

4.3 EXERCISES

 PRACTICE

Write the following equations in logarithmic terms.

1. $625 = 5^4$

2. $216 = 6^3$

3. $x^3 = 27$

4. $b^2 = 3.2$

5. $4.2^3 = C$

6. $1.3^2 = V$

7. $4^x = 31$

8. $16^{2x} = 215$

9. $(4x)^{\sqrt{5}} = 13$

10. $e^x = \pi$

11. $2^{e^x} = 11$

12. $4^e = N$

Write the following logarithmic equations as exponential equations.

13. $\log_3 81 = 4$

14. $\log_2 \left(\frac{1}{8} \right) = -3$

15. $\log_b 4 = \frac{1}{2}$

16. $\log_y 9 = 2$

17. $\log_2 15 = b$

18. $\log_5 8 = d$

19. $\log_5 W = 12$

20. $\log_7 T = 6$

21. $\log_\pi (2x) = 4$

22. $\log_{\sqrt{3}} (2\pi) = x$

23. $\ln 2 = x$

24. $\ln(5x) = 3$

Sketch the graphs of the following functions. State their domain and range. See Examples 2 and 3.

25. $f(x) = \log_3 (x - 1)$

26. $g(x) = \log_5 (x + 2) - 1$

27. $r(x) = \log_{\frac{1}{2}} (x - 3)$

28. $p(x) = 3 - \log_2 (x + 1)$

29. $q(x) = \log_3 (2 - x)$

30. $s(x) = \log_{\frac{1}{3}} (5 - x)$

31. $h(x) = \log_7 (x - 3) + 3$

32. $m(x) = \log_{\frac{1}{2}} (1 - x)$

33. $f(x) = \log_3 (6 - x)$

34. $p(x) = 4 - \log(x + 3)$

35. $s(x) = -\log_{\frac{1}{3}} (-x)$

36. $g(x) = \log_5 (2x) - 1$

Match the graph of the appropriate equation to the logarithmic function.

37. $f(x) = \log_2 (x - 1)$

38. $f(x) = \log_2 (2 - x)$

39. $f(x) = \log_2 (-x)$

40. $f(x) = \log_2 (x - 3)$

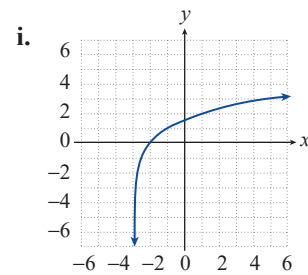
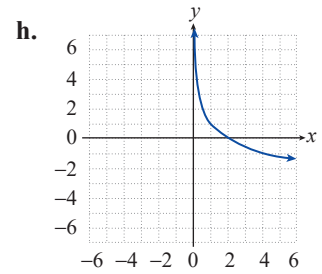
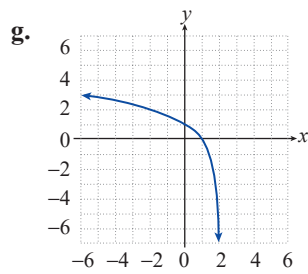
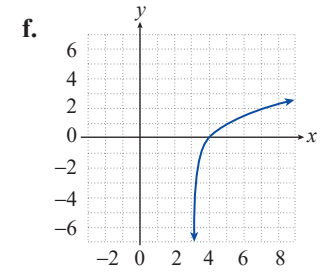
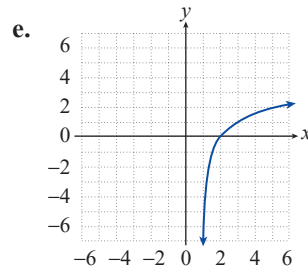
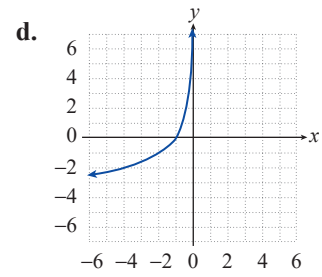
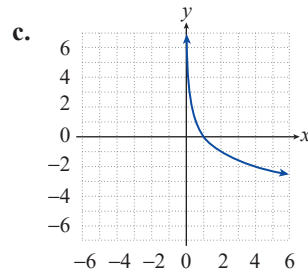
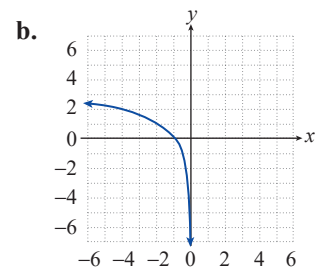
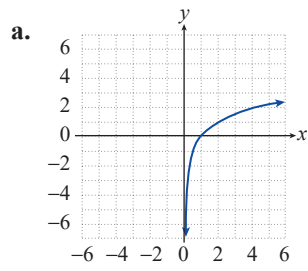
41. $f(x) = 1 - \log_2 x$

