

## 5.4 Assess Your Understanding

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**'Are You Prepared?'** Answers are given at the end of these exercises. If you get a wrong answer, read the pages listed in red.

1. Solve each inequality:

(a)  $3x - 7 \leq 8 - 2x$  (pp. A75–A78)

(b)  $x^2 - x - 6 > 0$  (pp. 155–157)

2. Solve the inequality:  $\frac{x-1}{x+4} > 0$  (pp. 214–217)

3. Solve:  $2x + 3 = 9$  (pp. A44–A51)

### Concepts and Vocabulary

4. The domain of the logarithmic function  $f(x) = \log_a x$  is \_\_\_\_\_.

5. The graph of every logarithmic function  $f(x) = \log_a x$ , where  $a > 0$  and  $a \neq 1$ , passes through three points: \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.

6. If the graph of a logarithmic function  $f(x) = \log_a x$ , where  $a > 0$  and  $a \neq 1$ , is increasing, then its base must be larger than \_\_\_\_\_.

7. **True or False** If  $y = \log_a x$ , then  $y = a^x$ .

8. **True or False** The graph of  $f(x) = \log_a x$ , where  $a > 0$  and  $a \neq 1$ , has an  $x$ -intercept equal to 1 and no  $y$ -intercept.

### Skill Building

In Problems 9–16, change each exponential statement to an equivalent statement involving a logarithm.

9.  $9 = 3^2$

10.  $16 = 4^2$

11.  $a^2 = 1.6$

12.  $a^3 = 2.1$

13.  $2^x = 7.2$

14.  $3^x = 4.6$

15.  $e^x = 8$

16.  $e^{2.2} = M$

In Problems 17–24, change each logarithmic statement to an equivalent statement involving an exponent.

17.  $\log_2 8 = 3$

18.  $\log_3 \left( \frac{1}{9} \right) = -2$

19.  $\log_a 3 = 6$

20.  $\log_b 4 = 2$

21.  $\log_3 2 = x$

22.  $\log_2 6 = x$

23.  $\ln 4 = x$

24.  $\ln x = 4$

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In Problems 25–36, find the exact value of each logarithm without using a calculator.

25.  $\log_2 1$

26.  $\log_5 8$

27.  $\log_2 25$

28.  $\log_3 \left( \frac{1}{9} \right)$

29.  $\log_{1/2} 16$

30.  $\log_{1/3} 9$

31.  $\log_{10} \sqrt{10}$

32.  $\log_5 \sqrt[3]{25}$

33.  $\log_{\sqrt{2}} 4$

34.  $\log_{\sqrt{3}} 9$

35.  $\ln \sqrt{e}$

36.  $\ln e^3$

In Problems 37–48, find the domain of each function.

37.  $f(x) = \ln(x - 3)$

38.  $g(x) = \ln(x - 1)$

39.  $F(x) = \log_2 x^2$

40.  $H(x) = \log_5 x^3$

41.  $f(x) = 3 - 2 \log_4 \left[ \frac{x}{2} - 5 \right]$

42.  $g(x) = 8 + 5 \ln(2x + 3)$

43.  $f(x) = \ln \left( \frac{1}{x+1} \right)$

44.  $g(x) = \ln \left( \frac{1}{x-5} \right)$

45.  $g(x) = \log_5 \left( \frac{x+1}{x} \right)$

46.  $h(x) = \log_3 \left( \frac{x}{x-1} \right)$

47.  $f(x) = \sqrt{\ln x}$

48.  $g(x) = \frac{1}{\ln x}$

In Problems 49–56, use a calculator to evaluate each expression. Round your answer to three decimal places.

49.  $\ln \frac{5}{3}$

50.  $\frac{\ln 5}{3}$

51.  $\frac{\ln \frac{10}{3}}{0.04}$

52.  $\frac{\ln \frac{2}{3}}{-0.1}$

53.  $\frac{\ln 4 + \ln 2}{\log 4 + \log 2}$

54.  $\frac{\log 15 + \log 20}{\ln 15 + \ln 20}$

55.  $\frac{2 \ln 5 + \log 50}{\log 4 - \ln 2}$

56.  $\frac{3 \log 80 - \ln 5}{\log 5 + \ln 20}$

57. Find  $a$  so that the graph of  $f(x) = \log_a x$  contains the point  $(2, 2)$ .

58. Find  $a$  so that the graph of  $f(x) = \log_a x$  contains the point  $\left( \frac{1}{2}, -4 \right)$ .

In Problems 59–62, graph each function and its inverse on the same Cartesian plane.