

Chapter 1 The Set of Real Numbers

Section 1.1 Practice Exercises

1. (a) product
(b) factors
(c) numerator; b
(d) lowest
(e) 1; 4
(f) reciprocals
(g) multiple
(h) least
2. Numerator 7; denominator 8; proper
3. Numerator 2; denominator 3; proper
4. Numerator 9; denominator 5; improper
5. Numerator 5; denominator 2; improper
6. Numerator 6; denominator 6; improper
7. Numerator 4; denominator 4; improper
8. Numerator 12; denominator 1; improper
9. Numerator 5; denominator 1; improper
10. Numerator 6; denominator 7; proper
11. $\frac{3}{4}$
12. $\frac{4}{5}$
13. $\frac{4}{3}$
14. $\frac{5}{4}$
15. $\frac{1}{6}$
16. $\frac{1}{8}$
17. $\frac{2}{2}$
18. $\frac{4}{4}$
19. $\frac{5}{2}$ or $2\frac{1}{2}$
20. $\frac{5}{3}$ or $1\frac{2}{3}$
21. $\frac{6}{2}$ or 3
22. $\frac{6}{3}$ or 2
23. The set of whole numbers includes the number 0 and the set of natural numbers does not.
24. A proper fraction represents a number less than one unit. An improper fraction represents a number greater than or equal to a whole unit.
25. Answers may vary. One example would be $\frac{2}{4}$.
26. Answers may vary. One example would be $\frac{2}{6}$.
27. Prime
28. Composite
29. Composite
30. Prime
31. Composite
32. Prime
33. Prime
34. Composite
35. $2 \times 2 \times 3 \times 3$

36. $2 \times 5 \times 7$

37. $2 \times 3 \times 7$

38. 5×7

39. $2 \times 5 \times 11$

40. $2 \times 2 \times 2 \times 17$

41. $3 \times 3 \times 3 \times 5$

42. $3 \times 5 \times 7$

43. $\frac{3}{15} = \frac{\cancel{3}}{\cancel{3} \times 5} = \frac{1}{5}$

44. $\frac{8}{12} = \frac{\cancel{2} \times \cancel{2} \times 2}{\cancel{2} \times \cancel{2} \times 3} = \frac{2}{3}$

45. $\frac{16}{6} = \frac{\cancel{2} \times 2 \times 2 \times 2}{\cancel{2} \times 3} = \frac{8}{3}$ or $2\frac{2}{3}$

46. $\frac{20}{12} = \frac{\cancel{2} \times \cancel{2} \times 5}{\cancel{2} \times \cancel{2} \times 3} = \frac{5}{3}$ or $1\frac{2}{3}$

47. $\frac{42}{48} = \frac{\cancel{2} \times \cancel{3} \times 7}{\cancel{2} \times 2 \times 2 \times 2 \times \cancel{3}} = \frac{7}{8}$

48. $\frac{35}{80} = \frac{\cancel{5} \times 7}{2 \times 2 \times 2 \times 2 \times \cancel{5}} = \frac{7}{16}$

49. $\frac{48}{64} = \frac{\cancel{2} \times \cancel{2} \times \cancel{2} \times \cancel{2} \times 3}{\cancel{2} \times \cancel{2} \times \cancel{2} \times \cancel{2} \times 2 \times 2} = \frac{3}{4}$

50. $\frac{32}{48} = \frac{\cancel{2} \times \cancel{2} \times \cancel{2} \times \cancel{2} \times 2}{\cancel{2} \times \cancel{2} \times \cancel{2} \times \cancel{2} \times 3} = \frac{2}{3}$

51. $\frac{110}{176} = \frac{\cancel{2} \times 5 \times \cancel{11}}{\cancel{2} \times 2 \times 2 \times 2 \times \cancel{11}} = \frac{5}{8}$

52. $\frac{70}{120} = \frac{\cancel{2} \times \cancel{5} \times 7}{\cancel{2} \times 2 \times 2 \times 3 \times \cancel{5}} = \frac{7}{12}$

53. $\frac{200}{150} = \frac{\cancel{2} \times 2 \times 2 \times \cancel{5} \times \cancel{5}}{\cancel{2} \times 3 \times \cancel{5} \times \cancel{5}} = \frac{4}{3}$ or $1\frac{1}{3}$

54. $\frac{210}{119} = \frac{2 \times 3 \times 5 \times \cancel{7}}{\cancel{7} \times 17} = \frac{30}{17}$ or $1\frac{13}{17}$

55. False: When adding/subtracting fractions, it is necessary to have a common denominator.

56. True

57. $\frac{10}{13} \times \frac{26}{15} = \frac{2 \times 2 \times \cancel{5} \times \cancel{13}}{3 \times \cancel{5} \times \cancel{13}} = \frac{4}{3}$ or $1\frac{1}{3}$

58. $\frac{15}{28} \times \frac{7}{9} = \frac{\cancel{3} \times 5 \times \cancel{7}}{2 \times 2 \times \cancel{3} \times 3 \times \cancel{7}} = \frac{5}{12}$

59. $\frac{3}{7} \div \frac{9}{14} = \frac{3}{7} \times \frac{14}{9} = \frac{2 \times \cancel{3} \times \cancel{7}}{3 \times \cancel{3} \times \cancel{7}} = \frac{2}{3}$

60. $\frac{7}{25} \div \frac{1}{5} = \frac{7}{25} \times \frac{5}{1} = \frac{\cancel{5} \times 7}{\cancel{5} \times 5} = \frac{7}{5}$ or $1\frac{2}{5}$

61. $\frac{9}{10} \times 5 = \frac{9}{10} \times \frac{5}{1} = \frac{3 \times 3 \times \cancel{5}}{2 \times \cancel{5}} = \frac{9}{2}$ or $4\frac{1}{2}$

62. $\frac{3}{7} \times 14 = \frac{3}{7} \times \frac{14}{1} = \frac{2 \times 3 \times \cancel{7}}{\cancel{7}} = \frac{6}{1} = 6$

63. $\frac{12}{5} \div 4 = \frac{12}{5} \div \frac{4}{1} = \frac{12}{5} \times \frac{1}{4} = \frac{\cancel{12}^3 \times 1}{5 \times \cancel{4}_1} = \frac{3}{5}$

64. $\frac{20}{6} \div 5 = \frac{20}{6} \div \frac{5}{1}$
 $= \frac{20}{6} \times \frac{1}{5}$
 $= \frac{\cancel{20}^4 \times 1}{6 \times \cancel{5}_1} = \frac{4}{6} = \frac{2}{3}$

65. $\frac{5}{2} \times \frac{10}{21} \times \frac{7}{5} = \frac{\cancel{5}^1 \times \cancel{10}^5 \times \cancel{7}^1}{\cancel{2}_1 \times \cancel{21}_3 \times \cancel{5}_1} = \frac{5}{3}$ or $1\frac{2}{3}$

66. $\frac{55}{9} \times \frac{18}{32} \times \frac{24}{11} = \frac{\cancel{55}^5 \times \cancel{18}^2 \times \cancel{24}^3}{\cancel{9}_1 \times \cancel{32}_4 \times \cancel{11}_1}$
 $= \frac{30}{4} = \frac{15}{2}$ or $7\frac{1}{2}$

67. $\frac{9}{100} \div \frac{13}{1000} = \frac{9}{100} \times \frac{1000}{13}$
 $= \frac{9 \times \cancel{1000}^{10}}{\cancel{100}_1 \times 13} = \frac{90}{13}$ or $6\frac{12}{13}$

68. $\frac{1000}{17} \div \frac{10}{3} = \frac{1000}{17} \times \frac{3}{10}$
 $= \frac{\cancel{1000}^{100} \times 3}{17 \times \cancel{10}_1} = \frac{300}{17}$ or $17\frac{11}{17}$

69. $\frac{1}{3}$ of \$2112 = $\frac{1}{3} \times \frac{2112}{1} = \frac{2112}{3} = \704

$$70. \frac{1}{4} \text{ of } \$4200 = \frac{1}{4} \times \frac{4200}{1} = \frac{4200}{4} = \$1050$$

71. The statement “five-sixths of the students passed the first test” translates

to “students passed = $\frac{5}{6} \times 42$ ”

$$\frac{5}{6} \times 42 = \frac{5}{6} \times \frac{42}{1} = \frac{5 \times \cancel{42}^7}{\cancel{6}^1 \times 1} = \frac{35}{1}$$

35 students passed the test.

$$72. \frac{3}{5} \text{ of } 10 = \frac{3}{5} \times \frac{10}{1} = \frac{30}{5} = 6, 6 \text{ pages}$$

$$73. 4 \text{ yd} \div \frac{1}{2} \text{ yd} = \frac{4}{1} \times \frac{2}{1} = \frac{8}{1} = 8, 8 \text{ pieces}$$

$$74. 4 \text{ cups} \div \frac{1}{3} \text{ cup} = \frac{4}{1} \times \frac{3}{1} \\ = \frac{12}{1} \\ = 12 \text{ servings}$$

$$75. 6 \text{ lb} \div \frac{3}{4} \text{ lb} = \frac{6}{1} \times \frac{4}{3} = \frac{24}{3} = 8, 8 \text{ jars}$$

76. Divide the length of the nail $\left(\frac{7}{8} \text{ in.}\right)$ by

the amount the nail goes into the board

with each strike $\left(\frac{1}{16} \text{ in.}\right)$.

$$\frac{7}{8} \div \frac{1}{16} = \frac{7}{8} \times \frac{16}{1} \\ = \frac{7 \times \cancel{16}^2}{\cancel{8}^1 \times 1} \\ = \frac{14}{1} = 14 \text{ strikes}$$

Beth must make 14 strikes.

$$77. \frac{5}{14} + \frac{1}{14} = \frac{6}{14} = \frac{\cancel{2} \times 3}{\cancel{2} \times 7} = \frac{3}{7}$$

$$78. \frac{9}{5} + \frac{1}{5} = \frac{10}{5} = 2$$

$$79. \frac{17}{24} - \frac{5}{24} = \frac{12}{24} = \frac{1}{2}$$

$$80. \frac{11}{18} - \frac{5}{18} = \frac{6}{18} = \frac{1}{3}$$

$$81. 6 = 2 \times 3 \\ 15 = 3 \times 5 \\ 2 \times 3 \times 5 = 30$$

$$82. 12 = 2^2 \times 3 \\ 30 = 3 \times 5 \\ 2^2 \times 3 \times 5 = 60$$

$$83. 20 = 2^2 \times 5 \\ 8 = 2^3 \\ 4 = 2^2$$

$$2^3 \times 5 = 40 \\ 84. 24 = 2^3 \times 3 \\ 40 = 2^3 \times 5 \\ 30 = 3 \times 5 \\ 2^3 \times 3 \times 5 = 120$$

$$85. \frac{1}{8} + \frac{3}{4} = \frac{1}{8} + \frac{6}{8} = \frac{7}{8}$$

$$86. \frac{3}{16} + \frac{1}{2} = \frac{3}{16} + \frac{8}{16} = \frac{11}{16}$$

$$87. \frac{11}{8} - \frac{3}{10} = \frac{55}{40} - \frac{12}{40} = \frac{43}{40} \text{ or } 1 \frac{3}{40}$$

$$88. \frac{12}{35} - \frac{1}{10} = \frac{24}{70} - \frac{7}{70} = \frac{17}{70}$$

$$89. \frac{7}{26} - \frac{2}{13} = \frac{7}{26} - \frac{4}{26} = \frac{3}{26}$$

$$90. \frac{25}{24} - \frac{5}{16} = \frac{50}{48} - \frac{15}{48} = \frac{35}{48}$$

$$91. \frac{7}{18} + \frac{5}{12} = \frac{14}{36} + \frac{15}{36} = \frac{29}{36}$$

$$92. \frac{3}{16} + \frac{9}{20} = \frac{15}{80} + \frac{36}{80} = \frac{51}{80}$$

$$93. \frac{5}{4} - \frac{1}{20} = \frac{25}{20} - \frac{1}{20} = \frac{24}{20} = \frac{6}{5} \text{ or } 1 \frac{1}{5}$$

$$94. \frac{7}{6} - \frac{1}{24} = \frac{28}{24} - \frac{1}{24} = \frac{27}{24} = \frac{9}{8} \text{ or } 1\frac{1}{8}$$

$$95. \frac{5}{12} + \frac{5}{16} = \frac{20}{48} + \frac{15}{48} = \frac{35}{48}$$

$$96. \frac{3}{25} + \frac{8}{35} = \frac{21}{175} + \frac{40}{175} = \frac{61}{175}$$

$$97. \frac{1}{6} + \frac{3}{4} - \frac{5}{8} = \frac{4}{24} + \frac{18}{24} - \frac{15}{24} = \frac{7}{24}$$

$$98. \frac{1}{2} + \frac{2}{3} - \frac{5}{12} = \frac{6}{12} + \frac{8}{12} - \frac{5}{12} = \frac{9}{12} = \frac{3}{4}$$

$$99. \frac{4}{7} + \frac{1}{2} + \frac{3}{4} = \frac{16}{28} + \frac{14}{28} + \frac{21}{28} = \frac{51}{28} \text{ or } 1\frac{23}{28}$$

$$100. \frac{9}{10} + \frac{4}{5} + \frac{3}{4} = \frac{18}{20} + \frac{16}{20} + \frac{15}{20} \\ = \frac{49}{20} \text{ or } 2\frac{9}{20}$$

$$101. \frac{2}{3} + \frac{1}{4} = \frac{8}{12} + \frac{3}{12} = \frac{11}{12}, \frac{11}{12} \text{ cup sugar}$$

$$102. \frac{3}{4} + \frac{3}{8} = \frac{6}{8} + \frac{3}{8} = \frac{9}{8}, \frac{9}{8} \text{ in. or } 1\frac{1}{8} \text{ in.}$$

$$103. \frac{1}{2} - \frac{9}{25} = \frac{25}{50} - \frac{18}{50} = \frac{7}{50}, \frac{7}{50} \text{ in.}$$

$$104. \frac{3}{4} - \frac{7}{10} = \frac{15}{20} - \frac{14}{20} = \frac{1}{20}, \frac{1}{20} \text{ in.}$$

$$105. 3\frac{1}{5} \times 2\frac{7}{8} = \frac{16}{5} \times \frac{23}{8} \\ = \frac{\cancel{16}^2 \times 23}{5 \times \cancel{8}_2} = \frac{46}{5} \text{ or } 9\frac{1}{5}$$

$$106. 2\frac{1}{2} \times 1\frac{4}{5} = \frac{\cancel{2}^1}{2} \times \frac{9}{\cancel{5}_3} = \frac{9}{2} = 4\frac{1}{2}$$

