

Chapter 2

Chapter Opener

Math in the Real World (p. 61)

distance = rate \times time

$$= \frac{10.5 \text{ meters}}{1 \text{ second}} \times 10 \text{ seconds}$$

$$= 105 \text{ meters}$$

The athlete ran about 105 meters.

Prerequisite Skills Quiz (p. 62)

1. A numerical expression consists only of numbers and operations. A variable expression consists of numbers, operations, and at least one variable.

$$\begin{array}{r} 3.8 \\ + 7.1 \\ \hline 10.9 \end{array}$$

$$\begin{array}{r} 8.23 \\ - 4.97 \\ \hline 3.26 \end{array}$$

$$\begin{array}{r} 5.5 \\ \times 9.4 \\ \hline 220 \\ 495 \\ \hline 51.70 \end{array}$$

$$\begin{array}{r} 2.1 \overline{)6.93} \\ \underline{42} \\ 273 \\ \underline{210} \\ 630 \\ \underline{630} \\ 0 \end{array}$$

$$\begin{array}{r} 3.3 \\ 21 \overline{)69.3} \\ \underline{63} \\ 63 \\ \underline{63} \\ 0 \end{array}$$

$$6.93 \div 2.1 = 3.3$$

6. Expression: $x + 7$

7. Expression: $\frac{x}{4}$

8. $-19 + 12 = -7$

9. $8 - (-20) = 8 + 20 = 28$

10. $6(-7) = -42$

11. $-75 \div (-5) = 15$

Lesson 2.1

2.1 Checkpoint (pp. 64–65)

1. $(17 + 36) + 13$
 $= (36 + 17) + 13$ Commutative property of addition
 $= 36 + (17 + 13)$ Associative property of addition
 $= 36 + 30$ Add 17 and 13.
 $= 66$ Add 36 and 30.
2. $8(-3)(5)$
 $= (-3)(8)(5)$ Commutative property of multiplication
 $= (-3)(40)$ Multiply 8 and 5.
 $= -120$ Multiply -3 and 40.
3. $3.4 + 9.7 + 7.6$
 $= (3.4 + 9.7) + 7.6$ Use order of operations.
 $= (9.7 + 3.4) + 7.6$ Commutative property of addition
 $= 9.7 + (3.4 + 7.6)$ Associative property of addition
 $= 9.7 + 11$ Add 3.4 and 7.6.
 $= 20.7$ Add 9.7 and 11.

4. $5x^2y = 5(-6)^2(20)$ Substitute -6 for x and 20 for y .
 $= 5(36)(20)$ Evaluate power.
 $= [5(36)](20)$ Use order of operations.
 $= [(36)5](20)$ Commutative property of multiplication
 $= (36)[5(20)]$ Associative property of multiplication
 $= (36)(100)$ Multiply 5 and 20.
 $= 3600$ Multiply 36 and 100.

5. $m + 5 + 9 = (m + 5) + 9 = m + (5 + 9) = m + 14$

6. $6(3k) = [6(3)](k) = 18k$

7. $4 + x + (-1) = (4 + x) + (-1)$
 $= (x + 4) + (-1)$
 $= x + [4 + (-1)]$
 $= x + 3$

8. $(2r)(-5) = (2)[(-5)r] = [2(-5)](r) = -10r$

9. $z^4 \cdot 1 = z^4$ illustrates the identity property of multiplication.

10. 100 centimeters = 1 meter

Factor 1: $\frac{100 \text{ centimeters}}{1 \text{ meter}}$

Factor 2: $\frac{1 \text{ meter}}{100 \text{ centimeters}}$

Use factor 2.

$$400 \text{ centimeters} = \frac{400}{100} \text{ centimeters} \cdot \frac{1 \text{ meter}}{100 \text{ centimeters}}$$

$$= 4 \text{ meters}$$

2.1 Guided Practice (p. 66)

1. $4 + (3 + 9) = (4 + 3) + 9$ Associative property of addition
2. First, use order of operations to get $5 \cdot 17 \cdot 2 = (5 \cdot 17) \cdot 2$. Next, use the associative property of multiplication to get $5 \cdot (17 \cdot 2)$. Use the commutative property of multiplication to obtain $5 \cdot (2 \cdot 17)$. Finally, use the associative property of multiplication of get $(5 \cdot 2) \cdot 17$. Multiply: $10 \cdot 17 = 170$.
3. $(26 + 18) + 34$
 $= (18 + 26) + 34$ Commutative property of addition
 $= 18 + (26 + 34)$ Associative property of addition
 $= 18 + 60$ Add 26 and 34.
 $= 78$ Add 18 and 60.
4. $-4(9)(-5)$
 $= -4(-5)(9)$ Commutative property of multiplication
 $= 20(9)$ Multiply -4 and -5 .
 $= 180$ Multiply 20 and 9.

Chapter 2 *continued*

5. $(-6)(1)(10)$
 $= (-6)(10)(1)$ Commutative property of multiplication
 $= (-60)(1)$ Multiply -6 and 10 .
 $= -60$ Identity property of multiplication
6. When $x = 5$ and $y = -2$;
 $33xy = 33(5)(-2) = 33(-10) = -330$
7. When $x = 5$ and $y = -2$; $x \cdot 11 \cdot y^2 = (5) \cdot 11(-2)^2$
 $= 5 \cdot 11 \cdot 4$
 $= 5 \cdot (11 \cdot 4)$
 $= 5 \cdot (4 \cdot 11)$
 $= (5 \cdot 4) \cdot 11$
 $= 20 \cdot 11$
 $= 220$
8. When $x = 5$ and $y = -2$;
 $x^2 + y^3 + 15 = (5)^2 + (-2)^3 + 15$
 $= 25 + (-8) + 15$
 $= [25 + (-8)] + 15$
 $= (-8 + 25) + 15$
 $= -8 + (25 + 15)$
 $= -8 + 40 = 32$
9. $x + 6 + 11 = (x + 6) + 11 = x + (6 + 11) = x + 17$
10. $9(-5a) = [9(-5)](a) = -45a$
11. $-2 + y + 8 = (-2 + y) + 8$
 $= [y + (-2)] + 8$
 $= y + [(-2) + 8]$
 $= y + 6$
12. $n + q = q + n$ Commutative property of addition
13. $-4ab = -4ba$ Commutative property of multiplication
14. $(3 \cdot 8) \cdot 2 = 3 \cdot (8 \cdot 2)$ Associative property of multiplication
15. The conversion factor should be $\frac{1 \text{ pound}}{16 \text{ ounces}}$ so that the common factor of ounces can be divided out. This gives
 $80 \text{ ounces} = \cancel{80 \text{ ounces}}^5 \cdot \frac{1 \text{ pound}}{\cancel{16 \text{ ounces}}_1} = 5 \text{ pounds.}$

