

Chapter 1 Introduction to Real Numbers and Algebraic Expressions

Section 1.1: Fractions Practice Exercises

1. (a) product
(b) factors
(c) numerator; b
(d) lowest
(e) 1; 4
(f) reciprocals
(g) multiple
(h) least
3. Numerator 2; denominator 3; proper
5. Numerator 5; denominator 2; improper
7. Numerator 4; denominator 4; improper
9. Numerator 5; denominator 1; improper
11. $\frac{3}{4}$
13. $\frac{4}{3}$
15. $\frac{1}{6}$
17. $\frac{2}{2}$
19. $\frac{5}{2}$ or $2\frac{1}{2}$
21. $\frac{6}{2}$ or 3
23. The set of whole numbers includes the number 0 and the set of natural numbers does not.
25. Answers may vary. One example would be $\frac{2}{4}$.
27. Prime
29. Composite
31. Composite
33. Prime
35. $2 \times 2 \times 3 \times 3$
37. $2 \times 3 \times 7$
39. $2 \times 5 \times 11$
41. $3 \times 3 \times 3 \times 5$
43. $\frac{3}{15} = \frac{\cancel{3}}{\cancel{3} \times 5} = \frac{1}{5}$
45. $\frac{16}{6} = \frac{\cancel{2} \times 2 \times 2 \times 2}{\cancel{2} \times 3} = \frac{8}{3}$ or $2\frac{2}{3}$
47. $\frac{42}{48} = \frac{\cancel{2} \times \cancel{3} \times 7}{\cancel{2} \times 2 \times 2 \times 2 \times \cancel{3}} = \frac{7}{8}$
49. $\frac{48}{64} = \frac{\cancel{2} \times \cancel{2} \times \cancel{2} \times \cancel{2} \times 3}{\cancel{2} \times \cancel{2} \times \cancel{2} \times \cancel{2} \times 2 \times 2} = \frac{3}{4}$
51. $\frac{110}{176} = \frac{\cancel{2} \times 5 \times \cancel{11}}{\cancel{2} \times 2 \times 2 \times 2 \times \cancel{11}} = \frac{5}{8}$
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 $1\frac{1}{3}$
55. False: When adding/subtracting fractions, it is necessary to have a common denominator.
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 $1\frac{1}{3}$
59. $\frac{3}{7} \div \frac{9}{14} = \frac{3}{7} \times \frac{14}{9} = \frac{2 \times \cancel{3} \times \cancel{7}}{3 \times \cancel{3} \times \cancel{7}} = \frac{2}{3}$
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 $4\frac{1}{2}$
63. $\frac{12}{5} \div 4 = \frac{12}{5} \div \frac{4}{1} = \frac{12}{5} \times \frac{1}{4}$
 $= \frac{\cancel{12}^3 \times 1}{5 \times \cancel{4}_1} = \frac{3}{5}$

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

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

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

71. The statement "five-sixths of the students passed the first test" translates to "students passed = $\frac{5}{6} \times 42$ "

$$\frac{5}{6} \times 42 = \frac{5}{6} \times \frac{42}{1} = \frac{5 \times \cancel{42}^7}{\cancel{6}_2 \times 1} = \frac{35}{1}$$

35 students passed the test.

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

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

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

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

$$81. 6 = 2 \times 3$$

$$15 = 3 \times 5$$

$$2 \times 3 \times 5 = 30$$

$$83. 20 = 2^2 \times 5$$

$$8 = 2^3$$

$$4 = 2^2$$

$$2^3 \times 5 = 40$$

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

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

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

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

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

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

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

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

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

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

$$105. 3\frac{1}{5} \times 2\frac{7}{8} = \frac{16}{5} \times \frac{23}{8} \\ = \frac{\cancel{16}^2 \times 23}{5 \times \cancel{8}_1} = \frac{46}{5} \text{ or } 9\frac{1}{5}$$

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

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

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

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

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

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

$$119. 26\frac{3}{8} \div 3 = \frac{211}{8} \div \frac{3}{1} \\ = \frac{211}{8} \times \frac{1}{3} = \frac{211}{24} = 8\frac{19}{24} \text{ in.}$$