$$107. 1\frac{2}{9} \div 7\frac{1}{3} = \frac{11}{9} \div \frac{22}{3} = \frac{\cancel{11}}{9} \times \frac{3}{\cancel{22}_2} = \frac{1}{6}$$

$$108. 2\frac{2}{5} \div 1\frac{2}{7} = \frac{12}{5} \div \frac{9}{7} \\ = \frac{\cancel{12}^4}{5} \times \frac{7}{\cancel{9}_3} \\ = \frac{28}{15} \text{ or } 1\frac{13}{15}$$

$$109. 1\frac{2}{9} \div 6 = \frac{11}{9} \times \frac{1}{6} = \frac{11}{9 \times 6} = \frac{11}{54}$$

$$110. 2\frac{2}{5} \div 2 = \frac{12}{5} \div 2 \\ = \frac{12}{5} \times \frac{1}{2} \\ = \frac{\cancel{2} \times 2 \times 3 \times 1}{\cancel{2} \times 5} \\ = \frac{6}{5} \text{ or } 1\frac{1}{5}$$

$$111. 2\frac{1}{8} + 1\frac{3}{8} = \frac{17}{8} + \frac{11}{8} \\ = \frac{28}{8} \\ = \frac{\cancel{2} \times \cancel{2} \times 7}{\cancel{2} \times \cancel{2} \times 2} \\ = \frac{7}{2} \text{ or } 3\frac{1}{2}$$

$$112. 1\frac{3}{14} + 1\frac{1}{14} = \frac{17}{14} + \frac{15}{14} = \frac{32}{14} = \frac{16}{7} \text{ or } 2\frac{2}{7}$$

$$113. 3\frac{1}{2} - 1\frac{7}{8} = \frac{7}{2} - \frac{15}{8} = \frac{28}{8} - \frac{15}{8} = \frac{13}{8} \text{ or } 1\frac{5}{8}$$

$$114. 5\frac{1}{3} - 2\frac{3}{4} = \frac{16}{3} - \frac{11}{4} \\ = \frac{64}{12} - \frac{33}{12} = \frac{31}{12} \text{ or } 2\frac{7}{12}$$

$$115. 1\frac{1}{6} + 3\frac{3}{4} = \frac{7}{6} + \frac{15}{4} \\ = \frac{14}{12} + \frac{45}{12} \\ = \frac{59}{12} \text{ or } 4\frac{11}{12}$$

$$116. 4\frac{1}{2} + 2\frac{2}{3} = \frac{9}{2} + \frac{8}{3} \\ = \frac{27}{6} + \frac{16}{6} \\ = \frac{43}{6} \text{ or } 7\frac{1}{6}$$

$$117. 1 - \frac{7}{8} = \frac{8}{8} - \frac{7}{8} = \frac{1}{8}$$

$$118. 2 - \frac{3}{7} = \frac{14}{7} - \frac{3}{7} = \frac{11}{7} \text{ or } 1\frac{4}{7}$$

$$\begin{aligned}
 119. \quad 26\frac{3}{8} \div 3 &= \frac{211}{8} \div \frac{3}{1} \\
 &= \frac{211}{8} \times \frac{1}{3} \\
 &= \frac{211}{24} \\
 &= 8\frac{19}{24} \text{ in.}
 \end{aligned}$$

$$\begin{aligned}
 120. \quad 3\frac{5}{6} + 1\frac{3}{4} &= \frac{23}{6} + \frac{7}{4} \\
 &= \frac{46}{12} + \frac{21}{12} \\
 &= \frac{67}{12} \\
 &= 5\frac{7}{12} \text{ ft}
 \end{aligned}$$

$$\begin{aligned}
 121. \quad 2\frac{3}{4} - 1\frac{1}{6} &= \frac{11}{4} - \frac{7}{6} = \frac{33}{12} - \frac{14}{12} \\
 &= \frac{19}{12} \\
 &= 1\frac{7}{12} \text{ hr}
 \end{aligned}$$

$$\begin{aligned}
 122. \quad 3\frac{3}{4} \div \frac{3}{8} &= \frac{15}{4} \div \frac{3}{8} \\
 &= \frac{15}{4} \times \frac{8}{3} \\
 &= \frac{\cancel{15}^5}{\cancel{4}_1} \times \frac{\cancel{8}^2}{\cancel{3}_1} \\
 &= 10
 \end{aligned}$$

Antonio can make 10 sandwiches.

$$123. \quad 1\frac{1}{2} + \frac{3}{4} = \frac{3}{2} + \frac{3}{4} = \frac{6}{4} + \frac{3}{4} = \frac{9}{4} = 2\frac{1}{4} \text{ lb}$$

$$\begin{aligned}
 124. \quad 5\frac{1}{2} - 4\frac{5}{6} &= \frac{11}{2} - \frac{29}{6} \\
 &= \frac{33}{6} - \frac{29}{6} = \frac{4}{6} = \frac{2}{3} \text{ mi}
 \end{aligned}$$

$$125. \quad 6\frac{1}{4} \times 4 = \frac{25}{4} \times \frac{4}{1} = \frac{25}{\cancel{4}} \times \frac{\cancel{4}}{1} = 25 \text{ in.}$$

$$\begin{aligned}
 126. \quad \frac{3}{4} \times 6 &= \frac{3}{4} \times \frac{6}{1} \\
 &= \frac{3}{\cancel{4}_2} \times \frac{\cancel{6}^3}{1} = \frac{9}{2} \text{ in. or } 4\frac{1}{2} \text{ in.}
 \end{aligned}$$

Section 1.2 Calculator Exercises

1. ≈ 3.464101615

3. ≈ 12.56637061

2. ≈ 9.949874371

4. ≈ 1.772453851

Section 1.2 Practice Exercises

1. (a) variable

(h) opposites

(b) constants

(i) $|a|$; 0

(c) set

$$2. \quad 4\frac{1}{2} - 1\frac{5}{6} = \frac{9}{2} - \frac{11}{6}$$

(d) inequalities

$$= \frac{27}{6} - \frac{11}{6}$$

(e) a is less than b

$$= \frac{16}{6} = \frac{8}{3} \text{ or } 2\frac{2}{3}$$

(f) c is greater than or equal to d

(g) 5 is not equal to 6

Chapter 1 The Set of Real Numbers

$$3. 4\frac{1}{2} \times 1\frac{5}{6} = \frac{9^3}{2} \times \frac{11}{6^2} = \frac{33}{4} \text{ or } 8\frac{1}{4}$$

$$4. 4\frac{1}{2} \div 1\frac{5}{6} = \frac{9}{2} \div \frac{11}{6} \\ = \frac{9}{2} \times \frac{6^3}{11} = \frac{27}{11} \text{ or } 2\frac{5}{11}$$

$$5. y - 3 = 18 - 3 = 15$$

$$6. 3q = 3(5) = 15$$

$$7. \frac{15}{t} = \frac{15}{5} = 3$$

$$8. 8 + w = 8 + 12 = 20$$

$$9. 6d = 6\left(\frac{2}{3}\right) = \frac{6 \times 2}{3} = \frac{12}{3} = 4$$

$$10. \frac{6}{5}h = \frac{6}{5}(10) = \frac{6}{5} \times \frac{10}{1} = \frac{60}{5} = 12$$

$$11. c - 2 - d = 15.4 - 2 - 8.1 = 5.3$$

$$12. 1.1 + t + s = 1.1 + 93.2 + 11.5 = 105.8$$

$$13. abc = \frac{1}{10} \times \frac{1}{4} \times \frac{1}{2} = \frac{1 \times 1 \times 1}{10 \times 4 \times 2} = \frac{1}{80}$$

$$14. x - y - z = \frac{7}{8} - \frac{1}{2} - \frac{1}{4} \\ = \frac{7}{8} - \frac{4}{8} - \frac{2}{8} \\ = \frac{7 - 4 - 2}{8} = \frac{1}{8}$$

$$15. (a) 1.29s = 1.29(3) = 3.87, \$3.87$$

$$(b) 1.29s = 1.29(8) = 10.32, \$10.32$$

$$(c) 1.29s = 1.29(10) = 12.90, \$12.90$$

$$16. (a) 240h = 240(4) = 960, 960 \text{ calories}$$

$$(b) 240h = 240\left(2\frac{1}{2}\right) \\ = 240\left(\frac{5}{2}\right) \\ = \frac{240 \times 5}{2} = \frac{1200}{2} = 600,$$

600 calories

$$(c) 240h = 240\left(1\frac{1}{4}\right) \\ = 240\left(\frac{5}{4}\right) \\ = \frac{240 \times 5}{4} = \frac{1200}{4} = 300,$$

300 calories

$$17. (a) 850 - b = 850 - 475 = 375,$$

375 calories

$$(b) 850 - b = 850 - 220 = 630,$$

630 calories

$$(c) 850 - b = 850 - 580 = 270,$$

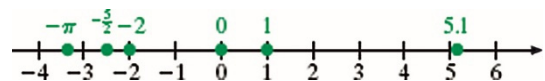
270 calories

$$18. (a) \frac{d}{25} = \frac{200}{25} = 8, 8 \text{ gal}$$

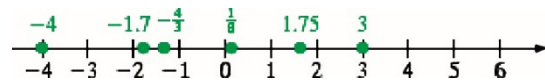
$$(b) \frac{d}{25} = \frac{450}{25} = 18, 18 \text{ gal}$$

$$(c) \frac{d}{25} = \frac{180}{25} = 7\frac{5}{25} = 7\frac{1}{5} = 7.2, 7.2 \text{ gal}$$

19.



20.



21. a. a terminating decimal; rational number

22. a. a terminating decimal; rational number

23. b. repeating decimal; rational number

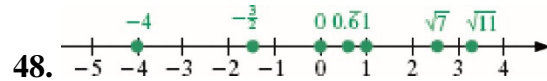
24. b. repeating decimal; rational number

25. a. a terminating decimal; rational number

26. a. a terminating decimal; rational number

Section 1.2 Introduction to Algebra and the Set of Real Numbers

27. c. a nonterminating, nonrepeating decimal; irrational number
28. c. a nonterminating, nonrepeating decimal; irrational number
29. a. a terminating decimal; rational number
30. a. a terminating decimal; rational number
31. a. a terminating decimal; rational number
32. a. a terminating decimal; rational number
33. b. a repeating decimal; rational number
34. b. a repeating decimal; rational number
35. c. a nonterminating, nonrepeating decimal; irrational number
36. c. a nonterminating, nonrepeating decimal; irrational number
37. Answers vary; for example: π , $-\sqrt{2}$, $\sqrt{3}$
38. Answers vary; for example: $-\frac{1}{2}$, 5 , $0.\bar{3}$
39. Answers vary; for example: -4 , -1 , 0
40. Answers vary; for example: -5 , -2 , -1
41. Answers vary; for example: $-\frac{3}{4}$, $\frac{1}{2}$, 0.206
42. Yes, all of the numbers in set A are real numbers.
43. $-\frac{3}{2}$, -4 , $0.\bar{6}$, 0 , 1
44. $0, 1$
45. 1
46. $\sqrt{11}$, $\sqrt{7}$
47. -4 , 0 , 1



- 48.
49. (a) Since Kane's score is 0 and Pak's score is -8 , $0 > -8$.
 (b) Since Scorenstam's score is 7 and Davies' score is -4 , $7 > -4$.
 (c) Since Pak's score is -8 and McCurdy's score is 3 , $-8 < 3$.
 (d) Since Kane's score is 0 and Davies's score is -4 , $0 > -4$.
50. (a) $2250 \text{ ft} > 433 \text{ ft}$
 (b) $-8 \text{ ft} < 579 \text{ ft}$
 (c) $-8 \text{ ft} < 0 \text{ ft}$
 (d) $579 \text{ ft} > 433 \text{ ft}$
51. -18
52. -2
53. 6.1
54. 2.5
55. $\frac{5}{8}$
56. $\frac{1}{3}$
57. $-\frac{7}{3}$
58. $-\frac{1}{9}$
59. 3
60. 5.1
61. $-\frac{7}{3}$
62. 7
63. 8
64. -36
65. -72.1
66. $-\frac{9}{10}$

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67. 2

68. 7

69. 1.5

70. 3.7

71. -1.5

72. -3.7

73. $\frac{3}{2}$

74. $\frac{7}{4}$

75. -10

76. -20

77. $-\frac{1}{2}$

78. $-\frac{11}{3}$

79. False; $|n|$ is never negative.

80. False; $|m|$ is never negative.

81. True; 5 is to the right of 2.

82. True; 8 is to the left of 10.

83. False; 6 is equal to 6.

84. False; 19 is equal to 19.

85. True; -7 is equal to -7.

86. True; -1 is equal to -1.

87. False; $\frac{3}{2}$ is to the right of $\frac{1}{6}$.

88. True; $-\frac{1}{4}$ is to the right of $-\frac{7}{8}$.

89. False; -5 is to the left of -2.

90. False; 6 is to the right of -10.

91. False; 8 is equal to 8.

92. False; 10 is equal to 10.

93. True; 2 is to the right of 1.

94. False; 3 is to the right of 1.

95. True; $\frac{1}{9}$ is equal to $\frac{1}{9}$.

96. True; $\frac{1}{3}$ is equal to $\frac{1}{3}$.

97. False; 7 is equal to 7.

98. False; 13 is equal to 13.

99. True; -1 is to the left of 1.

100. True; -6 is to the left of 6.

101. True; 8 is equal to 8.

102. True; 11 is equal to 11.

103. True; 2 is equal to 2.

104. True; 21 is equal to 21.

105. For all $a < 0$ since $-a$ is the opposite of a .

106. For all $a \geq 0$, all nonnegative real numbers.

Section 1.3 Calculator Exercises

1. 2

2. 91

3. 84

4. 12

5. 49

6. 18

7. 4

8. 27

9. 0.5

Section 1.3 Practice Exercises

1. (a) quotient; product; sum; difference

(b) base; exponent; power

(c) 8^2 (d) p^4

(e) radical; square

(f) order of operations

2. $-4, 5\bar{6}, 0, 4.0\bar{2}, \frac{7}{9}$

3. 56

4. 9.2

5. -19

6. 34.2

7. $\frac{1}{6} \cdot \frac{1}{6} \cdot \frac{1}{6} \cdot \frac{1}{6} = \left(\frac{1}{6}\right)^4$

