CHAPTER 1 REVIEW EXERCISES

Section 1.1

Which elements of the following set are **a.** natural numbers, **b.** whole numbers, **c.** integers, **d.** rational numbers, **e.** irrational numbers, **f.** real numbers?

1. $\left\{\frac{3}{7}, -\sqrt{4}, 2^3, 5.3, |-2.1|, \sqrt{17}, 0\right\}$

Describe the following set using set-builder notation. There may be more than one correct way to do this.

2. $\left\{\frac{1}{2}, \frac{1}{4}, \frac{1}{6}, \frac{1}{8}, \frac{1}{10}, \ldots\right\}$

Write each set as an interval using interval notation.

3. $4 \le x < 17$

4. $\{x | -8 \le x \le -1\}$

Evaluate the absolute value expressions.

5. $-|-4-3|$

6. $-|11-2|$

7. $\left|\sqrt{9}-7\right|$

8. $\left|\sqrt{5}-\sqrt{11}\right|$

9. $-\frac{|x|}{|-x|}$

10. Liz, Monica, Peter, James, and Melissa are comparing their ages. Liz is older than Peter and Melissa is the youngest. James is the oldest and Peter is older than Monica. Order them from youngest to oldest.

Identify the components of the algebraic expressions, as indicated.

11. Identify the terms in the expression $\frac{x^2}{2y} + 12.1x - \sqrt{y+5}$.

12. Identify the coefficients in the expression $\frac{x^2}{2y} + 12.1x - \sqrt{y+5}$.

Evaluate the following algebraic expressions for the given values of the variables.

13. $7y^2 - \frac{1}{3}\pi xy + 8x^3$ for $x = -2$ and $y = 2$

14. $x^2z^3 + 5\sqrt{3x-2y}$ for $x = 2, y = 1,$ and $z = -1$

15. $\left|-3x + x^2y\right| - \frac{xy}{2}$ for $x = -3$ and $y = 4$

16. $3\sqrt{\frac{xy}{3}} - 2y^2$ for $x = 2$ and $y = 6$

Identify the property that justifies each of the following statements. If one of the cancellation properties is being used to transform an equation, identify the quantity that is being added to both sides or the quantity by which both sides are being multiplied.

17. $-4 + x = x - 4$

18. $12a^2 = 8b \Leftrightarrow 3a^2 = 2b$

19. $(x-3)(z-2) = 0 \Rightarrow x - 3 = 0$ or $z - 2 = 0$

Simplify the following set expressions.

20. $(-4,8)\cup[5,13]$

21. $(-4,8)\cap[5,13]$

Section 1.2

Use the properties of exponents to simplify each of the following expressions, writing your answer with only positive exponents.

22. $\left(2^3a^{-2}b^4\right)^{-1}c^{-3}$

23. $\dfrac{-4t^0\left(s^2t^{-2}\right)^{-3}}{2^3st^{-3}}$

24. $\left[\left(3y^{-2}z\right)^{-1}\right]^{-3}$

25. $\dfrac{3^2x^{-4}\left(y^2z\right)^{-2}}{\left(2z^{-3}\right)^{-1}y^{-6}}$

Convert each number from scientific notation to standard notation, or vice versa, as indicated.

26. -3.005×10^{-4}; convert to standard

27. 69,520,000; convert to scientific

Evaluate each expression using the properties of exponents. Use a calculator only to check your final answer.

28. $\left(3.46\times10^8\right)\left(1.2\times10^4\right)$

29. $\dfrac{2.4\times10^{-12}}{(1.2)\times10^{-4}}$

30. Sam is making a piñata in the shape of a sphere and needs to know how much candy to buy to fill it. If the radius of the piñata is 10 inches, what is the volume of the piñata?

Evaluate the following radical expressions.

31. $\sqrt{3^2+4^2}$

32. $\dfrac{\sqrt[3]{\sqrt{15}}}{\sqrt{\sqrt[3]{5}}}$

Simplify the following radical expressions. Rationalize all denominators and use only positive exponents.

33. $\sqrt{25x^{20}}$

34. $\sqrt{16x^2}$

35. $\sqrt[3]{-64x^{-9}y^3}$

36. $\dfrac{\sqrt{3a^3}}{\sqrt{12a}}$

37. $\sqrt[3]{\dfrac{8x^2}{3y^{-4}}}$

38. $\sqrt[4]{\dfrac{a^9b^{-4}}{81}}$

39. $\dfrac{4}{\sqrt{2}-\sqrt{6}}$

40. $\dfrac{3}{\sqrt{x}+\sqrt{2}}$

Simplify the following expressions.