2.1 Practice and Problem Solving (pp. 66–68)

16. $32 + 16 + 8$
 $= (32 + 16) + 8$ Use order of operations.
 $= (16 + 32) + 8$ Commutative property of addition
 $= 16 + (32 + 8)$ Associative property of addition
 $= 16 + 40$ Add 32 and 8.
 $= 56$ Add 16 and 40.
17. $15(-9)(2)$
 $= [15(-9)](2)$ Use order of operations.
 $= [(-9)15](2)$ Commutative property of multiplication
 $= (-9)[15(2)]$ Associative property of multiplication
 $= (-9)(30)$ Multiply 15 and 2.
 $= -270$ Multiply -9 and 30.
18. $7 \cdot 1 + 0 = 7 + 0$ Identity property of multiplication
 $= 7$ Identity property of addition
19. $45 + 29 + 55$
 $= (45 + 29) + 55$ Use order of operations.
 $= (29 + 45) + 55$ Commutative property of addition
 $= 29 + (45 + 55)$ Associative property of addition
 $= 29 + 100$ Add 45 and 55.
 $= 129$ Add 29 and 100.
20. When $a = 9$ and $b = -4$;
 $5ab = 5(9)(-4) = 5(-4)(9) = -20(9) = -180$
21. When $a = 9$ and $b = -4$; $b(25a^2) = (-4)[25(9)^2]$
 $= (-4)[25(81)]$
 $= [(-4)25](81)$
 $= -100(81)$
 $= -8100$
22. When $a = 9$ and $b = -4$;
 $11 + 4b + a = 11 + 4(-4) + (9)$
 $= 11 + (-16) + 9$
 $= [11 + (-16)] + 9$
 $= [(-16)] + 11 + 9$
 $= (-16) + (11 + 9)$
 $= (-16) + 20$
 $= 4$
23. When $a = 9$ and $b = -4$;
 $3a + b^2 + 13 = 3(9) + (-4)^2 + 13$
 $= 3(9) + 16 + 13$
 $= 27 + 16 + 13$
 $= (27 + 16) + 13$
 $= (16 + 27) + 13$
 $= 16 + (27 + 13)$
 $= 16 + 40$
 $= 56$
24. $x + 17 + 12 = (x + 17) + 12 = x + (17 + 12) = x + 29$
25. $3 + j + (-9) = (3 + j) + (-9)$
 $= (j + 3) + (-9)$
 $= j + [3 + (-9)]$
 $= j + (-6)$
 $= j - 6$
26. $-8(6c) = [-8(6)](c) = -48c$

Chapter 2 *continued*

27. $(5y)(26) = 5[y(26)] = 5[26y] = [5(26)](y) = 130y$

28. $mn + 0 = mn$ Identity property of addition

29. $19 \cdot 5^3 = 5^3 \cdot 19$ Commutative property of multiplication

30. $(2x + 3y) + z = 2x + (3y + z)$ Associative property of addition

31. $(-7u)(1) = -7u$ Identity property of multiplication

32. 5280 feet = 1 mile

$$\text{Factor 1: } \frac{5280 \text{ feet}}{1 \text{ mile}} \quad \text{Factor 2: } \frac{1 \text{ mile}}{5280 \text{ feet}}$$

Use factor 1.

$$4 \text{ miles} = 4 \cancel{\text{ miles}} \cdot \frac{5280 \text{ feet}}{1 \cancel{\text{ mile}}} = 21,120 \text{ feet}$$

33. 1 kilogram = 1000 grams

$$\text{Factor 1: } \frac{1 \text{ kilogram}}{1000 \text{ grams}} \quad \text{Factor 2: } \frac{1000 \text{ grams}}{1 \text{ kilogram}}$$

Use factor 2.

$$7.5 \text{ kilograms} = 7.5 \cancel{\text{ kilograms}} \cdot \frac{1000 \text{ grams}}{1 \cancel{\text{ kilogram}}} = 7500 \text{ grams}$$

34. 60 seconds = 1 minute

$$\text{Factor 1: } \frac{60 \text{ seconds}}{1 \text{ minute}} \quad \text{Factor 2: } \frac{1 \text{ minute}}{60 \text{ seconds}}$$

Use factor 2.

$$360 \text{ seconds} = 3\cancel{60} \text{ seconds} \cdot \frac{1 \text{ minute}}{60 \cancel{\text{ seconds}}} = 6 \text{ minutes}$$

35. 1 square foot = 144 square inches

$$\text{Factor 1: } \frac{1 \text{ square foot}}{144 \text{ square inches}}$$

$$\text{Factor 2: } \frac{144 \text{ square inches}}{1 \text{ square foot}}$$

Use factor 1.

$$432 \text{ square inches} = 3\cancel{432} \text{ square inches} \cdot \frac{1 \text{ square foot}}{144 \cancel{\text{ square inches}}} = 3 \text{ square feet}$$

36. The total number of calories is the sum of the three sources.

$$\begin{aligned} 144 + 108 + 56 &= (144 + 108) + 56 \\ &= (108 + 144) + 56 \\ &= 108 + (144 + 56) \\ &= 108 + 200 \\ &= 308 \end{aligned}$$

There are 308 Calories in a breakfast sandwich.

