MATH 34A HALF-LIFE, DOUBLING TIME, AND COMPOUND INTEREST

HW#6 21. In a 3 acre apple orchard, it is decided to plant 15 or more trees per acre. If 15 trees are planted per acre then each mature tree will yield 400 apples per year. For each additional tree planted per acre, the number of apples produced by each tree decreases by 8 per year. Express the total number of apples A produced per year in terms of the number n of tree per acre.

Exponential Model. An area is contaminated by 30 grams of a radioactive element. The concentration drops by 6% every 4 months. How many grams will remain after 27 months?

General Formula.

Doubling-Time. The population of a bacteria doubles every 2 hours.

a) If there are initally P_0 grams how much is there after t hours?

b) How many hours does it take until the population triples?

Compound Interest. You deposited $10000 in a bank that pays 0.1% interest.

a) If interest is compounded quarterly, how much money will there be in t years later?

b) How many years will it take until you have a million dollars?

Half-Life. The biological half-life of caffeine - the time required for the body to eliminate half of the total amount of caffeine - is about 5 hours for a healthy adult. Suppose it is the day before exam and you want to study for 12 hours. The caffeine content of a Starbucks coffee is as follows:

Tall	Grande	Venti
260mg	330mg	415mg

If you need at least 60mg of caffeine in your body at all time to focus, which size should you get?

Compound Interest. The current undergraduate tuition at UCSB is about $12200/year. Assume that it costs another $12000 for housing, food, transportation, etc.

a) If you pay for everything with student loans, how much will you own four years later?

b) The annual interest rate for direct unsubsidized loans is about 7%, compound yearly say. If you decide to go to graduate school for a Ph.D. degree, and if you never pay your student loan or interest during that time, how much will you owe six years later when you graduate?

Quiz Preparation. Container A contains 75% pure silver and container B contains 80% pure silver. How much do you need from each container to obtain 14 grams of 78% silver? (Hint: Let x grams and y grams be the amounts you need from containers A and B, respectively. Translate the following equations

$$\text{amount from } A + \text{amout from } B \;=\; \text{amount in mixture}$$
$$\text{silver from } A + \text{silver from } B \;=\; \text{silver in mixture}$$

using x, y, and the numbers given, and then solve for x and y).