EXERCISE SET 4.2

Practice Exercises

In Exercises 1–8, write each equation in its equivalent exponential form.

1. $4 = \log_2 16$
2. $6 = \log_2 64$
3. $2 = \log_3 x$
4. $2 = \log_9 x$
5. $5 = \log_b 32$
6. $3 = \log_b 27$
7. $\log_6 216 = y$
8. $\log_5 125 = y$

In Exercises 9–20, write each equation in its equivalent logarithmic form.

9. $2^3 = 8$
10. $5^4 = 625$
11. $2^{-4} = \frac{1}{16}$
12. $5^{-3} = \frac{1}{125}$
13. $\sqrt[3]{8} = 2$
14. $\sqrt[3]{64} = 4$
15. $13^2 = x$
16. $15^2 = x$
17. $b^3 = 1000$
18. $b^3 = 343$
19. $7^y = 200$
20. $8^y = 300$

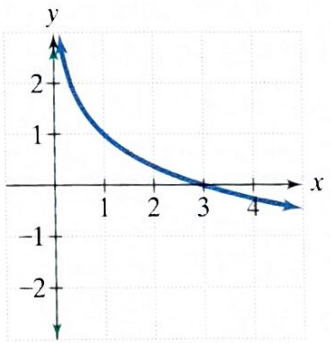
In Exercises 21–42, evaluate each expression without using a calculator.

21. $\log_4 16$
22. $\log_7 49$
23. $\log_2 64$
24. $\log_3 27$
25. $\log_5 \frac{1}{5}$
26. $\log_6 \frac{1}{6}$
27. $\log_2 \frac{1}{8}$
28. $\log_3 \frac{1}{9}$
29. $\log_7 \sqrt{7}$
30. $\log_6 \sqrt{6}$
31. $\log_2 \frac{1}{\sqrt{2}}$
32. $\log_3 \frac{1}{\sqrt{3}}$
33. $\log_{64} 8$
34. $\log_{81} 9$
35. $\log_5 5$
36. $\log_{11} 11$
37. $\log_4 1$
38. $\log_6 1$
39. $\log_5 5^7$
40. $\log_4 4^6$
41. $8^{\log_8 19}$
42. $7^{\log_7 23}$
43. Graph $f(x) = 4^x$ and $g(x) = \log_4 x$ in the same rectangular coordinate system.
44. Graph $f(x) = 5^x$ and $g(x) = \log_5 x$ in the same rectangular coordinate system.
45. Graph $f(x) = \left(\frac{1}{2}\right)^x$ and $g(x) = \log_{\frac{1}{2}} x$ in the same rectangular coordinate system.
46. Graph $f(x) = \left(\frac{1}{4}\right)^x$ and $g(x) = \log_{\frac{1}{4}} x$ in the same rectangular coordinate system.

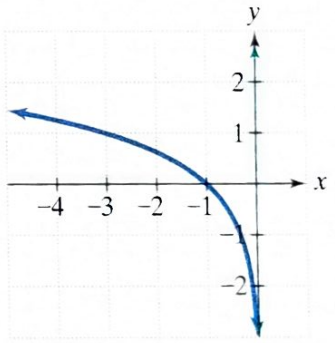
In Exercises 47–52, the graph of a logarithmic function is given. Select the function for each graph from the following options:

$$f(x) = \log_3 x,\ g(x) = \log_3(x - 1),\ h(x) = \log_3 x - 1,$$
$$F(x) = -\log_3 x,\ G(x) = \log_3(-x),\ H(x) = 1 - \log_3 x.$$

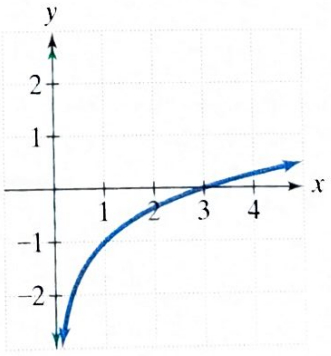
47.



48.



49.



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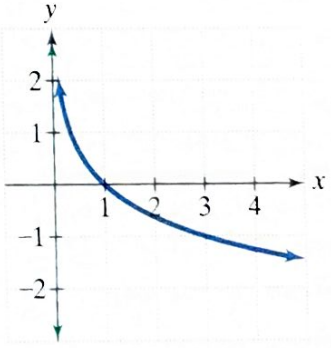
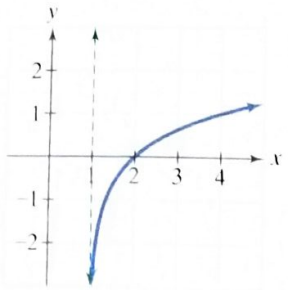
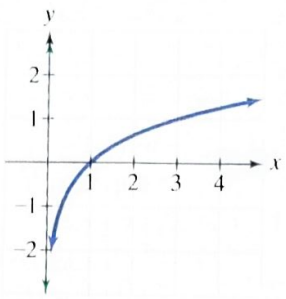


51.



