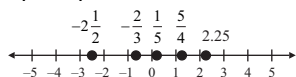


Chapter 1

Section 1.2 Practice

- Since 8 is to the right of 6 on the number line, the statement $8 < 6$ is false.
- Since 100 is to the right of 10 on the number line, the statement $100 > 10$ is true.
- Since $21 = 21$, the statement $21 \leq 21$ is true.
- Since $21 = 21$, the statement $21 \geq 21$ is true.
- Since neither $0 > 5$ nor $0 = 5$ is true, the statement $0 \geq 5$ is false.
- Since $25 > 22$, the statement $25 \geq 22$ is true.
- Fourteen is greater than or equal to fourteen is written as $14 \geq 14$.
 - Zero is less than five is written as $0 < 5$.
 - Nine is not equal to 10 is written as $9 \neq 10$.
- The integer -8 represents 8 feet below sea level.
- $\frac{5}{4} = 1\frac{1}{4}$



- $-11 < -9$ since -11 is to the left of -9 on the number line.
 - By comparing digits in the same places, we find that $4.511 > 4.151$, since $0.5 > 0.1$.
 - By dividing, we find that $\frac{7}{8} = 0.875$ and $\frac{2}{3} = 0.66\ldots$. Since $0.875 > 0.66\ldots$, then $\frac{7}{8} > \frac{2}{3}$.
- The natural numbers are 6 and 913.
 - The whole numbers are 0, 6, and 913.
 - The integers are -100 , 0, 6, and 913.

- The rational numbers are -100 , $-\frac{2}{5}$, 0, 6, and 913.
 - The irrational number is π .
 - All numbers in the given set are real numbers.
- $|7| = 7$ since 7 is 7 units from 0 on the number line.
 - $|-8| = 8$ since -8 is 8 units from 0 on the number line.
 - $\left|\frac{2}{3}\right| = \frac{2}{3}$
 - $|0| = 0$ since 0 is 0 units from 0 on the number line.
 - $|-3.06| = 3.06$
 - $|-4| = 4$
 - $-3 < |0|$ since $-3 < 0$.
 - $|-2.7| > |-2|$ since $2.7 > 2$.
 - $|-6| \leq |-16|$ since $6 < 16$.
 - $|10| < \left|-10\frac{1}{3}\right|$ since $10 < 10\frac{1}{3}$.

Vocabulary and Readiness Check

- The whole numbers are $\{0, 1, 2, 3, 4, \dots\}$.
- The natural numbers are $\{1, 2, 3, 4, 5, \dots\}$.
- The symbols \neq , \leq , and $>$ are called inequality symbols.
- The integers are $\{\dots, -3, -2, -1, 0, 1, 2, 3, \dots\}$.
- The real numbers are $\{\text{all numbers that correspond to points on the number line}\}$.
- The rational numbers are $\left\{\frac{a}{b} \mid a \text{ and } b \text{ are integers, } b \neq 0\right\}$.

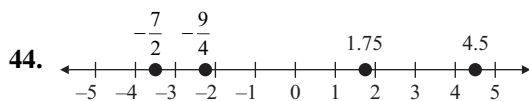
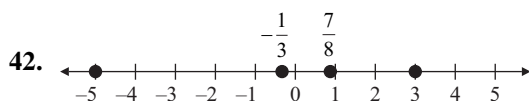
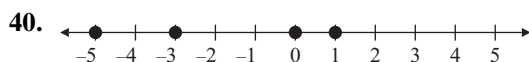
7. The integer 0 is neither positive nor negative.
8. The point on a number line halfway between 0 and $\frac{1}{2}$ can be represented by $\frac{1}{4}$.
9. The distance between a real number a and 0 is called the absolute value of a .
10. The absolute value of a is written in symbols as $|a|$.

Exercise Set 1.2

2. Since 8 is to the right of 5 on the number line, $8 > 5$.
4. Since 9 is to the left of 15 on the number line, $9 < 15$.
6. $1.13 = 1.13$
8. Since 20 is to the right of 0 on the number line, $20 > 0$.
10. Since 0 is to the left of 100 on the number line, $0 < 100$.
12. Since 360 is to the right of 180 on the number line, $360 \geq 180$.
14. Since 8 is to the left of 9 on the number line, $8 \geq 9$ is false.
16. Since -16 is to the right of -17 on the number line, $-16 > -17$ is true.
18. 1.02 can be written as 1.020. Then comparing digits with the same place value, we have $0.000 < 0.001$. Thus the statement $1.02 > 1.021$ is false.
20. Rewrite the fractions with a common denominator and compare numerators.

$$\frac{4}{5} = \frac{44}{55}; \frac{9}{11} = \frac{45}{55}$$
 Since $44 < 45$, then $\frac{4}{5} \leq \frac{9}{11}$ is true.
22. $-13 \leq 13$ has the same meaning as $13 \geq -13$.
24. $5 > 3$ has the same meaning as $3 < 5$.
26. $-4 < -2$ has the same meaning as $-2 > -4$.

28. Twenty is greater than two is written as $20 > 2$.
30. Negative ten is less than or equal to thirty-seven is written as $-10 \leq 37$.
32. Negative seven is not equal to seven is written as $-7 \neq 7$.
34. The integer 535 represents 535 feet above sea level. The integer -8 represents 8 feet below sea level.
36. The integer $-38,792$ represents 38,792 fewer students.
38. The integer 17 represents an ascent of 17 feet. The integer -15 represents a descent of 15 feet.



46. $\frac{1}{4}$ is a rational number and a real number.
48. $-\frac{1}{7}$ is a rational number and a real number.
50. 7941 is a natural number, a whole number, an integer, a rational number, and a real number.
52. $\sqrt{3}$ is an irrational number and a real number.
54. True; every natural number is positive.
56. False; $\frac{1}{2}$ is not an integer.
58. True; every rational number is also a real number.
60. True; every whole number is an integer.
62. $|11.2| = 11.2$ since 11.2 is 11.2 units from 0 on the number line.
64. $|-17| = 17$ since -17 is 17 units from 0 on the number line.

66. $\left|\frac{10}{7}\right| = \frac{10}{7}$ since $\frac{10}{7}$ is $\frac{10}{7}$ units from 0 on the number line.

68. $\left|-\frac{1}{15}\right| = \frac{1}{15}$ since $-\frac{1}{15}$ is $\frac{1}{15}$ unit from 0 on the number line.

70. $|-12| = 12$
 $|0| = 0$
 Since 12 is to the right of 0 on the number line,
 $|-12| > |0|$.

72. $\left|\frac{2}{5}\right| = \frac{2}{5}$
 $\left|-\frac{2}{5}\right| = \frac{2}{5}$
 Since $\frac{2}{5} = \frac{2}{5}$, then $\left|\frac{2}{5}\right| = \left|-\frac{2}{5}\right|$.

74. $|-5.01| = 5.01$
 $|-5| = 5$
 Since 5.01 is to the right of 5 on the number line,
 $|-5.01| > |-5|$.

76. $|-12| = 12$
 $\frac{-24}{2} = -12$
 Since 12 is to the right of -12 on the number line,
 $|-12| > \frac{-24}{2}$.

78. The apple production in 2006 was 690 thousand bushels, while the production in 2007 was 917 thousand bushels.
 $690 \text{ thousand} < 917 \text{ thousand}$, or
 $690,000 < 917,000$

80. The year corresponding to the tallest bar is 2003, so the largest crop was in 2003.

82. The 2009 cranberry production in Massachusetts was 190 million pounds, while the 2009 cranberry production in Wisconsin was 400 million pounds.
 $190 \text{ million} < 400 \text{ million}$, or
 $190,000,000 < 400,000,000$

84. The bars for Oregon and New Jersey are almost the same length, so Oregon and New Jersey had almost equal cranberry crops in 2009.

86. Since 0.96 is to the left of 0.98 on the number line, $0.96 < 0.98$.

88. Antares: 0.96
 Spica: 0.98
 Since $0.96 < 0.98$, Spica is dimmer than Antares.

90. Since the dimmest star corresponds to the largest apparent magnitude, which is 1.35, the dimmest star is Regulus.

92. answers may vary

Section 1.3 Practice

1. a. $4^2 = 4 \cdot 4 = 16$

b. $2^2 = 2 \cdot 2 = 4$

c. $3^4 = 3 \cdot 3 \cdot 3 \cdot 3 = 81$

d. $9^1 = 9$

e. $\left(\frac{2}{5}\right)^3 = \left(\frac{2}{5}\right)\left(\frac{2}{5}\right)\left(\frac{2}{5}\right) = \frac{2 \cdot 2 \cdot 2}{5 \cdot 5 \cdot 5} = \frac{8}{125}$

f. $(0.8)^2 = (0.8)(0.8) = 0.64$

2. $3 \cdot 2 + 4^2 = 3 \cdot 2 + 16 = 6 + 16 = 22$

3. $28 \div 7 \cdot 2 = 4 \cdot 2 = 8$

4. $\frac{9}{5} \cdot \frac{1}{3} - \frac{1}{3} = \frac{9}{15} - \frac{1}{3} = \frac{9}{15} - \frac{5}{15} = \frac{4}{15}$

5. $5 + 3[2(3 \cdot 4 + 1) - 20] = 5 + 3[2(12 + 1) - 20]$
 $= 5 + 3[2(13) - 20]$
 $= 5 + 3[26 - 20]$
 $= 5 + 3[6]$
 $= 5 + 18$
 $= 23$

6. $\frac{1 + |7 - 4| + 3^2}{8 - 5} = \frac{1 + |3| + 3^2}{8 - 5}$
 $= \frac{1 + 3 + 3^2}{3}$
 $= \frac{1 + 3 + 9}{3}$
 $= \frac{13}{3}$

7. a. Replace
- y
- with 4.

$$3y^2 = 3 \cdot (4)^2 = 3 \cdot 16 = 48$$

- b. Replace
- x
- with 1 and
- y
- with 4.

$$2y - x = 2(4) - 1 = 8 - 1 = 7$$

- c. Replace
- x
- with 1 and
- y
- with 4.

$$\frac{11x}{3y} = \frac{11 \cdot 1}{3 \cdot 4} = \frac{11}{12}$$

- d. Replace
- x
- with 1 and
- y
- with 4.

$$\frac{x}{y} + \frac{6}{y} = \frac{1}{4} + \frac{6}{4} = \frac{7}{4}$$

- e. Replace
- x
- with 1 and
- y
- with 4.

$$y^2 - x^2 = 4^2 - 1^2 = 16 - 1 = 15$$

- 8.
- $5x - 10 = x + 2$

$$5(3) - 10 \stackrel{?}{=} 3 + 2$$

$$15 - 10 \stackrel{?}{=} 5$$

$$5 = 5 \quad \text{True}$$

3 is a solution.

9. a.
- $5 \cdot x$
- and
- $5x$
- are both ways to denote the product of 5 and
- x
- .

- b. A number added to 7 is denoted by
- $7 + x$
- .

- c. A number divided by 11.2 is denoted by

$$x \div 11.2 \text{ or } \frac{x}{11.2}.$$

- d. A number subtracted from 8 is denoted by
- $8 - x$
- .

- e. Twice a number, plus 1 is denoted by
- $2x + 1$
- .

10. a. The ratio of a number and 6 is 24 is written

$$\text{as } \frac{x}{6} = 24.$$

- b. The difference of 10 and a number is 18 is written as
- $10 - x = 18$
- .

- c. One less than twice a number is 99 is written as
- $2x - 1 = 99$
- .

Calculator Explorations

1. $5^3 = 125$

2. $7^4 = 2401$

3. $9^5 = 59,049$

4. $8^6 = 262,144$

5. $2(20 - 5) = 30$

6. $3(14 - 7) + 21 = 42$

7. $24(862 - 455) + 89 = 9857$

8. $99 + (401 + 962) = 1462$

9. $\frac{4623 + 129}{36 - 34} = 2376$

10. $\frac{956 - 452}{89 - 86} = 168$

Vocabulary and Readiness Check

1. In
- 2^5
- , the 2 is called the
- base
- and the 5 is called the
- exponent
- .

2. True or false:
- 2^5
- means 2.5.
- false

3. To simplify
- $8 + 2 \cdot 6$
- , which operation should be performed first?
- multiplication

4. To simplify
- $(8 + 2) \cdot 6$
- , which operation should be performed first?
- addition

5. To simplify
- $9(3 - 2) \div 3 + 6$
- , which operation should be performed first?
- subtraction

6. To simplify
- $8 \div 2 \cdot 6$
- , which operation should be performed first?
- division

7. A combination of operations on letters (variables) and numbers is an
- expression
- .

8. A letter that represents a number is a
- variable
- .

- 9.
- $3x - 2y$
- is called an
- expression
- and the letters
- x
- and
- y
- are
- variables
- .

10. Replacing a variable in an expression by a number and then finding the value of the expression is called
- evaluating the expression
- .

