CHAPTER 7 REVIEW EXERCISES

Section 7.1

Sketch the graphs of the following functions. State their domain and range.

1. $f(x) = \left(\frac{1}{2}\right)^{x-1} + 3$

2. $r(x) = 2^{-x+4} - 2$

3. $h(x) = 3^x$

4. $f(x) = 1 - 2^{-x}$

5. $p(x) = \left(\frac{1}{4}\right)^x$

6. $s(x) = (0.2)^{x-2}$

7. $g(x) = 4 - 2^x$

8. $m(x) = \frac{1}{2^x} - 3$

9. $f(x) = \frac{1}{2^{4-x}}$

10. $r(x) = \left(\frac{9}{2}\right)^{3-x}$

Solve the following exponential equations.

11. $3^x = 243$

12. $2^{-x} = 16$

13. $0.5^x = 0.25$

14. $3^{3x-5} = 81$

15. $\left(\frac{2}{5}\right)^{-4x} = \left(\frac{25}{4}\right)^{x-1}$

16. $10{,}000^x = 10^{-2x-12}$

17. $9^{x-1} = 27^{-x+2}$

18. $\left(\frac{1}{3}\right)^{x-1} = 81^{\frac{1}{2}}$

19. $5^{3x-6} = 1$

Section 7.2

20. Melissa has recently inherited $15,000 that she wants to deposit into a savings account for 10 years. She has determined that her two best bets are an account that compounds annually at a rate of 3.95% and an account that compounds continuously at an annual rate of 3.85%. Which account would pay Melissa more interest?

21. Bill has come upon a 37-gram sample of iodine-131. He isolates the sample and waits for 2 weeks. After this time period, only 11 grams of iodine-131 remain. What is the half-life of this isotope?

22. Katherine is working in a lab testing bacteria populations. Starting out with a population of 870 bacteria, she notices that the population doubles every 22 minutes. Find **a.** the equation for the population P in terms of time t in minutes, and **b.** the time it would take for the population to reach 7500 bacteria.

23. The number of fruit flies in an experimental population after t hours is given by $Q(t) = 20e^{0.03t}$, $t \geq 0$.

a. How large is the population of fruit flies after 72 hours?
b. Find the initial number of fruit flies in the population.

24. In 1986, a nuclear reactor accident occurred in Chernobyl in what was then the Soviet Union. The explosion spread radioactive chemicals over hundreds of square miles and the government evacuated the city and surrounding areas. To see why the city is now uninhabited, consider the model $P = 10e^{-0.00002845t}$.

This model represents the amount of plutonium that remains (from an initial amount of 10 pounds) after t years. Sketch the graph of this function over the interval from $t = 0$ to $t = 100{,}000$. How much of the 10 pounds will remain after 100,000 years?

Section 7.3

Write the following equations in logarithmic terms.

25. $3^x = 8$ **26.** $(3a)^{\sqrt{2}} = 10$ **27.** $4^{3a} = 4096$

Write the following logarithmic equations as exponential equations.

28. $\log_4 64 = x$ **29.** $\log_3\left(\frac{1}{27}\right) = -3$ **30.** $\log_8(2A) = 3$

Sketch the graphs of the following functions. State their domain and range.

31. $f(x) = -\log_3(-x)$ **32.** $f(x) = \log_{\frac{1}{2}} x$ **33.** $m(x) = \log_{\frac{1}{2}}(x+2)$

Evaluate the following logarithmic expressions without the use of a calculator.

34. $\log_{27}\left(9^{\log 1000}\right)$ **35.** $\log_{\frac{1}{3}} 9$ **36.** $\log_4\left(\frac{1}{64}\right)$

37. $\log_{\frac{1}{2}} 8$ **38.** $\log_{\sqrt{3}}\left(\frac{1}{3}\right)$ **39.** $\ln\left(\sqrt[3]{e^2}\right)$

Use the elementary properties of logarithms to solve the following equations.

