

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 cobalt-56 is 78.76 days. If there are 2000 grams of the cobalt-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 $P = (2 \times 10^5)(2.5)^t$, 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 your 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 its 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.