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

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

$$= 2\frac{1}{4} \text{ lb}$$

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

Section 1.2 Introduction to Algebra and the Set of Real Numbers

Section 1.2 Calculator Exercises

$$1. \approx 3.464101615$$

$$3. \approx 12.56637061$$

Section 1.2 Practice Exercises

1. (a) variable

(b) constants

(c) set

(d) inequalities

(e) a is less than b

(f) c is greater than or equal to d

(g) 5 is not equal to 6

(h) opposites

(i) $|a|$; 0

$$3. 4\frac{1}{2} \times 1\frac{5}{6} = \frac{9^3}{2} \times \frac{11}{6_2} = \frac{33}{4} \text{ or } 8\frac{1}{4}$$

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

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

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

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

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

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

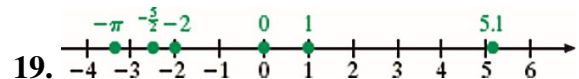
$$(b) 1.29s = 1.29(8) = 10.32, \$10.32$$

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

$$17. (a) 850 - b = 850 - 475 = 375, \\ 375 \text{ calories}$$

$$(b) 850 - b = 850 - 220 = 630, \\ 630 \text{ calories}$$

$$(c) 850 - b = 850 - 580 = 270, \\ 270 \text{ calories}$$



21. a. a terminating decimal; rational number

23. b. repeating decimal; rational number

25. a. a terminating decimal; rational number

27. c. a nonterminating, nonrepeating decimal; irrational number

29. a. a terminating decimal; rational number
31. a. a terminating decimal; rational number
33. b. a repeating decimal; rational number
35. c. a nonterminating, nonrepeating decimal; irrational number
37. Answers vary; for example: π , $-\sqrt{2}$, $\sqrt{3}$
39. Answers vary; for example: -4 , -1 , 0
41. Answers vary; for example: $-\frac{3}{4}$, $\frac{1}{2}$, 0.206
43. $-\frac{3}{2}$, -4 , $0.\bar{6}$, 0 , 1
45. 1
47. -4 , 0 , 1
49. (a) Since Kane's score is 0 and Pak's score is -8 , $0 > -8$.
 (b) Since Scorenstan'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' score is -4 , $0 > -4$.
51. -18
53. 6.1
55. $\frac{5}{8}$
57. $-\frac{7}{3}$
59. 3
61. $-\frac{7}{3}$
63. 8
65. -72.1
67. 2
69. 1.5
71. -1.5
73. $\frac{3}{2}$
75. -10
77. $-\frac{1}{2}$
79. False; $|n|$ is never negative.
81. True; 5 is to the right of 2 .
83. False; 6 is equal to 6 .
85. True; -7 is equal to -7 .
87. False; $\frac{3}{2}$ is to the right of $\frac{1}{6}$.
89. False; -5 is to the left of -2 .
91. False; 8 is equal to 8 .
93. True; 2 is to the right of 1 .
95. True; $\frac{1}{9}$ is equal to $\frac{1}{9}$.
97. False; 7 is equal to 7 .
99. True; -1 is to the left of 1 .
101. True; 8 is equal to 8 .
103. True; 2 is equal to 2 .
105. For all $a < 0$ since $-a$ is the opposite of a

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

Section 1.3 Calculator Exercises

1. 2

3. 84

5. 49

7. 4

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

3. 56

5. -19

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

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

11. $(5c)^5$

13. (a) x

(b) Yes, 1

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

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

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

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

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

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

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

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

31. $\sqrt{81} = 9$

33. $\sqrt{4} = 2$

35. $\sqrt{144} = 12$

37. $\sqrt{16} = 4$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\begin{aligned}
 69. \quad & 48 - 13 \times 3 + [(50 - 7 \times 5) + 2] \\
 & = 48 - 39 + [15 + 2] \\
 & = 26
 \end{aligned}$$

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

$$\begin{aligned}
 73. \quad & \frac{15 - 5(3 \cdot 2 - 4)}{10 - 2(4 \cdot 5 - 16)} \\
 & = \frac{15 - 5(2)}{10 - 2(4)} \\
 & = \frac{15 - 10}{10 - 8} \\
 & = \frac{5}{2}
 \end{aligned}$$