11. A statement of the form "expression = expression" is called an
- equation
- .

12. A value for the variable that makes the equation a true statement is called a solution.

Exercise Set 1.3

2. $5^4 = 5 \cdot 5 \cdot 5 \cdot 5 = 625$

4. $4^4 = 4 \cdot 4 \cdot 4 \cdot 4 = 256$

6. $1^8 = 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 = 1$

8. $8^1 = 8$

10. $9^2 = 9 \cdot 9 = 81$

12. $\left(\frac{6}{11}\right)^2 = \left(\frac{6}{11}\right)\left(\frac{6}{11}\right) = \frac{6 \cdot 6}{11 \cdot 11} = \frac{36}{121}$

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

16. $(1.5)^2 = 1.5 \cdot 1.5 = 2.25$

18. $(0.4)^3 = 0.4 \cdot 0.4 \cdot 0.4 = 0.064$

20. $9 \cdot 9 \cdot \pi = 9^2 \pi$ square meters

22. $8 + 5 \cdot 3 = 8 + 15 = 23$

24. $12 \cdot 5 - 3 \cdot 6 = 60 - 18 = 42$

26. $48 \div 6 \cdot 2 = 8 \cdot 2 = 16$

28. $6 - 2 \cdot 2 + 2^5 = 6 - 2 \cdot 2 + 32$
 $= 6 - 4 + 32$
 $= 2 + 32$
 $= 34$

30. $2 \cdot 5^2 = 2 \cdot 25 = 50$

32. $\frac{3}{4} \cdot \frac{1}{2} + \frac{2}{3} = \frac{3}{8} + \frac{2}{3} = \frac{9}{24} + \frac{16}{24} = \frac{25}{24}$

34. $\frac{8-5}{24-20} = \frac{3}{4}$

36. $3[4 + 3(6 - 4)] = 3[4 + 3(2)]$
 $= 3[4 + 6]$
 $= 3[10]$
 $= 30$

38. $\frac{14 - 2 \cdot 3}{12 - 8} = \frac{14 - 6}{4} = \frac{8}{4} = 2$

40. $\frac{15 - |3 - 1|}{12 - 3 \cdot 2} = \frac{15 - |2|}{12 - 6} = \frac{15 - 2}{6} = \frac{13}{6}$

42. $\frac{3 + 6(8 - 5)}{4^2 + 2} = \frac{3 + 6(3)}{16 + 2} = \frac{3 + 18}{18} = \frac{21}{18} = \frac{7}{6}$

44. $\frac{16 + |13 - 5| + 4^2}{17 - 5} = \frac{16 + 8 + 16}{12} = \frac{40}{12} = \frac{10}{3}$

46. $3 + 4[8(5 \cdot 5 - 20) - 41] = 3 + 4[8(25 - 20) - 41]$
 $= 3 + 4[8(5) - 41]$
 $= 3 + 4[40 - 41]$
 $= 3 + 4[-1]$
 $= 3 - 4$
 $= -1$

48. $\left(\frac{3}{8}\right)^2 + \frac{1}{4} + \frac{1}{8} \cdot \frac{3}{2} = \frac{9}{64} + \frac{1}{4} + \frac{1}{8} \cdot \frac{3}{2}$
 $= \frac{9}{64} + \frac{1}{4} + \frac{3}{16}$
 $= \frac{9}{64} + \frac{16}{64} + \frac{12}{64}$
 $= \frac{37}{64}$

50. Replace x with 1.
 $4x = 4(1) = 4$

52. Replace y with 3 and z with 5.
 $\frac{y}{2z} = \frac{3}{2(5)} = \frac{3}{10}$

54. Replace y with 3.
 $6y - 8 = 6(3) - 8 = 18 - 8 = 10$

56. Replace y with 3 and z with 5.
 $|5z - 2y| = |5(5) - 2(3)| = |25 - 6| = |19| = 19$

58. Replace x with 1, y with 3, and z with 5.
 $yz - x = 3(5) - 1 = 15 - 1 = 14$

60. Replace
- z
- with 5.

$$2z^2 = 2(5^2) = 2(25) = 50$$

62. Replace
- x
- with 12,
- y
- with 8, and
- z
- with 4.

$$\frac{y}{z} + 8x = \frac{8}{4} + 8(12) = 2 + 8(12) = 2 + 96 = 98$$

64. Replace
- x
- with 12 and
- y
- with 8.

$$\begin{aligned} y^2 - 3x + y &= (8)^2 - 3(12) + 8 \\ &= 64 - 3(12) + 8 \\ &= 64 - 36 + 8 \\ &= 28 + 8 \\ &= 36 \end{aligned}$$

66. Replace
- x
- with 12 and
- y
- with 8.

$$\begin{aligned} \frac{y^2 + x}{x^2 + 3y} &= \frac{(8)^2 + 12}{(12)^2 + 3(8)} \\ &= \frac{64 + 12}{144 + 3(8)} \\ &= \frac{76}{144 + 24} \\ &= \frac{76}{168} \\ &= \frac{4 \cdot 19}{4 \cdot 42} \\ &= \frac{19}{42} \end{aligned}$$

- 68.
- $2x + 7 = 3x$

$$2(6) + 7 \stackrel{?}{=} 3(6)$$

$$12 + 7 \stackrel{?}{=} 18$$

$$19 = 18 \quad \text{False}$$

Since the result is false, 6 is not a solution of the given equation.

- 70.
- $4x + 2 = x + 8$

$$4(2) + 2 \stackrel{?}{=} 2 + 8$$

$$8 + 2 \stackrel{?}{=} 2 + 8$$

$$10 = 10 \quad \text{True}$$

Since the result is true, 2 is a solution of the given equation.

- 72.
- $3x - 10 = 8$

$$3(6) - 10 \stackrel{?}{=} 8$$

$$18 - 10 \stackrel{?}{=} 8$$

$$8 = 8 \quad \text{True}$$

Since the result is true, 6 is a solution of the given equation.

- 74.
- $x + 6 = x + 6$

$$10 + 6 \stackrel{?}{=} 10 + 6$$

$$16 = 16 \quad \text{True}$$

Since the result is true, 10 is a solution of the given equation.

- 76.
- $4 = 1 - x$

$$4 \stackrel{?}{=} 1 - 1$$

$$4 = 0 \quad \text{False}$$

Since the result is false, 1 is not a solution of the given equation.

- 78.
- $\frac{2}{7}x = \frac{3}{14}$

$$\frac{2}{7} \cdot 6 \stackrel{?}{=} \frac{3}{14}$$

$$\frac{12}{7} \stackrel{?}{=} \frac{3}{14}$$

$$\frac{24}{14} = \frac{3}{14} \quad \text{False}$$

Since the result is false, 6 is not a solution of the given equation.

80. A number increased by 9 is written as
- $x + 9$
- .

82. Five decreased by a number is written as
- $5 - x$
- .

84. The quotient of a number and 9 is written as
- $\frac{x}{9}$
- .

86. Twice a number, decreased by 72 is written as
- $2x - 72$
- .

88. Four subtracted from eight is equal to two squared is written as
- $8 - 4 = 2^2$
- .

90. The difference of sixteen and four is greater than ten is written as
- $16 - 4 > 10$
- .

92. Seven subtracted from a number is 0 is written as
- $x - 7 = 0$
- .

94. 9.1 times a number equals 4 is written as
- $9.1x = 4$
- .

96. Eight added to twice a number is 42 is written as
- $2x + 8 = 42$
- .

98. Yes; answers may vary

100. a. $(1 + 4) \cdot 6 - 3 = 5 \cdot 6 - 3 = 30 - 3 = 27$

b. $1 + 4 \cdot (6 - 3) = 1 + 4 \cdot 3 = 1 + 12 = 13$

c. $1 + 4 \cdot 6 - 3 = 1 + 24 - 3 = 25 - 3 = 22$

d. $(1 + 4) \cdot (6 - 3) = 5 \cdot 3 = 15$

	Length, l	Width, w	Perimeter of Rectangle: $2l + 2w$	Area of Rectangle: lw
102.	6 in.	1 in.	$2l + 2w$ $= 2(6 \text{ in.}) + 2(1 \text{ in.})$ $= 12 \text{ in.} + 2 \text{ in.}$ $= 14 \text{ in.}$	lw $= (6 \text{ in.})(1 \text{ in.})$ $= 6 \text{ sq in.}$
104.	4.6 in.	2.4 in.	$2l + 2w$ $= 2(4.6 \text{ in.}) + 2(2.4 \text{ in.})$ $= 9.2 \text{ in.} + 4.8 \text{ in.}$ $= 14 \text{ in.}$	lw $= (4.6 \text{ in.})(2.4 \text{ in.})$ $= 11.04 \text{ sq in.}$

106. answers may vary

108. $2 \cdot (5 + 3^2) = 2 \cdot (5 + 9) = 2 \cdot 14 = 28$

110. a. $3x^2 - 26$ is an expression since it does not contain the equal symbol “=”.

b. $3x^2 - 26 = 1$ is an equation since it contains the equal symbol.

c. $2x - 5 = 7x - 5$ is an equation since it contains the equal symbol.

d. $9y + x - 8$ is an expression since it does not contain the equal symbol.

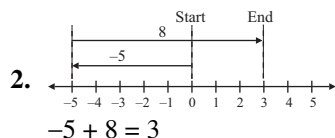
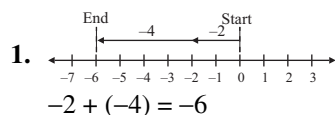
e. $3^2 - 4(5 - 3)$ is an expression since it does not contain the equal symbol.

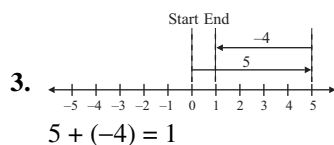
112. answers may vary

114. answers may vary, for example, $2(10 - 7) + 1$:

$2(10 - 7) + 1 = 2(3) + 1 = 6 + 1 = 7$

Section 1.4 Practice





4. $-8 + (-5) = -13$

5. $(-14) + 6 = -8$

6. $(-17) + (-10) = -27$

7. $(-4) + 12 = 8$

8. $1.5 + (-3.2) = -1.7$

9. $-\frac{5}{12} + \left(-\frac{1}{12}\right) = -\frac{6}{12} = -\frac{6 \cdot 1}{6 \cdot 2} = -\frac{1}{2}$

10. $12.1 + (-3.6) = 8.5$

11. $-\frac{4}{5} + \frac{2}{3} = -\frac{12}{15} + \frac{10}{15} = -\frac{2}{15}$

12. a. $16 + (-9) + (-9) = 7 + (-9) = -2$

b. $[3 + (-13)] + [-4 + (-7)] = [-10] + [-11] = -21$

13. The opposite of -35 is 35 .

14. The opposite of 12 is -12 .

15. The opposite of $-\frac{3}{11}$ is $\frac{3}{11}$.

16. The opposite of 1.9 is -1.9 .

17. a. $-(-22) = 22$

b. $-\left(-\frac{2}{7}\right) = \frac{2}{7}$

c. $-(-x) = x$

d. $-|-14| = -14$

e. $-|2.3| = -2.3$

18. $30 + (-30) = 0$

19. $-81 + 81 = 0$

20. $x + 3y = -6 + 3(2) = -6 + 6 = 0$

21. $x + y = -13 + (-9) = -22$

22. Temperature at 8 a.m. $= -7 + (+4) + (+7)$
 $= -3 + (+7)$
 $= 4$

The temperature was 4°F at 8 a.m.**Vocabulary and Readiness Check**

1. If n is a number, then $-n + n = \underline{0}$.

2. Since $x + n = n + x$, we say that addition is commutative.

3. If a is a number, then $-(-a) = \underline{a}$.

4. Since $n + (x + a) = (n + x) + a$, we say that addition is associative.

Exercise Set 1.4

2. $9 + (-12) = -3$

4. $-6 + (-14) = -20$

6. $16 + (-4) = 12$

8. $-10 + 5 = -5$

10. $-7 + (-4) = -11$

12. $-11 + (-5) = -16$

14. $-5 + 9 = 4$

16. $8 + (-6) = 2$

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

20. $23 + (-23) = 0$

22. $53 + (-37) = 16$

24. $-26 + 14 = -12$

26. $-18 + (-26) = -44$

28. $9.2 + (-11.4) = -2.2$

30. $144 + (-88) = 56$

32. $-6.7 + (-7.6) = -14.3$

34. $-\frac{5}{12} + \frac{7}{12} = \frac{2}{12} = \frac{2 \cdot 1}{2 \cdot 6} = \frac{1}{6}$