37. The total amount of money is the product of the hours worked each day, the wage per hour, and the number of days in a work week.

$$\begin{aligned} 4 \cdot 8 \cdot 5 &= (4 \cdot 8) \cdot 5 \\ &= (8 \cdot 4) \cdot 5 \\ &= 8 \cdot (4 \cdot 5) \\ &= 8 \cdot 20 \\ &= 160 \end{aligned}$$

You earn \$160 each week.

38. 1 ton = 2000 pounds

$$\text{Factor 1: } \frac{1 \text{ ton}}{2000 \text{ pounds}} \quad \text{Factor 2: } \frac{2000 \text{ pounds}}{1 \text{ ton}}$$

Use factor 2.

$$110 \text{ tons} = 110 \cancel{\text{ tons}} \cdot \frac{2000 \text{ pounds}}{1 \cancel{\text{ ton}}} = 220,000 \text{ pounds}$$

Argentinosaurus weighed about 220,000 pounds.

39. 1 square yard = 9 square feet

$$\text{Factor 1: } \frac{1 \text{ square yard}}{9 \text{ square feet}} \quad \text{Factor 2: } \frac{9 \text{ square feet}}{1 \text{ square yard}}$$

Use factor 1.

$$2808 \text{ square feet} = 2\cancel{808} \text{ square feet} \cdot \frac{1 \text{ square yard}}{9 \cancel{\text{ square feet}}} = 312 \text{ square yards}$$

A regulation tennis court has an area of 312 square yards.

40. No. *Sample answer:* You have to put on your socks before you put on your shoes.

41. $1.25 + 1.38 + 0.75$

$$\begin{aligned} &= (1.25 + 1.38) + 0.75 && \text{Use order of operations.} \\ &= (1.38 + 1.25) + 0.75 && \text{Commutative property of addition} \\ &= 1.38 + (1.25 + 0.75) && \text{Associative property of addition} \\ &= 1.38 + 2 && \text{Add 1.25 and 0.75.} \\ &= 3.38 && \text{Add 1.38 and 2.} \end{aligned}$$

42. $44 + 19 + 16 + 31$

$$\begin{aligned} &= (44 + 19) + 16 + 31 && \text{Use order of operations.} \\ &= 44 + (19 + 16) + 31 && \text{Associative property of addition} \\ &= 44 + (16 + 19) + 31 && \text{Commutative property of addition} \\ &= (44 + 16) + 19 + 31 && \text{Associative property of addition} \\ &= 60 + 19 + 31 && \text{Add 44 and 16.} \\ &= 60 + (19 + 31) && \text{Use order of operations.} \\ &= 60 + 50 && \text{Add 19 and 31.} \\ &= 110 && \text{Add 60 and 50.} \end{aligned}$$

Chapter 2 *continued*

43. $4(20)(25)(-5)$
 $= [4(20)](25)(-5)$ Use order of operations.
 $= 4[(20)(25)](-5)$ Associative property of multiplication
 $= 4[(25)(20)](-5)$ Commutative property of multiplication
 $= [4(25)](20)(-5)$ Associative property of multiplication
 $= 100(20)(-5)$ Multiply 4 and 25.
 $= 2000(-5)$ Multiply 100 and 20.
 $= -10,000$ Multiply 2000 and -5 .

44. When $x = -5$, $y = 3$, and $z = 2$;

$$\begin{aligned} x^2yz^2 &= (-5)^2(3)(2)^2 \\ &= (25)(3)(4) \\ &= [(25)(3)](4) \\ &= [(3)(25)](4) \\ &= (3)[(25)(4)] \\ &= 3(100) \\ &= 300 \end{aligned}$$

45. When $x = -5$, $y = 3$, and $z = 2$;

$$\begin{aligned} 15yxz &= 15(3)(-5)(2) \\ &= [15(3)](-5)(2) \\ &= 15(3)[(-5)(2)] \\ &= 15(3)(-10) \\ &= [15(3)](-10) \\ &= [3(15)](-10) \\ &= 3[15(-10)] \\ &= 3(-150) \\ &= -450 \end{aligned}$$

46. When $x = -5$, $y = 3$, and $z = 2$;

$$\begin{aligned} 2x + 9y + 5z &= 2(-5) + 9(3) + 5(2) \\ &= -10 + 27 + 10 \\ &= (-10 + 27) + 10 \\ &= [27 + (-10)] + 10 \\ &= 27 + [(-10) + 10] \\ &= 27 + 0 \\ &= 27 \end{aligned}$$

47. a. $4.7 + 8.5 + 6.3 = (4.7 + 8.5) + 6.3$
 $= (8.5 + 4.7) + 6.3$
 $= 8.5 + (4.7 + 6.3)$
 $= 8.5 + 11$
 $= 19.5$

The sum of the surveyor's measurements is 19.5 meters.

b. Mean: $\frac{4.7 + 8.5 + 6.3}{3} = \frac{19.5}{3} = 6.5$

The mean depth is 6.5 meters.

48. a. $5 \text{ yards} = 5 \text{ yards} \cdot \frac{3 \cancel{\text{feet}}}{1 \cancel{\text{yard}}} \cdot \frac{12 \cancel{\text{inches}}}{1 \cancel{\text{foot}}}$

b. $5 \cdot 3 \cdot 12 = (5 \cdot 3) \cdot 12$
 $= (3 \cdot 5) \cdot 12$
 $= 3 \cdot (5 \cdot 12)$
 $= 3 \cdot 60$
 $= 180$

A swordfish is 180 inches long.

c. A swordfish is $\frac{180}{18} = 10$ times as long as a mackerel.

49.

Expression	Result	Expression	Result
$8 - 3$	5	$3 - 8$	-5
$10 \div 5$	2	$5 \div 10$	$\frac{1}{2}$
$(15 - 9) - 4$	2	$15 - (9 - 4)$	10
$(48 \div 6) \div 2$	4	$48 \div (6 \div 2)$	16

No. *Sample answer:* The results of evaluating each expression after attempting to apply a commutative or associative property are different from those before applying the property.

