

SHOW ALL WORK FOR FULL CREDIT!!

[points] totals 100

1. The populations of countries A and B are described as follows:
[16]

<u>Country</u>	<u>Current Population</u>	<u>Annual Increase</u>
A	100 Million	3%
B	150 Million	2%

- a. Write an equation for Country A describing its population (P) as a function of years from the present (t).
 - b. What will Country A's population be in 20 years?
 - c. Construct a graph of your function with **at least two points** clearly labeled.
 - d. Assuming the growth pattern given in the table continues indefinitely, will population A at some point surpass population B? Explain without using any further calculations!
2. You wish to invest \$1000 in either of two investments. One receives *simple* interest at an

[20] annual rate of 10% and the other receives interest *compounded quarterly* at an annual rate of 4%.

- a. For each investment write an equation describing the amount (A) which you will have t years from now.

Simple:

Compound:

- b. How much will you have with each investment after 5 years?

Simple:

Compound:

- c. If you planned to keep your money invested for a long period of time which investment will eventually be more profitable? Explain your answer without using any additional calculations!

3. For each function draw a rough sketch which shows the general shape of the graph.

[12]

a. $y = 10 (3)^{2x}$

b. $y = 10 (.3)^{2x}$

c. $y = 10 (3)^{-2x}$

4. You belong to a club of used-sock collectors. As such collectors are a dying breed your club is decreasing in membership each year. You currently have 100 members.

[12]

- a. Suppose you are losing 5 members per year. Write the size (P) of your club as a function of years (t) from the present.
- b. Suppose you are losing 5 percent of your membership year. Write the size (P) of your club as a function of years (t) from the present.

5. Fill In The Blank

[12]

- a. If the amount of increase in a population is the same, year after year, the increase can be described as _____ growth.
- b. If the percent increase in a population is the same, year after year, the increase can be described as _____ growth.
- c. Simple interest corresponds to accumulating interest only on the _____, whereas compound interest also accumulates interest on previous _____.

6. Consider the following linear program (LP):

[16]

minimize $P = 3x + 2y$

subject to

$$2x + 2y < 4$$

$$3x + y > 6$$

$$x > 0, y > 0$$

a. Graph the feasible region:

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

c. For the above LP:

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

7. [12] 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 at least 50 g. of protein in your diet and at most 3000 calories. Your two foods have the following characteristics per serving:

	<u>Cost (\$)</u>	<u>Calories</u>	<u>Protein (g)</u>
Canned Milk	.30	140	7
Peanut Butter	.10	190	8

Write a linear program (LP) which can be used to determine how much of each food you should eat per day. Your LP must be complete in all respects!