# EXERCISE SET 4.4

Solve each exponential equation in Exercises 1–22 by expressing each side as a power of the same base and then equating exponents.

**1.** $2^x = 64$

**2.** $3^x = 81$

**3.** $5^x = 125$

**4.** $5^x = 625$

**5.** $2^{2x-1} = 32$

**6.** $3^{2x+1} = 27$

**7.** $4^{2x-1} = 64$

**8.** $5^{3x-1} = 125$

**9.** $32^x = 8$

**10.** $4^x = 32$

**11.** $9^x = 27$

**12.** $125^x = 625$

**13.** $3^{1-x} = \frac{1}{27}$

**14.** $5^{2-x} = \frac{1}{125}$

**15.** $6^{\frac{x-3}{4}} = \sqrt{6}$

**16.** $7^{\frac{x-2}{6}} = \sqrt{7}$

**17.** $4^x = \dfrac{1}{\sqrt{2}}$

**18.** $9^x = \dfrac{1}{\sqrt[3]{3}}$

**19.** $8^{x+3} = 16^{x-1}$

**20.** $8^{1-x} = 4^{x+2}$

**21.** $e^{x+1} = \dfrac{1}{e}$

**22.** $e^{x+4} = \dfrac{1}{e^{2x}}$

Solve each exponential equation in Exercises 23–48. Express the solution set in terms of natural logarithms or common logarithms. Then use a calculator to obtain a decimal approximation, correct to two decimal places, for the solution.

**23.** $10^x = 3.91$

**24.** $10^x = 8.07$

**25.** $e^x = 5.7$

**26.** $e^x = 0.83$

**27.** $5^x = 17$

**28.** $19^x = 143$

**29.** $5e^x = 23$

**30.** $9e^x = 107$

**31.** $3e^{5x} = 1977$

**32.** $4e^{7x} = 10.273$

**33.** $e^{1-5x} = 793$

**34.** $e^{1-8x} = 7957$

**35.** $e^{5x-3} - 2 = 10,476$

**36.** $e^{4x-5} - 7 = 11.243$

**37.** $7^{x+2} = 410$

**38.** $5^{x-3} = 137$

**39.** $7^{0.3x} = 813$

**40.** $3^{\frac{x}{7}} = 0.2$

**41.** $5^{2x+3} = 3^{x-1}$

**42.** $7^{2x+1} = 3^{x+2}$

**43.** $e^{2x} - 3e^x + 2 = 0$

**44.** $e^{2x} - 2e^x - 3 = 0$

**45.** $e^{4x} + 5e^{2x} - 24 = 0$

**46.** $e^{4x} - 3e^{2x} - 18 = 0$

**47.** $3^{2x} + 3^x - 2 = 0$

**48.** $2^{2x} + 2^x - 12 = 0$

Solve each logarithmic equation in Exercises 49–92. Be sure to reject any value of x that is not in the domain of the original logarithmic expressions. Give the exact answer. Then, where necessary, use a calculator to obtain a decimal approximation, correct to two decimal places, for the solution.

**49.** $\log_3 x = 4$

**50.** $\log_5 x = 3$

**51.** $\ln x = 2$

**52.** $\ln x = 3$

**53.** $\log_4(x + 5) = 3$

**54.** $\log_5(x - 7) = 2$

**55.** $\log_2(x + 25) = 4$

**56.** $\log_2(x + 50) = 5$

**57.** $\log_3(x + 4) = -3$

**58.** $\log_7(x + 2) = -2$

**59.** $\log_4(3x + 2) = 3$

**60.** $\log_2(4x + 1) = 5$

**61.** $5 \ln(2x) = 20$

**62.** $6 \ln(2x) = 30$

**63.** $6 + 2 \ln x = 5$

**64.** $7 + 3 \ln x = 6$

**65.** $\ln\sqrt{x + 3} = 1$

**66.** $\ln\sqrt{x + 4} = 1$

**67.** $\log_5 x + \log_5(4x - 1) = 1$

**68.** $\log_6(x + 5) + \log_6 x = 2$

**69.** $\log_3(x + 6) + \log_3(x + 4) = 1$

**70.** $\log_6(x + 3) + \log_6(x + 4) = 1$

**71.** $\log_2(x + 2) - \log_2(x - 5) = 3$

**72.** $\log_4(x + 2) - \log_4(x - 1) = 1$

**73.** $2 \log_3(x + 4) = \log_3 9 + 2$

**74.** $3 \log_2(x - 1) = 5 - \log_2 4$

**75.** $\log_2(x - 6) + \log_2(x - 4) - \log_2 x = 2$

**76.** $\log_2(x - 3) + \log_2 x - \log_2(x + 2) = 2$

**77.** $\log(x + 4) = \log x + \log 4$

**78.** $\log(5x + 1) = \log(2x + 3) + \log 2$

**79.** $\log(3x - 3) = \log(x + 1) + \log 4$

**80.** $\log(2x - 1) = \log(x + 3) + \log 3$

**81.** $2 \log x = \log 25$

**82.** $3 \log x = \log 125$

**83.** $\log(x + 4) - \log 2 = \log(5x + 1)$

**84.** $\log(x + 7) - \log 3 = \log(7x + 1)$

**85.** $2 \log x - \log 7 = \log 112$

**86.** $\log(x - 2) + \log 5 = \log 100$

**87.** $\log x + \log(x + 3) = \log 10$

**88.** $\log(x + 3) + \log(x - 2) = \log 14$

**89.** $\ln(x - 4) + \ln(x + 1) = \ln(x - 8)$

**90.** $\log_2(x - 1) - \log_2(x + 3) = \log_2\left(\dfrac{1}{x}\right)$

**91.** $\ln(x - 2) - \ln(x + 3) = \ln(x - 1) - \ln(x + 7)$

**92.** $\ln(x - 5) - \ln(x + 4) = \ln(x - 1) - \ln(x + 2)$