50. a. $\frac{a}{1} = a$

51. a. $\$12 - \$4 = \$8$

The profit on each box is \$8.

b. The total profit is the product of the number of members, the number of boxes each member sells, and the profit on each box sold.

$$\begin{aligned} 10 \cdot x \cdot 8 &= (10 \cdot x) \cdot 8 \\ &= 10 \cdot (x \cdot 8) \\ &= 10 \cdot (8 \cdot x) \\ &= (10 \cdot 8) \cdot x \\ &= 80x \end{aligned}$$

c. If $x = 25$; $80x = 80(25) = 2000$.

If each member sells 25 boxes, the total profit is \$2000.

52. a. The sum of the numbers in each pair is 101.

b. There are 100 pairs of numbers.

c. If S is the sum of the integers 1 through 100, then $2S = 100 \cdot 101 = 10,100$.

d. The sum of the integers 1 through 100 is S , or

$$\frac{10,100}{2} = 5050.$$

Sample answer: The sum of all the pairs shown, $2S$, is 10,100. But because this represents the sum of the integers 1 through 100 written twice, the sum of the integers 1 through 100 is half of $2S$, or $10,100 \div 2 = 5050$.

2.1 Mixed Review (p. 68)

53. $3^4 = 3 \cdot 3 \cdot 3 \cdot 3 = 81$

54. $2^5 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 32$

Chapter 2 continued

55. $10^3 = 10 \cdot 10 \cdot 10 = 1000$

56. $2 + 3 \cdot 8 = 2 + 24 = 26$

57. $7 + 6^2 \div 9 = 7 + 36 \div 9 = 7 + 4 = 11$

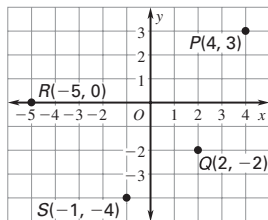
58. $19 + 5 \cdot 11 - 4 = 19 + 55 - 4 = 74 - 4 = 70$

59.

Total cost	=	Cost per box of spaghetti	•	Number of boxes of spaghetti	+	Cost per jar of sauce	•	Number of jars of sauce
	=	\$1.19	•	3	+	\$2.39	•	4
	=	\$3.57 + \$9.56						
	=	\$13.13						

The total cost of the items is \$13.13.

60–63.



60. Begin at the origin. Move 4 units to the right, then 3 units up. Point P is located in Quadrant I.

61. Begin at the origin. Move 2 units to the right, then 2 units down. Point Q is located in Quadrant IV.

62. Begin at the origin. Move 5 units to the left. Point R is located on the x -axis.

63. Begin at the origin. Move 1 unit to the left, then 4 units down. Point S is located in Quadrant III.

2.1 Standardized Test Practice (p. 68)

64. B

65. H

Focus on Measurement

Practice (p. 70)

1. $1 \text{ lb} \approx 0.454 \text{ kg}$

Factor 1: $\frac{1 \text{ lb}}{0.454 \text{ kg}}$ Factor 2: $\frac{0.454 \text{ kg}}{1 \text{ lb}}$

Use factor 1.

$56 \text{ kg} \approx 56 \cancel{\text{kg}} \times \frac{1 \text{ lb}}{0.454 \cancel{\text{kg}}} \approx 123 \text{ lb}$

$56 \text{ kg} \approx 123 \text{ lb}$

2. $1 \text{ fl oz} \approx 29.573 \text{ mL}$

Factor 1: $\frac{1 \text{ fl oz}}{29.573 \text{ mL}}$ Factor 2: $\frac{29.573 \text{ mL}}{1 \text{ fl oz}}$

Use factor 1.

$150 \text{ mL} \approx 150 \cancel{\text{mL}} \times \frac{1 \text{ fl oz}}{29.573 \cancel{\text{mL}}} \approx 5 \text{ fl oz}$

$150 \text{ mL} \approx 5 \text{ fl oz}$

3. $1 \text{ in.} = 2.54 \text{ cm}$

Factor 1: $\frac{1 \text{ in.}}{2.54 \text{ cm}}$ Factor 2: $\frac{2.54 \text{ cm}}{1 \text{ in.}}$

Use factor 2.

$14 \text{ in.} = 14 \cancel{\text{in.}} \times \frac{2.54 \text{ cm}}{1 \cancel{\text{in.}}} = 35.56 \approx 36 \text{ cm}$

$14 \text{ in.} \approx 36 \text{ cm}$

4. $1 \text{ mi} \approx 1.609 \text{ km}$

Factor 1: $\frac{1 \text{ mi}}{1.609 \text{ km}}$ Factor 2: $\frac{1.609 \text{ km}}{1 \text{ mi}}$

Use factor 2.

$88 \text{ mi} \approx 88 \cancel{\text{mi}} \times \frac{1.609 \text{ km}}{1 \cancel{\text{mi}}} \approx 142 \text{ km}$

$88 \text{ mi} \approx 142 \text{ km}$

5. $1 \text{ qt} \approx 0.946 \text{ L}$

Factor 1: $\frac{1 \text{ qt}}{0.946 \text{ L}}$ Factor 2: $\frac{0.946 \text{ L}}{1 \text{ qt}}$

Use factor 2.

$36 \text{ qt} \approx 36 \cancel{\text{qt}} \times \frac{0.946 \text{ L}}{1 \cancel{\text{qt}}} \approx 34 \text{ L}$

$36 \text{ qt} \approx 34 \text{ L}$

6. $1 \text{ oz} \approx 28.35 \text{ g}$

Factor 1: $\frac{1 \text{ oz}}{28.35 \text{ g}}$ Factor 2: $\frac{28.35 \text{ g}}{1 \text{ oz}}$

Use factor 1.

$452 \text{ g} \approx 452 \cancel{\text{g}} \times \frac{1 \text{ oz}}{28.35 \cancel{\text{g}}} \approx 16 \text{ oz}$

$452 \text{ g} \approx 16 \text{ oz}$

7. $1 \text{ gal} \approx 3.785 \text{ L}$

Factor 1: $\frac{1 \text{ gal}}{3.785 \text{ L}}$ Factor 2: $\frac{3.785 \text{ L}}{1 \text{ gal}}$

Use factor 2.