36. $-\frac{5}{9} + \frac{1}{3} = -\frac{5}{9} + \frac{3}{9} = -\frac{2}{9}$
38. $-\frac{5}{6} + \left(-\frac{2}{3}\right) = -\frac{5}{6} + \left(-\frac{4}{6}\right) = -\frac{9}{6} = -\frac{3 \cdot 3}{3 \cdot 2} = -\frac{3}{2}$
40. $|-6| + (-61) = 6 + (-61) = -55$
42. $-9 + 15 + (-5) = 6 + (-5) = 1$
44. $-18 + (-6) + (-40) = -24 + (-40) = -64$
46. $-14 + (-3) + 11 = -17 + 11 = -6$
48. $|7 + (-17)| = |-10| = 10$
50. $8 + (-2) + 7 = 6 + 7 = 13$
52. $[-2 + (-7)] + [-11 + 22] = [-9] + [11] = 2$
54. $|43 + (-73)| + |-20| = |-30| + |-20| = 30 + 20 = 50$
56. $-30 + [1 + (-6) + 8] = -30 + [-5 + 8]$
 $= -30 + [3]$
 $= -27$
58. $-44 + 16 = -28$
 The sum of -44 and 16 is -28 .
60. The additive inverse of 4 is -4 .
62. The additive inverse of -8 is 8 .
64. The additive inverse of $-\frac{1}{4}$ is $\frac{1}{4}$.
66. Since $|-11| = 11$, the additive inverse of $|-11|$ is -11 .
68. $-|-5| = -5$
70. $-(-14) = 14$
72. $-(-8.4) = 8.4$
74. $-(-7m) = 7m$
76. $-\left|-\frac{2}{3}\right| = -\frac{2}{3}$
78. $x + y = -1 + (-29) = -30$
80. $3x + y = 3(7) + (-11) = 21 + (-11) = 10$
82. The sum of -30 and 15 is $-30 + 15 = -15$.
84. The sum of -49 , -2 , and 40 is
 $-49 + (-2) + 40 = -51 + 40 = -11$.
86. $0 + (-248) + 8 + (-16) + (-28) + 32$
 $= -248 + 8 + (-16) + (-28) + 32$
 $= -240 + (-16) + (-28) + 32$
 $= -256 + (-28) + 32$
 $= -284 + 32$
 $= -252$
 The diver's final depth is 252 feet below the surface.
88. $-4 + 49 = 45$
 The temperature rose to 45° .
90. $-52 + 439 = 387$
 Your elevation is 387 feet.
92. $-2 + 2 + (-2) + (-2) + (-2)$
 $= 0 + (-2) + (-2) + (-2)$
 $= -2 + (-2) + (-2)$
 $= -4 + (-2)$
 $= -6$
 The final score for round 1 was -6 .
94. $-27.1 + (-12.2) + 7.2 + 29.4 = -39.3 + 7.2 + 29.4$
 $= -32.1 + 29.4$
 $= -2.7$
 The total net income for fiscal year 2009 was $-\$2.7$ million.
96. The longest bar below 0 corresponds to February, so the lowest low temperature was in February.
98. The shortest bar below 0 corresponds to November.
100. $\frac{-19.3 + 27.0 + 8.8}{3} = \frac{7.7 + 8.8}{3} = \frac{16.5}{3} = 5.5$
 The average temperature for the months of January, September, and October is 5.5°F .
102. answers may vary
104. $-4 + 14 = 10$
106. $-15 + (-17) = -32$
108. True
110. True

112. answers may vary

Section 1.5 Practice

1. a. $-20 - 6 = -20 + (-6) = -26$

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

c. $7 - 17 = 7 + (-17) = -10$

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

2. $9.6 - (-5.7) = 15.3$

3. $-\frac{4}{9} - \frac{2}{9} = -\frac{4}{9} + \left(-\frac{2}{9}\right) = -\frac{6}{9} = -\frac{2}{3}$

4. $-\frac{1}{4} - \left(-\frac{2}{5}\right) = -\frac{1}{4} + \frac{2}{5} = -\frac{5}{20} + \frac{8}{20} = \frac{3}{20}$

5. a. $-11 - 7 = -11 + (-7) = -18$

b. $35 - (-25) = 35 + 25 = 60$

6. a. $-20 - 5 + 12 - (-3) = -20 + (-5) + 12 + 3 = -10$

b. $5.2 - (-4.4) + (-8.8) = 5.2 + 4.4 + (-8.8) = 0.8$

7. a. $-9 + [(-4 - 1) - 10] = -9 + [(-4 + (-1)) - 10] = -9 + [(-5) - 10] = -9 + [-5 + (-10)] = -9 + [-15] = -24$

b. $5^2 - 20 + [-11 - (-3)] = 5^2 - 20 + [-11 + 3] = 5^2 - 20 + [-8] = 25 - 20 + (-8) = 25 + (-20) + (-8) = 5 + (-8) = -3$

8. a. Replace x with 1 and y with -4 .

$$\frac{x-y}{14+x} = \frac{1-(-4)}{14+1} = \frac{1+4}{15} = \frac{5}{15} = \frac{1}{3}$$

b. Replace x with 1 and y with -4 .

$$x^2 - y = (1)^2 - (-4) = 1 - (-4) = 1 + 4 = 5$$

9. $-1 + x = 1$

$$-1 + (-2) \stackrel{?}{=} 1$$

$$-3 = 1 \text{ False}$$

 -2 is not a solution.10. $29,028 - (-1312) = 29,028 + 1312 = 30,340$
Mount Everest is 30,340 feet higher than the Dead Sea.11. a. These angles are supplementary, so their sum is 180° . This means that $m\angle x$ is $180^\circ - 78^\circ$.
 $m\angle x = 180^\circ - 78^\circ = 102^\circ$ b. These angles are complementary, so their sum is 90° . This means that $m\angle y$ is $90^\circ - 81^\circ$.
 $m\angle y = 90^\circ - 81^\circ = 9^\circ$

Vocabulary and Readiness Check

1. It is true that $a - b = a + (-b)$. b2. The opposite of n is $-n$. a3. To evaluate $x - y$ for $x = -10$ and $y = -14$, we replace x with -10 and y with -14 and evaluate $-10 - (-14)$. d4. The expression $-5 - 10$ equals $-5 + (-10)$. c

Exercise Set 1.5

2. $-12 - 8 = -12 + (-8) = -20$

4. $8 - 11 = 8 + (-11) = -3$

6. $12 - (-5) = 12 + 5 = 17$

8. $3 - (-6) = 3 + 6 = 9$

10. $-60 - (-48) = -60 + 48 = -12$

12. $-8 - 4 = -8 + (-4) = -12$

14. $15 - (-33) = 15 + 33 = 48$

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

18. $-36 - 51 = -36 + (-51) = -87$

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

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

$$24. \quad 8.3 - 11.2 = 8.3 + (-11.2) = -2.9$$

$$26. \quad -6.1 - (-5.3) = -6.1 + 5.3 = -0.8$$

$$28. \quad \frac{3}{4} - \frac{7}{8} = \frac{3}{4} + \left(-\frac{7}{8}\right) = \frac{6}{8} + \left(-\frac{7}{8}\right) = -\frac{1}{8}$$

$$30. \quad -\frac{1}{10} - \frac{7}{8} = -\frac{1}{10} + \left(-\frac{7}{8}\right) = -\frac{4}{40} + \left(-\frac{35}{40}\right) = -\frac{39}{40}$$

$$32. \quad 4.3 - (-0.87) = 4.3 + 0.87 = 5.17$$

$$34. \quad 0 - (-4.21) = 0 + 4.21 = 4.21$$

$$36. \quad 3 - (-2) = 3 + 2 = 5$$

-2 subtracted from 3 is 5.

$$38. \quad -17 - (-1) = -17 + 1 = -16$$

The difference between -17 and -1 is -16.

$$40. \quad -4 - 9 = -4 + (-9) = -13$$

9 subtracted from -4 is -13.

$$42. \quad 11 - (-14) = 11 + 14 = 25$$

11 decreased by -14 is 25.

$$44. \quad -16 - (-3) + (-11) - 14 = -16 + 3 + (-11) + (-14)$$

$$= -13 + (-11) + (-14)$$

$$= -24 + (-14)$$

$$= -38$$

$$46. \quad 7 - 12 + (-5) - 2 + (-2)$$

$$= 7 + (-12) + (-5) + (-2) + (-2)$$

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

$$= -10 + (-2) + (-2)$$

$$= -12 + (-2)$$

$$= -14$$

$$48. \quad -9 - (3 - 8) = -9 - (-5) = -9 + 5 = -4$$

$$50. \quad 2^3 - 6 \cdot 3 = 8 - 18 = 8 + (-18) = -10$$

$$52. \quad 4 - 6(7 - 3) = 4 - 6[7 + (-3)]$$

$$= 4 - 6(4)$$

$$= 4 - 24$$

$$= 4 + (-24)$$

$$= -20$$

$$54. \quad (2 - 3) + 5^2 = [2 + (-3)] + 5^2$$

$$= -1 + 5^2$$

$$= -1 + 25$$

$$= 24$$

$$56. \quad -5 + [(4 - 15) - (-6) - 8]$$

$$= -5 + [(4 + (-15)) + 6 + (-8)]$$

$$= -5 + [(-11) + 6 + (-8)]$$

$$= -5 + [-5 + (-8)]$$

$$= -5 + [-13]$$

$$= -18$$

$$58. \quad |-2| + 6^2 + (-3 - 8) = |-2| + 6^2 + [-3 + (-8)]$$

$$= 2 + 36 + (-11)$$

$$= 38 + (-11)$$

$$= 27$$

$$60. \quad \text{Replace } x \text{ with } -5 \text{ and } y \text{ with } 4.$$

$$y - x = 4 - (-5) = 4 + 5 = 9$$

$$62. \quad \text{Replace } x \text{ with } -5 \text{ and } y \text{ with } 4.$$

$$\frac{15 - x}{y + 2} = \frac{15 - (-5)}{4 + 2} = \frac{15 + 5}{4 + 2} = \frac{20}{6} = \frac{2 \cdot 10}{2 \cdot 3} = \frac{10}{3}$$

$$64. \quad \text{Replace } x \text{ with } -5, y \text{ with } 4, \text{ and } t \text{ with } 10.$$

$$|y| + 3x - 2t = |4| + 3(-5) - 2(10)$$

$$= 4 + (-15) - 20$$

$$= -11 - 20$$

$$= -11 + (-20)$$

$$= -31$$

$$66. \quad \text{Replace } x \text{ with } -5 \text{ and } t \text{ with } 10.$$

$$t^2 - x = 10^2 - (-5) = 10^2 + 5 = 100 + 5 = 105$$

$$68. \quad \text{Replace } x \text{ with } -5, y \text{ with } 4, \text{ and } t \text{ with } 10.$$

$$\frac{|5y - x|}{6t} = \frac{|5(4) - (-5)|}{6(10)}$$

$$= \frac{|20 + 5|}{6(10)}$$

$$= \frac{|25|}{6(10)}$$

$$= \frac{25}{60}$$

$$= \frac{5 \cdot 5}{12 \cdot 5}$$

$$= \frac{5}{12}$$

$$70. \quad x - 10 = -7$$

$$3 - 10 \stackrel{?}{=} -7$$

$$3 + (-10) \stackrel{?}{=} -7$$

$$-7 = -7 \quad \text{True}$$

Since the result is true, 3 is a solution of the given equation.

72. $-x - 6 = -x - 1$
 $-(-10) - 6 \stackrel{?}{=} -(-10) - 1$
 $10 - 6 \stackrel{?}{=} 10 - 1$
 $10 + (-6) \stackrel{?}{=} 10 + (-1)$
 $4 = 9$ False

Since the result is false, -10 is not a solution of the given equation.

74. $4 = 1 - x$
 $4 \stackrel{?}{=} 1 - 5$
 $4 \stackrel{?}{=} 1 + (-5)$
 $4 = -4$ False

Since the result is false, 5 is not a solution of the given equation.

76. $134 - (-80) = 134 + 80 = 214$
 Therefore, 134°F is 214°F warmer than -80°F .

78. $93 - 18 - 26 = 93 + (-18) + (-26)$
 $= 75 + (-26)$
 $= 49$

She owes \$49 on her account.

80. Supplementary angles sum to 180° .
 $180^{\circ} - 105^{\circ} = y$
 $180^{\circ} + (-105^{\circ}) = y$
 $75^{\circ} = y$

82. $15 - 24 = 15 + (-24) = -9$
 Her new score is -9 .

84. $4101 - (-226) = 4101 + 226 = 4327$
 Bishop Airport is 4327 feet higher than the Furnace Creek Airport.

86. $x = 90^{\circ} - 50^{\circ}$
 $x = 90^{\circ} + (-50^{\circ})$
 $x = 40^{\circ}$

88. The difference of -3 and a number is $-3 - x$.

90. Add a number and -36 is $x + (-36)$.

92.

Month	Monthly Increase or Decrease
July	$33.6 - 29.7 + 33.6 + (-29.7) = 3.9^{\circ}$
August	$33.3 - 33.6 = 33.3 + (-33.6) = -0.3^{\circ}$
September	$27.0 - 33.3 = 27.0 + (-33.3) = -6.3^{\circ}$
October	$8.8 - 27.0 = 8.8 + (-27.0) = -18.2^{\circ}$
November	$-6.9 - 8.8 = -6.9 + (-8.8) = -15.7^{\circ}$
December	$-17.2 - (-6.9) = -17.2 + 6.9 = -10.3^{\circ}$

94. The largest negative number corresponds to October.

96. answers may vary

98. $-4 - 8 = -4 + (-8) = -12$

100. $-3 - (-10) = -3 + 10 = 7$

102. true; answers may vary

104. true; answers may vary

106. Since 4.362 is less than 7.0086, the answer is negative.

$$4.362 - 7.0086 = -2.6466$$

Integrated Review

1. The opposite of a positive number is a negative number.

2. The sum of two negative numbers is a negative number.

3. The absolute value of a negative number is a positive number.

4. The absolute value of zero is 0.

5. The sum of two positive numbers is a positive number.

6. The sum of a number and its opposite is 0.

7. The absolute value of a positive number is a positive number.

8. The reciprocal of a negative number is a negative number.

9. The opposite of $\frac{1}{7}$ is $-\frac{1}{7}$.

The absolute value of $\frac{1}{7}$ is $\frac{1}{7}$.