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; $0.12 < 0.20$

$$\begin{aligned}
 77. \quad & A = lw = 360 \cdot 160 \\
 & = 57,600 \text{ ft}^2
 \end{aligned}$$

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

$$81. 3x$$

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

$$85. 2 - a$$

$$87. 2y + x$$

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

$$91. 3 - Q$$

$$\begin{aligned}
 93. \quad & 2y^3 = 2(\quad)^3 \\
 & = 2(2)^3 \\
 & = 2(8) = 16
 \end{aligned}$$

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

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

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

$$\begin{aligned}
 101. \quad & \frac{\sqrt{\frac{1}{9} + \frac{2}{3}}}{\sqrt{\frac{4}{25} + \frac{3}{5}}} = \frac{\frac{1}{3} + \frac{2}{3}}{\frac{2}{5} + \frac{3}{5}} = \frac{\frac{3}{3}}{\frac{5}{5}} \\
 & = \frac{1}{1} = 1
 \end{aligned}$$

$$\begin{aligned}
 103. \quad & \frac{|-2|}{|-10| - |2|} = \frac{2}{10 - 2} \\
 & = \frac{2}{8} \\
 & = \frac{1}{4}
 \end{aligned}$$

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

Division must be performed before multiplication.

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

Subtraction must be performed before addition.

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 Addition of Real Numbers

Section 1.4 Practice Exercises

1. (a) negative

(b) b

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

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

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

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

$$11. -7 + 10 = 3$$

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

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

$$17. -19 + 2 = -17$$

$$19. -4 + 11 = 7$$

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

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

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

$$27. -3 + 0 = -3$$

$$29. -16 + 16 = 0$$

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

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

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

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

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

$$41. -42 + (3) + 45 + (-6) = -45 + 45 + (-6) \\ = -6$$

$$43. -5 + (-3) + (-7) + 4 + 8 \\ = -8 + (-7) + 4 + 8 \\ = -3$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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.

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

$$75. y + 3\sqrt{z} = -2 + 3\sqrt{16} \\ = -2 + 3 \cdot 4 \\ = -2 + 12 \\ = 10$$

$$77. |x| + |y| = |-3| + |-2| \\ = 3 + 2 = 5$$

$$79. -x + y = -(-3) + (-2) \\ = 3 + (-2) \\ = 1$$

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

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

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

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

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

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

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

$$95. \text{ (a) } 52. 23 + (-52. 95) = -\$0. 72$$

(b) Yes

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

Section 1.5 Subtraction of Real Numbers

Section 1.5 Calculator Exercises

$$1. -13$$

$$3. 711$$

$$5. -17. 7$$

$$7. -17$$

Section 1.5 Practice Exercises

$$1. \text{ (a) } -b$$

(b) positive

$$3. x^2$$

$$5. -b + 2$$

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

$$9. -3$$

$$11. -12$$

$$13. 4$$

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

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

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

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

$$23. 23 - 17 = 6$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$= -10$$

$$53. 6 - 8 - 2 - 10 = 6 + (-8) + (-2) + (-10) \\ = -14$$

$$55. 10 + (-14) + 6 - 22 \\ = 10 + (-14) + 6 + (-22) \\ = 16 + (-36) = -20$$

$$57. -112.846 + (-13.03) - 47.312 \\ = -173.188$$

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

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

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

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

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

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

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

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

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

$$77. 6 + 8 - (-2) - 4 + 1 = 14 + 2 - 4 + 1 \\ = 16 - 4 + 1 = 13$$

$$79. -1 - 7 + (-3) - 8 + 10 = -8 + (-3) - 8 + 10 \\ = -9$$

$$81. 2 - (-8) + 7 + 3 - 15 = 2 + 8 + 7 + 3 - 15 \\ = 17 + 3 - 15 = 5$$

$$83. -6 + (-1) + (-8) + (-10) \\ = -7 + (-8) + (-10) = -25$$

$$85. -4 - \{11 - [4 - (-9)]\} = -4 - \{11 - [4 + 9]\} \\ = -4 - \{11 - 13\} \\ = -4 - (-2) = -2$$