$12 \text{ gal} \approx 12 \cancel{\text{gal}} \times \frac{3.785 \text{ L}}{1 \cancel{\text{gal}}} \approx 45 \text{ L}$

$12 \text{ gal} \approx 45 \text{ L}$

8. $1 \text{ ft} = 0.3048 \text{ m}$

Factor 1: $\frac{1 \text{ ft}}{0.3048 \text{ m}}$ Factor 2: $\frac{0.3048 \text{ m}}{1 \text{ ft}}$

Use factor 1.

$21 \text{ m} = 21 \cancel{\text{m}} \times \frac{1 \text{ ft}}{0.3048 \cancel{\text{m}}} \approx 69 \text{ ft}$

$21 \text{ m} \approx 69 \text{ ft}$

9. $1 \text{ lb} \approx 0.454 \text{ kg}$

Factor 1: $\frac{1 \text{ lb}}{0.454 \text{ kg}}$ Factor 2: $\frac{0.454 \text{ kg}}{1 \text{ lb}}$

Use factor 2.

$7 \text{ lb} \approx 7 \cancel{\text{lb}} \times \frac{0.454 \text{ kg}}{1 \cancel{\text{lb}}} \approx 3 \text{ kg}$

$7 \text{ lb} \approx 3 \text{ kg}$

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10. 6 qt $\stackrel{?}{>}$ 5.9 L

$$6 \text{ qt } \stackrel{?}{>} 5.9 \cancel{\text{L}} \times \frac{1 \text{ qt}}{0.946 \cancel{\text{L}}}$$

$$6 \text{ qt } \stackrel{?}{>} 6.24 \text{ qt}$$

$$6 \text{ qt} < 6.24 \text{ qt}$$

$$6 \text{ qt} < 5.9 \text{ L}$$

11. 13 km $\stackrel{?}{>}$ 7 mi

$$13 \text{ km } \stackrel{?}{>} 7 \cancel{\text{mi}} \times \frac{1.609 \text{ km}}{1 \cancel{\text{mi}}}$$

$$13 \text{ km } \stackrel{?}{>} 11.26 \text{ km}$$

$$13 \text{ km} > 11.26 \text{ km}$$

$$13 \text{ km} > 7 \text{ mi}$$

12. 17.6 lb $\stackrel{?}{>}$ 8 kg

$$17.6 \text{ lb } \stackrel{?}{>} 8 \cancel{\text{kg}} \times \frac{1 \text{ lb}}{0.454 \cancel{\text{kg}}}$$

$$17.6 \text{ lb } \stackrel{?}{>} 17.62 \text{ lb}$$

$$17.6 \text{ lb} < 17.62 \text{ lb}$$

$$17.6 \text{ lb} < 8 \text{ kg}$$

13. 900 mL $\stackrel{?}{>}$ 30 fl oz

$$900 \text{ mL } \stackrel{?}{>} 30 \cancel{\text{fl oz}} \times \frac{29.573 \text{ mL}}{1 \cancel{\text{fl oz}}}$$

$$900 \text{ mL } \stackrel{?}{>} 887.19 \text{ mL}$$

$$900 \text{ mL} > 887.19 \text{ mL}$$

$$900 \text{ mL} > 30 \text{ fl oz}$$

14. 63 ft $\stackrel{?}{>}$ 19 m

$$63 \text{ ft } \stackrel{?}{>} 19 \cancel{\text{m}} \times \frac{1 \text{ ft}}{0.3048 \cancel{\text{m}}}$$

$$63 \text{ ft } \stackrel{?}{>} 62.34 \text{ ft}$$

$$63 \text{ ft} > 62.34 \text{ ft}$$

$$63 \text{ ft} > 19 \text{ m}$$

15. 34 g $\stackrel{?}{>}$ 1.2 oz

$$34 \text{ g } \stackrel{?}{>} 1.2 \cancel{\text{oz}} \times \frac{28.35 \text{ g}}{1 \cancel{\text{oz}}}$$

$$34 \text{ g } \stackrel{?}{>} 34.02 \text{ g}$$

$$34 \text{ g} < 34.02 \text{ g}$$

$$34 \text{ g} < 1.2 \text{ oz}$$

16. 150 cm $\stackrel{?}{>}$ 59 in.

$$150 \text{ cm } \stackrel{?}{>} 59 \cancel{\text{in.}} \times \frac{2.54 \text{ cm}}{1 \cancel{\text{in.}}}$$

$$150 \text{ cm } \stackrel{?}{>} 149.86 \text{ cm}$$

$$150 \text{ cm} > 149.86 \text{ cm}$$

$$150 \text{ cm} > 59 \text{ in.}$$

17. 18 gal $\stackrel{?}{>}$ 67.9 L

$$18 \text{ gal } \stackrel{?}{>} 67.9 \cancel{\text{L}} \times \frac{1 \text{ gal}}{3.785 \cancel{\text{L}}}$$

$$18 \text{ gal } \stackrel{?}{>} 17.94 \text{ gal}$$

$$18 \text{ gal} > 17.94 \text{ gal}$$

$$18 \text{ gal} > 67.9 \text{ L}$$

18. 5 lb $\stackrel{?}{>}$ 2268 g

$$5 \cancel{\text{lb}} \times \frac{0.454 \text{ kg}}{1 \cancel{\text{lb}}} \stackrel{?}{>} 2268 \text{ g}$$

$$2.27 \text{ kg } \stackrel{?}{>} 2268 \text{ g}$$

$$2.27 \cancel{\text{kg}} \times \frac{1000 \text{ g}}{1 \cancel{\text{kg}}} \stackrel{?}{>} 2268 \text{ g}$$

$$2270 \text{ g } \stackrel{?}{>} 2268 \text{ g}$$

$$2270 \text{ g} > 2268 \text{ g}$$

$$5 \text{ lb} > 2268 \text{ g}$$

19. Convert miles to kilometers.

$$3 \text{ mi} \approx 3 \cancel{\text{mi}} \times \frac{1.609 \text{ km}}{1 \cancel{\text{mi}}} \approx 4.827 \text{ km}$$

Convert kilometers to meters.