10. The opposite of $-\frac{12}{5}$ is $\frac{12}{5}$.

The absolute value of $-\frac{12}{5}$ is $\frac{12}{5}$.

11. The number whose opposite is -3 is 3 .
The absolute value of 3 is 3 .

12. The number whose opposite is $\frac{9}{11}$ is $-\frac{9}{11}$.

The absolute value of $-\frac{9}{11}$ is $\frac{9}{11}$.

13. $-19 + (-23) = -42$

14. $7 - (-3) = 7 + 3 = 10$

15. $-15 + 17 = 2$

16. $-8 - 10 = -8 + (-10) = -18$

17. $18 + (-25) = -7$

18. $-2 + (-37) = -39$

19. $-14 - (-12) = -14 + 12 = -2$

20. $5 - 14 = 5 + (-14) = -9$

21. $4.5 - 7.9 = 4.5 + (-7.9) = -3.4$

22. $-8.6 - 1.2 = -8.6 + (-1.2) = -9.8$

23. $-\frac{3}{4} - \frac{1}{7} = -\frac{3}{4} + \left(-\frac{1}{7}\right) = -\frac{21}{28} + \left(-\frac{4}{28}\right) = -\frac{25}{28}$

24. $\frac{2}{3} - \frac{7}{8} = \frac{2}{3} + \left(-\frac{7}{8}\right) = \frac{16}{24} + \left(-\frac{21}{24}\right) = -\frac{5}{24}$

25. $-9 - (-7) + 4 - 6 = -9 + 7 + 4 + (-6)$
 $= -2 + 4 + (-6)$
 $= 2 + (-6)$
 $= -4$

26. $11 - 20 + (-3) - 12 = 11 + (-20) + (-3) + (-12)$
 $= -9 + (-3) + (-12)$
 $= -12 + (-12)$
 $= -24$

27. $24 - 6(14 - 11) = 24 - 6[14 + (-11)]$
 $= 24 - 6(3)$
 $= 24 + (-6)(3)$
 $= 24 + (-18)$
 $= 6$

28. $30 - 5(10 - 8) = 30 - 5[10 + (-8)]$
 $= 30 - 5(2)$
 $= 30 + (-5)(2)$
 $= 30 + (-10)$
 $= 20$

$$\begin{aligned}
 29. \quad (7-17)+4^2 &= [7+(-17)]+4^2 \\
 &= -10+4^2 \\
 &= -10+16 \\
 &= 6
 \end{aligned}$$

$$\begin{aligned}
 30. \quad 9^2+(10-30) &= 9^2+[10+(-30)] \\
 &= 9^2+(-20) \\
 &= 81+(-20) \\
 &= 61
 \end{aligned}$$

$$\begin{aligned}
 31. \quad |-9|+3^2+(-4-20) &= |-9|+3^2+[-4+(-20)] \\
 &= 9+9+(-24) \\
 &= 18+(-24) \\
 &= -6
 \end{aligned}$$

$$\begin{aligned}
 32. \quad |-4-5|+5^2+(-50) &= |-4+(-5)|+5^2+(-50) \\
 &= |-9|+5^2+(-50) \\
 &= 9+25+(-50) \\
 &= 34+(-50) \\
 &= -16
 \end{aligned}$$

$$\begin{aligned}
 33. \quad -7+[(1-2)+(-2-9)] \\
 &= -7+[(1+(-2))+(-2+(-9))] \\
 &= -7+[(1+(-2))+(-11)] \\
 &= -7+(-12) \\
 &= -19
 \end{aligned}$$

$$\begin{aligned}
 34. \quad -6+[(1-2)+(-2-9)] \\
 &= -6+[(1+(-2))+(-2+(-9))] \\
 &= -6+[(1+(-2))+(-11)] \\
 &= -6+(-7) \\
 &= -13
 \end{aligned}$$

$$35. \quad 1-5 = 1+(-5) = -4$$

$$36. \quad -3-(-2) = -3+2 = -1$$

$$37. \quad \frac{1}{4} - \left(-\frac{2}{5}\right) = \frac{1}{4} + \frac{2}{5} = \frac{5}{20} + \frac{8}{20} = \frac{13}{20}$$

$$38. \quad -\frac{5}{8} - \frac{1}{10} = -\frac{5}{8} + \left(-\frac{1}{10}\right) = -\frac{25}{40} + \left(-\frac{4}{40}\right) = -\frac{29}{40}$$

$$\begin{aligned}
 39. \quad 2(19-17)^3-3(-7+9)^2 \\
 &= 2[19+(-17)]^3+(-3)(-7+9)^2 \\
 &= 2(2)^3+(-3)(2)^2 \\
 &= 2(8)+(-3)(4) \\
 &= 16+(-12) \\
 &= 4
 \end{aligned}$$

$$\begin{aligned}
 40. \quad 3(10-9)^2+6(20-19)^3 \\
 &= 3[10+(-9)]^2+6[20+(-19)]^3 \\
 &= 3(1)^2+6(1)^3 \\
 &= 3(1)+6(1) \\
 &= 3+6 \\
 &= 9
 \end{aligned}$$

$$\begin{aligned}
 41. \quad \text{Replace } x \text{ with } -2 \text{ and } y \text{ with } -1. \\
 x-y = -2-(-1) = -2+1 = -1
 \end{aligned}$$

$$\begin{aligned}
 42. \quad \text{Replace } x \text{ with } -2 \text{ and } y \text{ with } -1. \\
 x+y = -2+(-1) = -3
 \end{aligned}$$

$$\begin{aligned}
 43. \quad \text{Replace } y \text{ with } -1 \text{ and } z \text{ with } 9. \\
 y+z = -1+9 = 8
 \end{aligned}$$

$$\begin{aligned}
 44. \quad \text{Replace } y \text{ with } -1 \text{ and } z \text{ with } 9. \\
 z-y = 9-(-1) = 9+1 = 10
 \end{aligned}$$

$$45. \quad \text{Replace } x \text{ with } -2, y \text{ with } -1, \text{ and } z \text{ with } 9.$$

$$\begin{aligned}
 \frac{|5z-x|}{y-x} &= \frac{|5(9)-(-2)|}{-1-(-2)} \\
 &= \frac{|45+2|}{-1+2} \\
 &= \frac{|47|}{1} \\
 &= \frac{47}{1} \\
 &= 47
 \end{aligned}$$

$$46. \quad \text{Replace } x \text{ with } -2, y \text{ with } -1, \text{ and } z \text{ with } 9.$$

$$\begin{aligned}
 \frac{|-x-y+z|}{2z} &= \frac{|-(-2)-(-1)+9|}{2(9)} \\
 &= \frac{|2+1+9|}{18} \\
 &= \frac{|12|}{18} \\
 &= \frac{12}{18} \\
 &= \frac{2 \cdot 6}{3 \cdot 6} \\
 &= \frac{2}{3}
 \end{aligned}$$

Section 1.6 Practice

$$1. \quad -8(3) = -24$$

$$2. \quad 5(-30) = -150$$

$$3. \quad -4(-12) = 48$$

$$4. \quad -\frac{5}{6} \cdot \frac{1}{4} = -\frac{5 \cdot 1}{6 \cdot 4} = -\frac{5}{24}$$

$$5. \quad 6(-2.3) = -13.8$$

$$6. \quad -15(-2) = 30$$

$$7. \quad \text{a.} \quad 5(0)(-3) = 0(-3) = 0$$

$$\text{b.} \quad (-1)(-6)(-7) = (6)(-7) = -42$$

$$\text{c.} \quad (-2)(4)(-8)(-1) = (-8)(-8)(-1) \\ = 64(-1) \\ = -64$$

$$8. \quad \text{a.} \quad (-2)^4 = (-2)(-2)(-2)(-2) = 16$$

$$\text{b.} \quad -2^4 = -(2 \cdot 2 \cdot 2 \cdot 2) = -16$$

$$\text{c.} \quad (-1)^5 = (-1)(-1)(-1)(-1)(-1) = -1$$

$$\text{d.} \quad -1^5 = -(1 \cdot 1 \cdot 1 \cdot 1 \cdot 1) = -1$$

$$\text{e.} \quad \left(-\frac{7}{9}\right)^2 = \left(-\frac{7}{9}\right)\left(-\frac{7}{9}\right) = \frac{49}{81}$$

$$9. \quad \text{a.} \quad \text{The reciprocal of 13 is } \frac{1}{13} \text{ since } 13 \cdot \frac{1}{13} = 1.$$

$$\text{b.} \quad \text{The reciprocal of } \frac{7}{15} \text{ is } \frac{15}{7} \text{ since} \\ \frac{7}{15} \cdot \frac{15}{7} = 1.$$

$$\text{c.} \quad \text{The reciprocal of } -5 \text{ is } -\frac{1}{5} \text{ since} \\ -5 \cdot -\frac{1}{5} = 1.$$

$$\text{d.} \quad \text{The reciprocal of } -\frac{8}{11} \text{ is } -\frac{11}{8} \text{ since} \\ -\frac{8}{11} \cdot -\frac{11}{8} = 1.$$

$$\text{e.} \quad \text{The reciprocal of 7.9 is } \frac{1}{7.9} \text{ since} \\ 7.9 \cdot \frac{1}{7.9} = 1.$$

$$10. \quad \text{a.} \quad -12 \div 4 = -12 \cdot \frac{1}{4} = -3$$

$$\text{b.} \quad \frac{-20}{-10} = -20 \cdot -\frac{1}{10} = 2$$

$$\text{c.} \quad \frac{36}{-4} = 36 \cdot -\frac{1}{4} = -9$$

$$11. \quad \text{a.} \quad \frac{-25}{5} = -5$$

$$\text{b.} \quad \frac{-48}{-6} = 8$$

$$\text{c.} \quad \frac{50}{-2} = -25$$

$$\text{d.} \quad \frac{-72}{0.2} = -360$$

$$12. \quad -\frac{5}{9} \div \frac{2}{3} = -\frac{5}{9} \cdot \frac{3}{2} = -\frac{15}{18} = -\frac{3 \cdot 5}{3 \cdot 6} = -\frac{5}{6}$$

$$13. \quad -\frac{2}{7} \div \left(-\frac{1}{5}\right) = -\frac{2}{7} \cdot \left(-\frac{5}{1}\right) = \frac{10}{7}$$

$$14. \quad \text{a.} \quad \frac{-7}{0} \text{ is undefined.}$$

$$\text{b.} \quad \frac{0}{-2} = 0$$

$$15. \quad \text{a.} \quad \frac{0(-5)}{3} = \frac{0}{3} = 0$$

$$\text{b.} \quad -3(-9) - 4(-4) = 27 - (-16) = 27 + 16 = 43$$

$$\text{c.} \quad (-3)^2 + 2[(5-15) - |-4-1|] \\ = (-3)^2 + 2[(-10) - |-5|] \\ = (-3)^2 + 2[-10-5] \\ = (-3)^2 + 2(-15) \\ = 9 + (-30) \\ = -21$$

$$\text{d.} \quad \frac{-7(-4) + 2}{-10 - (-5)} = \frac{28 + 2}{-10 + 5} = \frac{30}{-5} = -6$$

$$\begin{aligned} \text{e. } \frac{5(-2)^3 + 52}{-4 + 1} &= \frac{5(-8) + 52}{-3} \\ &= \frac{-40 + 52}{-3} \\ &= \frac{12}{-3} \\ &= -4 \end{aligned}$$

16. a. Replace x with -1 and y with -5 .

$$\frac{3y}{45x} = \frac{3(-5)}{45(-1)} = \frac{-15}{-45} = \frac{15 \cdot 1}{15 \cdot 3} = \frac{1}{3}$$

- b. Replace x with -1 and y with -5 .

$$\begin{aligned} x^2 - y^3 &= (-1)^2 - (-5)^3 \\ &= 1 - (-125) \\ &= 1 + 125 \\ &= 126 \end{aligned}$$

- c. Replace x with -1 and y with -5 .

$$\frac{x + y}{3x} = \frac{-1 + (-5)}{3(-1)} = \frac{-6}{-3} = 2$$

$$\begin{aligned} 17. \quad \frac{x}{4} - 3 &= x + 3 \\ \frac{-8}{4} - 3 &\stackrel{?}{=} -8 + 3 \\ -2 - 3 &\stackrel{?}{=} -5 \\ -5 &= -5 \quad \text{True} \\ -8 &\text{ is a solution.} \end{aligned}$$

18. total score $= 4 \cdot (-13) = -52$
The card player's total score was -52 .

Calculator Explorations

- $-38(26 - 27) = 38$
- $-59(-8) + 1726 = 2198$
- $134 + 25(68 - 91) = -441$
- $45(32) - 8(218) = -304$
- $\frac{-50(294)}{175 - 205} = 490$
- $\frac{-444 - 444.8}{-181 - (-181)}$ is undefined.
- $9^5 - 4550 = 54,499$

$$8. \quad 5^8 - 6259 = 384,366$$

$$9. \quad (-125)^2 = 15,625$$

$$10. \quad -125^2 = -15,625$$

Vocabulary and Readiness Check

- The product of a negative number and a positive number is a negative number.
- The product of two negative numbers is a positive number.
- The quotient of two negative numbers is a positive number.
- The quotient of a negative number and a positive number is a negative number.
- The product of a negative number and zero is 0.
- The reciprocal of a negative number is a negative number.
- The quotient of 0 and a negative number is 0.
- The quotient of a negative number and 0 is undefined.