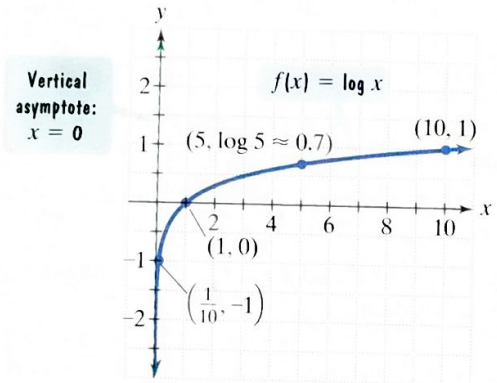
52.



In Exercises 53–58, begin by graphing $f(x) = \log_2 x$. Then use transformations of this graph to graph the given function. What is the vertical asymptote? Use the graphs to determine each function's domain and range.

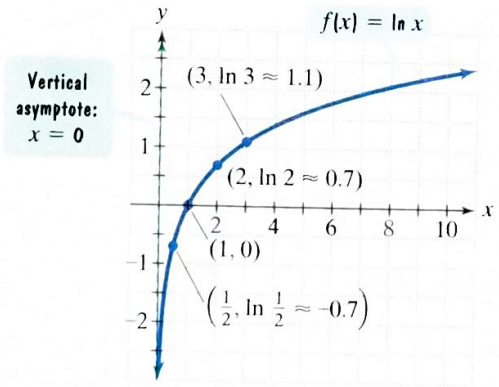
53. $g(x) = \log_2(x + 1)$
54. $g(x) = \log_2(x + 2)$
55. $h(x) = 1 + \log_2 x$
56. $h(x) = 2 + \log_2 x$
57. $g(x) = \frac{1}{2}\log_2 x$
58. $g(x) = -2\log_2 x$

The figure shows the graph of $f(x) = \log x$. In Exercises 59–64, use transformations of this graph to graph each function. Graph and give equations of the asymptotes. Use the graphs to determine each function's domain and range.



59. $g(x) = \log(x - 1)$
60. $g(x) = \log(x - 2)$
61. $h(x) = \log x - 1$
62. $h(x) = \log x - 2$
63. $g(x) = 1 - \log x$
64. $g(x) = 2 - \log x$

The figure shows the graph of $f(x) = \ln x$. In Exercises 65–74, use transformations of this graph to graph each function. Graph and give equations of the asymptotes. Use the graphs to determine each function's domain and range.



65. $g(x) = \ln(x + 2)$
66. $g(x) = \ln(x + 1)$
67. $h(x) = \ln(2x)$
68. $h(x) = \ln\left(\frac{1}{2}x\right)$
69. $g(x) = 2 \ln x$
70. $g(x) = \frac{1}{2} \ln x$
71. $h(x) = -\ln x$
72. $h(x) = \ln(-x)$
73. $g(x) = 2 - \ln x$
74. $g(x) = 1 - \ln x$

In Exercises 75–80, find the domain of each logarithmic fun

75. $f(x) = \log_5(x + 4)$
76. $f(x) = \log_5(x + 6)$
77. $f(x) = \log(2 - x)$
78. $f(x) = \log(7 - x)$
79. $f(x) = \ln(x - 2)^2$
80. $f(x) = \ln(x - 7)^2$

In Exercises 81–100, evaluate or simplify each expression w using a calculator.

81. $\log 100$
82. $\log 1000$
83. $\log 10^7$
84. $\log 10^8$
85. $10^{\log 33}$
86. $10^{\log 53}$
87. $\ln 1$
88. $\ln e$
89. $\ln e^6$
90. $\ln e^7$
91. $\ln \frac{1}{e^6}$
92. $\ln \frac{1}{e^7}$
93. $e^{\ln 125}$
94. $e^{\ln 300}$
95. $\ln e^{9x}$
96. $\ln e^{13x}$
97. $e^{\ln 5x^2}$
98. $e^{\ln 7x^2}$
99. $10^{\log\sqrt{x}}$
100. $10^{\log\sqrt[3]{x}}$

Practice Plus

In Exercises 101–104, write each equation in its equivalent exponential form. Then solve for x.

101. $\log_3(x - 1) = 2$
102. $\log_5(x + 4) = 2$
103. $\log_4 x = -3$
104. $\log_{64} x = \frac{2}{3}$

In Exercises 105–108, evaluate each expression without using a calculator.

105. $\log_3(\log_7 7)$
106. $\log_5(\log_2 32)$
107. $\log_2(\log_3 81)$
108. $\log(\ln e)$

In Exercises 109–112, find the domain of each logarithmic function.

109. $f(x) = \ln(x^2 - x - 2)$
110. $f(x) = \ln(x^2 - 4x - 12)$
111. $f(x) = \log\left(\frac{x + 1}{x - 5}\right)$
112. $f(x) = \log\left(\frac{x - 2}{x + 5}\right)$