$$4.827 \text{ km} \approx 4.827 \cancel{\text{km}} \times \frac{1000 \text{ m}}{1 \cancel{\text{km}}} \approx 4827 \text{ m}$$

$$3 \text{ mi} \approx 4827 \text{ m}$$

20. Convert quarts to liters.

$$9 \text{ qt} \approx 9 \cancel{\text{qt}} \times \frac{0.946 \text{ L}}{1 \cancel{\text{qt}}} \approx 8.514 \text{ L}$$

Convert liters to milliliters.

$$8.514 \text{ L} \approx 8.514 \cancel{\text{L}} \times \frac{1000 \text{ mL}}{1 \cancel{\text{L}}} \approx 8514 \text{ mL}$$

$$9 \text{ qt} \approx 8514 \text{ mL}$$

21. Convert grams to ounces.

$$880 \text{ g} \approx 880 \cancel{\text{g}} \times \frac{1 \text{ oz}}{28.35 \cancel{\text{g}}} \approx 31.04 \text{ oz}$$

Convert ounces to pounds.

$$31.04 \text{ oz} \approx 31.04 \cancel{\text{oz}} \times \frac{1 \text{ lb}}{16 \cancel{\text{oz}}} \approx 2 \text{ lb}$$

$$880 \text{ g} \approx 2 \text{ lb}$$

22. Convert liters to gallons.

$$150 \text{ L} \approx 150 \cancel{\text{L}} \times \frac{1 \text{ gal}}{3.785 \cancel{\text{L}}} \approx 40 \text{ gal}$$

$$150 \text{ L} \approx 40 \text{ gal}$$

23. Convert pounds to kilograms.

$$105 \text{ lb} \approx 105 \cancel{\text{lb}} \times \frac{0.454 \text{ kg}}{1 \cancel{\text{lb}}} \approx 47.67 \text{ kg}$$

Convert kilograms to grams.

$$47.67 \text{ kg} \approx 47.67 \cancel{\text{kg}} \times \frac{1000 \text{ g}}{1 \cancel{\text{kg}}} \approx 47,670 \text{ g}$$

$$105 \text{ lb} \approx 47,670 \text{ g}$$

24. Convert centimeters to inches.

$$390 \text{ cm} \approx 390 \cancel{\text{cm}} \times \frac{1 \text{ in.}}{2.54 \cancel{\text{cm}}} \approx 153.54 \text{ in.}$$

Convert inches to feet.

$$153.54 \text{ in.} \approx 153.54 \cancel{\text{in.}} \times \frac{1 \text{ ft}}{12 \cancel{\text{in.}}} \approx 13 \text{ feet}$$

$$390 \text{ cm} \approx 13 \text{ feet}$$

Chapter 2 *continued*

25. Convert tons to kilograms.

$$4 \text{ t} \approx 4 \cancel{\text{t}} \times \frac{907.2 \text{ kg}}{1 \cancel{\text{t}}} \approx 3629 \text{ kg}$$

$$4 \text{ t} \approx 3629 \text{ kg}$$

26. Convert yards to feet.

$$120 \text{ yd} = 120 \cancel{\text{yd}} \times \frac{3 \text{ ft}}{1 \cancel{\text{yd}}} = 360 \text{ ft}$$

Convert feet to meters.

$$360 \text{ ft} = 360 \cancel{\text{ft}} \times \frac{0.3048 \text{ m}}{1 \cancel{\text{ft}}} \approx 110 \text{ m}$$

$$120 \text{ yd} \approx 110 \text{ m}$$

27. Convert liters to quarts.

$$10 \text{ L} \approx 10 \cancel{\text{L}} \times \frac{1 \text{ qt}}{0.946 \cancel{\text{L}}} \approx 10.57 \text{ qt}$$

Convert quarts to pints.

$$10.57 \text{ qt} \approx 10.57 \cancel{\text{qt}} \times \frac{2 \text{ pt}}{1 \cancel{\text{qt}}} \approx 21 \text{ pt}$$

$$10 \text{ L} \approx 21 \text{ pt}$$

28. Convert miles to kilometers.

$$460 \text{ mi} \approx 460 \cancel{\text{mi}} \times \frac{1.609 \text{ km}}{1 \cancel{\text{mi}}} \approx 740.14 \text{ km}$$

This distance is 740.14 km.

29. Convert kilograms to pounds.

$$454 \text{ kg} \approx 454 \cancel{\text{kg}} \times \frac{1 \text{ lb}}{0.454 \cancel{\text{kg}}} \approx 1000 \text{ lb}$$

This weight is 1000 lb.

30. Find the volumes of liquids in liters.

Convert milliliters to liters.

$$250 \text{ mL} = 250 \cancel{\text{mL}} \times \frac{1 \text{ L}}{1000 \cancel{\text{mL}}} = 0.25 \text{ L}$$

Convert quarts to liters.

$$0.5 \text{ qt} \approx 0.5 \cancel{\text{qt}} \times \frac{0.946 \text{ L}}{1 \cancel{\text{qt}}} \approx 0.473 \text{ L}$$

Compare the volumes of the two liquids.

$$0.25 \text{ L} < 0.473 \text{ L}$$

$$250 \text{ mL} < 0.5 \text{ qt}$$

The beaker containing 0.5 quart of ethyl alcohol contains more liquid.

31. Convert liters to gallons.

$$5 \text{ gal} \approx 5 \cancel{\text{gal}} \times \frac{3.785 \text{ L}}{1 \cancel{\text{gal}}} \approx 18.9 \text{ L}$$

The water cooler holds 18.9 L.

32. perimeter in millimeters = $35 \text{ mm} \times 4 = 140 \text{ mm}$

$$\text{perimeter in centimeters} = 140 \cancel{\text{mm}} \times \frac{1 \text{ cm}}{10 \cancel{\text{mm}}} = 14 \text{ cm}$$

$$\text{perimeter in inches} \approx 14 \cancel{\text{cm}} \times \frac{1 \text{ in.}}{2.54 \cancel{\text{cm}}} \approx 5.5 \text{ in.}$$

The perimeter of the badge is 5.5 in.