Exercise Set 1.6

- $-8(5) = -40$
- $7(-4) = -28$
- $-6(-11) = 66$
- $-2 \cdot 37 = -74$
- $-\frac{1}{8} \left(-\frac{1}{3} \right) = \frac{1}{24}$
- $6(-2.5) = -15$
- $(-2)(-3)(-4) = 6(-4) = -24$
- $(3)(-5)(-2)(0) = -15(-2)(0) = 30(0) = 0$
- $(-3)^3 = (-3)(-3)(-3) = 9(-3) = -27$
- $-6^2 = -6 \cdot 6 = -36$

$$22. \left(-\frac{2}{7}\right)^2 = \left(-\frac{2}{7}\right)\left(-\frac{2}{7}\right) = \frac{4}{49}$$

$$24. -0.8^2 = -0.8 \cdot 0.8 = -0.64$$

$$26. \text{The reciprocal of } \frac{1}{7} \text{ is } 7 \text{ since } \frac{1}{7} \cdot 7 = 1.$$

$$28. \text{The reciprocal of } -8 \text{ is } -\frac{1}{8} \text{ since } -8 \cdot \left(-\frac{1}{8}\right) = 1.$$

$$30. \text{The reciprocal of } -\frac{6}{13} \text{ is } -\frac{13}{6} \text{ since}$$

$$-\frac{6}{13} \cdot \left(-\frac{13}{6}\right) = 1.$$

$$32. \text{The reciprocal of } 1.5 \text{ is } \frac{1}{1.5} \text{ since } 1.5 \left(\frac{1}{1.5}\right) = 1.$$

$$34. \frac{36}{-9} = -4$$

$$36. -60 \div 5 = -60 \cdot \frac{1}{5} = -12$$

$$38. \frac{0}{-9} = 0$$

$$40. \frac{8}{0} \text{ is undefined.}$$

$$42. \frac{4}{5} \div \left(-\frac{1}{2}\right) = \frac{4}{5} \cdot \left(-\frac{2}{1}\right) = -\frac{8}{5}$$

$$44. -4.9 \div -0.07 = \frac{-4.9}{-0.07} = 70$$

$$46. (-7)(-7) = 49$$

$$48. \frac{2}{7} \left(-\frac{2}{11}\right) = -\frac{4}{77}$$

$$50. \frac{-45}{-9} = 5$$

$$52. \frac{14}{-2} = -7$$

$$54. (-2)^5 = (-2)(-2)(-2)(-2)(-2)$$

$$= 4(-2)(-2)(-2)$$

$$= -8(-2)(-2)$$

$$= 16(-2)$$

$$= -32$$

$$56. (-0.3)^3 = (-0.3)(-0.3)(-0.3)$$

$$= 0.09(-0.3)$$

$$= -0.027$$

$$58. -\frac{5}{6} \left(-\frac{3}{10}\right) = \frac{15}{60} = \frac{1 \cdot 15}{4 \cdot 15} = \frac{1}{4}$$

$$60. -\frac{1}{10} \div \left(-\frac{8}{11}\right) = -\frac{1}{10} \cdot \left(-\frac{11}{8}\right) = \frac{11}{80}$$

$$62. -1.3(-0.6) = 0.78$$

$$64. \frac{-86}{2.5} = -34.4$$

$$66. -3^4 = -3 \cdot 3 \cdot 3 \cdot 3 = -81$$

$$68. (-1)^7 = (-1)(-1)(-1)(-1)(-1)(-1)(-1) = -1$$

$$70. -12(12) = -144$$

$$72. -\frac{5}{12} \div \frac{5}{12} = -\frac{5}{12} \cdot \frac{12}{5} = -\frac{60}{60} = -1$$

$$74. -8 - 11 = -8 + (-11) = -19$$

$$76. -8(-11) = 88$$

$$78. 6(-15) = -90$$

$$80. 6 + (-15) = -9$$

$$82. \frac{-6(-3)}{-4} = \frac{18}{-4} = -\frac{2 \cdot 9}{2 \cdot 2} = -\frac{9}{2}$$

$$84. -4(3 - 9) = -4[3 + (-9)] = -4(-6) = 24$$

$$86. -8(-3) - 4(-1) = 24 - (-4) = 24 + 4 = 28$$

$$88. 3^2 - 2[(3 - 5) - (2 - 9)] = 3^2 - 2[(-2) - (-7)]$$

$$= 3^2 - 2[-2 + 7]$$

$$= 9 - 2(5)$$

$$= 9 - 10$$

$$= 9 + (-10)$$

$$= -1$$

$$90. \frac{3^2 + 4}{5} = \frac{9 + 4}{5} = \frac{13}{5}$$

$$92. \frac{-2 - 4^2}{3(-6)} = \frac{-2 - 16}{-18} = \frac{-2 + (-16)}{-18} = \frac{-18}{-18} = 1$$

$$94. \frac{-20 + (-4)^2(3)}{1 - 5} = \frac{-20 + 16(3)}{-4} = \frac{-20 + 48}{-4} = \frac{28}{-4} = \frac{7 \cdot 4}{-1 \cdot 4} = -7$$

$$96. \frac{(-2)^2 - 4}{4 - 9} = \frac{4 - 4}{4 - 9} = \frac{4 + (-4)}{4 + (-9)} = \frac{0}{-5} = 0$$

$$98. \frac{8 - 3(-2)}{2 - 5(-4)} = \frac{8 - (-6)}{2 - (-20)} = \frac{8 + 6}{2 + 20} = \frac{14}{22} = \frac{2 \cdot 7}{2 \cdot 11} = \frac{7}{11}$$

$$100. \frac{|-3 + 6| + |-2 + 7|}{|-2 \cdot 2|} = \frac{|3| + |5|}{|-4|} = \frac{3 + 5}{4} = \frac{8}{4} = 2$$

$$102. \frac{8(-7) + (-2)(-6)}{(-9)(3) + (-10)(-11)} = \frac{-56 + 12}{-27 + 110} = \frac{-44}{83} = -\frac{44}{83}$$

104. Replace x with -5 and y with -3 .

$$\frac{2y - 12}{x - 4} = \frac{2(-3) - 12}{-5 - 4} = \frac{-6 - 12}{-5 - 4} = \frac{-6 + (-12)}{-5 + (-4)} = \frac{-18}{-9} = 2$$

106. Replace x with -5 and y with -3 .

$$\frac{10 - y}{x - 8} = \frac{10 - (-3)}{-5 - 8} = \frac{10 + 3}{-5 + (-8)} = \frac{13}{-13} = -1$$

108. Replace x with -5 and y with -3 .

$$\frac{2y + 3}{-5 - x} = \frac{2(-3) + 3}{-5 - (-5)} = \frac{-6 + 3}{-5 + 5} = \frac{-3}{0} \text{ is undefined.}$$

110. Replace x with -5 and y with -3 .

$$\frac{y^2 - x}{2x} = \frac{(-3)^2 - (-5)}{2(-5)} = \frac{9 + 5}{-10} = \frac{14}{-10} = -\frac{7 \cdot 2}{5 \cdot 2} = -\frac{7}{5}$$

$$112. \quad 17 - 4x = x + 27$$

$$17 - 4(-2) \stackrel{?}{=} -2 + 27$$

$$17 - (-8) \stackrel{?}{=} -2 + 27$$

$$17 + 8 \stackrel{?}{=} -2 + 27$$

$$25 = 25 \quad \text{True}$$

Since the result is true, -2 is a solution of the given equation.

$$114. \quad \frac{x}{6} - 3 = 5$$

$$\frac{48}{6} - 3 \stackrel{?}{=} 5$$

$$8 - 3 \stackrel{?}{=} 5$$

$$8 + (-3) \stackrel{?}{=} 5$$

$$5 = 5 \quad \text{True}$$

Since the result is true, 48 is a solution of the given equation.

$$116. \quad \frac{x + 4}{5} = -6$$

$$\frac{-30 + 4}{5} \stackrel{?}{=} -6$$

$$\frac{-26}{5} = -6 \quad \text{False}$$

Since the result is false, -30 is not a solution of the given equation.

118. The quotient of -8 and a number is $\frac{-8}{x}$ or $-8 \div x$.

120. The sum of a number and -12 is $x + (-12)$.
122. The difference of a number and -10 is $x - (-10)$.
124. Multiply a number by -17 is $x \cdot (-17)$ or $-17x$.
126. A loss of \$400 is represented by -400 .
 $7 \cdot (-400) = -2800$
 His total loss was \$2800.
128. A drop of 5 degrees is represented by -5 .
 $6 \cdot (-5) = -30$
 The total drop in temperature was 30 degrees.
130. True since the product of any number of positive integers is positive.
132. True since the product of any number of positive integers is positive.
134. $\frac{330}{-1} = -330$
 The surface temperature of Neptune is -330°F .
136. answers may vary
138. answers may vary
140. $2[-3 + (-4)] = 2(-7) = -14$
142. $-9 - (-4)(-6) = -9 - 24 = -9 + (-24) = -33$

Section 1.7 Practice

1. a. $7 \cdot y = y \cdot 7$
 b. $4 + x = x + 4$
2. a. $5 \cdot (-3 \cdot 6) = (5 \cdot -3) \cdot 6$
 b. $(-2 + 7) + 3 = -2 + (7 + 3)$
 c. $(q + r) + 17 = q + (r + 17)$
 d. $(ab) \cdot 21 = a \cdot (b \cdot 21)$
3. Since the order of two numbers was changed but their grouping was not, the statement is true by the commutative property of multiplication.
4. Since the grouping of the numbers was changed and their order was not, the statement is true by the associative property of addition.
5. $(-3 + x) + 17 = -3 + (x + 17)$
 $= -3 + (17 + x)$
 $= (-3 + 17) + x$
 $= 14 + x$
6. $4(5x) = (4 \cdot 5) \cdot x = 20x$
7. $5(x + y) = 5(x) + 5(y) = 5x + 5y$
8. $-3(2 + 7x) = -3(2) + (-3)(7x) = -6 - 21x$
9. $4(x + 6y - 2z) = 4(x) + 4(6y) - 4(2z)$
 $= 4x + 24y - 8z$
10. $-1(3 - a) = (-1)(3) - (-1)(a) = -3 + a$
11. $-(8 + a - b) = -1(8 + a - b)$
 $= (-1)(8) + (-1)(a) - (-1)(b)$
 $= -8 - a + b$
12. $\frac{1}{2}(2x + 4) + 9 = \frac{1}{2}(2x) + \frac{1}{2}(4) + 9$
 $= 1x + 2 + 9$
 $= x + 11$
13. $9 \cdot 3 + 9 \cdot y = 9(3 + y)$
14. $4x + 4y = 4(x + y)$
15. $7(a + b) = 7 \cdot a + 7 \cdot b$ illustrates the distributive property.
16. $12 + y = y + 12$ illustrates the commutative property of addition.
17. $-4 \cdot (6 \cdot x) = (-4 \cdot 6) \cdot x$ illustrates the associative property of multiplication.
18. $6 + (z + 2) = 6 + (2 + z)$ illustrates the commutative property of addition.
19. $3\left(\frac{1}{3}\right) = 1$ illustrates the multiplicative inverse property.
20. $(x + 0) + 23 = x + 23$ illustrates the identity element for addition.
21. $(7 \cdot y) \cdot 10 = y \cdot (7 \cdot 10)$ illustrates the commutative and associative properties of multiplication.

Vocabulary and Readiness Check

1. $x + 5 = 5 + x$ is a true statement by the commutative property of addition.
2. $x \cdot 5 = 5 \cdot x$ is a true statement by the commutative property of multiplication.
3. $3(y + 6) = 3 \cdot y + 3 \cdot 6$ is true by the distributive property.
4. $2 \cdot (x \cdot y) = (2 \cdot x) \cdot y$ is a true statement by the associative property of multiplication.
5. $x + (7 + y) = (x + 7) + y$ is a true statement by the associative property of addition.
6. The numbers $-\frac{2}{3}$ and $-\frac{3}{2}$ are called reciprocals or multiplicative inverses.
7. The numbers $-\frac{2}{3}$ and $\frac{2}{3}$ are called opposites or additive inverses.