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

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

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

$$93. |10 + (-3)| - |-12 + (-6)| = |7| - |-18| \\ = 7 - 18 = -11$$

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

$$97. (a + b) - c = (-2 + (-6)) - (-1) \\ = -8 + 1 = -7$$

$$99. a - (b + c) = -2 - (-6 + (-1)) \\ = -2 - (-7) \\ = -2 + 7 = 5$$

$$101. (a - b) - c = (-2 - (-6)) - (-1) \\ = (4) + 1 = 5$$

$$103. a - (b - c) = -2 - (-6 - (-1)) \\ = -2 - (-5) \\ = -2 + 5 = 3$$

Problem Recognition Exercises

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

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

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

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

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

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

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

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

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

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

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

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

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

Section 1.6 Multiplication and Division of Real Numbers

Section 1.6 Calculator Exercises

1. 30

3. 625

5. -625

7. 5. 76

9. 4

Section 1.6 Practice Exercises

1. (a) $\frac{1}{a}$

(b) 0

(c) 0

(d) undefined

(e) positive

(f) negative

(g) 1; $-\frac{3}{2}$

(h) All of these

3. True; $20 \leq 20$

5. False; $6 \leq 0$

7. -56

9. 143

11. -12. 76

13. $\left(-\frac{2}{3}\right)\left(-\frac{9}{8}\right) = \frac{18}{24} = \frac{3}{4}$

15. $(-6)^2 = 36$

17. $-6^2 = -36$

19. $\left(-\frac{3}{5}\right)^3 = \left(-\frac{3}{5}\right)\left(-\frac{3}{5}\right)\left(-\frac{3}{5}\right) = -\frac{27}{125}$

21. $(-0. 2)^4 = 0. 0016$

23. $\frac{54}{-9} = -6$

25. $\frac{-15}{-17} = \frac{15}{17}$

27. $\frac{-14}{-14} = 1$

29. $\frac{13}{-65} = -\frac{1}{5}$

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

33. $-5 \cdot 0 = 0$

35. No number multiplied by 0 equals 6.

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

39. $2 \cdot 3 = 6$

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

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

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

47. $-6 \cdot 0 = 0$

49. Undefined

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

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

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

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

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

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

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

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

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

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

71. $-3^2 = -9$

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

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

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

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

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

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

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

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

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

91. $12 \div (-2)(4) = (-6)(4) = -24$

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

95. $8 - 2^3 \cdot 5 + 3 - (-6) = 8 - 8 \cdot 5 + 3 + 6$
 $= 8 - 40 + 3 + 6$
 $= -23$

97. $-(2-8)^2 \div (-6) \cdot 2 = -36 \div (-6) \cdot 2$
 $= 6 \cdot 2 = 12$

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

101. $\frac{-4+5}{(-2) \cdot 5 + 10} = \frac{1}{-10+10}$
 $= \frac{1}{0}$ is undefined

103. $-4 - 3[2 - (-5 + 3)] - 8 \cdot 2^2$
 $= -4 - 3[2 - (-2)] - 8 \cdot 4$
 $= -4 - 3[4] - 32$
 $= -4 - 12 - 32$
 $= -48$

$$105. -|-11|-|5| = -1-5 = -6$$

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

$$109. \frac{6-3[2-(6-8)]^2}{-2|2-5|} = \frac{6-3[2-(-2)]^2}{-2 \cdot 3} \\ = \frac{6-3 \cdot 16}{-6} = \frac{6-48}{-6} \\ = \frac{-42}{-6} = 7$$

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

$$113. 4(2x-z) = 4(2(-2)-6) \\ = 4(-4-6) \\ = 4(-10) = -40$$

$$115. \frac{3x+2y}{y} = \frac{3(-2)+2(-4)}{-4} \\ = \frac{-6+(-8)}{-4} = \frac{-14}{-4} = \frac{7}{2}$$

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

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

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

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

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

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

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

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

The average loss was 1 oz.