8. $10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 = 10^6$

9. $a \cdot a \cdot a \cdot b \cdot b = a^3 b^2$

10. $7 \cdot x \cdot x \cdot y \cdot y = 7x^2 y^2$

11. $(5c)^5$

12. $3wz^4$

13. (a) x

(b) Yes, 1

14. (a) y

(b) Yes, 1

15. $x^3 = x \cdot x \cdot x$

16. $y^4 = y \cdot y \cdot y \cdot y$

17. $(2b)^3 = 2b \cdot 2b \cdot 2b$

18. $(8c)^2 = 8c \cdot 8c$

19. $10y^5 = 10 \cdot y \cdot y \cdot y \cdot y \cdot y$

20. $x^2 y^3 = x \cdot x \cdot y \cdot y \cdot y$

21. $2wz^2 = 2 \cdot w \cdot z \cdot z$

22. $3a^3 b = 3 \cdot a \cdot a \cdot a \cdot b$

23. $6^2 = 6 \cdot 6 = 36$

24. $5^3 = 5 \cdot 5 \cdot 5 = 125$

25. $\left(\frac{1}{7}\right)^2 = \frac{1}{7} \cdot \frac{1}{7} = \frac{1}{49}$

26. $\left(\frac{1}{2}\right)^5 = \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{32}$

27. $(0.2)^3 = 0.2 \cdot 0.2 \cdot 0.2 = 0.008$

28. $(0.8)^2 = 0.8 \cdot 0.8 = 0.64$

29. $2^6 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 64$

30. $13^2 = 169$

31. $\sqrt{81} = 9$

32. $\sqrt{64} = 8$

33. $\sqrt{4} = 2$

34. $\sqrt{9} = 3$

35. $\sqrt{144} = 12$

36. $\sqrt{49} = 7$

37. $\sqrt{16} = 4$

38. $\sqrt{36} = 6$

39. $\sqrt{\frac{1}{9}} = \sqrt{\left(\frac{1}{3}\right)^2} = \frac{1}{3}$

40. $\sqrt{\frac{1}{64}} = \sqrt{\left(\frac{1}{8}\right)^2} = \frac{1}{8}$

41. $\sqrt{\frac{25}{81}} = \sqrt{\left(\frac{5}{9}\right)^2} = \frac{5}{9}$

42. $\sqrt{\frac{49}{100}} = \sqrt{\left(\frac{7}{10}\right)^2} = \frac{7}{10}$

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43. $8 + 2 \cdot 6 = 8 + 12 = 20$

44. $7 + 3 \cdot 4 = 7 + 12 = 19$

45. $(8 + 2)6 = 10 \cdot 6 = 60$

46. $(7 + 3)4 = 10 \cdot 4 = 40$

47. $4 + 2 \div 2 \cdot 3 + 1 = 4 + 3 + 1 = 8$

48. $5 + 12 \div 2 \cdot 6 - 1 = 5 + 36 - 1 = 40$

49. $81 - 4 \cdot 3 + 3^2 = 81 - 12 + 9 = 78$

50. $100 - 25 \cdot 2 - 5^2 = 100 - 50 - 25 = 25$

51. $\frac{1}{4} \cdot \frac{2}{3} - \frac{1}{6} = \frac{1}{2} \cdot \frac{2^1}{3} - \frac{1}{6} = \frac{1}{6} - \frac{1}{6} = 0$

52. $\frac{3}{4} \cdot \frac{2}{3} + \frac{2}{3} = \frac{1}{2} \cdot \frac{2^1}{3} + \frac{2}{3}$
 $= \frac{1}{2} + \frac{2}{3}$
 $= \frac{3}{6} + \frac{4}{6} = \frac{7}{6}$

53. $\left(\frac{11}{6} - \frac{3}{8}\right) \cdot \frac{4}{5} = \left(\frac{44}{24} - \frac{9}{24}\right) \cdot \frac{4}{5}$
 $= \frac{35}{24} \cdot \frac{4}{5}$
 $= \frac{7}{6}$

54. $\left(\frac{9}{8} - \frac{1}{3}\right) \cdot \frac{3}{4} = \left(\frac{27}{24} - \frac{8}{24}\right) \cdot \frac{3}{4}$
 $= \frac{19}{24} \cdot \frac{3}{4}$
 $= \frac{19}{32}$

55. $3[5 + 2(8 - 3)] = 3[5 + 2(5)]$
 $= 3[15]$
 $= 45$

56. $2[4 + 3(6 - 4)]$
 $= 2[4 + 3(2)] = 2[10] = 20$

57. $10 + |-6| = 10 + 6 = 16$

58. $18 + |-3| = 18 + 3 = 21$

59. $21 - |8 - 2| = 21 - 6 = 15$

60. $12 - |6 - 1| = 12 - 5 = 7$

61. $2^2 + \sqrt{9} \cdot 5 = 4 + 15 = 19$

62. $3^2 + \sqrt{16} \cdot 2 = 9 + 8 = 17$

63. $3 \cdot 5^2 = 3 \cdot 25 = 75$

64. $10 \cdot 2^3 = 10 \cdot 8 = 80$

65. $\sqrt{9+16} - 2 = \sqrt{25} - 2 = 5 - 2 = 3$

66. $\sqrt{36+13} - 5 = \sqrt{49} - 5 = 7 - 5 = 2$

67. $[4^2 \cdot (6 - 4) \div 8] + [7 \cdot (8 - 3)]$
 $= [16 \cdot 2 \div 8] + [7 \cdot 5]$
 $= 4 + 35$
 $= 39$

68. $(18 \div \sqrt{4}) \cdot \{(9^2 - 1) \div 2\} - 15$
 $= (9) \cdot \{40 \div 2\} - 15$
 $= 9 \cdot 20 - 15$
 $= 180 - 15$
 $= 165$

69. $48 - 13 \times 3 + [(50 - 7 \times 5) + 2]$
 $= 48 - 39 + [15 + 2]$
 $= 9 + 17$
 $= 26$

70. $80 \div 16 \cdot 2 + (6^2 - |-2|)$
 $= 10 + (36 - 2)$
 $= 44$

71. $\frac{7 + 3(8 - 2)}{(7 + 3)(8 - 2)}$
 $= \frac{7 + 18}{(10)(6)}$
 $= \frac{25}{60} = \frac{5}{12}$

72. $\frac{16 - 8 \div 4}{4 + 8 \div 4 - 2}$
 $= \frac{16 - 2}{4 + 2 - 2}$
 $= \frac{14}{4} = \frac{7}{2}$

Section 1.3 Exponents, Square Roots, and the Order of Operations

$$\begin{aligned} 73. \quad & \frac{15 - 5(3 \cdot 2 - 4)}{10 - 2(4 \cdot 5 - 16)} \\ &= \frac{15 - 5(2)}{10 - 2(4)} \\ &= \frac{5}{2} \end{aligned}$$

$$\begin{aligned} 74. \quad & \frac{5(7 - 3) + 8(6 - 4)}{4[7 + 3(2 \cdot 9 - 8)]} \\ &= \frac{5(4) + 8(2)}{4[7 + 30]} \\ &= \frac{36}{148} = \frac{9}{37} \end{aligned}$$

75. (a) debt-to-income ratio

$$\begin{aligned} &= \frac{\text{payments}}{\text{take-home pay}} \\ &= \frac{52 + 20 + 65 + 43}{1500} \\ &= \frac{180}{1500} = 0.12 \end{aligned}$$

(b) yes; $0.12 < 0.20$

76. (a) debt-to-income ratio

$$\begin{aligned} &= \frac{\text{payments}}{\text{take-home pay}} \\ &= \frac{115 + 63 + 95 + 77 + 100}{2000} \\ &= \frac{450}{2000} = 0.225 \end{aligned}$$

(b) no; $0.225 > 0.15$

$$77. A = lw = 360 \cdot 160 = 57,600 \text{ ft}^2$$

$$78. A = 2l + 2w = 2 \cdot 360 + 2 \cdot 160 = 1040 \text{ ft}$$

$$79. A = \frac{1}{2}(b_1 + b_2)h = \frac{1}{2}(6 + 8)3 = 21 \text{ ft}^2$$

$$80. V = lwh = 25 \cdot 20 \cdot 2 = 1000 \text{ yd}^3$$

$$81. 3x$$

$$82. b + 6$$

$$83. \frac{x}{7} \text{ or } x \div 7$$

$$84. \frac{4}{k} \text{ or } 4 \div k$$

$$85. 2 - a$$

$$86. t - 3$$

$$87. 2y + x$$

$$88. 9 - 3p$$

$$89. 4(x + 12)$$

$$90. 2(x - 3)$$

$$91. 3 - Q$$

$$92. t - 14$$

$$93. 2y^3 = 2(\quad)^3 = 2(2)^3 = 2(8) = 16$$

$$94. 3z^2 = 3(\quad)^2 = 3(10)^2 = 3(100) = 300$$

$$95. |z - 8| = |(\quad) - 8| = |10 - 8| = |2| = 2$$

$$96. |x - 3| = |(\quad) - 3| = |4 - 3| = |1| = 1$$

$$\begin{aligned} 97. 5\sqrt{x} &= 5\sqrt{(\quad)} \\ &= 5\sqrt{4} = 5(2) = 10 \end{aligned}$$

$$\begin{aligned} 98. \sqrt{z-1} &= \sqrt{(\quad)-1} \\ &= \sqrt{(10)-1} = \sqrt{9} = 3 \end{aligned}$$

$$\begin{aligned} 99. yz - x &= (\quad)(\quad) - (\quad) \\ &= (2)(10) - (4) \\ &= 20 - 4 \\ &= 16 \end{aligned}$$

$$\begin{aligned} 100. z - xy &= (\quad) - (\quad)(\quad) \\ &= (10) - (4)(2) \\ &= 10 - 8 \\ &= 2 \end{aligned}$$

$$101. \frac{\sqrt{\frac{1}{9} + \frac{2}{3}}}{\sqrt{\frac{4}{25} + \frac{3}{5}}} = \frac{\frac{1}{3} + \frac{2}{3}}{\frac{2}{5} + \frac{3}{5}} = \frac{\frac{3}{3}}{\frac{5}{5}} = \frac{1}{1} = 1$$

$$102. \frac{5 - \sqrt{9}}{\sqrt{\frac{4}{9} + \frac{1}{3}}} = \frac{5 - 3}{\frac{2}{3} + \frac{1}{3}} = \frac{2}{1} = 2$$

$$103. \frac{|-2|}{|-10| - |2|} = \frac{2}{10 - 2} = \frac{2}{8} = \frac{1}{4}$$

$$104. \frac{|-4|^2}{2^2 + \sqrt{144}} = \frac{16}{4 + 12} = \frac{16}{16} = 1$$

105. (a) $36 \div 4 \cdot 3 = 9 \cdot 3 = 27$

Division must be performed before multiplication.

(b) $36 - 4 + 3 = 32 + 3 = 35$

Subtraction must be performed before addition.

106. Multiplication or division are performed in order from left to right.

Addition or subtraction are performed in order from left to right.

107. This is acceptable, provided division and multiplication are performed in order from left to right, and subtraction and addition are performed in order from left to right.

Section 1.4 Practice Exercises

1. (a) negative

(b) b

2. $-2 < 0$

3. $\frac{9}{2} > \frac{3}{4}$

4. $-2 > -\frac{5}{2}$

5. $0 > -\frac{5}{2}$

6. $\frac{3}{4} < 1.6$

7. $\frac{3}{4} > -\frac{5}{2}$

8. (a) 8

(b) -8

9. $-2 + (-4) = -6$

10. $-3 + (-5) = -8$

11. $-7 + 10 = 3$

12. $-2 + 9 = 7$

13. $6 + (-3) = 3$

14. $8 + (-2) = 6$

15. $2 + (-5) = -3$

16. $7 + (-3) = 4$

17. $-19 + 2 = -17$

18. $-25 + 18 = -7$

19. $-4 + 11 = 7$

20. $-3 + 9 = 6$

21. $-16 + (-3) = -19$

22. $-12 + (-23) = -35$

23. $-2 + (-21) = -23$

24. $-13 + (-1) = -14$

25. $0 + (-5) = -5$

26. $0 + (-4) = -4$

27. $-3 + 0 = -3$

28. $-8 + 0 = -8$

29. $-16 + 16 = 0$

30. $11 + (-11) = 0$

31. $41 + (-41) = 0$

32. $-15 + 15 = 0$

33. $4 + (-9) = -5$

34. $6 + (-9) = -3$

35. $7 + (-2) + (-8) = -3$

36. $2 + (-3) + (-6) = -1 + (-6) = -7$

37. $-17 + (-3) + 20 = -20 + 20 = 0$

38. $-9 + (-6) + 15 = -15 + 15 = 0$

39. $-3 + (-8) + (-12) = -11 + (-12) = -23$

40. $-8 + (-2) + (-13) = -10 + (-13) = -23$

$$\begin{aligned} 41. & -42 + (3) + 45 + (-6) \\ & = -45 + 45 + (-6) \\ & = -6 \end{aligned}$$

$$\begin{aligned} 42. & 36 + (-3) + (-8) + (-25) \\ & = 33 + (-8) + (-25) \\ & = 0 \end{aligned}$$

$$\begin{aligned} 43. & -5 + (-3) + (-7) + 4 + 8 \\ & = -8 + (-7) + 4 + 8 \\ & = -3 \end{aligned}$$

$$\begin{aligned} 44. & -13 + (-1) + 5 + 2 + (-20) \\ & = -14 + 5 + 2 + (-20) \\ & = -7 + (-20) \\ & = -27 \end{aligned}$$

$$45. 23.81 + (-2.51) = 21.3$$

$$46. -9.23 + 10.53 = 1.3$$

$$47. -\frac{2}{7} + \frac{1}{14} = -\frac{4}{14} + \frac{1}{14} = -\frac{3}{14}$$

$$48. -\frac{1}{8} + \frac{5}{16} = -\frac{2}{16} + \frac{5}{16} = \frac{3}{16}$$

$$49. \frac{2}{3} + \left(-\frac{5}{6}\right) = \frac{4}{6} + \left(-\frac{5}{6}\right) = -\frac{1}{6}$$

$$50. \frac{1}{2} + \left(-\frac{3}{4}\right) = \frac{2}{4} + \left(-\frac{3}{4}\right) = -\frac{1}{4}$$

$$\begin{aligned} 51. & -\frac{7}{8} + \left(-\frac{1}{16}\right) = -\frac{14}{16} + \left(-\frac{1}{16}\right) \\ & = -\frac{15}{16} \end{aligned}$$

$$52. -\frac{1}{9} + \left(-\frac{4}{3}\right) = -\frac{1}{9} + \left(-\frac{12}{9}\right) = -\frac{13}{9}$$

$$53. -\frac{1}{4} + \frac{3}{10} = -\frac{5}{20} + \frac{6}{20} = \frac{1}{20}$$

