

**Word Problems****Solve the following problems. Show your work.**

1. An equation for loudness, in decibels, is  $L = 10\log_{10}R$ , where  $R$  is the relative intensity of the sound. Sounds that reach levels of 120 decibels or more are painful to humans. What is the relative intensity of 120 decibels
2. An earthquake rated at 3.5 on the Richter scale is felt by many people, and an earthquake rated at 4.5 may cause local damage. The Richter scale magnitude reading  $m$  is given by  $m = \log_{10}x$ , where  $x$  represents the amplitude of the seismic wave causing ground motion. How many times greater is the amplitude of an earthquake that measures 4.5 on the Richter scale than on the measures 3.5?
3. Rob is solving a problem involving logarithms. He does everything correctly except for one thing. He mistakenly writes  $\log_2 a + \log_2 b = \log_2(a + b)$ . However, after substituting the values for  $a$  and  $b$  in his problem, he amazingly still gets the right answer! The value of  $a$  was 11. What must the value of  $b$  have been?
4. Spencer has \$20,898 in his account earning 3% interest each year.  
Travis has \$21,000 in his account earning 4% interest each year.
  - a. How long will it take Spencer and Travis to each have \$30,000 in their separate accounts?
  - b. Who will end up with more money after 3 years?
5. Your savings account has \$2,000 in it. It is earning interest at a rate of 2%. How many years will it take you to have \$3,000?
6. You paid \$5,000 for your car in 2012. It depreciates at a rate of 22% per year. In what year will your car be worth \$500?
7. The population of crows in Ames is 15,000 this winter. If population increases by 7% each year, how many years will it take for the population of crows to be 20,000?

$$A = P(1 + r)^n$$

P = principal amount (initial investment)

r = interest rate (as a decimal)

n = number of times(years)

8. In 2014 there were 200 puppies at the rescue shelter. In 2015 there were 157. If the amount of dogs in the shelter is decreasing exponentially, how many years from 2014 will there be 5 dogs left?
  
9. A gallon of milk costs \$3 now and the price is increasing 4% per year. How many years will it take for a gallon of milk to cost \$4?
  
10. When Rita was five, she had \$1 in her piggy bank. The next year she doubled the amount that she had in her piggy bank to \$2. She decided that each year she would double the amount in her piggy bank. How old will Rita be when she has at least \$1,000 in her piggy bank?
  
11. An investment of \$2,000 receives 5% interest annually. After how many years has the investment increased to at least \$2,500?