to the input variable
_____ Begins as exponential growth but then growth slows down
_____ Percent change is the same each time period
_____ The population has a natural upper limit
_____ A number by which you repeatedly multiply

EXTRA CREDIT [+5]

A city's population is described using the equation $P = 100,000(.95)^t$, where t represents years since 1980.

- a. What is happening to the size of this population each year? **Be as a specific as possible and explain your answer.**
- b. What will happen to this population if this pattern continues indefinitely?
- c. Sketch a graph to represent the size of this population over time.