40. $\log_6\left(6^{\log_5 x}\right) = 3$ **41.** $\log_9\left(x^{\frac{1}{2}}\right) = \frac{3}{4}$

42. $\log_x\left(\log_{\frac{1}{2}}\left(\frac{1}{16}\right)\right) = 2$ **43.** $\log_4(2x-1) = 2$

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

44. $\ln(4x) = 3.2$ **45.** $\ln(x-7) = 5$ **46.** $\log_7(4x-3) = 4$

Section 7.4

Use the properties of logarithms to expand the following expressions as much as possible. Simplify any numerical expressions that can be evaluated without a calculator.

47. $\log\left(\sqrt{\dfrac{x^3}{4\pi^5}}\right)$

48. $\ln\left(\dfrac{\sqrt{a^5}mn^2}{e^5}\right)$

49. $\log_3\left(27a^3\right)$

50. $\ln\left(\ln\left(e^{2ex}\right)\right)$

Use the properties of logarithms to condense the following expressions as much as possible, writing each answer as a single term with a coefficient of 1.

51. $\dfrac{1}{3}\left(\log_2\left(a^5\right)-\log_2\left(bc^3\right)\right)$

52. $\ln 4-\ln\left(x^2\right)-7\ln y$

53. $\log_2\left(x^2-9\right)-\log_2\left(x+3\right)$

54. $2\log a+3\log b-\dfrac{1}{2}\log c-\log d$

55. $\log_3\left(x-2\right)+\log_3 x-\log_3\left(x^2+4\right)$

Use the properties of logarithms to write each of the following as a single term that does not contain a logarithm.

56. $6^{3\log_6 x}$

57. $5^{\log_5 x-2\log_5 y}$

Evaluate the following logarithmic expressions.

58. $\log_3 17$

59. $\log_{1.4} 8$

60. $4\log_{\frac{1}{2}} 3$

Without using a calculator, evaluate the following expressions.

61. $\ln\left(\dfrac{1}{e^2}\right)+\ln\left(e^2\right)$

62. $\log_4\left(64^2\right)$

63. On the Richter scale, the magnitude R on a earthquake of intensity I is given by $R=\log\left(\dfrac{I}{I_0}\right)$, where $I_0=1$ is the minimum intensity used for comparison. Find the intensity per unit of area for the following values of R.

a. $R=8.4$ **b.** $R=6.85$ **c.** $R=9.1$

Section 7.5

Solve the following exponential and logarithmic equations. When appropriate, write the answer as both an exact expression and as a decimal approximation. Round your answer to two decimal places if necessary.

64. $e^{8-5x}=16$

65. $10^{\frac{6}{x}}=321$

66. $7^{\frac{x}{3}-4}=19$

67. $e^{4x}=5^{3x+1}$

68. $24=3e^{x+2}$

69. $3^{2x-1}=2^{2-x}$

70. $\ln\left(x+1\right)+\ln\left(x-1\right)=\ln\left(x+5\right)$

71. $\log_2(x+3)+\log_2(x+4)=\log_2(3x+8)$

72. $\log_5(8x-3)=3$

73. $\log_7(4x)-\log_7 6=2$

74. $\ln(5x+8)=\ln(40-3x)$

Using the properties of logarithmic functions, simplify the following functions as much as possible. Write each function as a single term with a coefficient of 1, if possible.

75. $f(x)=0.75\ln(x^4)$

76. $f(x)=6\log(\sqrt{2x})$

77. $f(x)=4\log(x^3)-\log(x^2)$

78. $f(x)=0.5\ln(9x^6)$

79. $f(x)=2\log(7^{\log_9 3})$

80. $f(x)=2\ln(3^{\log_4 8})$

81. Rick puts $6500 in a high interest money market account at 4.36% annual interest compounded monthly. Assuming he makes no deposits or withdrawals, how long will it take for his investment to grow to $7000?

82. Sodium-24 has a half-life of approximately 15 hours. How long would it take for 350 grams of sodium-24 to decay to 12 grams?