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

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

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

Problem Recognition Exercises

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

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

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

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

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

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

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

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

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

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

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

$$\text{(d) } -5 - (-10) = 5$$

$$7. \text{(a) } -4(-16) = 64$$

$$\text{(b) } -4 - (-16) = 12$$

$$\text{(c) } -4 \div (-16) = \frac{1}{4}$$

$$\text{(d) } -4 + (-16) = -20$$

$$9. \text{(a) } 80(-5) = -400$$

$$\text{(b) } 80 - (-5) = 85$$

(c) $80 \div (-5) = -16$

(d) $80 + (-5) = 75$

11. (a) $|-6| + |2| = 6 + 2 = 8$

(b) $|-6 + 2| = |-4| = 4$

(c) $|-6| - |-2| = 6 - 2 = 4$

(d) $|-6 - 2| = |-8| = 8$

Section 1.7 Properties of Real Numbers and Simplifying Expressions

Section 1.7 Practice Exercises

1. (a) constant

(b) coefficient

(c) 1; 1

(d) like

3. $(-2) + 9 = 7$

5. $-1 - (-19) = -1 + 19 = 18$

7. $-27 \div 5 = -\frac{27}{5} = -5.4$

9. $0(-15) = 0$

11. $\frac{25}{21} - \frac{6}{7} = \frac{25}{21} - \frac{18}{21} = \frac{7}{21} = \frac{1}{3}$

13. $\left(-\frac{11}{12}\right) \div \left(-\frac{5}{4}\right) = \left(-\frac{11}{12}\right) \cdot \left(-\frac{4}{5}\right)$
 $= \frac{44}{60} = \frac{11}{15}$

15. $-8 + 5$

17. $x + 8$

19. $4(5)$

21. $-12x$

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

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

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

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

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

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

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

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

39. Reciprocal

41. Zero

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

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

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

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

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

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

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

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

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

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

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

65. $4(6z) = 24z$

67. $-2(7x) = -14x$

69. $-4(1 + x) = -4 - 4x$

71. b

73. i

75. g

77. d

79. h

81. Term: $2x$, coefficient 2;

Term: $-y$, coefficient -1 ;

Term: $18xy$, coefficient 18;

Term: 5, coefficient 5.

83. Term: $-x$, coefficient -1 ;

Term: $8y$, coefficient 8;

Term: $-9x^2y$, coefficient -9 ;

Term: -3 , coefficient -3 .

85. The variable factors are different.

87. The variables are the same *and* raised to the same power.

89. Answers vary: $5y$, $-2x$, 6

$$91. -4p - 2p = -6p$$

$$93. 2y^2 - 5y^2 - 3y^2 = -6y^2$$

$$95. 8x^3y + 3 - 7 - x^3y = 7x^3y - 4$$

$$97. \frac{2}{5} + 2t - \frac{3}{5} + t - \frac{6}{5} = 3t - \frac{7}{5}$$

$$99. -3(2x - 4) + 10 = -6x + 12 + 10 \\ = -6x + 22$$

$$101. 4(w + 3) - 12 = 4w + 12 - 12 = 4w$$

$$103. 5 - 3(x - 4) = 5 - 3x + 12 = -3x + 17$$

$$105. -3(2t + 4w) + 8(2t - 4w) \\ = -6t - 12w + 16t + 32w \\ = 10t - 4w$$

$$107. 2(q - 5u) - (2q + 8u) \\ = 2q - 10u - 2q - 8u = -18u$$

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

$$111. 10(5.1a - 3.1) + 4 = 51a - 31 + 4 \\ = 51a - 27$$

$$113. -4m + 2(m - 3) + 2m \\ = -4m + 2m - 6 + 2m = -6$$

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

$$117. 7n - 2(n - 3) - 6 + n \\ = 7n - 2n + 6 - 6 + n = 6n$$

$$119. 6(x + 3) - 12 - 4(x - 3) \\ = 6x + 18 - 12 - 4x + 12 = 2x + 18$$

$$121. 0.2(6c - 1.6) + c \\ = 1.2c - 0.32 + c = 2.2c - 0.32$$

$$123. 6 + 2[-8 - 3(2x + 4)] + 10x \\ = 6 + 2[-8 - 6x - 12] + 10x \\ = 6 + 2[-6x - 20] + 10x \\ = 6 - 12x - 40 + 10x = -2x - 34$$

$$125. 1 - 3[2(z + 1) - 5(z - 2)] \\ = 1 - 3[2z + 2 - 5z + 10] \\ = 1 - 3[-3z + 12] \\ = 1 + 9z - 36 \\ = 9z - 35$$

127. Equivalent

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

131. Not equivalent. Subtraction is not commutative.

133. Equivalent

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

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