Student Reference: Perimeter and Area

Checkpoint (p. 72)

1. $P = 2\ell + 2w = 2(11) + 2(7) = 22 + 14 = 36 \text{ ft}$

2. $P = 4s = 4(8.5) = 34 \text{ m}$

3. $P = a + b + c = 27 + 22 + 24 = 49 + 24 = 73 \text{ in.}$

4. $A = s^2 = 18^2 = 324 \text{ in.}^2$

5. $A = \ell w = 30 \cdot 20 = 600 \text{ cm}^2$

6. $A = \frac{1}{2}bh = \frac{1}{2} \cdot 10 \cdot 6 = 5 \cdot 6 = 30 \text{ m}^2$

7. $P = 2\ell + 2w = 2(84) + 2(50) = 168 + 100 = 268 \text{ ft}$

$$A = \ell w = 84 \cdot 50 = 4200 \text{ ft}^2$$

8. a. Square A: $P = 4s = 4(3) = 12 \text{ ft}$

Square B: $P = 4s = 4(6) = 24 \text{ ft}$

b. Square A: $A = s^2 = 3^2 = 9 \text{ ft}^2$

Square B: $A = s^2 = 6^2 = 36 \text{ ft}^2$

c. *Sample answer:* The perimeter of square B is twice as large as the perimeter of square A. The area of square B is 4 times as large as the area of square A.

Lesson 2.2

2.2 Checkpoint (p. 74)

1. $3(8 + 5) = 3(8) + 3(5) = 24 + 15 = 39$

2. $(2 + 9)2 = 2(2) + 9(2) = 4 + 18 = 22$

3. $6(11 - 4) = 6(11) - 6(4) = 66 - 24 = 42$

4. $(3 - 14)(-5) = 3(-5) - 14(-5)$

$$= -15 - (-70)$$

$$= -15 + 70$$

$$= 55$$

5. $4(105) = 4(100 + 5) = 4(100) + 4(5) = 400 + 20 = 420$

6. $3(97) = 3(100 - 3) = 3(100) - 3(3) = 300 - 9 = 291$

7. $5(2.9) = 5(3 - 0.1) = 5(3) - 5(0.1) = 15 - 0.5 = 14.5$

8. $8(7.02) = 8(7 + 0.02)$

$$= 8(7) + 8(0.02)$$

$$= 56 + 0.16$$

$$= 56.16$$

9. $8(x + 2) = 8(x) + 8(2) = 8x + 16$

10. $(7 - t)(-4) = 7(-4) - t(-4)$

$$= -28 - (-4t)$$

$$= -28 + 4t$$

$$= 4t - 28$$

11. $9(3m + 5) = 9(3m) + 9(5) = 27m + 45$

12. $-2(6y - 4) = -2(6y) - (-2)(4)$

$$= -12y - (-8)$$

$$= -12y + 8$$

Chapter 2 *continued*

2.2 Guided Practice (p. 75)

- The distributive property is illustrated by the statement $3(4 - 9) = 3(4) - 3(9)$.
- No; *Sample answer:* By the distributive property, $2(x + 1) = 2(x) + 2(1) = 2x + 2$.
 $2x + 2 \neq 2x + 1$, so $2(x + 1)$ and $2x + 1$ are not equivalent variable expressions.
- $3(96) = 3(100 - 4) = 3(100) - 3(4) = 300 - 12 = 288$
- $6(103) = 6(100 + 3) = 6(100) + 6(3) = 600 + 18 = 618$
- $2(8.95) = 2(9 - 0.05)$
 $= 2(9) - 2(0.05)$
 $= 18 - 0.1$
 $= 17.9$
- $4(7.09) = 4(7 + 0.09)$
 $= 4(7) + 4(0.09)$
 $= 28 + 0.36$
 $= 28.36$
- $2(x - 6) = 2(x) - 2(6) = 2x - 12$
- $(y + 11)(-3) = y(-3) + 11(-3)$
 $= -3y + (-33)$
 $= -3y - 33$
- $5(4k + 9) = 5(4k) + 5(9) = 20k + 45$
- $-4(2n - 7) = -4(2n) - (-4)(7)$
 $= -8n - (-28)$
 $= -8n + 28$
- a. $A = \text{length} \cdot \text{width} = (20 + \ell)15$
b. $A = \begin{matrix} \text{Area of} & \text{Area of} \\ \text{living room} & + & \text{game room} \end{matrix}$
 $= \text{length} \cdot \text{width} + \text{length} \cdot \text{width}$
 $= 20 \cdot 15 + \ell \cdot 15$
 $= 300 + 15\ell$
c. $(20 + \ell)15 = 20(15) + \ell(15) = 300 + 15\ell$

