CHAPTER 9

Mid-Chapter Quiz

Lessons 9-1 through 9-3

RABBIT POPULATION **For Exercises 1 and 2, use the following information.** (Lesson 9-1)

Rabbits reproduce at a tremendous rate and their population increases exponentially in the absence of natural enemies. Suppose there were originally 65,000 rabbits in a region and two years later there are 2,500,000.

1. Write an exponential function that could be used to model the rabbit population y in that region. Write the function in terms of x, the number of years since the original year.
2. Assume that the rabbit population continued to grow at that rate. Estimate the rabbit population in that region seven years later.
3. Determine whether $5(1.2)^x$ represents exponential *growth* or *decay*. Explain. (Lesson 9-1)
4. **SAVINGS** Suppose you deposit $500 in an account paying 4.5% interest compounded semiannually. Find the dollar value of the account rounded to the nearest penny after 10 years. (Lesson 9-1)

Evaluate each expression. (Lesson 9-2)

5. $\log_8 16$
6. $\log_4 4^{15}$
7. **MULTIPLE CHOICE** What is the value of n if $\log_3 3^{4n-1} = 11$? (Lesson 9-2)

   A 3

   B 4

   C 6

   D 12

Solve each equation or inequality. Check your solution. (Lessons 9-1 through 9-3)

8. $3^{4x} = 3^{3-x}$
9. $3^{2n} \leq \frac{1}{9}$
10. $3^{5x} \cdot 81^{1-x} = 9^{x-3}$
11. $49^x = 7^{x^2-15}$
12. $\log_2 (x + 6) > 5$
13. $\log_5 (4x - 1) = \log_5 (3x + 2)$
14. **MULTIPLE CHOICE** Find the value of x for $\log_2 (9x + 5) = 2 + \log_2 (x^2 - 1)$. (Lesson 9-3)

    F -0.4 **H** 1

    G 0 **J** 3

HEALTH **For Exercises 15–17, use the following information.** (Lesson 9-3)

The pH of a person's blood is given by the function $\text{pH} = 6.1 + \log_{10} B - \log_{10} C$, where B is the concentration of bicarbonate, which is a base, in the blood, and C is the concentration of carbonic acid in the blood.

Substance	pH
Lemon juice	2.3
Milk	6.4
Baking soda	8.4
Ammonia	11.9
Drain cleaner	14.0

15. Use the Quotient Property of Logarithms to simplify the formula for blood pH.
16. Most people have a blood pH of 7.4. What is the approximate ratio of bicarbonate to carbonic acid for blood with this pH?
17. If a person's ratio of bicarbonate to carbonic acid is 17.5:2.25, determine which substance has a pH closest to this person's blood.

ENERGY **For Exercises 18–20, use the following information.** (Lesson 9-3)

The energy E (in kilocalories per gram molecule) needed to transport a substance from the outside to the inside of a living cell is given by $E = 1.4(\log_{10} C_2 - \log_{10} C_1)$, where C_1 is the concentration of the substance outside the cell and C_2 is the concentration inside the cell.

18. Express the value of E as one logarithm.
19. Suppose the concentration of a substance inside the cell is twice the concentration outside the cell. How much energy is needed to transport the substance on the outside of the cell to the inside? (Use $\log_{10} 2 \approx 0.3010$.)
20. Suppose the concentration of a substance inside the cell is four times the concentration outside the cell. How much energy is needed to transport the substance from the outside of the cell to the inside?