

Exercises

Communicate

- Describe the relationship between logarithmic functions and exponential functions.
- State the domain and range of logarithmic functions. How are they related to the domain and range of exponential functions?
- Explain how to approximate the value of x in $2^x = 58$ by using the table feature of a graphics calculator.

Guided Skills Practice

- Write $4^2 = 16$ in logarithmic form. (EXAMPLE 1)
- Write $\log_5 25 = 2$ in exponential form. (EXAMPLE 1)

Solve each equation for x . Round your answers to the nearest thousandth. (EXAMPLE 2)

6. $10^x = 568$

7. $10^x = \frac{1}{500}$

Find the value of v in each equation. (EXAMPLE 3)

8. $v = \log_7 49$

9. $2 = \log_v 144$

10. $2 = \log_4 v$

APPLICATION

11. CHEMISTRY The pH of black coffee is 5. What is $[H^+]$ for this coffee? (EXAMPLE 4)

Practice and Apply

Write each equation in logarithmic form.

12. $11^2 = 121$

13. $5^4 = 625$

14. $3^5 = 243$

15. $6^3 = 216$

16. $6^{-2} = \frac{1}{36}$

17. $7^{-2} = \frac{1}{49}$

18. $27^{\frac{1}{3}} = 3$

19. $16^{\frac{1}{4}} = 2$

20. $\left(\frac{1}{4}\right)^{-3} = 64$

21. $\left(\frac{1}{9}\right)^{-2} = 81$

22. $\left(\frac{1}{3}\right)^2 = \frac{1}{9}$

23. $\left(\frac{1}{2}\right)^3 = \frac{1}{8}$

Write each equation in exponential form.

24. $\log_6 36 = 2$

25. $\log_{10} 1000 = 3$

26. $\log_{10} 0.001 = -3$

27. $\log_{10} 0.1 = -1$

28. $3 = \log_9 729$

29. $3 = \log_7 343$

30. $\log_3 \frac{1}{81} = -4$

31. $\log_2 \frac{1}{32} = -5$

32. $-2 = \log_2 \frac{1}{4}$

33. $-3 = \log_3 \frac{1}{27}$

34. $\log_{121} 11 = \frac{1}{2}$

35. $\log_{144} 12 = \frac{1}{2}$

Find the approximate value of each logarithmic expression.

36. $\log_{10} 1026$

37. $\log_{10} 79$

38. $\log_{10} 8$

39. $\log_{10} 21,050$

40. $\log_{10} 0.08$

41. $\log_{10} 0.9$

42. $\log_{10} 0.002$

43. $\log_{10} 0.00013$

Solve each equation for x . Round your answers to the nearest hundredth.

44. $10^x = 31$

45. $10^x = 12$

46. $10^x = 7210$

47. $10^x = 3588$

48. $10^x = 1.498$

49. $10^x = 1.89$

50. $10^x = 0.0054$

51. $10^x = 0.035$

52. $10^x = \frac{3}{49}$

53. $10^x = \frac{1}{1085}$

54. $10^x = \sqrt{7.4}$

55. $10^x = \frac{1}{\sqrt{500}}$

Find the value of v in each equation.

56. $v = \log_{10} 1000$

57. $v = \log_4 64$

58. $v = \log_7 343$

59. $v = \log_{17} 289$

60. $v = \log_3 3$

61. $v = \log_7 7$

62. $v = \log_{10} 0.001$

63. $v = \log_{10} 0.01$

64. $v = \log_2 \frac{1}{4}$

65. $v = \log_{10} \frac{1}{100}$

66. $v = \log_4 1$

67. $v = \log_9 1$

68. $3 = \log_6 v$

69. $2 = \log_7 v$

70. $1 = \log_5 v$

71. $1 = \log_3 v$

72. $\frac{1}{2} = \log_9 v$

73. $\frac{1}{3} = \log_8 v$

74. $-2 = \log_6 v$

75. $-3 = \log_4 v$

76. $0 = \log_{13} v$

77. $0 = \log_2 v$

78. $\log_v 16 = 2$

79. $\log_v 125 = 3$

80. $\log_v 9 = \frac{1}{2}$

81. $\log_v 4 = \frac{1}{3}$

82. $\log_v \frac{1}{16} = -4$

83. $\log_v \frac{1}{8} = -3$

84. $\log_v 216 = 3$

85. $\log_v 243 = 5$

86. Graph $f(x) = 3^x$ along with f^{-1} . Make a table of values that illustrates the relationship between f and f^{-1} .

87. Graph $f(x) = 3^{-x}$ along with f^{-1} . Make a table of values that illustrates the relationship between f and f^{-1} .

CHALLENGES

Find the value of each expression.

88. $\log_{27} \sqrt{3}$

89. $\log_2 16\sqrt{2}$

90. $\log_{\frac{1}{2}} 8$

TRANSFORMATIONS Let $f(x) = \log_{10} x$. For each function, identify the transformations from f to g .

91. $g(x) = 3 \log_{10} x$

92. $g(x) = -5 \log_{10} x$

93. $g(x) = \frac{1}{2} \log_{10} x + 1$

94. $g(x) = 0.25 \log_{10} x - 2$

95. $g(x) = -\log_{10}(x - 2)$

96. $g(x) = \log_{10}(x + 5) - 3$

CHEMISTRY Calculate $[H^+]$ for each of the following:

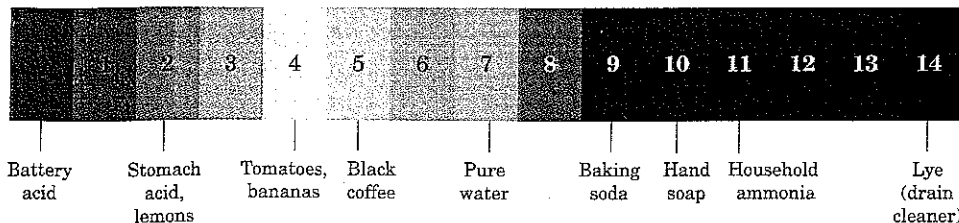
97. household ammonia with a pH of about 10

98. distilled water with a pH of 7

99. human blood with a pH of about 7.4

100. CHEMISTRY How much greater is $[H^+]$ for lemon juice, which has a pH of 2.1, than $[H^+]$ for water, which has a pH of 7.0?

pH paper turns red in an acidic solution, $0 < \text{pH} < 7$; the paper turns green in a neutral solution, indicating a pH of 7; and the paper turns blue in a basic solution, $7 < \text{pH} < 14$.



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