Rewrite the equation in exponential form.

1. \( \log_7 49 = 2 \)
2. \( \log_2 16 = 4 \)
3. \( \log_5 125 = 3 \)
4. \( \log_{16} 4 = \frac{1}{2} \)
5. \( \log_4 \frac{1}{4} = -1 \)
6. \( \log_3 \frac{1}{9} = -2 \)

Evaluate the logarithm without using a calculator.

7. \( \log_9 81 \)
8. \( \log_8 1 \)
9. \( \log_3 \frac{1}{3} \)
10. \( \log_4 2 \)
11. \( \log_{27} 3 \)
12. \( \log_4 4^{2/3} \)

Use a calculator to evaluate the logarithm. Round the result to three decimal places.

13. \( \ln \sqrt{5} \)
14. \( \log 110 \)
15. \( \ln \frac{1}{2} \)

Find the inverse of the function.

16. \( y = \log_3 x \)
17. \( y = \ln x \)
18. \( y = \log_{1/5} x \)
19. \( y = \log \frac{x}{2} \)
20. \( y = \log_6 (x + 2) \)
21. \( y = \log_3 9x \)

Graph the function. State the domain and range.

22. \( f(x) = \log_3 x \)
23. \( f(x) = \log_3 (x + 2) \)
24. \( f(x) = -\log_3 x - 1 \)

25. Galloping Speed  Four-legged animals run with two different types of motion: trotting and galloping. An animal that is trotting has at least one foot on the ground at all times. An animal that is galloping has all four feet off the ground at times. The number \( S \) of strides per minute at which an animal breaks from a trot to a gallop is related to the animal’s weight \( w \) (in pounds) by the model \( S = 256.2 - 47.9 \log w \). Approximate the number of strides per minute for a 450 pound horse when it breaks from a trot to a gallop.

26. Tornadoes   The wind speed \( S \) (in miles per hour) near the center of a tornado is related to the distance \( d \) (in miles) the tornado travels by the model \( S = 93 \log d + 65 \). Approximate the wind speed of a tornado that traveled 75 miles.
Match the expression with the logarithm that has the same value.

1. \( \log \sqrt{2} + \log \sqrt{8} \)  
2. \( \log 4 - \log 10 \)  
3. \( 2 \log 4 - \log 2 \)  
4. \(-3 \log \frac{1}{3}\)

A. \( \log \frac{2}{5} \)  
B. \( \log 27 \)  
C. \( \log 4 \)  
D. \( \log 8 \)

Use \( \log 4 = 0.602 \) and \( \log 7 = 0.845 \) to evaluate the logarithm.

5. \( \log 28 \)  
6. \( \log \frac{7}{4} \)  
7. \( \log 16 \)

8. \( \log 49 \)  
9. \( \log \frac{1}{4} \)  
10. \( \log 49/64 \)

Expand the expression.

11. \( \log_3 3x \)  
12. \( \log_2 \frac{2x}{5} \)  
13. \( \log_7 x^2y \)

14. \( \log_2 \frac{x^2}{4} \)  
15. \( \ln \sqrt{xy} \)  
16. \( \log 5 \sqrt{r} \)

17. \( \ln 1/2x^2 \)  
18. \( \log_y 2x^3 \)  
19. \( \log_6 \frac{x3y^2}{z} \)

Condense the expression.

20. \( \log_3 4 + \log_3 2 + \log_3 2 \)  
21. \( \log 4 + 3 \log x + \log y \)

22. \( \log 3 + \frac{1}{2} \log x - \log 5 \)  
23. \( 2 \ln x - \ln 3 + \ln 6 \)

24. \( 3 \log x + \log 4 - \log x - \log 6 \)  
25. \( 3 \ln(x + 1) - 2 \ln y + \ln y + \ln 2 \)

Use the change-of-base formula to evaluate the logarithm. Round your result to three decimal places.

26. \( \log_7 12 \)  
27. \( \log_4 112 \)  
28. \( \log_2 1.25 \)

29. \( \log_{2.2} 22 \)  
30. \( \log_{4.2} 18.1 \)  
31. \( \log_{1/3} 0.0005 \)

In Exercises 32–34, use the following information.

Henderson-Hasselbach Formula  The pH of a patient’s blood can be calculated using the Henderson-Hasselbach Formula, \( \text{pH} = 6.1 + \log \frac{B}{C} \), where \( B \) is the concentration of bicarbonate and \( C \) is the concentration of carbonic acid. The normal pH of blood is approximately 7.4.

32. Expand the right side of the formula.

33. Find the pH of blood that has bicarbonate concentration of 38 and carbonic acid concentration of 2.0.

34. Is the pH in Exercise 33 above normal or below normal?