

CHAPTER 4 TEST

- Graph $f(x) = 2^x$ and $g(x) = 2^{x+1}$ in the same rectangular coordinate system.
- Graph $f(x) = \log_2 x$ and $g(x) = \log_2(x - 1)$ in the same rectangular coordinate system.
- Write in exponential form: $\log_5 125 = 3$.
- Write in logarithmic form: $\sqrt{36} = 6$.
- Find the domain: $f(x) = \ln(3 - x)$.

In Exercises 6–7, use properties of logarithms to expand each logarithmic expression as much as possible. Where possible, evaluate logarithmic expressions without using a calculator.

6. $\log_4(64x^5)$ 7. $\log_3\left(\frac{\sqrt[3]{x}}{81}\right)$

In Exercises 8–9, write each expression as a single logarithm.

8. $6 \log x + 2 \log y$ 9. $\ln 7 - 3 \ln x$
10. Use a calculator to evaluate $\log_{15} 71$ to four decimal places.

In Exercises 11–18, solve each equation.

11. $3^{x-2} = 9^{x+4}$ 12. $5^x = 1.4$
13. $400e^{0.005x} = 1600$ 14. $e^{2x} - 6e^x + 5 = 0$
15. $\log_6(4x - 1) = 3$ 16. $2 \ln(3x) = 8$
17. $\log x + \log(x + 15) = 2$
18. $\ln(x - 4) - \ln(x + 1) = \ln 6$
19. On the decibel scale, the loudness of a sound, D , in decibels, is given by $D = 10 \log \frac{I}{I_0}$, where I is the intensity of the sound, in watts per meter², and I_0 is the intensity of a sound barely audible to the human ear. If the intensity of a sound is $10^{12}I_0$, what is its loudness in decibels? (Such a sound is potentially damaging to the ear.)

In Exercises 20–22, simplify each expression.

20. $\ln e^{5x}$
21. $\log_b b$
22. $\log_6 1$

Use the compound interest formulas to solve Exercises 23–25.

23. Suppose you have \$3000 to invest. Which investment yields the greater return over 10 years: 6.5% compounded semiannually or 6% compounded continuously? How much more (to the nearest dollar) is yielded by the better investment?
24. How long, to the nearest tenth of a year, will it take \$4000 to grow to \$8000 at 5% annual interest compounded quarterly?
25. What interest rate, to the nearest tenth of a percent, is required for an investment subject to continuous compounding to double in 10 years?
26. The function

$$A = 82.3e^{-0.004t}$$

models the population of Germany, A , in millions, t years after 2010.

- a. What was the population of Germany in 2010?
- b. Is the population of Germany increasing or decreasing? Explain.
- c. In which year will the population of Germany be 79.1 million?
27. The 2010 population of Asia was 4121 million; in 2050, it is projected to be 5231 million. Write the exponential growth function that describes the population of Asia, in millions, t years after 2010.
28. Use the exponential decay model, $A = A_0e^{kt}$, to solve this exercise. The half-life of iodine-131 is 7.2 days. How long will it take for a sample of this substance to decay to 30% of its original amount? Round to one decimal place.