42. $f(x) = -\log_2 x$

43. $f(x) = -\log_2 (-x)$

44. $f(x) = \log_2 x$

45. $f(x) = \log_2 (x + 3)$



Evaluate the following logarithmic expressions without the use of a calculator. See Examples 4 and 6.

46. $\log_7(\sqrt{7})$

47. $\log_{\frac{1}{2}} 4$

48. $\log_9\left(\frac{1}{81}\right)$

49. $\log_3 27$

50. $\log_{27} 3$

51. $\log_9\left(\frac{1}{3}\right)$

52. $\log_{27} 9$

53. $\log_{\frac{1}{16}}\left(\frac{1}{8}\right)$

54. $\log_3(\log_{27} 3)$

55. $\ln e^{2.89}$

56. $\log(0.0001)$

57. $\log_a\left(a^{\frac{5}{3}}\right)$

58. $\ln\left(\frac{1}{e}\right)$

59. $\log(\log(10^{10}))$

60. $\log_3 1$

61. $\ln(\sqrt[5]{e})$

62. $\log_{\frac{1}{16}} 4$

63. $\log_8 4^{\log 1000}$

Use the elementary properties of logarithms to solve the following equations. See Example 5.

64. $\log_{16} x = \frac{3}{4}$

65. $\log_{16}(x^2) = \frac{3}{4}$

66. $\log_{16} x = -\frac{3}{4}$

67. $\log_5(5^{\log_3 x}) = 2$

68. $\log_a(a^{\log_b x}) = 0$

69. $\log_3(9^{2x}) = -2$

70. $\log_{\frac{1}{3}}(3^x) = 2$

71. $\log_7(3x) = -1$

72. $4^{\log_3 x} = 0$

73. $\log(x^{10}) = 10$

74. $\log_x\left(\log_{\frac{1}{2}}\left(\frac{1}{4}\right)\right) = 1$

75. $6^{\log_x(e^2)} = e$

Hint: Note that $\log_a b = \log_{a^2} b^2$. This follows from the fact that

$$\log_a b = y \Leftrightarrow b = a^y \Leftrightarrow b^2 = a^{2y} = (a^2)^y \Leftrightarrow \log_{a^2} b^2 = y.$$

Solve the following logarithmic equations, using a calculator if necessary to evaluate the logarithms. See Examples 5 and 6. Express your answer either as a fraction or a decimal rounded to two decimal places.

76. $\log(3x) = 2.1$

77. $\log(x^2) = -2$

78. $\ln(x+1) = 3$

79. $\ln(2x) = -1$

80. $\ln(e^x) = 5.6$

81. $\ln(\ln(x^2)) = 0$

82. $\log 19 = 3x$

83. $\log(e^x) = 5.6$

84. $\log_9(2x-1) = 2$

85. $\log(\log(x-2)) = 1$

86. $\log(300^{\log x}) = 9$