$$54. -\frac{7}{6} + \frac{7}{8} = -\frac{28}{24} + \frac{21}{24} = -\frac{7}{24}$$

$$\begin{aligned} 55. & -2.1 + \left(-\frac{3}{10}\right) = -2.1 + -0.3 \\ & = -2.4 \text{ or } -\frac{12}{5} \end{aligned}$$

$$\begin{aligned} 56. & -8.3 + \left(-\frac{9}{10}\right) = -8.3 + -0.9 \\ & = -9.2 \text{ or } -\frac{46}{5} \end{aligned}$$

$$57. \frac{3}{4} + (-0.5) = 0.75 + (-0.5) = 0.25 \text{ or } \frac{1}{4}$$

$$58. -\frac{3}{2} + 0.45 = -1.5 + 0.45 = -1.05 \text{ or } -\frac{21}{20}$$

$$59. 8.23 + (-8.23) = 0$$

$$60. -7.5 + 7.5 = 0$$

$$61. -\frac{7}{8} + 0 = -\frac{7}{8}$$

$$62. 0 + \left(-\frac{21}{22}\right) = -\frac{21}{22}$$

$$\begin{aligned} 63. & -\frac{3}{2} + \left(-\frac{1}{3}\right) + \frac{5}{6} = -\frac{9}{6} + \left(-\frac{2}{6}\right) + \frac{5}{6} \\ & = -\frac{6}{6} = -1 \end{aligned}$$

$$64. -\frac{7}{8} + \frac{7}{6} + \frac{7}{12} = -\frac{21}{24} + \frac{28}{24} + \frac{14}{24} = \frac{21}{24} = \frac{7}{8}$$

$$65. -\frac{2}{3} + \left(-\frac{1}{9}\right) + 2 = -\frac{6}{9} + \left(-\frac{1}{9}\right) + \frac{18}{9} = \frac{11}{9}$$

$$66. -\frac{1}{4} + \left(-\frac{3}{2}\right) + 2 = -\frac{1}{4} + \left(-\frac{6}{4}\right) + \frac{8}{4} = \frac{1}{4}$$

$$67. -47.36 + 24.28 = -23.08$$

$$68. -0.015 + (0.0026) = -0.0124$$

$$69. -0.000617 + (-0.0015) = -0.002117$$

$$70. -5315.26 + (-314.89) = -5630.15$$

71. To add two numbers with different signs, subtract the smaller absolute value from the larger absolute value and apply the sign of the number with the larger absolute value.

72. To add two numbers with the same sign, add their absolute values and apply the sign.

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$$\begin{aligned} 73. \quad x + y + \sqrt{z} &= -3 + (-2) + \sqrt{16} \\ &= -5 + 4 \\ &= -1 \end{aligned}$$

$$\begin{aligned} 74. \quad 2z + x + y &= 2 \cdot 16 + (-3) + (-2) \\ &= 27 \end{aligned}$$

$$\begin{aligned} 75. \quad y + 3\sqrt{z} &= -2 + 3\sqrt{16} \\ &= -2 + 3 \cdot 4 \\ &= -2 + 12 \\ &= 10 \end{aligned}$$

$$\begin{aligned} 76. \quad -\sqrt{z} + y &= -\sqrt{16} + (-2) \\ &= -4 + (-2) = -6 \end{aligned}$$

$$\begin{aligned} 77. \quad |x| + |y| &= |-3| + |-2| \\ &= 3 + 2 \\ &= 5 \end{aligned}$$

$$\begin{aligned} 78. \quad z + x + |y| &= 16 + (-3) + |-2| \\ &= 13 + 2 \\ &= 15 \end{aligned}$$

$$\begin{aligned} 79. \quad -x + y &= -(-3) + (-2) \\ &= 3 + (-2) \\ &= 1 \end{aligned}$$

$$\begin{aligned} 80. \quad x + (-y) + z &= (-3) + [-(-2)] + 16 \\ &= -3 + 2 + 16 \\ &= -1 + 16 \\ &= 15 \end{aligned}$$

$$81. \quad -6 + (-10); -16$$

$$82. \quad -3 + 5; 2$$

$$83. \quad -3 + 8; 5$$

$$84. \quad 21 + 4; 25$$

$$85. \quad -21 + 17; -4$$

$$86. \quad -7 + 24; 17$$

$$87. \quad 3(-14 + 20); 18$$

$$88. \quad 2(6 + (-10)); -8$$

$$89. \quad (-7 + (-2)) + 5; -4$$

$$90. \quad (4 + (-1)) + (-6); -3$$

$$91. \quad -5 + 13 + (-11); -3^\circ\text{F}$$

$$92. \quad 4 + (-9) + 2; -3^\circ\text{F}$$

$$93. \quad -8 + 1 + 2 + (-5) = -10; \text{ Amara lost 10 lb.}$$

$$\begin{aligned} 94. \quad 200 + 750 + (-340) + (-290) + 900 \\ &= 1220; \\ &\text{Alan had a profit of \$1220.} \end{aligned}$$

$$95. \quad \text{(a) } 52.23 + (-52.95) = -\$0.72$$

(b) Yes

$$96. \quad \text{(a) } 40.02 + (-40.96) = -\$0.94$$

(b) Yes

$$97. \quad -5 + 0 + (-1) + (-1) + 1 = -6; \text{ She was 6 below par.}$$

$$\begin{aligned} 98. \quad \text{(a) } -50,000 + (-32,000) + (-5000) \\ &+ 13,000 + 26,000 \\ \text{(b) } &-\$48,000; \text{ a loss} \end{aligned}$$

Section 1.5 Calculator Exercises

$$1. \quad -13$$

$$2. \quad -5$$

$$3. \quad 711$$

$$4. \quad -0.18$$

$$5. \quad -17.7$$

$$6. \quad -990$$

$$7. \quad -17$$

$$8. \quad 38$$

Section 1.5 Practice Exercises

1. (a) $-b$

(b) positive

2. $\sqrt{6}$

3. x^2

4. $-7 + 10$

5. $-b + 2$

6. $4^2 - 6 \div 2 = 16 - 6 \div 2 = 16 - 3 = 13$

7. $1 + 36 \div 9 \cdot 2 = 1 + 4 \cdot 2 = 1 + 8 = 9$

8. $14 - |10 - 6| = 14 - |4| = 14 - 4 = 10$

9. -3

10. -7

11. -12

12. -9

13. 4

14. 4

15. $3 - 5 = 3 + (-5) = -2$

16. $9 - 12 = -3$

17. $3 - (-5) = 3 + 5 = 8$

18. $9 - (-12) = 9 + 12 = 21$

19. $-3 - 5 = -3 + (-5) = -8$

20. $-9 - 12 = -9 + (-12) = -21$

21. $-3 - (-5) = -3 + 5 = 2$

22. $-9 - (-5) = -9 + 5 = -4$

23. $23 - 17 = 6$

24. $14 - 2 = 12$

25. $23 - (-17) = 23 + 17 = 40$

26. $14 - (-2) = 14 + 2 = 16$

27. $-23 - 17 = -23 + (-17) = -40$

28. $-14 - 2 = -14 + (-2) = -16$

29. $-23 - (-23) = 0$

30. $-14 - (-14) = 0$

31. $-6 - 14 = -6 + (-14) = -20$

32. $-9 - 12 = -9 + (-12) = -21$

33. $-7 - 17 = -7 + (-17) = -24$

34. $-8 - 21 = -8 + (-21) = -29$

35. $13 - (-12) = 13 + 12 = 25$

36. $20 - (-5) = 20 + 5 = 25$

37. $-14 - (-9) = -14 + 9 = -5$

38. $-21 - (-17) = -21 + 17 = -4$

39. $-\frac{6}{5} - \frac{3}{10} = -\frac{12}{10} + \left(-\frac{3}{10}\right) = -\frac{15}{10} = -\frac{3}{2}$

40. $-\frac{2}{9} - \frac{5}{3} = -\frac{2}{9} + \left(-\frac{15}{9}\right) = -\frac{17}{9}$

41. $\frac{3}{8} - \left(-\frac{4}{3}\right) = \frac{9}{24} + \frac{32}{24} = \frac{41}{24}$

42. $\frac{7}{10} - \left(-\frac{5}{6}\right) = \frac{21}{30} + \frac{25}{30} = \frac{46}{30} = \frac{23}{15}$

43. $\frac{1}{2} - \frac{1}{10} = \frac{5}{10} - \frac{1}{10} = \frac{4}{10} = \frac{2}{5}$

44. $\frac{2}{7} - \frac{3}{14} = \frac{4}{14} - \frac{3}{14} = \frac{1}{14}$

45. $-\frac{11}{12} - \left(-\frac{1}{4}\right) = -\frac{11}{12} + \frac{3}{12} = -\frac{8}{12} = -\frac{2}{3}$

46. $-\frac{7}{8} - \left(-\frac{1}{6}\right) = -\frac{21}{24} + \frac{4}{24} = -\frac{17}{24}$

47. $6.8 - (-2.4) = 6.8 + 2.4 = 9.2$

48. $7.2 - (-1.9) = 7.2 + 1.9 = 9.1$

49. $3.1 - 8.82 = 3.10 + (-8.82) = -5.72$

50. $1.8 - 9.59 = 1.80 + (-9.59) = -7.79$

51. $-4 - 3 - 2 - 1$

$= -4 + (-3) + (-2) + (-1)$

$= -10$

52. $-10 - 9 - 8 - 7 = -10 + (-9) + (-8) + (-7)$
 $= -34$

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$$\begin{aligned} 53. \quad 6 - 8 - 2 - 10 &= 6 + (-8) + (-2) + (-10) \\ &= -14 \end{aligned}$$

$$\begin{aligned} 54. \quad 20 - 50 - 10 - 5 \\ &= 20 + (-50) + (-10) + (-5) \\ &= -45 \end{aligned}$$

$$\begin{aligned} 55. \quad 10 + (-14) + 6 - 22 \\ &= 10 + (-14) + 6 + (-22) \\ &= 16 + (-36) \\ &= -20 \end{aligned}$$

$$\begin{aligned} 56. \quad -3 - (-8) + (-11) - 6 \\ &= -3 + 8 + (-11) + (-6) \\ &= 8 + (-20) \\ &= -12 \end{aligned}$$

$$\begin{aligned} 57. \quad -112.846 + (-13.03) - 47.312 \\ &= -173.188 \end{aligned}$$

$$\begin{aligned} 58. \quad -96.473 + (-36.02) - 16.617 \\ &= -149.11 \end{aligned}$$

$$59. \quad 0.085 - (-3.14) + (0.018) = 3.243$$

$$\begin{aligned} 60. \quad 0.00061 - (-0.00057) + 0.0014 \\ &= 0.00258 \end{aligned}$$

$$61. \quad 6 - (-7); 13$$

$$62. \quad 18 - (-1); 19$$

$$63. \quad 3 - 18; -15$$

$$64. \quad 8 - 21; -13$$

$$65. \quad -5 - (-11); 6$$

$$66. \quad -2 - (-18); 16$$

$$67. \quad -1 - (-13); 12$$

$$68. \quad -19 - (-31); 12$$

$$69. \quad -32 - 20; -52$$

$$70. \quad -3 - 7; -10$$

$$71. \quad 200 + 400 + 600 + 800 - 1000; \$1000$$

$$72. \quad 1200 - 500 + 800; \$1500$$

$$73. \quad 113^\circ - (-39^\circ) = 152^\circ\text{F}$$

$$74. \quad 75^\circ - (-52^\circ) = 127^\circ\text{F}$$

$$75. \quad 8848 - (-11,033 \text{ m}) = 19,881 \text{ m}$$

$$76. \quad 20,320 \text{ ft} - (-282 \text{ ft}) = 20,602 \text{ ft}$$

$$\begin{aligned} 77. \quad 6 + 8 - (-2) - 4 + 1 &= 14 + 2 - 4 + 1 \\ &= 16 - 4 + 1 \\ &= 13 \end{aligned}$$

$$\begin{aligned} 78. \quad -3 - (-4) + 1 - 2 - 5 &= -3 + 4 + 1 - 2 - 5 \\ &= 2 - 2 - 5 \\ &= -5 \end{aligned}$$

$$\begin{aligned} 79. \quad -1 - 7 + (-3) - 8 + 10 &= -8 + (-3) - 8 + 10 \\ &= -9 \end{aligned}$$

$$\begin{aligned} 80. \quad 13 - 7 + 4 - 3 - (-1) &= 6 + 4 - 3 + 1 \\ &= 8 \end{aligned}$$

$$\begin{aligned} 81. \quad 2 - (-8) + 7 + 3 - 15 &= 2 + 8 + 7 + 3 - 15 \\ &= 17 + 3 - 15 \\ &= 5 \end{aligned}$$

$$82. \quad 8 - (-13) + 1 - 9 = 8 + 13 + 1 - 9 = 13$$

$$\begin{aligned} 83. \quad -6 + (-1) + (-8) + (-10) \\ &= -7 + (-8) + (-10) \\ &= -25 \end{aligned}$$

$$\begin{aligned} 84. \quad -8 + (-3) + (-5) + (-2) \\ &= -11 + (-5) + (-2) \\ &= -18 \end{aligned}$$

$$\begin{aligned} 85. \quad -4 - \{11 - [4 - (-9)]\} &= -4 - \{11 - [4 + 9]\} \\ &= -4 - \{11 - 13\} \\ &= -4 - (-2) \\ &= -2 \end{aligned}$$

$$\begin{aligned} 86. \quad 15 - \{25 + 2[3 - (-1)]\} &= 15 - \{25 + 2[4]\} \\ &= 15 - \{25 + 8\} \\ &= 15 - 33 \\ &= -18 \end{aligned}$$

$$\begin{aligned} 87. \quad -\frac{13}{10} + \frac{8}{15} - \left(-\frac{2}{5}\right) &= -\frac{39}{30} + \frac{16}{30} + \frac{12}{30} \\ &= -\frac{11}{30} \end{aligned}$$

$$\begin{aligned} 88. \quad \frac{11}{14} - \left(-\frac{9}{7}\right) - \frac{3}{2} &= \frac{11}{14} + \frac{18}{14} - \frac{21}{14} \\ &= \frac{8}{14} = \frac{4}{7} \end{aligned}$$

$$\begin{aligned} 89. & \left(\frac{2}{3} - \frac{5}{9}\right) - \left(\frac{4}{3} - (-2)\right) \\ & = \left(\frac{6}{9} - \frac{5}{9}\right) - \left(\frac{4}{3} + \frac{6}{3}\right) \\ & = \frac{1}{9} - \frac{10}{3} \\ & = \frac{1}{9} - \frac{30}{9} = -\frac{29}{9} \end{aligned}$$

