

MATH 103 - Test #1 - 2/25/00

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

1. Consider Cities A, B and C which have the following characteristics.

	<u>Current Population</u>	<u>Projected Growth</u>
A)	10 Million	2 percent per year
B)	15 Million	1 percent per year
C)	25 Million	0.1 million people per year

- a. For each of these cities **write an equation** which describes the population  $P$  as a function of time  $t$ . ( $t =$  years from now).

[9]

A)

B)

C)

- b. Compute the projected population for Cities B and C for the years 2010, 2020 & 2030.

[9]

<u>Year</u>	<u>t</u>	<u>City B</u>	<u>City C</u>
2000	0	15	25
2010			
2020			
2030			

- c. Using the information in (b), graph the growth equations for Cities B and C. **Be sure to make carefully drawn and well-labeled graphs.** Represent your equations using *continuous* graphs.

[8]

- d. Assuming that these patterns continue indefinitely into the future,  
which population will be the *largest*, “in the long run?”    A.    B.    C.  
which population will be the *smallest*, “in the long run?”    A.    B.    C.

[6]

Explain the above answers based on the *type of growth* that is occurring and/or the *growth rates* involved.

2. In January of 1995, I invested \$12,000 in a mutual fund. During the past five years the fund has increased in value by 31% each year. Assuming all dividends were reinvested in the fund and I made no additional deposits, approximately how much is in this fund as of January, 2000?

[15]

3. In the following equation  $v$  represents the volume of water in a tank  $t$  minutes after an inlet pipe is opened. (The units for  $v$  is gallons.)

[16]

$$v = 1000 + 25t$$

1. In the context of this problem what does the value 1000 represent?
  2. In the context of this problem what does the value 25 represent?
  3. After how many minutes will the tank contain 1760 gallons?
4. Suppose you place \$2000 in a savings account which advertises an annual interest rate of 8%, compounded *quarterly*. Also interest is added to the account and you make no further deposits or withdrawals.

[20]

- a. What is the total amount of money you will have in your account after 3 years?
- b. The total percent increase over this three-year period is more than the 24% you might have expected. Explain this phenomenon in light of the “compounding effect.”

5. If a population is growing exponentially, then the *percent growth* each year is (decreasing / the same / increasing). **Circle one of the choices.**  
The *amount of growth* each year will be (decreasing / the same / increasing ).

[5]

6. A population is represented by the equation  $P = 7000 (.8)^t$ , where  $t$  is in years.

[12]

- a. What is the initial size of the population?
  
  
  
  
  
  
  
  
  
  
- b. Describe what is happening to this population each year.
  
  
  
  
  
  
  
  
  
  
- c. Make a rough sketch of the graph representing this population model.

EXTRA CREDIT: Choose ONE of the following for 5 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. Be sure to use the technical terms we discussed in class and sketch a graph of this type of growth model.

- B. Use the “Malthusian population model” to answer the following question.

A country has 50 million people in 1980. Its annual birth rate is 15 births per 1000 people in the population. Its annual death rate is 10 deaths per 1000 people. Assuming these rates continued over the next 20 years find the country’s population in the year 2000.