Exercise Set 1.7

2. $8 + y = y + 8$ by the commutative property of addition.
4. $-2 \cdot x = x \cdot (-2)$ by the commutative property of multiplication.
6. $ab = ba$ by the commutative property of multiplication.
8. $19 + 3y = 3y + 19$ by the commutative property of addition.
10. $3 \cdot (x \cdot y) = (3x) \cdot y$ by the associative property of multiplication.
12. $(y + 4) + z = y + (4 + z)$ by the associative property of addition.
14. $(-3y) \cdot z = -3 \cdot (yz)$ by the associative property of multiplication.
16. $6 + (r + s) = (6 + r) + s$ by the associative property of addition.
18. $(r + 3) + 11 = r + (3 + 11) = r + 14$
20. $2(42x) = (2 \cdot 42)x = 84x$
22. $\frac{1}{8}(8z) = \left(\frac{1}{8} \cdot 8\right)z = 1z = z$
24. $7 + (x + 4) = 7 + (4 + x) = (7 + 4) + x = 11 + x$
26. $-3(12y) = (-3 \cdot 12)y = -36y$
28. $\frac{2}{7}\left(\frac{7}{2}r\right) = \left(\frac{2}{7} \cdot \frac{7}{2}\right)r = 1r = r$
30. $-\frac{1}{3}(7x) = \left(-\frac{1}{3} \cdot 7\right)x = -\frac{7}{3}x$
32. $7(a + b) = 7(a) + 7(b) = 7a + 7b$
34. $11(y - 4) = 11(y) - 11(4) = 11y - 44$
36. $5(7 + 8y) = 5(7) + 5(8y) = 35 + 40y$
38. $3(8x - 1) = 3(8x) - 3(1) = 24x - 3$
40. $2(x + 5) = 2(x) + 2(5) = 2x + 10$
42. $-3(z - y) = -3(z) - 3(-y) = -3z + 3y$
44. $-\frac{1}{2}(2r + 11) = -\frac{1}{2}(2r) - \frac{1}{2}(11) = -r - \frac{11}{2}$
46. $8(3y + z - 6) = 8(3y) + 8(z) + 8(-6)$
 $= 24y + 8z - 48$
48. $-4(4 + 2p + 5) + 16 = -4(4) - 4(2p) - 4(5) + 16$
 $= -16 - 8p - 20 + 16$
 $= (-16 + 16) - 8p - 20$
 $= 0 - 8p - 20$
 $= -8p - 20$
50. $-(9r + 5) = -1(9r + 5)$
 $= -1(9r) + (-1)(5)$
 $= -9r - 5$
52. $-(q - 2 + 6r) = -1(q - 2 + 6r)$
 $= -1(q) - 1(-2) - 1(6r)$
 $= -q + 2 - 6r$

$$\begin{aligned}
 54. \quad \frac{1}{4}(4x-2) - \frac{7}{2} &= \frac{1}{4}(4x) + \frac{1}{4}(-2) - \frac{7}{2} \\
 &= \left(\frac{1}{4} \cdot 4\right)x - \frac{1}{2} - \frac{7}{2} \\
 &= 1x - \frac{8}{2} \\
 &= x - 4
 \end{aligned}$$

$$\begin{aligned}
 56. \quad -\frac{1}{5}(10a-25b) &= -\frac{1}{5}(10a) - \frac{1}{5}(-25b) \\
 &= -2a + 5b
 \end{aligned}$$

$$\begin{aligned}
 58. \quad 10(4s+6) - 40 &= 10(4s) + 10(6) - 40 \\
 &= 40s + 60 - 40 \\
 &= 40s + 20
 \end{aligned}$$

$$\begin{aligned}
 60. \quad -11(5x+3) + 10 &= -11(5x) - 11(3) + 10 \\
 &= -55x - 33 + 10 \\
 &= -55x - 23
 \end{aligned}$$

$$\begin{aligned}
 62. \quad -0.6(2x+1) - 0.1 &= -0.6(2x) - 0.6(1) - 0.1 \\
 &= -1.2x - 0.6 - 0.1 \\
 &= -1.2x - 0.7
 \end{aligned}$$

$$64. \quad 14 \cdot z + 14 \cdot 5 = 14(z + 5)$$

$$66. \quad 9a + 9b = 9 \cdot a + 9 \cdot b = 9(a + b)$$

$$68. \quad (-3)a + (-3)y = (-3) \cdot a + (-3) \cdot y = -3(a + y)$$

$$70. \quad 25x + 25y = 25 \cdot x + 25 \cdot y = 25(x + y)$$

$$72. \quad 4(3 + 8) = 4 \cdot 3 + 4 \cdot 8 \text{ illustrates the distributive property.}$$

$$74. \quad 9 \cdot (x \cdot 7) = (9 \cdot x) \cdot 7 \text{ illustrates the associative property of multiplication.}$$

$$76. \quad 1 \cdot 9 = 9 \text{ illustrates the identity element of multiplication.}$$

$$78. \quad -4 \cdot (8 \cdot 3) = (8 \cdot 3) \cdot (-4) \text{ illustrates the commutative property of multiplication.}$$

$$80. \quad (a + 9) + 6 = a + (9 + 6) \text{ illustrates the associative property of addition.}$$

$$82. \quad (11 + r) + 8 = (r + 11) + 8 \text{ illustrates the commutative property of addition.}$$

$$84. \quad r + 0 = r \text{ illustrates the identity property of addition.}$$

$$86. \quad -\frac{3}{4}\left(-\frac{4}{3}\right) = 1 \text{ illustrates the multiplicative inverse property.}$$

$$88. \quad \text{The opposite of } -\frac{2}{3} \text{ is } \frac{2}{3}.$$

The reciprocal of $-\frac{2}{3}$ is $-\frac{3}{2}$.

$$90. \quad \text{The opposite of } 4y \text{ is } -4y.$$

The reciprocal of $4y$ is $\frac{1}{4y}$.

$$92. \quad \text{The expression is the opposite of } 7x \text{ or } -7x.$$

The reciprocal of $-7x$ is $-\frac{1}{7x}$.

$$94. \quad \text{False; the reciprocal of } -\frac{a}{2} \text{ is } -\frac{2}{a}.$$

The opposite of $-\frac{a}{2}$ is $\frac{a}{2}$.

$$96. \quad \text{"Putting on your shoes" and "putting on your socks" are not commutative, since the order in which they are performed affects the outcome.}$$

$$98. \quad \text{"Reading the sports section" and "reading the comics section" are commutative, since the order in which they are performed does not affect the outcome.}$$

$$100. \quad \text{"Baking a cake" and "eating the cake" are not commutative, since the order in which they are performed affects the outcome.}$$

$$102. \quad \text{"Dialing a number" and "turning on the cell phone" are not commutative, since the order in which they are performed affects the outcome.}$$

$$104. \quad \text{a. The property illustrated is the associative property of addition since the grouping of addition changed.}$$

$$\text{b. The property illustrated is the commutative property of addition since the order in which they are added changed.}$$

$$\text{c. The property illustrated is the commutative property of addition since the order in which they are added changed.}$$

$$106. \quad \text{answers may vary}$$

108. answers may vary

Section 1.8 Practice

1. a. The numerical coefficient of $-4x$ is -4 .
b. The numerical coefficient of $15y^3$ is 15 .
c. The numerical coefficient of x is 1 , since $x = 1x$.
d. The numerical coefficient of $-y$ is -1 , since $-y = -1y$.
e. The numerical coefficient of $\frac{z}{4}$ is $\frac{1}{4}$, since $\frac{z}{4}$ is $\frac{1}{4} \cdot z$.
2. a. $7x^2$ and $-6x^3$ are unlike terms, since the exponents on x are not the same.
b. $3x^2y^2$, $-x^2y^2$, and $4x^2y^2$ are like terms, since each variable and its exponent match.
c. $-5ab$ and $3ba$ are like terms, since $ab = ba$ by the commutative property.
d. $2x^3$ and $4y^3$ are unlike terms, since the variables are not the same.
e. $-7m^4$ and $7m^4$ are like terms, since the variable and its exponent match.
3. a. $9y - 4y = (9 - 4)y = 5y$
b. $11x^2 + x^2 = (11 + 1)x^2 = 12x^2$
c. $5y - 3x + 4x = 5y + (-3 + 4)x$
 $= 5y + 1x$
 $= 5y + x$
d. $14m^2 - m^2 + 3m^2 = (14 - 1 + 3)m^2 = 16m^2$
4. $7y + 2y + 6 + 10 = (7 + 2)y + (6 + 10) = 9y + 16$
5. $-2x + 4 + x - 11 = -2x + x + 4 - 11$
 $= (-2 + 1)x + (4 - 11)$
 $= -x - 7$
6. The terms $3z$ and $-3z^2$ cannot be combined because they are unlike terms.
7. $8.9y + 4.2y - 3 = (8.9 + 4.2)y - 3 = 13.1y - 3$
8. $3(11y + 6) = 3(11y) + 3(6) = 33y + 18$
9. $-4(x + 0.2y - 3) = -4(x) + (-4)(0.2y) - (-4)(3)$
 $= -4x - 0.8y + 12$
10. $-(3x + 2y + z - 1)$
 $= -1(3x + 2y + z - 1)$
 $= -1(3x) + (-1)(2y) + (-1)(z) - (-1)(1)$
 $= -3x - 2y - z + 1$
11. $4(4x - 6) + 20 = 16x - 24 + 20 = 16x - 4$
12. $5 - (3x + 9) + 6x = 5 - 3x - 9 + 6x$
 $= -3x + 6x + 5 - 9$
 $= 3x - 4$
13. $-3(7x + 1) - (4x - 2) = -21x - 3 - 4x + 2$
 $= -25x - 1$
14. $8 + 11(2y - 9) = 8 + 22y - 99 = -91 + 22y$
15. $(4x - 3) - (9x - 10) = 4x - 3 - 9x + 10 = -5x + 7$
16. Three times a number subtracted from 10 is written as $10 - 3x$. This expression cannot be simplified.
17. The sum of a number and 2, divided by 5, is written as $(x + 2) \div 5$ or $\frac{x + 2}{5}$. This expression cannot be simplified.
18. Three times a number, added to the sum of a number and 6, is written as $(x + 6) + 3x$.
 $(x + 6) + 3x = x + 6 + 3x = 4x + 6$
19. Seven times the difference of a number and 4 is written as $7(x - 4)$.
 $7(x - 4) = 7x - 28$

Vocabulary and Readiness Check

1. $14y^2 + 2x - 23$ is called an expression while $14y^2$, $2x$, and -23 are each called a term.
2. To multiply $3(-7x + 1)$, we use the distributive property.

3. To simplify an expression like $y + 7y$, we combine like terms.
4. The term z has an understood numerical coefficient of 1.
5. The terms $-x$ and $5x$ are like terms and the terms $5x$ and $5y$ are unlike terms.
6. For the term $-3x^2y$, -3 is called the numerical coefficient.
7. The numerical coefficient of $-7y$ is -7 .
8. The numerical coefficient of $3x$ is 3.
9. The numerical coefficient of x is 1, since $x = 1x$.
10. The numerical coefficient of $-y$ is -1 , since $-y = -1y$.
11. The numerical coefficient of $17x^2y$ is 17.
12. The numerical coefficient of $1.2xyz$ is 1.2.
13. $5y$ and $-y$ are like terms, since the variable and its exponent match.
14. $-2x^2y$ and $6xy$ are unlike terms, since the exponents on x are not the same.
15. $2z$ and $3z^2$ are unlike terms, since the exponents on z are not the same.
16. ab^2 and $-7ab^2$ are like terms, since each variable and its exponent match.
17. $8wz$ and $\frac{1}{7}zw$ are like terms, since $wz = zw$ by the commutative property.
18. $7.4p^3q^2$ and $6.2p^3q^2r$ are unlike terms, since the exponents on r are not the same.
8. $a + 3a - 2 - 7a = 1a + 3a - 7a - 2$
 $= (1 + 3 - 7)a - 2$
 $= -3a - 2$
10. $8p + 4 - 8p - 15 = 8p - 8p + 4 - 15$
 $= (8 - 8)p + (4 - 15)$
 $= 0p - 11$
 $= -11$
12. $7.9y - 0.7 - y + 0.2 = 7.9y - 1y - 0.7 + 0.2$
 $= (7.9 - 1)y + (-0.7 + 0.2)$
 $= 6.9y - 0.5$
14. $7c - 8 - c = 7c - 1c - 8 = (7 - 1)c - 8 = 6c - 8$
16. $5y - 14 + 7y - 20y = 5y + 7y - 20y - 14$
 $= (5 + 7 - 20)y - 14$
 $= -8y - 14$
18. $8h + 13h - 6 + 7h - h = 8h + 13h + 7h - 1h - 6$
 $= (8 + 13 + 7 - 1)h - 6$
 $= 27h - 6$
20. $8x^3 + x^3 - 11x^3 = (8 + 1 - 11)x^3 = -2x^3$
22. $2.8w - 0.9 - 0.5 - 2.8w$
 $= 2.8w - 2.8w - 0.9 - 0.5$
 $= (2.8 - 2.8)w + (-0.9 - 0.5)$
 $= 0w - 1.4$
 $= -1.4$
24. $0.4y - 6.7 + y - 0.3 - 2.6y$
 $= 0.4y + 1y - 2.6y - 6.7 - 0.3$
 $= (0.4 + 1 - 2.6)y + (-6.7 - 0.3)$
 $= -1.2y - 7$
26. $7(r + 3) = 7(r) + 7(3) = 7r + 21$
28. $-4(y + 6) = -4(y) - 4(6) = -4y - 24$
30. $-2(4x - 3z - 1) = -2(4x) - 2(-3z) - 2(-1)$
 $= -8x + 6z + 2$
32. $-(y + 5z - 7) = -1(y + 5z - 7)$
 $= -1(y) - 1(5z) - 1(-7)$
 $= -y - 5z + 7$
34. $9(z + 7) - 15 = 9z + 63 - 15 = 9z + 48$
36. $-3(2x + 5) - 6x = -6x - 15 - 6x$
 $= -6x - 6x - 15$
 $= -12x - 15$