$$\begin{aligned} 90. & \left(-\frac{9}{8} - \frac{1}{4}\right) - \left(-\frac{5}{6} + \frac{1}{8}\right) \\ & = \left(-\frac{9}{8} - \frac{2}{8}\right) - \left(-\frac{20}{24} + \frac{3}{24}\right) \\ & = -\frac{11}{8} - \left(-\frac{17}{24}\right) = -\frac{33}{24} + \frac{17}{24} \\ & = -\frac{16}{24} = -\frac{2}{3} \end{aligned}$$

$$91. \sqrt{29 + (-4)} - 7 = \sqrt{25} - 7 = 5 - 7 = -2$$

$$\begin{aligned} 92. 8 - \sqrt{98 + (-3) + 5} & = 8 - \sqrt{100} \\ & = 8 - 10 \\ & = -2 \end{aligned}$$

$$\begin{aligned} 93. |10 + (-3)| - |-12 + (-6)| & = |7| - |-18| \\ & = 7 - 18 \\ & = -11 \end{aligned}$$

$$94. |6 - 8| + |12 - 5| = |-2| + |7| = 2 + 7 = 9$$

$$95. \frac{3 - 4 + 5}{4 + (-2)} = \frac{4}{2} = 2$$

$$96. \frac{12 - 14 + 6}{6 + (-2)} = \frac{4}{4} = 1$$

$$\begin{aligned} 97. (a + b) - c & = (-2 + (-6)) - (-1) \\ & = -8 + 1 \\ & = -7 \end{aligned}$$

$$\begin{aligned} 98. (a - b) + c & = (-2 - (-6)) + (-1) \\ & = 4 + (-1) \\ & = 3 \end{aligned}$$

$$\begin{aligned} 99. a - (b + c) & = -2 - (-6 + (-1)) \\ & = -2 - (-7) \\ & = -2 + 7 \\ & = 5 \end{aligned}$$

$$\begin{aligned} 100. a + (b - c) & = -2 + (-6 - (-1)) \\ & = -2 + -5 \\ & = -7 \end{aligned}$$

$$\begin{aligned} 101. (a - b) - c & = (-2 - (-6)) - (-1) \\ & = (4) + 1 \\ & = 5 \end{aligned}$$

$$\begin{aligned} 102. (a + b) + c & = (-2 + (-6)) + (-1) \\ & = (-8) + (-1) \\ & = -9 \end{aligned}$$

$$\begin{aligned} 103. a - (b - c) & = -2 - (-6 - (-1)) \\ & = -2 - (-5) \\ & = -2 + 5 \\ & = 3 \end{aligned}$$

$$\begin{aligned} 104. a + (b + c) & = -2 + (-6 + (-1)) \\ & = -2 + (-7) \\ & = -9 \end{aligned}$$

Problem Recognition Exercises

1. Add their absolute values and apply a negative sign.

2. Subtract the smaller absolute value from the larger absolute value. Apply the sign of the number with the larger absolute value.

3. (a) $14 + (-8) = 6$

(b) $-14 + 8 = -6$

(c) $-14 + (-8) = -22$

(d) $14 - (-8) = 14 + 8 = 22$

(e) $-14 - 8 = -14 + (-8) = -22$

4. (a) $-5 - (-3) = -5 + 3 = -2$

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(b) $-5 + (-3) = -8$

(c) $-5 - 3 = -5 + (-3) = -8$

(d) $-5 + 3 = -2$

(e) $5 - (-3) = 5 + 3 = 8$

5. (a) $-25 + 25 = 0$

(b) $25 - 25 = 25 + (-25) = 0$

(c) $25 - (-25) = 25 + 25 = 50$

(d) $-25 - (-25) = -25 + 25 = 0$

(e) $-25 + (-25) = -50$

6. (a) $\frac{1}{2} + \left(-\frac{2}{3}\right) = \frac{3}{6} + \left(-\frac{4}{6}\right)$
 $= -\frac{1}{6}$

(b) $-\frac{1}{2} + \left(\frac{2}{3}\right) = -\frac{3}{6} + \left(\frac{4}{6}\right)$
 $= \frac{1}{6}$

(c) $-\frac{1}{2} + \left(-\frac{2}{3}\right) = -\frac{3}{6} + \left(-\frac{4}{6}\right)$
 $= -\frac{7}{6}$

(d) $\frac{1}{2} - \left(-\frac{2}{3}\right) = \frac{1}{2} + \left(\frac{2}{3}\right)$
 $= \frac{3}{6} + \left(\frac{4}{6}\right) = \frac{7}{6}$

(e) $-\frac{1}{2} - \frac{2}{3} = -\frac{1}{2} + \left(-\frac{2}{3}\right)$
 $= -\frac{3}{6} + \left(-\frac{4}{6}\right) = -\frac{7}{6}$

7. (a) $3.5 - 7.1 = 3.5 + (-7.1)$
 $= -3.6$

(b) $3.5 - (-7.1) = 3.5 + 7.1$
 $= 10.6$

(c) $-3.5 + 7.1 = 3.6$

(d) $-3.5 - (-7.1) = -3.5 + 7.1$
 $= 3.6$

(e) $-3.5 + (-7.1) = -10.6$

8. (a) $6 - 1 + 4 - 5 = 6 + (-1) + 4 + (-5)$
 $= 4$

(b) $6 - (1 + 4) - 5 = 6 - (5) - 5$
 $= 6 + (-5) + (-5)$
 $= -4$

(c) $6 - (1 + 4 - 5) = 6 - (0)$
 $= 6$

(d) $(6 - 1) - (4 - 5) = 5 - (-1)$
 $= 5 + 1$
 $= 6$

9. (a) $-100 - 90 - 80 = -100 + (-90) + (-80)$
 $= -270$

(b) $-100 - (90 - 80) = -100 - (10)$
 $= -100 + (-10)$
 $= -110$

(c) $-100 + (90 - 80) = -100 + (10)$
 $= -90$

(d) $-100 - (90 + 80) = -100 - (170)$
 $= -270$

10. (a) $-8 - (-10) + 20^2 = -8 + 10 + 400$
 $= 402$

(b) $-8 - (-10 + 20)^2 = -8 - (10)^2$
 $= -8 - (100)$
 $= -8 + (-100)$
 $= -108$

(c) $[-8 - (-10) + 20]^2 = (-8 + 10 + 20)^2$
 $= (22)^2$
 $= 484$

(d) $[-8 - (-10)]^2 + 20 = (2)^2 + 20$
 $= 4 + 20$
 $= 24 = -108$

Section 1.6 Calculator Exercises

- | | |
|-----------|----------|
| 1. 30 | 7. 5. 76 |
| 2. -2 | 8. -1 |
| 3. 625 | 9. 4 |
| 4. 625 | 10. -36 |
| 5. -625 | |
| 6. -5. 76 | |

Section 1.6 Practice Exercises

- | | |
|--|---|
| 1. (a) $\frac{1}{a}$ | 14. $\left(-\frac{5}{4}\right)\left(-\frac{12}{25}\right) = \frac{60}{100} = \frac{3}{5}$ |
| (b) 0 | 15. $(-6)^2 = 36$ |
| (c) 0 | 16. $(-10)^2 = 100$ |
| (d) undefined | 17. $-6^2 = -36$ |
| (e) positive | 18. $-10^2 = -100$ |
| (f) negative | 19. $\left(-\frac{3}{5}\right)^3 = \left(-\frac{3}{5}\right)\left(-\frac{3}{5}\right)\left(-\frac{3}{5}\right) = -\frac{27}{125}$ |
| (g) 1; $-\frac{3}{2}$ | 20. $\left(-\frac{5}{2}\right)^3 = \left(-\frac{5}{2}\right)\left(-\frac{5}{2}\right)\left(-\frac{5}{2}\right) = -\frac{125}{8}$ |
| (h) All of these | 21. $(-0.2)^4 = 0.0016$ |
| 2. True; $4 > 1$ | 22. $(-0.1)^4 = 0.0001$ |
| 3. True; $20 \leq 20$ | 23. $\frac{54}{-9} = -6$ |
| 4. False; $0 > 0$ | 24. $\frac{-27}{3} = -9$ |
| 5. False; $6 \leq 0$ | 25. $\frac{-15}{-17} = \frac{15}{17}$ |
| 6. False; $11 \geq 17$ | 26. $\frac{-21}{-16} = \frac{21}{16}$ |
| 7. -56 | 27. $\frac{-14}{-14} = 1$ |
| 8. -12 | 28. $\frac{-21}{-21} = 1$ |
| 9. 143 | 29. $\frac{13}{-65} = -\frac{1}{5}$ |
| 10. 130 | |
| 11. -12. 76 | |
| 12. -40. 95 | |
| 13. $\left(-\frac{2}{3}\right)\left(-\frac{9}{8}\right) = \frac{18}{24} = \frac{3}{4}$ | |

Chapter 1 The Set of Real Numbers

$$30. \frac{7}{-77} = -\frac{1}{11}$$

$$31. (-2)(-7) = 14$$

$$32. (-6)(3) = -18$$

$$33. -5 \cdot 0 = 0$$

$$34. -4 \cdot 0 = 0$$

35. No number multiplied by 0 equals 6.

36. No number multiplied by 0 equals -4.

$$37. (-6)(4) = -24$$

$$38. (2)(-9) = -18$$

$$39. 2 \cdot 3 = 6$$

$$40. 8 \cdot 6 = 48$$

$$41. 2(-3) = -6$$

$$42. 8(-6) = -48$$

$$43. (-24) \div 3 = -8$$

$$44. (-52) \div 2 = -26$$

$$45. (-24) \div (-3) = 8$$

$$46. (-52) \div (-2) = 26$$

$$47. -6 \cdot 0 = 0$$

$$48. -8 \cdot 0 = 0$$

49. Undefined

50. Undefined

$$51. 0 \left(-\frac{2}{5} \right) = 0$$

$$52. 0 \left(-\frac{1}{8} \right) = 0$$

$$53. 0 \div \left(-\frac{1}{10} \right) = 0$$

$$54. 0 \div \left(\frac{4}{9} \right) = 0$$

$$55. \frac{-9}{6} = -\frac{3}{2}$$

$$56. \frac{-15}{10} = -\frac{3}{2}$$

$$57. \frac{-30}{-100} = \frac{3}{10}$$

$$58. \frac{-250}{-1000} = \frac{1}{4}$$

$$59. \frac{26}{-13} = -2$$

$$60. \frac{52}{-4} = -13$$

$$61. (1.72)(-4.6) = -7.912$$

$$62. 361.3(-14.9) = -5383.37$$

$$63. -0.02(-4.6) = 0.092$$

$$64. -0.06(-2.15) = 0.129$$

$$65. \frac{14.4}{-2.4} = -6$$

$$66. \frac{50.4}{-6.3} = -8$$

$$67. \frac{-5.25}{-2.5} = 2.1$$

$$68. \frac{-8.5}{-27.2} = 0.3125$$

$$69. (-3)^2 = 9$$

$$70. (-7)^2 = 49$$

$$71. -3^2 = -9$$

$$72. -7^2 = -49$$

$$73. \left(-\frac{4}{3} \right)^3 = \left(-\frac{4}{3} \right) \left(-\frac{4}{3} \right) \left(-\frac{4}{3} \right) \\ = -\frac{64}{27}$$

$$74. \left(-\frac{1}{5} \right)^3 \\ = \left(-\frac{1}{5} \right) \left(-\frac{1}{5} \right) \left(-\frac{1}{5} \right) \\ = -\frac{1}{125}$$

$$75. (-6.8) \div (-0.02) = 340$$

$$76. (-12.3) \div (-0.03) = 410$$

$$\begin{aligned}
 77. \left(-\frac{7}{8}\right) \div \left(-\frac{9}{16}\right) &= \left(-\frac{7}{8}\right) \cdot \left(-\frac{16}{9}\right) \\
 &= \frac{112}{72} \\
 &= \frac{\cancel{8} \cdot 14}{\cancel{8} \cdot 9} \\
 &= \frac{14}{9}
 \end{aligned}$$

$$\begin{aligned}
 78. \left(-\frac{22}{23}\right) \div \left(-\frac{11}{3}\right) &= \frac{22}{23} \cdot \frac{3}{11} \\
 &= \frac{66}{253} \\
 &= \frac{6 \cdot \cancel{11}}{23 \cdot \cancel{11}} \\
 &= \frac{6}{23}
 \end{aligned}$$

$$79. (-2)(-5)(-3) = (10)(-3) = -30$$

$$80. (-6)(-1)(-10) = (6)(-10) = -60$$

$$81. (-8)(-4)(-1)(-3) = (32)(3) = 96$$

$$82. (-6)(-1)(-3)(-5) = (6)(15) = 90$$

$$83. 100 \div (-10) \div (-5) = (-10) \div (-5) = 2$$

$$84. 150 \div (-15) \div (-2) = -10 \div (-2) = 5$$

$$85. -12 \div (-6) \div (-2) = 2 \div (-2) = -1$$

$$86. -36 \div (-2) \div 6 = 18 \div 6 = 3$$

$$\begin{aligned}
 87. \frac{2}{5} \cdot \frac{1}{3} \cdot \left(-\frac{10}{11}\right) &= \frac{2}{15} \cdot \left(-\frac{10}{11}\right) \\
 &= -\frac{20}{165} = -\frac{4}{33}
 \end{aligned}$$

$$\begin{aligned}
 88. \left(-\frac{9}{8}\right) \cdot \left(-\frac{2}{3}\right) \cdot \left(1\frac{5}{12}\right) &= \left(\frac{18}{24}\right) \cdot \left(\frac{17}{12}\right) \\
 &= \left(\frac{3}{4}\right) \cdot \left(\frac{17}{12}\right) \\
 &= \frac{51}{48} \\
 &= \frac{\cancel{3} \cdot 17}{\cancel{3} \cdot 16} \\
 &= \frac{17}{16} = 1\frac{1}{16}
 \end{aligned}$$

$$\begin{aligned}
 89. \left(1\frac{1}{3}\right) \div 3 \div \left(-\frac{7}{9}\right) &= \frac{4}{3} \cdot \frac{1}{3} \div \left(-\frac{7}{9}\right) \\
 &= \frac{4}{9} \cdot \left(-\frac{9}{7}\right) \\
 &= -\frac{4}{7}
 \end{aligned}$$

