Summer Session, Worksheet for Lesson 21
Applications of Exponential and Logarithmic Functions

1) Tritium has a half-life of 12.4 years. If a sample contains 100 grams, how many grams (rounded to the nearest tenth of a gram) will be remaining in 50 years?

2) The half-life of cobolt-56 is 78.76 days. If there are 2000 grams of the cobolt-56, how much (to the nearest tenth of a gram) is present after 100 days?

3) The population of a certain small city is predicted to grow according to the model, $P = 42(1.25)^t$, where P is **in thousands** and t is time in **years**.
   a) What was the population at time 0 years?
   b) What will be in population (to the nearest tenth of a thousand) after 20 years?

4) A colony of bacteria is growing according to the model $P = (2\times10^5)(2.5)^t$, where P is the population and t is the number of hours.
   a) How many bacteria were there initially?
   b) How many bacteria will there be in 7 hours? Write you answer using scientific notation rounded to 2 decimal places.

5) A city's population is growing according to the Population growth model. If the initial population is 75,000 and the growth rate is 0.012, what would be the population in
   a) 5 years?
   b) 10 years?
   (Round to the nearest whole numbers.)

6) A city's population is declining according to the model, $P = 12e^{-0.005t}$, where P is the population **in thousands** and t is time in years.
   a) What is the population at the initial time 0?
   b) What will be the population in 10 years (to the nearest tenth of a thousand)?

7) Suppose the life-expectancy of females in a certain country is given by the model, $L = 77.8(1.002)^x$, where L is the life-expectancy and x is the current age. How long can a woman currently 40 years old expect to live? 60 years old? Round your answers to the nearest tenth of a year.

8) The concentration x of a certain drug in an organ after t minutes is given by $x = 0.07(1-e^{-0.1t})$. Round to the nearest thousandth as a decimal or nearest tenth if changed to a percent.
   a) What is the initial concentration of the drug?
   a) Find the concentration after 15 minutes.

9) The percent P of the drug triazolam (a drug used to treat insomnia) remaining in a person's bloodstream after t hours is given by $P = e^{-0.3t}$. What percent will remain in the bloodstream after 24 hours? Round to 5 decimal places.

10) Before the parachute opens, the velocity v (in meters per second) of a skydiver is given by $v = 50(1 - e^{-0.2t})$. Round to the nearest tenth of a m/sec.

a) Find the initial velocity.

b) Find the velocity after 15 seconds.

11) The value of a copy machine is estimated to be $V = 5200(2)^{-0.2t}$ for t years after purchase and V is value in dollars.

a) What was the original value of the machine?

b) What will be the value after 5 years (to the nearest dollar)?

*12) Find the pH number for ammonia that has a hydronium ion concentration of (2.5×10^{-12}) moles per liter. Round to the nearest tenth.

*13) Find the pH number for human blood plasma that has a hydronium ion concentration of 4.0×10^{-8} moles per liter. Round to the nearest tenth.

*14) Suppose the intensity in a home movie theater system for a movie is $(5.2 \times 10^{9})I_0$. Find the average decibel level. Write answer in scientific notation rounded to 2 decimal places.

15) Find the decibel gain (to the nearest whole number) of an amplifier if its input is 0.3 volts and its output is 30 volts.

16) The growth of outpatient surgeries as a percent of total surgeries at hospitals is given approximately by $P = -1317 + 304 \ln x$ where P is the percent and x is the number of years since 1900. Predict what percent of surgeries were outpatient surgeries in 2000? Round to nearest tenth of a percent. What will be the percent in 2010? Can this be true?

17) An earthquake has amplitude of 9000 micrometers and a period of 0.09 seconds. Find its measurement on the Richter scale. Round to nearest tenth.

18) A second earthquake has amplitude of 9500 micrometers and a period of 0.05 seconds. Find it Richter scale measurement (to nearest tenth). Compare this measurement with that in problem 17. Which earthquake had a greater measurement?

19) A certain town's population is growing at a rate of 15% (0.15) per year. How long will it take the population to double if this rate remains constant? Round to the nearest tenth of a year.

20) The population of a local lake is growing at a rate of 11.3% per year. How long will it take the population to double? Round to the nearest tenth of a year.

21) For a certain area of the Atlantic Ocean, the intensity I_0 of light above the ocean is 11 lumens and the value of k is 0.5. Find the intensity of the light at a depth of 6 meters. Round to 2 decimal places.

*You will have to use the properties of logarithms to help you.