41. $\sqrt{18x^3y}-\sqrt[3]{16x^4y}$

42. $\left(2\sqrt{3}-5\sqrt{2}\right)^2$

Convert the following expressions from radical notation to exponential notation, or vice versa. Simplify each expression in the process, if possible.

43. $\sqrt{x^{-5}} \cdot \sqrt[4]{x^3}$

44. $\left(49x^4\right)^{\frac{1}{2}}\left(16x^{12}\right)^{\frac{3}{4}}$

Section 1.3

Add or subtract the polynomials, as indicated.

45. $\left(-4m^2-5m^3+4\right)+\left(m^4+7m^2-2\right)$

46. $\left(2xy+3x\right)-\left(8x^2y-6xy+3x-y\right)$

Multiply the polynomials, as indicated.

47. $\left(x^2+y\right)\left(3x-4y^3\right)$

48. $\left(a+5b\right)\left(5a-7ab+2b\right)$

Factor each of the following polynomials.

49. x^2-x-12

50. $2x^2+x-15$

51. $6a^2-7a-5$

52. $4a^2-9b^4$

53. $36x^6-y^2$

54. $nx+3mx-2ny-6my$

55. $2x^2+6x-5xy-15y$

56. $8x^3y^2+4x^3y-12xy^2$

Factor the following algebraic expressions.

57. $\left(3x-2y\right)^{\frac{4}{3}}-\left(3x-2y\right)^{\frac{2}{3}}$

58. $8x^{-2}+5x^{-1}$

Section 1.4

Simplify the following rational expressions, indicating which real values of the variable must be excluded.

59. $\dfrac{x^3+6x^2+9x}{x^3-9x}$

60. $\dfrac{x^2-9}{x^3-27}$

Perform the indicated operations on the rational expressions and simplify your answer.

61. $\dfrac{1}{x}-\dfrac{3}{x+2}-\dfrac{6}{x^2+2x}$

62. $\dfrac{a^3-8}{a^2-4}\div\dfrac{a^3+2a^2+4a}{a^3+2a^2}\cdot\dfrac{1}{a^2+a}$

Simplify the complex rational expressions.

63. $\dfrac{\dfrac{1}{2a}-\dfrac{1}{2b}}{\dfrac{2}{a}+\dfrac{2}{b}}$

64. $\dfrac{\dfrac{x}{3}-\dfrac{3}{x}}{-\dfrac{3}{x}+1}$

65. $\dfrac{\dfrac{x}{y}-\dfrac{y}{x}}{x^{-1}-y^{-1}}$

Section 1.5

Evaluate the following square root expressions.

66. $-\sqrt{-8x}$

67. $i^3\sqrt{-9}$

Simplify the following expressions.

68. $(7-2i)+(9i-5)$

69. $(5-3i)-(-12i)$

70. $(3-i)(6i^2-4)$

71. $\dfrac{17}{4-i}$

72. $\dfrac{2i}{3-i}$

73. $\dfrac{3+4i}{3-4i}$

74. $\left(\sqrt{-3}\right)\left(\sqrt{-16}\right)$

75. $\left(8-\sqrt{-2}\right)^2$

76. $\dfrac{2i\sqrt{-27}}{\sqrt{-16}}$

Section 1.6

Solve the following linear equations.

77. $2y-(1-y)=y+2(y-1)$

78. $\dfrac{x}{2}-\dfrac{1}{3}=x-\dfrac{1}{3}-\dfrac{x}{2}$

79. $-0.2x-0.5=-0.4x+0.75$

80. $-2(x-5)+1=3+(7x-2)$

Solve the following absolute value equations.

81. $|2x-7|=1$

82. $|2y-5|-1=|3-y|$

83. $|7z+5|+3=8$

84. $|w-5|=|3w+1|$

Solve the following absolute value equations geometrically and algebraically.

85. $|-2x+1|=7$

86. $|x+4|-|x-1|=0$

Solve each of the following equations for the indicated variable.

87. Area of a trapezoid: $A=\dfrac{1}{2}h(b+c)$; solve for c

88. Volume of a rectangular pyramid: $V=\dfrac{1}{3}lwh$; solve for l

89. Temperature conversions: $F=\dfrac{9}{5}C+32$; solve for C

90. Two trains leave the station at the same time in opposite directions. One travels at an average rate of 90 miles per hour, and the other at an average rate of 95 miles per hour. How far apart are the two trains after an hour and twenty minutes? Round your answer to one decimal place.

91. Two firefighters, Jake and Rose, each have $5000 to invest. Jake invests his money in a money market account with an annual return of 3.25%, while Rose invests hers in a CD paying 4.95% annually. How much more money does Rose have than Jake after 1 year?