$$\begin{aligned}
 90. -\frac{7}{8} \div \left(3\frac{1}{4}\right) \div (-2) &= -\frac{7}{8} \cdot \frac{4}{13} \div (-2) \\
 &= -\frac{7}{26} \cdot \left(-\frac{1}{2}\right) \\
 &= \frac{7}{52}
 \end{aligned}$$

$$\begin{aligned}
 91. 12 \div (-2)(4) &= (-6)(4) \\
 &= -24
 \end{aligned}$$

$$\begin{aligned}
 92. (-6) \cdot 7 \div (-2) &= -42 \div (-2) \\
 &= 21
 \end{aligned}$$

$$\begin{aligned}
 93. \left(-\frac{12}{5}\right) \div (-6) \cdot \left(-\frac{1}{8}\right) &= \left(-\frac{12}{5}\right) \cdot \left(-\frac{1}{6}\right) \cdot \left(-\frac{1}{8}\right) \\
 &= \frac{12}{30} \cdot \left(-\frac{1}{8}\right) \\
 &= \frac{2}{5} \cdot \left(-\frac{1}{8}\right) = -\frac{2}{40} = -\frac{1}{20}
 \end{aligned}$$

$$94. 10 \cdot \frac{1}{3} \div \frac{25}{6} = \frac{10}{3} \cdot \frac{6}{25} = \frac{60}{75} = \frac{4}{5}$$

$$\begin{aligned}
 95. 8 - 2^3 \cdot 5 + 3 - (-6) &= 8 - 8 \cdot 5 + 3 + 6 \\
 &= 8 - 40 + 3 + 6 \\
 &= -23
 \end{aligned}$$

$$96. -14 \div (-7) - 8 \cdot 2 + 3^3 = 2 - 16 + 27 = 13$$

$$\begin{aligned}
 97. -(2-8)^2 \div (-6) \cdot 2 &= -36 \div (-6) \cdot 2 \\
 &= 6 \cdot 2 \\
 &= 12
 \end{aligned}$$

$$\begin{aligned}
 98. -(3-5)^2 \cdot 6 \div (-4) &= -4 \cdot 6 \div (-4) \\
 &= -24 \div (-4) \\
 &= 6
 \end{aligned}$$

$$99. \frac{6(-4) - 2(5-8)}{-6-3-5} = \frac{-24+6}{-14} = \frac{-18}{-14} = \frac{9}{7}$$

$$100. \frac{3(-4) - 5(9-11)}{-9-2-3} = \frac{-12+10}{-14} = \frac{-2}{-14} = \frac{1}{7}$$

$$101. \frac{-4+5}{(-2) \cdot 5+10} = \frac{1}{-10+10}$$

$$= \frac{1}{0} \text{ is undefined}$$

$$102. \frac{-3+10}{2(-4)+8} = \frac{7}{-8+8}$$

$$= \frac{7}{0} \text{ is undefined}$$

$$103. -4 - 3[2 - (-5+3)] - 8 \cdot 2^2$$

$$= -4 - 3[2 - (-2)] - 8 \cdot 4$$

$$= -4 - 3[4] - 32$$

$$= -4 - 12 - 32$$

$$= -48$$

$$104. -6 - 5[-4 - (6-12)] + (-5)^2$$

$$= -6 - 5[-4 - (-6)] + 25$$

$$= -6 - 5[2] + 25$$

$$= -6 - 10 + 25$$

$$= 9$$

$$105. -|-1| - |5| = -1 - 5 = -6$$

$$106. -|-10| - |6| = -10 - 6 = -16$$

$$107. \frac{|2-9| - |5-7|}{10-15} = \frac{7-2}{-5} = \frac{5}{-5} = -1$$

$$108. \frac{|-2+6| - |3-5|}{13-11} = \frac{4-2}{2} = \frac{2}{2} = 1$$

$$109. \frac{6-3[2-(6-8)]^2}{-2|2-5|} = \frac{6-3[2-(-2)]^2}{-2 \cdot 3}$$

$$= \frac{6-3 \cdot 16}{-6}$$

$$= \frac{6-48}{-6}$$

$$= \frac{-42}{-6}$$

$$= 7$$

$$110. \frac{12-4[-6-(5-8)]^2}{4|6-10|}$$

$$= \frac{12-4[-6-(-3)]^2}{4 \cdot 4}$$

$$= \frac{12-4 \cdot 9}{16}$$

$$= \frac{12-36}{16} = \frac{-24}{16} = -\frac{3}{2}$$

$$111. -x^2 = -(-2)^2 = -4$$

$$112. x^2 = (-2)^2 = 4$$

$$113. 4(2x-z) = 4(2(-2)-6)$$

$$= 4(-4-6)$$

$$= 4(-10)$$

$$= -40$$

$$114. 6(3x+y) = 6(3(-2)+(-4))$$

$$= 6(-6+(-4))$$

$$= 6(-10)$$

$$= -60$$

$$115. \frac{3x+2y}{y} = \frac{3(-2)+2(-4)}{-4}$$

$$= \frac{-6+(-8)}{-4}$$

$$= \frac{-14}{-4}$$

$$= \frac{7}{2}$$

$$116. \frac{2z-y}{x} = \frac{2(6)-(-4)}{-2} = \frac{12+4}{-2}$$

$$= \frac{16}{-2} = -8$$

117. No, the first expression equals $10 \div (5x) = 2 \div x$, and the second equals $10 \div 5 \cdot x = 2x$.

118. Yes, the parentheses indicate that the divisor is the quantity $5x$.

$$119. -3.75(0.3) = -1.125$$

$$120. -0.4(-1.258) = 0.5032$$

Problem Recognition Exercises: Adding, Subtracting, Multiplying, and Dividing Real Numbers

$$121. \left(\frac{16}{5}\right) \div \left(-\frac{8}{9}\right) = \frac{16}{5} \cdot \left(-\frac{9}{8}\right) \\ = -\frac{144}{40} = -\frac{18}{5}$$

$$122. -\frac{3}{14} \div \frac{1}{7} = -\frac{3}{14} \cdot \frac{7}{1} = -\frac{21}{14} = -\frac{3}{2}$$

$$123. -0.4 + 6(-0.42) = -2.92$$

$$124. 0.5 + (-2)(0.125) = 0.25$$

$$125. -\frac{1}{4} - 6\left(-\frac{1}{3}\right) = -\frac{1}{4} + 2 = -\frac{1}{4} + \frac{8}{4} = \frac{7}{4}$$

$$126. -5 - \left(-\frac{5}{6}\right)\left(\frac{3}{8}\right) = -5 - \left(-\frac{15}{48}\right) \\ = -5 + \frac{5}{16} \\ = -\frac{80}{16} + \frac{5}{16} \\ = -\frac{75}{16}$$

$$127. -2(3) + 3 = -3; \text{ a loss of } \$3$$

$$128. -2(6) + 5 = -7; \text{ a loss of } \$7$$

$$129. 2(5) + 3(-3) = 1; \text{ Lorne was 1 sale} \\ \text{above quota for the week.}$$

$$130. 650 + 2(-400) + 2(-150) = -450; \\ \text{Valerie lost } \$450 \text{ for the week.}$$

$$131. \frac{12 + (-15) + 4 + (-9) + 3}{5} = -1;$$

The average loss was 1 oz.

$$132. \frac{-1.5 + (-2) + 1.5 + 2.5 + (-3) + (-0.5)}{6} \\ = -0.5;$$

The average loss was 0.5 in.

$$133. \text{(a) } -4 - 3 - 2 - 1 \\ = -4 + (-3) + (-2) + (-1) \\ = -10$$

$$\text{(b) } -4(-3)(-2)(-1) = 12(2) = 24$$

(c) Part (a) is subtraction; part (b) is multiplication.

$$134. \text{(a) } -10 - 9 - 8 - 7 \\ = -10 + (-9) + (-8) + (-7) \\ = -34$$

$$\text{(b) } -10(-9)(-8)(-7) = 90(56) = 5040$$

(c) Part (a) is subtraction; part (b) is multiplication.

Problem Recognition Exercises

$$1. \text{(a) } -8 - (-4) = -4$$

$$\text{(b) } -8(-4) = 32$$

$$\text{(c) } -8 + (-4) = -12$$

$$\text{(d) } -8 \div (-4) = 2$$

$$2. \text{(a) } 12 + (-2) = 10$$

$$\text{(b) } 12 - (-2) = 14$$

$$\text{(c) } 12(-2) = -24$$

$$\text{(d) } 12 \div (-2) = -6$$

$$3. \text{(a) } -36 + 9 = -27$$

$$\text{(b) } -36(9) = -324$$

$$\text{(c) } -36 \div 9 = -4$$

$$\text{(d) } -36 - 9 = -45$$

$$4. \text{(a) } 27 - (-3) = 30$$

$$\text{(b) } 27 + (-3) = 24$$

$$\text{(c) } 27(-3) = -81$$

$$\text{(d) } 27 \div (-3) = -9$$

$$5. \text{(a) } -5(-10) = 50$$

$$\text{(b) } -5 + (-10) = -15$$

$$\text{(c) } -5 \div (-10) = \frac{1}{2}$$

Chapter 1 The Set of Real Numbers

- (d) $-5 - (-10) = 5$
6. (a) $-20 \div 4 = -5$
(b) $-20 - 4 = -24$
(c) $-20 + 4 = -16$
(d) $-20(4) = -80$
7. (a) $-4(-16) = 64$
(b) $-4 - (-16) = 12$
(c) $-4 \div (-16) = \frac{1}{4}$
(d) $-4 + (-16) = -20$
8. (a) $-21 \div 3 = -7$
(b) $-21 - 3 = -24$
(c) $-21(3) = -63$
(d) $-21 + 3 = -18$
9. (a) $80(-5) = -400$
(b) $80 - (-5) = 85$
(c) $80 \div (-5) = -16$
- (d) $80 + (-5) = 75$
10. (a) $-14 - (-21) = 7$
(b) $-14(-21) = 294$
(c) $-14 \div (-21) = \frac{2}{3}$
(d) $-14 + (-21) = -35$
11. (a) $|-6| + |2| = 6 + 2 = 8$
(b) $|-6 + 2| = |-4| = 4$
(c) $|-6| - |-2| = 6 - 2 = 4$
(d) $|-6 - 2| = |-8| = 8$
12. (a) $-|9| - |-7| = -9 - 7 = -16$
(b) $|-9| - |-7| = 9 - 7 = 2$
(c) $-|9 - 7| = -|2| = -2$
(d) $|-9 - 7| = |-16| = 16$

Section 1.7 Practice Exercises

1. (a) constant
(b) coefficient
(c) 1; 1
(d) like
2. $(-6) + 14 = 8$
3. $(-2) + 9 = 7$
4. $-13 - (-5) = -13 + 5 = -8$
5. $-1 - (-19) = -1 + 19 = 18$
6. $18 \div (-4) = -\frac{18}{4} = -\frac{9}{2} = -4.5$
7. $-27 \div 5 = -\frac{27}{5} = -5.4$
8. $-3 \cdot 0 = 0$
9. $0(-15) = 0$
10. $\frac{1}{2} + \frac{3}{8} = \frac{4}{8} + \frac{3}{8} = \frac{7}{8}$
11. $\frac{25}{21} - \frac{6}{7} = \frac{25}{21} - \frac{18}{21} = \frac{7}{21} = \frac{1}{3}$
12. $\left(-\frac{3}{5}\right)\left(\frac{4}{27}\right) = -\frac{12}{135} = -\frac{4}{45}$
13. $\left(-\frac{11}{12}\right) \div \left(-\frac{5}{4}\right) = \left(-\frac{11}{12}\right) \cdot \left(-\frac{4}{5}\right) = \frac{44}{60} = \frac{11}{15}$
14. $25 \cdot \left(-\frac{4}{5}\right) = -\left(\frac{25 \cdot 4}{5}\right) = -\frac{100}{5} = -20$
15. $-8 + 5$
16. $-2 + 7$
17. $x + 8$

Section 1.7 Properties of Real Numbers and Simplifying Expressions

18. $11 + p$

19. $4(5)$

20. $8(10)$

21. $-12x$

22. $-23y$

23. $x + (-3); -3 + x$

24. $y + (-7); -7 + y$

25. $4p + (-9); -9 + 4p$

26. $3m + (-12); -12 + 3m$

27. $(x + 4) + 9 = x + (4 + 9) = x + 13$

28. $-3 + (5 + z) = (-3 + 5) + z; 2 + z$

29. $-5(3x) = (-5 \cdot 3)x = -15x$

30. $-12(4z) = (-12 \cdot 4)z = -48z$

31. $\frac{6}{11}\left(\frac{11}{6}x\right) = \left(\frac{6}{11} \cdot \frac{11}{6}\right)x = x$

32. $\frac{3}{5}\left(\frac{5}{3}x\right) = \left(\frac{3}{5} \cdot \frac{5}{3}\right)x = x$

33. $-4\left(-\frac{1}{4}t\right) = \left(-4 \cdot -\frac{1}{4}\right)t = t$

34. $-5\left(-\frac{1}{5}w\right) = \left(-5 \cdot -\frac{1}{5}\right)w = w$

35. $-8 + (2 + y) = (-8 + 2) + y = -6 + y$

36. $[x + (-5)] + 7 = x + [(-5) + 7] = x + 2$

37. $-5(2x) = (-5 \cdot 2)x = -10x$

38. $-10(6t) = (-10 \cdot 6)t = -60t$

39. Reciprocal

40. Opposite

41. Zero

42. One

43. $6(5x + 1) = 6(5x) + 6(1) = 30x + 6$

44. $2(x + 7) = 2x + 2(7) = 2x + 14$

45. $-2(a + 8) = -2a + (-2)(8) = -2a - 16$

46. $-3(2z + 9) = -3(2z) + (-3)(9)$
 $= -6z - 27$

47. $3(5c - d) = 3(5c) - 3d = 15c - 3d$

48. $4(w - 13z) = 4w - 4(13z) = 4w - 52z$

49. $-7(y - 2) = -7y - (-7)(2) = -7y + 14$

50. $-2(4x - 1) = -2(4x) - (-2)(1) = -8x + 2$

51. $-\frac{2}{3}(x - 6) = -\frac{2}{3}x - \left(-\frac{2}{3}\right)(6)$
 $= -\frac{2}{3}x + \frac{12}{3}$
 $= -\frac{2}{3}x + 4$

52. $-\frac{1}{4}(2b - 8) = -\frac{1}{4}(2b) - \left(-\frac{1}{4}\right)(8)$
 $= -\frac{2}{4}b + \frac{8}{4}$
 $= -\frac{1}{2}b + 2$