Exercise Set 1.8

2. $3x + 2x = (3 + 2)x = 5x$
4. $c - 7c + 2c = 1c - 7c + 2c = (1 - 7 + 2)c = -4c$
6. $6g + 5 - 3g - 7 = 6g - 3g + 5 - 7$
 $= (6 - 3)g + (5 - 7)$
 $= 3g - 2$

$$\begin{aligned} 38. \quad 2(6x-1)-(x-7) &= 12x-2-x+7 \\ &= 12x-x-2+7 \\ &= 11x+5 \end{aligned}$$

$$\begin{aligned} 40. \quad 8y-2-3(y+4) &= 8y-2-3y-12 \\ &= 8y-3y-2-12 \\ &= 5y-14 \end{aligned}$$

$$\begin{aligned} 42. \quad -11c-(4-2c) &= -11c-4+2c \\ &= -11c+2c-4 \\ &= -9c-4 \end{aligned}$$

$$\begin{aligned} 44. \quad (8-5y)-(4+3y) &= 8-5y-4-3y \\ &= -5y-3y+8-4 \\ &= -8y+4 \end{aligned}$$

$$\begin{aligned} 46. \quad 4(2x-3)-(x+1) &= 8x-12-x-1 \\ &= 8x-x-12-1 \\ &= 7x-13 \end{aligned}$$

$$\begin{aligned} 48. \quad \frac{1}{5}(9y+2)+\frac{1}{10}(2y-1) &= \frac{9}{5}y+\frac{2}{5}+\frac{2}{10}y-\frac{1}{10} \\ &= \frac{9}{5}y+\frac{1}{5}y+\frac{4}{10}-\frac{1}{10} \\ &= \frac{10}{5}y+\frac{3}{10} \\ &= 2y+\frac{3}{10} \end{aligned}$$

$$\begin{aligned} 50. \quad 8+4(3x-4) &= 8+12x-16 \\ &= 8-16+12x \\ &= -8+12x \end{aligned}$$

$$\begin{aligned} 52. \quad 0.2(k+8)-0.1k &= 0.2k+1.6-0.1k \\ &= 0.2k-0.1k+1.6 \\ &= 0.1k+1.6 \end{aligned}$$

$$54. \quad 14-11(5m+3n)=14-55m-33n$$

$$\begin{aligned} 56. \quad 7(2x+5)-4(x+2)-20x \\ &= 14x+35-4x-8-20x \\ &= 14x-4x-20x+35-8 \\ &= -10x+27 \end{aligned}$$

$$\begin{aligned} 58. \quad \frac{1}{3}(9x-6)-(x-2) &= 3x-2-x+2 \\ &= 3x-x-2+2 \\ &= 2x \end{aligned}$$

$$\begin{aligned} 60. \quad (y+16)+(3y-5) &= y+16+3y-5 \\ &= y+3y+16-5 \\ &= 4y+11 \end{aligned}$$

$$\begin{aligned} 62. \quad (12+x)-(4x-7) &= 12+x-4x+7 \\ &= x-4x+12+7 \\ &= -3x+19 \end{aligned}$$

$$\begin{aligned} 64. \quad (2m-6)-(m-3) &= 2m-6-m+3 \\ &= 2m-m-6+3 \\ &= m-3 \end{aligned}$$

66. The difference of a number and two, divided by five is written as $\frac{x-2}{5}$.

68. Eight more than triple a number is written as $3x+8$.

70. The sum of 3 times a number and 10, subtracted from 9 times the number is written as $9x-(3x+10)=9x-3x-10=6x-10$.

72. Six times the difference of a number and 5 is written as $6(x-5)=6x-30$.

74. Half a number minus the product of the number and eight is written as $0.5x-8x=-7.5x$.

76. Since 1 cylinder balances 2 cubes, 2 cylinders would balance 4 cubes (not 3). The scale is not balanced.

78. Since 1 cylinder balances 2 cubes and 1 cone balances 1 cube, both sides are equivalent to 2 cubes. The scale is balanced.

80. answers may vary

$$\begin{aligned} 82. \quad 5+(3x-1)+(2x+5) &= 5+3x-1+2x+5 \\ &= 3x+2x+5-1+5 \\ &= 5x+9 \end{aligned}$$

The perimeter is $(5x+9)$ centimeters.

$$\begin{aligned} 84. \quad 5x+10(3x)+25(30x-1) &= 5x+30x+750x-25 \\ &= 35x+750x-25 \\ &= 785x-25 \end{aligned}$$

Their value is $(785x-25)\phi$.

86. no; answers may vary

Chapter 1 Vocabulary Check

1. The symbols \neq , $<$, and $>$ are called inequality symbols.
2. A mathematical statement that two expressions are equal is called and equation.
3. The absolute value of a number is the distance between that number and 0 on a number line.
4. A symbol used to represent a number is called a variable.
5. Two numbers that are the same distance from 0 but lie on opposite sides of 0 are called opposites.
6. The number in a fraction above the fraction bar is called the numerator.
7. A solution of an equation is a value for the variable that makes the equation a true statement.
8. Two numbers whose product is 1 are called reciprocals.
9. In 2^3 , the 2 is called the base and the 3 is called the exponent.
10. The numerical coefficient of a term is its numerical factor.
11. The number in a fraction below the fraction bar is called the denominator.
12. Parentheses and brackets are examples of grouping symbols.
13. A term is a number or the product of a number and variables raised to powers.
14. Terms with the same variables raised to the same powers are called like terms.
15. If terms are not like terms, then they are unlike terms.
3. Since -4 is to the right of -5 on the number line, $-4 > -5$.
4. Since $\frac{12}{2} = 6$ is to the right of -8 on the number line, $\frac{12}{2} > -8$.
5. Since $|-7| = 7$ is to the left of $|-8| = 8$ on the number line, $|-7| < |-8|$.
6. Since $|-9| = 9$ is to the right of -9 on the number line, $|-9| > -9$.
7. $-|-1| = -1$
8. Since $|-14| = 14$ and $-(-14) = 14$, $|-14| = -(-14)$.
9. Since 1.2 is to the right of 1.02 on the number line, $1.2 > 1.02$.
10. Since $-\frac{3}{2} = -\frac{6}{4}$ and $-\frac{6}{4}$ is to the left of $-\frac{3}{4}$ on the number line, $-\frac{3}{2} < -\frac{3}{4}$.
11. Four is greater than or equal to negative three is written as $4 \geq -3$.
12. Six is not equal to five is written as $6 \neq 5$.
13. 0.03 is less than 0.3 is written as $0.03 < 0.3$.
14. Since 155 is to the left of 400 on the number line, $155 < 400$.
15.
 - a. The natural numbers are 1, 3.
 - b. The whole numbers are 0, 1, 3.
 - c. The integers are -6 , 0, 1, 3.
 - d. The rational numbers are -6 , 0, 1, $1\frac{1}{2}$, 3, 9.62.
 - e. The irrational number is π .
 - f. The real numbers are all numbers in the set.

Chapter 1 Review

1. Since 8 is to the left of 10 on the number line, $8 < 10$.
2. Since 7 is to the right of 2 on the number line, $7 > 2$.
16.
 - a. The natural numbers are 2, 5.
 - b. The whole numbers are 2, 5.

- c. The integers are $-3, 2, 5$.
- d. The rational numbers are $-3, -1.6, 2, 5, \frac{11}{2}, 15.1$.
- e. The irrational numbers are $\sqrt{5}, 2\pi$.
- f. The real numbers are all numbers in the set.
17. Since $-4 < -2$, the most negative number is -4 which corresponds to Friday. Thus, Friday showed the greatest loss.
18. The greatest positive number is $+5$ which corresponds to Wednesday. Thus, Wednesday showed the greatest gain.
19. $6 \cdot 3^2 + 2 \cdot 8 = 6 \cdot 9 + 2 \cdot 8 = 54 + 16 = 70$
The answer is c.
20. $68 - 5 \cdot 2^3 = 68 - 5 \cdot 8 = 68 - 40 = 68 + (-40) = 28$
The answer is b.
21. $3(1 + 2 \cdot 5) + 4 = 3(1 + 10) + 4$
 $= 3(11) + 4$
 $= 33 + 4$
 $= 37$
22. $8 + 3(2 \cdot 6 - 1) = 8 + 3(12 - 1)$
 $= 8 + 3[12 + (-1)]$
 $= 8 + 3(11)$
 $= 8 + 33$
 $= 41$
23. $\frac{4 + |6 - 2| + 8^2}{4 + 6 \cdot 4} = \frac{4 + |6 + (-2)| + 8^2}{4 + 6 \cdot 4}$
 $= \frac{4 + |4| + 8^2}{4 + 6 \cdot 4}$
 $= \frac{4 + 4 + 64}{4 + 24}$
 $= \frac{72}{28}$
 $= \frac{18 \cdot 4}{7 \cdot 4}$
 $= \frac{18}{7}$
24. $5[3(2 + 5) - 5] = 5[3(7) - 5]$
 $= 5[21 - 5]$
 $= 5[21 + (-5)]$
 $= 5(16)$
 $= 80$
25. The difference of twenty and twelve is equal to the product of two and four is written as
 $20 - 12 = 2 \cdot 4$.
26. The quotient of nine and two is greater than negative five is written as $\frac{9}{2} > -5$.
27. Replace x with 6 and y with 2.
 $2x + 3y = 2(6) + 3(2) = 12 + 6 = 18$
28. Replace x with 6, y with 2, and z with 8.
 $x(y + 2z) = 6[2 + 2(8)] = 6(2 + 16) = 6(18) = 108$
29. Replace x with 6, y with 2, and z with 8.
 $\frac{x}{y} + \frac{z}{2y} = \frac{6}{2} + \frac{8}{2(2)} = \frac{6}{2} + \frac{8}{4} = 3 + 2 = 5$
30. Replace x with 6 and y with 2.
 $x^2 - 3y^2 = 6^2 - 3(2)^2$
 $= 36 - 3(4)$
 $= 36 - 12$
 $= 36 + (-12)$
 $= 24$
31. Replace a with 37 and b with 80.
 $180 - a - b = 180 - 37 - 80$
 $= 180 + (-37) + (-80)$
 $= 143 + (-80)$
 $= 63$
The measure of the unknown angle is 63° .
32. Replace a with 93, b with 80, and c with 82.
 $360 - a - b - c = 360 - 93 - 80 - 82$
 $= 360 + (-93) + (-80) + (-82)$
 $= 267 + (-80) + (-82)$
 $= 187 + (-82)$
 $= 105$
The measure of the unknown angle is 105° .

33. $7x - 3 = 18$

$7(3) - 3 \stackrel{?}{=} 18$

$21 - 3 \stackrel{?}{=} 18$

$21 + (-3) \stackrel{?}{=} 18$

$18 = 18$

Since the results is true, 3 is a solution of the given equation.

34. $3x^2 + 4 = x - 1$

$3(1)^2 + 4 \stackrel{?}{=} 1 - 1$

$3(1) + 4 \stackrel{?}{=} 0$

$3 + 4 \stackrel{?}{=} 0$

$7 = 0$

Since the result is false, 1 is not a solution of the given equation.

35. The opposite of -9 is 9.

36. The opposite of $\frac{2}{3}$ is $-\frac{2}{3}$.

37. The opposite of $|-2| = 2$ is -2 .

38. The opposite of $-|-7| = -7$ is 7.

39. $-15 + 4 = -11$

40. $-6 + (-11) = -17$

41. $\frac{1}{16} + \left(-\frac{1}{4}\right) = \frac{1}{16} + \left(-\frac{4}{16}\right) = -\frac{3}{16}$

42. $-8 + |-3| = -8 + 3 = -5$

43. $-4.6 + (-9.3) = -13.9$

44. $-2.8 + 6.7 = 3.9$

45. $6 - 20 = 6 + (-20) = -14$

46. $-3.1 - 8.4 = -3.1 + (-8.4) = -11.5$

47. $-6 - (-11) = -6 + 11 = 5$

48. $4 - 15 = 4 + (-15) = -11$

$$\begin{aligned} 49. \quad -21 - 16 + 3(8 - 2) &= -21 + (-16) + 3[8 + (-2)] \\ &= -21 + (-16) + 3(6) \\ &= -21 + (-16) + 18 \\ &= -37 + 18 \\ &= -19 \end{aligned}$$

$$\begin{aligned} 50. \quad \frac{11 - (-9) + 6(8 - 2)}{2 + 3 \cdot 4} &= \frac{11 + 9 + 6[8 + (-2)]}{2 + 3 \cdot 4} \\ &= \frac{11 + 9 + 6(6)}{2 + 3 \cdot 4} \\ &= \frac{11 + 9 + 36}{2 + 12} \\ &= \frac{56}{14} \\ &= 4 \end{aligned}$$

51. Replace x with 3, y with -6 , and z with -9 .

$$\begin{aligned} 2x^2 - y + z &= 2(3)^2 - (-6) + (-9) \\ &= 2(9) + 6 + (-9) \\ &= 18 + 6 + (-9) \\ &= 24 + (-9) \\ &= 15 \end{aligned}$$

The answer is a.

