MATH 103 - Test #1 - 3/6/98 ____________________

Part A: A lake contains 20 frogs. Consider the following growth patterns:

a. The frog population increases by *5 frogs* per month.
b. The frog population increases by *5 percent* per month.

1. For each of these growth patterns, write an equation expressing the population (P) as a function of months (t) from the present.

[8]

a. 5 frogs per month

b. 5 percent per month

2. Determine the number of frogs after 1, 2 and 3 months under each of these patterns.

[8]

a.

t	P
0	500
1	
2	
3	

b.

t	P
0	500
1	
2	
3	

3. Graph your two functions, using the tables in #2.

[8]

a. b.

4. In situation (a), while the amount of growth is the same each month, the *percent growth*
[8] is (decreasing / increasing / the same).

In situation (b), while the percent growth is the same each month, the *amount of growth* is (decreasing / increasing / the same).

The growth described in situation (a) can be described as _________ growth.

The growth described in situation (b) can be described as _________ growth.

Part B: You plan to place $1000 in a savings account and leave it there for 2 years. Account A pays interest at an annual rate of *12.5% compounded annually*. Account B pays interest at an annual rate of *12% compounded monthly*.

1. Determine the amount you will have in each account after the 2 years. **Show all work!**
[12]

a. 12.5% compounded annually

b. 12% compounded monthly

2. Explain how the "compounding effect" allows you to earn money using method (b) even though the annual interest rate is lower.
[4]

Part C: Suppose the growth patterns of three towns are described by the functions below, where *t* measures years from the present.

X: P = $1000\,(1.04)^t$
Y: P = $2000\,(1.03)^t$
Z: P = $5000 + 100t$

1. What is the *current size* of Town Y?
[4]

2. Which town will be the largest in the long run? **Explain your answer fully!**
[4]

3. Town Z is growing by (circle one):
[4]

> 100% per year
> 5000 people per year
> 100 people per year

Part D: Linear Programming

1. Consider the following linear program (LP):

minimize $P = 2x + 4y$

subject to

$$2x + 2y \ \$ \ 8$$
$$3x + y \ \# \ 6$$
$$x \ \$ \ 0, \ y \ \$ \ 0$$

a. Graph the feasible region. **Show all work needed** including calculations needed to find the intersection of the two constraints.

[14]

b. Determine the *optimal solution* and *objective value* for this LP. **Show all worked needed to justify your answer!**

[8]

c. For the above LP:

[8]

> circle the *objective function*
> draw a box around a *constraint*
> what are the *decisions variables*?
> list one *feasible point*

2. You wish to determine a daily diet which costs as little as possible. Unfortunately you have only two foods to choose from -- Canned Milk and Peanut Butter. Your only requirements are that you must have <u>at least</u> 45 g. of protein in your diet and <u>at most</u> 2800 calories. Your two foods have the following characteristics per serving:

[14]

	Cost (\$)	Calories	Protein (g)
Canned Milk	.25	150	6
Peanut Butter	.15	180	7

Write a linear program which can be used to determine how much of each food you should eat per day. ***Your LP must be complete in all respects -- you can use #1 above as an example!***