53. $\frac{1}{3}(m - 3) = \frac{1}{3}m - \frac{1}{3} \cdot 3 = \frac{1}{3}m - 1$

54. $\frac{2}{5}(n - 5) = \frac{2}{5}n - \frac{2}{5}(5) = \frac{2}{5}n - 2$

55. $-(2p + 10) = -2p - 10$

56. $-(7q + 1) = -7q - 1$

57. $-2(-3w - 5z + 8)$
 $= -2(-3w) - 2(-5z) - 2(8)$
 $= 6w + 10z - 16$

58. $-4(-7a - b - 3)$
 $= -4(-7a) - 4(-b) - 4(-3)$
 $= 28a + 4b + 12$

59. $4(x + 2y - z) = 4(x) + 4(2y) - 4(z)$
 $= 4x + 8y - 4z$

60. $-6(2a - b + c)$
 $= -6(2a) - (-6)(b) + (-6)(c)$
 $= -12a + 6b - 6c$

61. $-(-6w + x - 3y) = 6w - x + 3y$

62. $-(-p - 5q - 10r) = p + 5q + 10r$

63. $2(3 + x) = 6 + 2x$

64. $5(4 + y) = 20 + 5y$

65. $4(6z) = 24z$
66. $8(2p) = 16p$
67. $-2(7x) = -14x$
68. $3(-11t) = -33t$
69. $-4(1+x) = -4 - 4x$
70. $-9(2+y) = -18 - 9y$
71. b
72. f
73. i
74. c
75. g
76. e
77. d
78. a
79. h
80. Term: $3xy$, coefficient 3;
 Term: $-6x^2$, coefficient -6 ;
 Term: y , coefficient 1;
 Term: -17 , coefficient -17
81. Term: $2x$, coefficient 2;
 Term: $-y$, coefficient -1 ;
 Term: $18xy$, coefficient 18;
 Term: 5 , coefficient 5.
82. Term: x^4 , coefficient 1;
 Term: $-10xy$, coefficient -10 ;
 Term: 12 , coefficient 12;
 Term: $-y$, coefficient -1 .
83. Term: $-x$, coefficient -1 ;
 Term: $8y$, coefficient 8;
 Term: $-9x^2y$, coefficient -9 ;
 Term: -3 , coefficient -3 .
84. The exponents on x are different.
85. The variable factors are different.
86. The variables are the same *and* raised to the same power.
87. The variables are the same *and* raised to the same power.
88. Answers vary: $5y, -2y, y$
89. Answers vary: $5y, -2x, 6$
90. $5k - 10k = -5k$
91. $-4p - 2p = -6p$
92. $-7x^2 + 14x^2 = 7x^2$
93. $2y^2 - 5y^2 - 3y^2 = -6y^2$
94. $2ab + 5 + 3ab - 2 = 5ab + 3$
95. $8x^3y + 3 - 7 - x^3y = 7x^3y - 4$
96. $\frac{1}{4}a + b - \frac{3}{4}a - 5b = -\frac{2}{4}a - 4b$
 $= -\frac{1}{2}a - 4b$
97. $\frac{2}{5} + 2t - \frac{3}{5} + t - \frac{6}{5} = 3t - \frac{7}{5}$
98. $2.8z - 8.1z + 6 - 15.2 = -5.3z - 9.2$
99. $-3(2x - 4) + 10$
 $= -6x + 12 + 10$
 $= -6x + 22$
100. $-2(4a + 3) - 14$
 $= -8a - 6 - 14$
 $= -8a - 20$
101. $4(w + 3) - 12 = 4w + 12 - 12 = 4w$
102. $5(2r + 6) - 30 = 10r + 30 - 30 = 10r$
103. $5 - 3(x - 4) = 5 - 3x + 12 = -3x + 17$
104. $4 - 2(3x + 8) = 4 - 6x - 16 = -6x - 12$
105. $-3(2t + 4w) + 8(2t - 4w)$
 $= -6t - 12w + 16t + 32w$
 $= 10t - 44w$
106. $-5(5y + 9z) + 3(3y + 6z)$
 $= -25y - 45z + 9y + 18z$
 $= -16y - 27z$

Section 1.7 Properties of Real Numbers and Simplifying Expressions

$$\begin{aligned} 107. & 2(q-5u)-(2q+8u) \\ & = 2q-10u-2q-8u \\ & = -18u \end{aligned}$$

$$\begin{aligned} 108. & 6(x+3y)-(6x-5y) \\ & = 6x+18y-6x+5y \\ & = 23y \end{aligned}$$

$$109. -\frac{1}{3}(6t+9)+10 = -2t-3+10 = -2t+7$$

$$110. -\frac{3}{4}(8+4q)+7 = -6-3q+7 = -3q+1$$

$$\begin{aligned} 111. & 10(5.1a-3.1)+4 = 51a-31+4 \\ & = 51a-27 \end{aligned}$$

$$\begin{aligned} 112. & 100(-3.14p-1.05)+212 \\ & = -314p-105+212 \\ & = -314p+107 \end{aligned}$$

$$\begin{aligned} 113. & -4m+2(m-3)+2m \\ & = -4m+2m-6+2m \\ & = -6 \end{aligned}$$

$$\begin{aligned} 114. & -3b+4(b+2)-8b = -3b+4b+8-8b \\ & = -3b+4b-8b+8 \\ & = -7b+8 \end{aligned}$$

$$\begin{aligned} 115. & \frac{1}{2}(10q-2)+\frac{1}{3}(2-3q) = 5q-1+\frac{2}{3}-q \\ & = 5q-q-1+\frac{2}{3} \\ & = 4q-\frac{1}{3} \end{aligned}$$

$$\begin{aligned} 116. & \frac{1}{5}(15-4p)-\frac{1}{10}(10p+5) \\ & = 3-\frac{4}{5}p-p-\frac{1}{2} \\ & = 3-\frac{1}{2}-\frac{4}{5}p-p \\ & = -\frac{9}{5}p+\frac{5}{2} \end{aligned}$$

$$\begin{aligned} 117. & 7n-2(n-3)-6+n \\ & = 7n-2n+6-6+n \\ & = 6n \end{aligned}$$

$$\begin{aligned} 118. & 8k-4(k-1)+7-k \\ & = 8k-4k+4+7-k \\ & = 3k+11 \end{aligned}$$

$$\begin{aligned} 119. & 6(x+3)-12-4(x-3) \\ & = 6x+18-12-4x+12 \\ & = 2x+18 \end{aligned}$$

$$\begin{aligned} 120. & 5(y-4)+3-6(y-7) \\ & = 5y-20+3-6y+42 \\ & = -y+25 \end{aligned}$$

$$\begin{aligned} 121. & 0.2(6c-1.6)+c \\ & = 1.2c-0.32+c \\ & = 2.2c-0.32 \end{aligned}$$

$$\begin{aligned} 122. & -1.1(5+3x)-3.1 \\ & = -5.5-8.8x-3.1 \\ & = -8.8x-8.6 \end{aligned}$$

$$\begin{aligned} 123. & 6+2[-8-3(2x+4)]+10x \\ & = 6+2[-8-6x-12]+10x \\ & = 6+2[-6x-20]+10x \\ & = 6-12x-40+10x \\ & = -2x-34 \end{aligned}$$

$$\begin{aligned} 124. & -3+5[-3-4(y+2)]-8y \\ & = -3+5[-3-4y-8]-8y \\ & = -3+5[-11-4y]-8y \\ & = -3-55-20y-8y \\ & = -28y-58 \end{aligned}$$

$$\begin{aligned} 125. & 1-3[2(z+1)-5(z-2)] \\ & = 1-3[2z+2-5z+10] \\ & = 1-3[-3z+12] \\ & = 1+9z-36 \\ & = 9z-35 \end{aligned}$$

$$\begin{aligned} 126. & 1-6[3(2t+2)-8(t+2)] \\ & = 1-6[6t+6-8t-16] \\ & = 1-6[-2t-10] \\ & = 1+12t+60 \\ & = 12t+61 \end{aligned}$$

127. Equivalent

128. Equivalent

129. Not equivalent. The terms are not *like* terms and cannot be combined.

130. Not equivalent. The terms are not *like* terms and cannot be combined.

131. Not equivalent. Subtraction is not commutative.

132. Not equivalent. Subtraction is not commutative.

133. Equivalent

134. Equivalent

135. (a) $10 + (1 + 9) + (2 + 8) + (3 + 7) + (4 + 6) + 5 = 55$

(b) $(1 + 19) + (2 + 18) + (3 + 17) + (4 + 16) + (5 + 15) + (6 + 14) + (7 + 13) + (8 + 12) + (9 + 11) + 10 + 20 = 210$

Group Activity

1. Substitute $C = 35$.

$$\begin{aligned} F &= \frac{9}{5}C + 32 \\ &= \frac{9}{5}(35) + 32 \\ &= 63 + 32 \\ &= 95 \end{aligned}$$

2. Substitute $n = 1.00$, $R = 0.0821$,

$$T = 273.15,$$

$$P = 1.0.$$

$$\begin{aligned} V &= \frac{nRT}{P} \\ &= \frac{1.00(0.0821)(273.15)}{1.0} \\ &= 22.425615 \\ &\approx 22.426 \end{aligned}$$

3. Substitute $k = 0.05$, $L = 200$, $r = 0.5$.

$$\begin{aligned} R &= k \left(\frac{L}{r^2} \right) \\ &= 0.05 \left(\frac{200}{0.5^2} \right) \\ &= 0.05(800) \\ &= 40 \end{aligned}$$

4. Substitute $x_1 = -8.3$, $x_2 = 3.3$, $y_1 = 4.6$, $y_2 = -9.2$.

$$\begin{aligned} m &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{-9.2 - 4.6}{3.3 - (-8.3)} \\ &= \frac{-13.8}{11.6} \\ &= -1.189655172 \approx -1.190 \end{aligned}$$

5. Substitute $\bar{x} = 69$, $\mu = 55$, $\sigma = 20$, $n = 25$

$$\begin{aligned} z &= \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}} \\ &= \frac{69 - 55}{\frac{20}{\sqrt{25}}} = \frac{14}{\frac{20}{5}} \\ &= \frac{14}{4} \\ &= 3.5 \end{aligned}$$

6. Substitute $R = 200$, $i = 0.08$, $n = 30$

$$\begin{aligned} S &= R \left[\frac{(1+i)^n - 1}{i} \right] \\ &= 200 \left[\frac{(1+0.08)^{30} - 1}{0.08} \right] \\ &= 22656.64222 \approx 22656.642 \end{aligned}$$

7. Substitute $a = 2$, $b = -7$, $c = -15$

$$\begin{aligned} x &= \frac{-b + \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(-7) + \sqrt{(-7)^2 - 4(2)(-15)}}{2(2)} \\ &= \frac{7 + \sqrt{49 + 120}}{4} \\ &= \frac{7 + \sqrt{169}}{4} \\ &= \frac{7 + 13}{4} = \frac{20}{4} = 5 \end{aligned}$$

8. Substitute $g = -32$, $t = 2.4$, $v_0 = 192$,

$$\begin{aligned} h_0 &= 288 \\ h &= \frac{1}{2}gt^2 + v_0t + h_0 \\ &= \frac{1}{2}(-32)(2.4)^2 + 192(2.4) + 288 \\ &= -92.16 + 460.8 + 288 \\ &= 656.64 \end{aligned}$$

Chapter 1 Review Exercises

Section 1.1

1. $\frac{14}{5}$; improper

2. $\frac{1}{6}$; proper

3. $\frac{3}{3}$; improper

4. $\frac{7}{1}$; improper

5. $2 \times 2 \times 2 \times 2 \times 7$

6. $\frac{84}{70} = \frac{6}{5}$

7. $\frac{2}{9} + \frac{3}{4} = \frac{8}{36} + \frac{27}{36} = \frac{35}{36}$

8. $\frac{7}{8} - \frac{1}{16} = \frac{14}{16} - \frac{1}{16} = \frac{13}{16}$

9. $\frac{3^2 21}{3^{24}} \times \frac{16^2}{49} = \frac{6}{21} = \frac{2}{7}$

10. $\frac{68}{34} \div \frac{20}{12} = \frac{17}{17} \times \frac{12^6}{20^5} = \frac{102}{95} = \frac{6}{5}$ or $1\frac{1}{5}$

11. $5\frac{1}{3} \div 1\frac{7}{9} = \frac{16}{3} \div \frac{16}{9} = \frac{1}{1} \times \frac{9^3}{16^1} = \frac{3}{1} = 3$

12. $3\frac{4}{5} - 2\frac{1}{10} = \frac{38}{10} - \frac{21}{10} = \frac{17}{10}$ or $1\frac{7}{10}$
or $3\frac{4}{5} - 2\frac{1}{10} = 3\frac{8}{10} - 2\frac{1}{10} = 1\frac{7}{10}$

13. $\frac{7}{10} \times 510,000,000 \text{ km}$
 $= 357,000,000 \text{ km}$

Section 1.2

14. (a) 7, 1

(b) 7, -4, 0, 1

(c) 7, 0, 1

(d) $7, \frac{1}{3}, -4, 0, -0.\bar{2}, 1$

(e) $-\sqrt{3}, \pi$

(f) $7, \frac{1}{3}, -4, 0 - \sqrt{3}, -0.\bar{2}, \pi, 1$

15. $\left| \frac{1}{2} \right| = \frac{1}{2}$

16. $|-6| = 6$

17. $|\sqrt{-7}| = \sqrt{7}$

18. $|0| = 0$

19. False

20. False

21. True

22. True

23. True

24. True

25. False

26. True

27. True

28. $8 - 2(4) = 8 - 8 = 0$

29. $(8)^2 - 4 = 64 - 4 = 60$

30. $\sqrt{(8)+(1)} = \sqrt{9} = 3$

31. $\sqrt{(8)+2(4)} = \sqrt{8+8} = \sqrt{16} = 4$

Section 1.3

32. $x \cdot \frac{2}{3}$ or $\frac{2}{3}x$

33. $\frac{7}{y}$ or $7 \div y$

34. $2 + 3b$

35. $a - 5$

36. $5k + 2$

37. $13z - 7$

38. $6^3 = 216$

39. $15^2 = 225$

40. $\sqrt{36} = 6$

41. $\frac{1}{\sqrt{100}} = \frac{1}{10}$

42. $\left(\frac{1}{4}\right)^2 = \frac{1}{16}$

43. $\left(\frac{3}{2}\right)^3 = \frac{27}{8}$

44. $15 - 7 \cdot 2 + 12 = 15 - 14 + 12 = 13$

45. $|-11| + |5| - (7 - 2) = 11 + 5 - 5 = 11$

46. $4^2 - (5 - 2)^2 = 16 - 9 = 7$

47. $22 - 3(8 \div 4)^2 = 22 - 3(2)^2 = 22 - 12 = 10$

Section 1.4

48. $-6 + 8 = 2$

49. $14 + (-10) = 4$

50. $21 + (-6) = 15$

51. $-12 + (-5) = -17$

52. $\frac{2}{7} + \left(-\frac{1}{9}\right) = \frac{18}{63} + \left(-\frac{7}{63}\right) = \frac{11}{63}$

53. $-\frac{8}{11} + \frac{1}{2} = -\frac{16}{22} + \frac{11}{22} = -\frac{5}{22}$

54. $-\frac{1}{10} + \left(-\frac{5}{6}\right) = -\frac{3}{30} - \left(\frac{25}{30}\right)$
 $= -\frac{28}{30} = -\frac{14}{15}$

55. $\left(-\frac{5}{2}\right) + \left(-\frac{1}{5}\right) = -\frac{25}{10} + \left(-\frac{2}{10}\right) = -\frac{27}{10}$

56. $-8.17 + 6.02 = -2.15$

57. $2.9 + (-7.18) = -4.28$

58. $13 + (-2) + (-8) = 11 + (-8) = 3$

59. $-5 + (-7) + 20 = -12 + 20 = 8$

60. $2 + 5 + (-8) + (-7) + 0 + 13 + (-1)$
 $= -1 + (-7) + 13 + (-1)$
 $= 4$

61. When a and b are both negative or when a and b have different signs and the

number with the larger absolute value is negative.