Section 1.7

Solve the following linear inequalities. Describe each solution set using interval notation and by graphing.

92. $-8x+3 \geq -9x+10$

93. $4(2x-5) < -3(-3x+8)$

94. $\dfrac{-2(x-1)}{3} \leq \dfrac{-2x}{4}$

95. $3.1(2x-1) > 7.2-4.1x$

96. $-5 < 3m+1 < 13$

97. $-14 < -2(3+y) \leq 8$

98. $2 < \dfrac{x+1}{4} \leq 7$

99. $-5|3+t| > -10$

100. $3+|2x-1| < 1$

101. $-2|x-1|+|3x-3| \geq 7$

102. $6+\dfrac{x}{5} \leq \dfrac{4}{5}$ or $5+2x \geq x-2$

103. $\dfrac{8x-5}{9} \leq 3$ or $2(3x-16) \geq 4(x-3)$

104. $2.9x+1.8 < 3(1.3x+6)$ and $7x < 5x+34$

Section 1.8

Solve the following quadratic equations.

105. $5x^2-13x-6=0$

106. $x^2=7$

107. $2(x-2)^2=-18$

108. $15x^2+3x+2=-8x$

109. $x^2-8x+14=0$

110. $3x^2-x+3=-7x$

111. $x^2=6x-16$

112. $-2x-7=-4x^2$

113. $2x^2+3x-10=10$

114. $x^2-7x-2=-12$

115. $1.7z^2-3.8z-2=0$

116. $2x^2+7x=x^2+2x-6$

Solve the following quadratic-like equations.

117. $(x^2+2)^2-7(x^2+2)+12=0$

118. $y^{\frac{2}{3}}+y^{\frac{1}{3}}-6=0$

119. $(t+2)^2-2(t+2)=24$

120. $x^4-13x^2+36=0$

Solve the following equations by factoring.

121. $x^3-4x^2-2x+8=0$

122. $2x^3+2x=5x^2$

123. $x^3-x^2+4x-4=0$

124. $x^4+7x^2-18=0$

125. $x^{\frac{7}{2}}-3x^{\frac{5}{2}}-4x^{\frac{3}{2}}=0$

126. $x^{\frac{7}{3}}+7x^{\frac{4}{3}}-8x^{\frac{1}{3}}=0$

127. $(x-2)^{\frac{3}{4}}+2(x-2)^{\frac{7}{4}}=0$

128. $(x-1)^{-\frac{1}{2}}+4(x-1)^{\frac{1}{2}}=0$

Use the connection between solutions of polynomial equations and polynomial factoring to answer the following questions.

129. Find b and c so the equation $x^3 + bx^2 + cx = 0$ has solutions of -2, 0, and 4.

130. Given that the equation $x^2 - 6x + m - 1 = 0$ has only one root, find m.

131. If the sum of the roots of the equation $x^2 + mx - 6 = 0$ is 5, then what is m?

Section 1.9

Solve the following rational equations.

132. $\dfrac{1}{x+2} + \dfrac{1}{x-3} - \dfrac{x}{x-3} = 0$

133. $\dfrac{1}{x-2} - \dfrac{x}{x+2} = \dfrac{2}{x^2-4}$

134. $\dfrac{y}{y-1} + \dfrac{1}{y-4} = \dfrac{y^2}{y^2-5y+4}$

135. $\dfrac{2}{x+1} - \dfrac{x}{x-3} = \dfrac{3x-21}{x^2-2x-3}$

136. Jim cleans a house in 6 hours. John cleans the same house in 8 hours. How long does it take for them to clean the house together?

Solve the following equations.

137. $\sqrt{-4-x} - 4 = x$

138. $\sqrt{5x-1} = 4 + \sqrt{x+3}$

139. $\sqrt{2x^2+8x+1} - x - 3 = 0$

140. $\sqrt{10x^2-14x+16} + 1 = 3x$

141. $x + 2 = \left(-x^2 + 11x + 19\right)^{\frac{1}{2}}$

142. $\left(2x^2+14x\right)^{\frac{1}{4}} = \left(-x^2-8\right)^{\frac{1}{4}}$

143. $(2x-5)^{\frac{1}{6}} = (x-2)^{\frac{1}{6}}$

144. $\left(x^2+x-16\right)^{\frac{1}{3}} = 2(x-1)^{\frac{1}{3}}$

145. The formula for the volume of a cone with radius r and height h is $V = \dfrac{1}{3}\pi r^2 h$. Solve the equation for r.