52. Replace x with 3 and y with -6 .

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

The answer is a.

$$\begin{aligned} 53. \quad 50 + 1 + (-2) + 5 + 1 + (-4) \\ &= 51 + (-2) + 5 + 1 + (-4) \\ &= 49 + 5 + 1 + (-4) \\ &= 54 + 1 + (-4) \\ &= 55 + (-4) \\ &= 51 \end{aligned}$$

The price at the end of the week is \$51.

$$\begin{aligned} 54. \quad 50 + 1 + (-2) + 5 &= 51 + (-2) + 5 = 49 + 5 = 54 \\ \text{The price at the end of the day on Wednesday is } &\$54. \end{aligned}$$

55. The reciprocal of -6 is $-\frac{1}{6}$.

56. The reciprocal of $\frac{3}{5}$ is $\frac{5}{3}$.

57. $6(-8) = -48$

58. $(-2)(-14) = 28$

59. $\frac{-18}{-6} = 3$

60. $\frac{42}{-3} = -14$

61. $-3(-6)(-2) = 18(-2) = -36$

62. $(-4)(-3)(0)(-6) = 12(0)(-6) = 0(-6) = 0$

63. $\frac{4(-3) + (-8)}{2 + (-2)} = \frac{-12 + (-8)}{2 + (-2)} = \frac{-20}{0}$ is undefined.

64.
$$\begin{aligned}\frac{3(-2)^2 - 5}{-14} &= \frac{3(4) - 5}{-14} \\ &= \frac{12 - 5}{-14} \\ &= \frac{7}{-14} \\ &= -\frac{1}{2}\end{aligned}$$

65. $-6 + 5 = 5 + (-6)$ illustrates the commutative property of addition.

66. $6 \cdot 1 = 6$ illustrates the multiplicative identity property.

67. $3(8 - 5) = 3 \cdot 8 - 3 \cdot 5$ illustrates the distributive property.

68. $4 + (-4) = 0$ illustrates the additive inverse property.

69. $2 + (3 + 9) = (2 + 3) + 9$ illustrates the associative property of addition.

70. $2 \cdot 8 = 8 \cdot 2$ illustrates the commutative property of multiplication.

71. $6(8 + 5) = 6 \cdot 8 + 6 \cdot 5$ illustrates the distributive property.

72. $(3 \cdot 8) \cdot 4 = 3 \cdot (8 \cdot 4)$ illustrates the associative property of multiplication.

73. $4 \cdot \frac{1}{4} = 1$ illustrates the multiplicative inverse property.

74. $8 + 0 = 8$ illustrates the additive identity property.

75. $4(8 + 3) = 4(3 + 8)$ illustrates the commutative property of addition.

76. $5(2 + 1) = 5 \cdot 2 + 5 \cdot 1$ illustrates the distributive property.

77. $5x - x + 2x = 5x - 1x + 2x = (5 - 1 + 2)x = 6x$

78. $0.2z - 4.6z - 7.4z = (0.2 - 4.6 - 7.4)z = -11.8z$

79.
$$\begin{aligned}\frac{1}{2}x + 3 + \frac{7}{2}x - 5 &= \frac{1}{2}x + \frac{7}{2}x + 3 - 5 \\ &= \left(\frac{1}{2} + \frac{7}{2}\right)x + 3 + (-5) \\ &= \frac{8}{2}x + (-2) \\ &= 4x - 2\end{aligned}$$

80.
$$\begin{aligned}\frac{4}{5}y + 1 + \frac{6}{5}y + 2 &= \frac{4}{5}y + \frac{6}{5}y + 1 + 2 \\ &= \left(\frac{4}{5} + \frac{6}{5}\right)y + 3 \\ &= \frac{10}{5}y + 3 \\ &= 2y + 3\end{aligned}$$

81.
$$\begin{aligned}2(n - 4) + n - 10 &= 2n - 8 + n - 10 \\ &= 2n + n - 8 - 10 \\ &= 3n - 18\end{aligned}$$

82.
$$\begin{aligned}3(w + 2) - (12 - w) &= 3w + 6 - 12 + w \\ &= 3w + w + 6 - 12 \\ &= 4w - 6\end{aligned}$$

83.
$$\begin{aligned}(x + 5) - (7x - 2) &= x + 5 - 7x + 2 \\ &= x - 7x + 5 + 2 \\ &= -6x + 7\end{aligned}$$

84.
$$\begin{aligned}(y - 0.7) - (1.4y - 3) &= y - 0.7 - 1.4y + 3 \\ &= y - 1.4y - 0.7 + 3 \\ &= -0.4y + 2.3\end{aligned}$$

85. Three times a number decreased by 7 is written as $3x - 7$.

86. Twice the sum of a number and 2.8, added to 3 times the number is written as

$$\begin{aligned} 2(x + 2.8) + 3x &= 2x + 5.6 + 3x \\ &= 2x + 3x + 5.6 \\ &= 5x + 5.6. \end{aligned}$$

87. $-|-11| = -11$
 $|11.4| = 11.4$

So, $-|-11| < |11.4|$.

88. Since $-1\frac{1}{2}$ is to the right of $-2\frac{1}{2}$ on the number

line, $-1\frac{1}{2} > -2\frac{1}{2}$.

89. $-7.2 + (-8.1) = -15.3$

90. $14 - 20 = 14 + (-20) = -6$

91. $4(-20) = -80$

92. $\frac{-20}{4} = -5$

93. $-\frac{4}{5}\left(\frac{5}{16}\right) = -\frac{20}{80} = -\frac{1 \cdot 20}{4 \cdot 20} = -\frac{1}{4}$

94. $-0.5(-0.3) = 0.15$

95. $8 \div 2 \cdot 4 = 4 \cdot 4 = 16$

96. $\begin{aligned} (-2)^4 &= (-2)(-2)(-2)(-2) \\ &= 4(-2)(-2) \\ &= -8(-2) \\ &= 16 \end{aligned}$

97. $\frac{-3 - 2(-9)}{-15 - 3(-4)} = \frac{-3 + 18}{-15 + 12} = \frac{15}{-3} = -5$

98. $\begin{aligned} 5 + 2[(7 - 5)^2 + (1 - 3)] \\ &= 5 + 2[(7 + (-5))^2 + (1 + (-3))] \\ &= 5 + 2[(2)^2 + (-2)] \\ &= 5 + 2[4 + (-2)] \\ &= 5 + 2(2) \\ &= 5 + 4 \\ &= 9 \end{aligned}$

99. $-\frac{5}{8} \div \frac{3}{4} = -\frac{5}{8} \cdot \frac{4}{3} = -\frac{20}{24} = -\frac{5 \cdot 4}{6 \cdot 4} = -\frac{5}{6}$

100. $\frac{-15 + (-4)^2 + |-9|}{10 - 2 \cdot 5} = \frac{-15 + 16 + 9}{10 - 10} = \frac{10}{0}$ is undefined.

101. $\begin{aligned} 7(3x - 3) - 5(x + 4) &= 21x - 21 - 5x - 20 \\ &= 21x - 5x - 21 - 20 \\ &= 16x - 41 \end{aligned}$

102. $\begin{aligned} 8 + 2(9x - 10) &= 8 + 18x - 20 \\ &= 18x + 8 - 20 \\ &= 18x - 12 \end{aligned}$

Chapter 1 Test

1. The absolute value of negative seven is greater than five is written as $|-7| > 5$.

2. The sum of nine and five is greater than or equal to four is written as $9 + 5 \geq 4$.

3. $-13 + 8 = -5$

4. $-13 - (-2) = -13 + 2 = -11$

5. $6 \cdot 3 - 8 \cdot 4 = 18 - 32 = 18 + (-32) = -14$

6. $(13)(-3) = -39$

7. $(-6)(-2) = 12$

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

9. $\frac{-8}{0}$ is undefined.

10. $\frac{|-6| + 2}{5 - 6} = \frac{6 + 2}{5 - 6} = \frac{8}{-1} = -8$

11. $\frac{1}{2} - \frac{5}{6} = \frac{3}{6} - \frac{5}{6} = -\frac{2}{6} = -\frac{1}{3}$

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

13. $-\frac{3}{5} + \frac{15}{8} = -\frac{24}{40} + \frac{75}{40} = \frac{51}{40}$ or $1\frac{11}{40}$

14. $3(-4)^2 - 80 = 3(16) - 80 = 48 - 80 = -32$

$$\begin{aligned}
 15. \quad & 6[5 + 2(3 - 8) - 3] = 6[5 + 2(3 + (-8)) - 3] \\
 & = 6[5 + 2(-5) - 3] \\
 & = 6[5 + (-10) + (-3)] \\
 & = 6[-5 + (-3)] \\
 & = 6[-8] \\
 & = -48
 \end{aligned}$$

$$16. \quad \frac{-12 + 3 \cdot 8}{4} = \frac{-12 + 24}{4} = \frac{12}{4} = 3$$

$$17. \quad \frac{(-2)(0)(-3)}{-6} = \frac{0(-3)}{-6} = \frac{0}{-6} = 0$$

18. Since -3 is to the right of -7 on the number line, $-3 > -7$.

19. Since 4 is to the right of -8 on the number line, $4 > -8$.

20. Since $|-3| = 3$ is to the right of 2 on the number line, $|-3| > 2$.

$$\begin{aligned}
 21. \quad & |-2| = 2 \\
 & -1 - (-3) = -1 + 3 = 2 \\
 & \text{Since } 2 = 2, |-2| = -1 - (-3).
 \end{aligned}$$

22. a. The natural numbers are $1, 7$.

b. The whole numbers are $0, 1, 7$.

c. The integers are $-5, -1, 0, 1, 7$.

d. The rational numbers are $-5, -1, \frac{1}{4}, 0, 1, 7, 11.6$.

e. The irrational numbers are $\sqrt{7}, 3\pi$.

f. The real numbers are $-5, -1, \frac{1}{4}, 0, 1, 7, 11.6, \sqrt{7}, 3\pi$.

$$\begin{aligned}
 23. \quad & \text{Replace } x \text{ with } 6 \text{ and } y \text{ with } -2. \\
 & x^2 + y^2 = 6^2 + (-2)^2 = 36 + 4 = 40
 \end{aligned}$$

$$\begin{aligned}
 24. \quad & \text{Replace } x \text{ with } 6, y \text{ with } -2, \text{ and } z \text{ with } -3. \\
 & x + yz = 6 + (-2)(-3) = 6 + 6 = 12
 \end{aligned}$$

25. Replace x with 6 and y with -2 .

$$\begin{aligned}
 2 + 3x - y &= 2 + 3(6) - (-2) \\
 &= 2 + 18 + 2 \\
 &= 20 + 2 \\
 &= 22
 \end{aligned}$$

26. Replace x with 6 , y with -2 , and z with -3 .

$$\begin{aligned}
 \frac{y + z - 1}{x} &= \frac{-2 + (-3) - 1}{6} \\
 &= \frac{-5 - 1}{6} \\
 &= \frac{-5 + (-1)}{6} \\
 &= \frac{-6}{6} \\
 &= -1
 \end{aligned}$$

27. $8 + (9 + 3) = (8 + 9) + 3$ illustrates the associative property of addition.

28. $6 \cdot 8 = 8 \cdot 6$ illustrates the commutative property of multiplication.

29. $-6(2 + 4) = -6 \cdot 2 + (-6) \cdot 4$ illustrates the distributive property.

30. $\frac{1}{6}(6) = 1$ illustrates the multiplicative inverse property.

31. The opposite of -9 is 9 .

32. The reciprocal of $-\frac{1}{3}$ of -3 .

33. Losses of yardage occurred on the second and third downs. -10 indicates a loss of 10 yards while -2 indicates a loss of 2 yards, so the greatest loss of yardage occurred on the second down.

$$\begin{aligned}
 34. \quad & 5 + (-10) + (-2) + 29 = -5 + (-2) + 29 \\
 & = -7 + 29 \\
 & = 22
 \end{aligned}$$

Since the team was 22 yards from the goal, a touchdown was scored.

35. $-14 + 31 = 17$
The temperature was 17° at noon.

36. $-1.5(280) = -420$
She lost \$420.

$$\begin{aligned} 37. \quad 2y - 6 - y - 4 &= 2y - y - 6 - 4 \\ &= 1y - 10 \\ &= y - 10 \end{aligned}$$

$$\begin{aligned} 38. \quad 2.7x + 6.1 + 3.2x - 4.9 &= 2.7x + 3.2x + 6.1 - 4.9 \\ &= 5.9x + 1.2 \end{aligned}$$

$$\begin{aligned} 39. \quad 4(x - 2) - 3(2x - 6) &= 4x - 8 - 6x + 18 \\ &= 4x - 6x - 8 + 18 \\ &= -2x + 10 \end{aligned}$$

$$\begin{aligned} 40. \quad -5(y + 1) + 2(3 - 5y) &= -5y - 5 + 6 - 10y \\ &= -5y - 10y - 5 + 6 \\ &= -15y + 1 \end{aligned}$$