62. $-45 + 117 - 80 = -8$; No. He would still be overdrawn by \$8.

Section 1.5

63. $13 - 25 = -12$
 64. $31 - (-2) = 31 + 2 = 33$
 65. $-8 - (-7) = -8 + 7 = -1$
 66. $-2 - 15 = -2 + (-15) = -17$
 67. $\left(-\frac{7}{9}\right) - \frac{5}{6} = -\frac{14}{18} - \frac{15}{18} = -\frac{29}{18}$
 68. $\frac{1}{3} - \frac{9}{8} = \frac{8}{24} - \frac{27}{24} = -\frac{19}{24}$
 69. $7 - 8.2 = -1.2$
 70. $-1.05 - 3.2 = -4.25$
 71. $-16.1 - (-5.9) = -16.1 + 5.9 = -10.2$
 72. $7.09 - (-5) = 7.09 + 5 = 12.09$
 73. $\frac{11}{2} - \left(-\frac{1}{6}\right) - \frac{7}{3} = \frac{33}{6} + \frac{1}{6} - \frac{14}{6} = \frac{20}{6} = \frac{10}{3}$
 74. $-\frac{4}{5} - \frac{7}{10} - \left(-\frac{13}{20}\right) = -\frac{16}{20} - \frac{14}{20} + \frac{13}{20} = -\frac{17}{20}$
 75. $6 - 14 - (-1) - 10 - (-21) - 5$
 $= 6 - 14 + 1 - 10 + 21 - 5$
 $= -8 - 9 + 16$
 $= -17 + 16$
 $= -1$
 76. If $a < b$ the expression will be negative.
 77. $-7 - (-18)$;
 $-7 - (-18) = 11$
 78. $-6 - 41$;
 $-6 - 41 = -47$

79. $7 - 13$;
 $7 - 13 = -6$
 80. $(20 - (-7)) - 5$;
 $(20 - (-7)) - 5 = 20 + 7 - 5 = 22$
 81. $(6 + (-12)) - 21$;
 $(6 + (-12)) - 21 = -6 - 21 = -27$
 82. $125^\circ - (-50^\circ) = 175^\circ\text{F}$

Section 1.6

83. $10(-17) = -170$
 84. $(-7)13 = -91$
 85. $(-52) \div 26 = -2$
 86. $(-48) \div (-16) = 3$
 87. $\frac{7}{4} \div \left(-\frac{21}{2}\right) = \frac{7}{4} \cdot \left(-\frac{2}{21}\right) = -\frac{14}{84} = -\frac{1}{6}$
 88. $\frac{2}{3} \left(-\frac{12}{11}\right) = -\frac{24}{33} = -\frac{8}{11}$
 89. $-\frac{21}{5} \cdot 0 = 0$
 90. $\frac{3}{4} \div 0$ is undefined.
 91. $0 \div (-14) = 0$
 92. $(-0.45)(-5) = 2.25$
 93. $-\frac{21}{14} = -\frac{3 \cdot 7}{2 \cdot 7} = -\frac{3}{2}$
 94. $\frac{-13}{-52} = \frac{13}{4 \cdot 13} = \frac{1}{4}$
 95. $(5)(-2)(3) = (-10)(3) = -30$
 96. $(-6)(-5)(15) = (30)(15) = 450$
 97. $\left(-\frac{1}{2}\right)\left(\frac{7}{8}\right)\left(-\frac{4}{7}\right) = \left(-\frac{7}{16}\right)\left(-\frac{4}{7}\right)$
 $= \frac{7 \cdot 4}{16 \cdot 7} = \frac{1}{4}$
 98. $\left(\frac{12}{13}\right)\left(-\frac{1}{6}\right)\left(\frac{13}{14}\right) = -\frac{12 \cdot 13}{13 \cdot 6 \cdot 14} = -\frac{1}{7}$

99. $40 \div 4 \div (-5) = 10 \div (-5) = -2$

100. $\frac{10}{11} \div \frac{7}{11} \div \frac{5}{9} = \frac{10}{11} \cdot \frac{11}{7} \div \frac{5}{9} = \frac{10}{7} \cdot \frac{9}{5} = \frac{18}{7}$

101. $9 - 4[-2(4 - 8) - 5(3 - 1)]$
 $= 9 - 4[-2(-4) - 5(2)]$
 $= 9 - 4[8 - 10]$
 $= 9 - 4[-2]$
 $= 9 + 8$
 $= 17$

102. $\frac{8(-3) - 6}{-7 - (-2)} = \frac{-24 - 6}{-7 + 2} = \frac{-30}{-5} = 6$

103. $\frac{2}{3} - \left(\frac{3}{8} + \frac{5}{6}\right) \div \frac{5}{3} = \frac{2}{3} - \left(\frac{9}{24} + \frac{20}{24}\right) \cdot \frac{3}{5}$
 $= \frac{16}{24} - \frac{29}{24} \cdot \frac{3}{5}$
 $= \frac{16}{24} - \frac{29}{40}$
 $= \frac{80}{120} - \frac{87}{120} = -\frac{7}{120}$

104. $5.4 - (0.3)^2 \div 0.09 = 5.4 - 0.09 \div 0.09$
 $= 5.4 - 1$
 $= 4.4$

105. $\frac{5 - [3 - (-4)^2]}{36 \div (-2)(3)}$
 $= \frac{5 - [3 - 16]}{(-18)(3)}$
 $= \frac{5 - [-13]}{-54}$
 $= \frac{18}{-54} = -\frac{1}{3}$

106. $|-8 + 5| - \sqrt{5^2 - 3^2}$
 $= |-3| - \sqrt{25 - 9}$
 $= 3 - \sqrt{16}$
 $= 3 - 4 = -1$

107. $3(x + 2) \div y = 3(4 + 2) \div (-9)$
 $= 18 \div (-9)$
 $= -2$

108. $\sqrt{x} - y$
 $= \sqrt{4} - (-9)$
 $= 2 - (-9)$
 $= 11$

109. $-xy = -(4)(-9) = 36$

110. $3x + 2y = 3(4) + 2(-9) = 12 + (-18)$
 $= -6$

111. $x = \mu + z\sigma$
 $x = (100) + (-1.96)(15)$
 $x = 70.6$

112. True

113. False; any nonzero real number raised to an even power is positive.

114. True

115. True

116. False; the product of two negative numbers is positive.

117. True

118. True

Section 1. 7

119. $2 + 3 = 3 + 2$

120. $(2 + 3) + 4 = 2 + (3 + 4)$

121. $5 + (-5) = 0$

122. $7 + 0 = 7$

123. $5 \cdot 2 = 2 \cdot 5$

124. $(8 \cdot 2)10 = 8(2 \cdot 10)$

125. $3 \cdot \frac{1}{3} = 1$

126. $8 \cdot 1 = 8$

127. $5x - 2y = 5x + (-2y)$; then use commutative property of addition.

128. $3a - 9y = 3a + (-9y)$; then use the commutative property of addition.

129. $3y, 10x, -12, xy$

130. $3, 10, -12, 1$

131. $3a + 3b - 4b + 5a - 10$
 $= 3a + 5a + 3b - 4b - 10$
 $= 8a - b - 10$

132. $-6p + 2q + 9 - 13q - p + 7$
 $= -6p - p + 2q - 13q + 9 + 7$
 $= -7p - 11q + 16$

133. $-2(4z + 9) = -8z - 18$

134. $5(4w - 8y + 1) = 20w - 40y + 5$

135. $2p - (p + 5w) + 3w$
 $= 2p - p - 5w + 3w$
 $= p - 2w$

136. $6(h + 3m) - 7h - 4m$
 $= 6h + 18m - 7h - 4m$
 $= -h + 14m$

137. $\frac{1}{2}(-6z) + q - 4\left(3q + \frac{1}{4}\right)$
 $= -3q + q - 12q - 1$
 $= -14q - 1$

138. $0.3b + 12(0.2 - 0.5b)$
 $= 0.3b + 2.4 - 6b$
 $= -5.7b + 2.4$

139. $-4[2(x + 1) - (3x + 8)]$
 $= -4[2x + 2 - 3x - 8]$
 $= -4[-x - 6]$
 $= 4x + 24$

140. $5[(7y - 3) + 3(y + 8)]$
 $= 5[7y - 3 + 3y + 24]$
 $= 5[10y + 21]$
 $= 50y + 105$

Chapter 1 Test

1. $\frac{135}{36} = \frac{15}{4}$

2. $\frac{5}{4} - \frac{5}{12} + \frac{2}{3} = \frac{15}{12} - \frac{5}{12} + \frac{8}{12} = \frac{18}{12} = \frac{3}{2}$

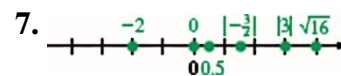
3. $4\frac{1}{12} \div 1\frac{1}{3} = \frac{49}{12} \div \frac{4}{3} = \frac{49}{12} \times \frac{3}{4}$
 $= \frac{49}{16} = 3\frac{1}{16}$

4. $4\frac{1}{4} - 1\frac{7}{8} = \frac{17}{4} - \frac{15}{8} = \frac{34}{8} - \frac{15}{8} = \frac{19}{8} = 2\frac{3}{8}$

5. Rational; all repeating decimals are rational numbers.

6. (a) $(4x)^3 = (4x)(4x)(4x)$

(b) $4x^3 = 4 \cdot x \cdot x \cdot x$



8. (a) False

(b) True

(c) True

(d) True

9. (a) Commutative property of multiplication

(b) Identity property of addition

(c) Associative property of addition

(d) Inverse property of multiplication

(e) Associative property of multiplication

10. (a) Twice the difference of a and b

(b) The difference of twice a and b

Chapter 1 The Set of Real Numbers

$$11. \frac{\sqrt{c}}{d^2} \text{ or } \sqrt{c} \div d^2$$

$$12. 12 - (-4);$$

$$12 - (-4) = 12 + 4 = 16$$

$$13. 6 - 8;$$

$$6 - 8 = -2$$

$$14. \frac{10}{-12}; -\frac{5}{6}$$

$$15. -\frac{1}{8} + \left(-\frac{3}{4}\right) = -\frac{1}{8} + \left(-\frac{6}{8}\right) = -\frac{7}{8}$$

$$16. -84 \div 7 = -12$$

$$17. 21 - (-7) = 21 + 7 = 28$$

$$18. -15 - (-3) = -15 + 3 = -12$$

$$19. -14 + (-2) - 16 = -14 + (-18) = -32$$

$$20. (-16)(-2)(-1)(-3) = (32)(3) = 96$$

$$21. -22 \cdot 0 = 0$$

$$22. 38 \div 0 \text{ is undefined.}$$

$$23. 18 + (-12) = 6$$

$$24. -10.06 - (-14.72) = -10.06 + 14.72 \\ = 4.66$$

$$25. 7(-4) = -28$$

$$26. \frac{2}{5} \div \left(-\frac{7}{10}\right) \cdot \left(-\frac{7}{6}\right) = \frac{2}{5} \cdot \left(-\frac{10}{7}\right) \cdot \left(-\frac{7}{6}\right) \\ = -\frac{2^1 4^1}{1^1 7^1} \cdot \left(-\frac{7^1}{6^1}\right) \\ = \frac{2}{3}$$

$$27. \frac{\sqrt{5^2 - 4^2}}{|-12 + 3|} = \frac{\sqrt{25 - 16}}{|-9|} \\ = \frac{\sqrt{9}}{9} \\ = \frac{3}{9} = \frac{1}{3}$$

$$28. 8 - [(2 - 4) - (8 - 9)] = 8 - [(-2) - (-1)] \\ = 8 - [-1] \\ = 8 + 1 \\ = 9$$

$$29. (8 - 10)\frac{3}{2} + (-5) = (-2)\frac{3}{2} + (-5) \\ = -3 + (-5) \\ = -8$$

$$30. -1.2 - (-10.7) = 8.5^\circ \text{C}$$

$$31. \text{(a) } 5 + 2 + (-10) + 4$$

(b) He gained 1 yd.

$$32. 3k - 20 + (-9k) + 12 = -6k - 8$$

$$33. -5x - 4y + 3 - 7x + 6y - 7 \\ = -5x - 7x - 4y + 6y + 3 - 7 \\ = -12x + 2y - 4$$

$$34. 4(p - 5) - (8p + 3) = 4p - 20 - 8p - 3 \\ = -4p - 23$$

$$35. -3(4m + 8p - 7) = -12m - 24p + 21$$

$$36. \frac{1}{2}(12p - 4) + \frac{1}{3}(2 - 6p) \\ = 6p - 2 + \frac{2}{3} - 2p \\ = 4p - \frac{4}{3}$$

$$37. y^2 - x = (-3)^2 - (4) = 9 - 4 = 5$$

$$38. 3x - 2y = 3(4) - 2(-3) \\ = 12 - (-6) \\ = 12 + 6 \\ = 18$$

$$39. y(x - 2) = -3(4 - 2) = -3(2) = -6$$

$$40. -y^2 - 4x + z = -(-3)^2 - 4(4) + (-7) \\ = -9 - 4(4) + (-7) \\ = -9 - 16 + (-7) \\ = -9 + (-16) + (-7) \\ = -32$$