2.2 Practice and Problem Solving (pp. 76–77)

- $2(5 + 3) = 2(5) + 2(3) = 10 + 6 = 16$
- $5(9 - 3) = 5(9) - 5(3) = 45 - 15 = 30$
- $(4 - 10)7 = 4(7) - 10(7) = 28 - 70 = -42$
- $(7.2 + 1.9)2 = 7.2(2) + 1.9(2) = 14.4 + 3.8 = 18.2$
- $-10(18 + 8) = -10(18) + (-10)8$
 $= -180 + (-80)$
 $= -260$
- $(6 + 21)(-3) = 6(-3) + 21(-3) = -18 + (-63) = -81$
- $(12 - 7)(-4) = 12(-4) - 7(-4)$
 $= -48 - (-28)$
 $= -48 + 28$
 $= -20$
- $6(-2.3 + 3.8) = 6(-2.3) + 6(3.8) = -13.8 + 22.8 = 9$
- $4(98) = 4(100 - 2) = 4(100) - 4(2) = 400 - 8 = 392$
- $7(109) = 7(100 + 9) = 7(100) + 7(9) = 700 + 63 = 763$
- $(211)(-3) = (200 + 11)(-3)$
 $= 200(-3) + 11(-3)$
 $= -600 + (-33)$
 $= -633$
- $-5(396) = -5(400 - 4)$
 $= -5(400) - (-5)(4)$
 $= -2000 - (-20)$
 $= -2000 + 20$
 $= -1980$
- $8(3.1) = 8(3 + 0.1) = 8(3) + 8(0.1) = 24 + 0.8 = 24.8$
- $2(1.99) = 2(2 - 0.01)$
 $= 2(2) - 2(0.01)$
 $= 4 - 0.02$
 $= 3.98$
- $-6(10.95) = -6(11 - 0.05)$
 $= -6(11) - (-6)(0.05)$
 $= -66 - (-0.3)$
 $= -66 + 0.3$
 $= -65.7$
- $(4.02)(-9) = (4 + 0.02)(-9)$
 $= 4(-9) + 0.02(-9)$
 $= -36 + (-0.18)$
 $= -36.18$
- $4(x - 2) = 4(x) - 4(2) = 4x - 8$
- $3(y + 9) = 3(y) + 3(9) = 3y + 27$
- $-2(3 - r) = -2(3) - (-2)(r)$
 $= -6 - (-2r)$
 $= -6 + 2r$
 $= 2r - 6$
- $(s + 20)(-7) = s(-7) + 20(-7)$
 $= -7s + (-140)$
 $= -7s - 140$
- $6(2p + 1) = 6(2p) + 6(1) = 12p + 6$
- $-5(5q - 4) = -5(5q) - (-5)(4)$
 $= -25q - (-20)$
 $= -25q + 20$
- $9(11 - 6m) = 9(11) - 9(6m) = 99 - 54m = -54m + 99$
- $(-2n - 3)(-8) = -2n(-8) - 3(-8)$
 $= 16n - (-24)$
 $= 16n + 24$
- Number of players in the NBA = Number of teams $\left(\begin{matrix} \text{Number} & \text{Number} \\ \text{of healthy} & \text{of injured} \\ \text{players} & \text{players} \end{matrix} \right)$
 $= 30(12 + 3)$
 $= 30(12) + 30(3)$
 $= 360 + 90$
 $= 450$

A maximum of 450 players can be in the NBA.

Chapter 2 *continued*

37. 295 in./year \approx 300 in./year;

so the total snowfall will be about $5(300) = 1500$ in.;

$$\begin{aligned} \text{Total snowfall} &= \text{Inches of snow} \cdot \text{Number} \\ \text{in 5 years} &= \text{each year} \cdot \text{of years} \\ &= 295 \cdot 5 \\ &= (300 - 5)5 \\ &= 300(5) - 5(5) \\ &= 1500 - 25 \\ &= 1475 \end{aligned}$$

In 5 years, the total snowfall will be about 1475 inches.
The estimation is close to the answer.

38. $A = \ell w = (3x - 2)4 = 3x(4) - 2(4) = 12x - 8$

The area is $(12x - 8)$ square units.

39. $A = \frac{1}{2}bh$

$$\begin{aligned} &= \frac{1}{2} \cdot 18(5a + 7) \\ &= 9(5a + 7) \\ &= 9(5a) + 9(7) \\ &= 45a + 63 \end{aligned}$$

The area is $(45a + 63)$ square units.

40. $A = \frac{1}{2}bh$

$$\begin{aligned} &= \frac{1}{2}(6 - 2y)13 \\ &= \left[\frac{1}{2}(6) - \frac{1}{2}(2y) \right] 13 \\ &= (3 - y)13 \\ &= 3(13) - y(13) \\ &= 39 - 13y \\ &= -13y + 39 \end{aligned}$$

The area is $(-13y + 39)$ square units.

41. $5(7 + 2 + 4) = 5(7) + 5(2) + 5(4)$

$$\begin{aligned} &= 35 + 10 + 20 \\ &= 45 + 20 \\ &= 65 \end{aligned}$$

42. $-3(9 - 1 + 6) = -3(9) - (-3)(1) + (-3)(6)$

$$\begin{aligned} &= -27 - (-3) + (-18) \\ &= -27 + 3 + (-18) \\ &= -24 + (-18) \\ &= -42 \end{aligned}$$

43. $(21 - 11 - 3)4 = 21(4) - 11(4) - 3(4)$

$$\begin{aligned} &= 84 - 44 - 12 \\ &= 40 - 12 \\ &= 28 \end{aligned}$$

44. a. $W = 1.9(a + b + c)$

$$\begin{aligned} &= 1.9(a) + 1.9(b) + 1.9(c) \\ &= 1.9a + 1.9b + 1.9c \end{aligned}$$

—CONTINUED—

44. —CONTINUED—

- b. When $a = 132$, $b = 91$, and $c = 85$;

$$\begin{aligned} W &= 1.9a + 1.9b + 1.9c \\ &= 1.9(132) + 1.9(91) + 1.9(85) \\ &= 250.8 + 172.9 + 161.5 \\ &= 585.2 \end{aligned}$$

The weight of the pumpkin is approximately 585 pounds.

45. a. $W = 4400(40 - d)$

$$\begin{aligned} &= 4400(40) - 4400(d) \\ &= 176,000 - 4400d \\ &= -4400d + 176,000 \end{aligned}$$

- b. When $d = 15$; $W = -4400d + 176,000$

$$\begin{aligned} &= -4400(15) + 176,000 \\ &= -66,000 + 176,000 \\ &= 110,000 \end{aligned}$$

The weight of the corn in the silo is about 110,000 pounds.

- c. Amount of corn = Pounds eaten \cdot Number
herd eats a day per cow of cows

$$\begin{aligned} &= 10 \cdot 100 \\ &= 1000 \end{aligned}$$

The herd eats 1000 pounds of corn a day.

Number = $\frac{\text{Amount of corn in silo}}{\text{Amount of corn needed each day}}$

$$\begin{aligned} &= \frac{110,000}{1000} \\ &= 110 \end{aligned}$$

The corn will last 110 days.

46. $x(x + 9) = x(x) + x(9) = x^2 + 9x$

47. $m(5 - m) = m(5) - m(m) = 5m - m^2 = -m^2 + 5m$

48. $(2u - 7)u = 2u(u) - 7(u) = 2u^2 - 7u$

49. $-3y(y + 8) = -3y(y) + (-3y)(8)$

$$\begin{aligned} &= -3y^2 + (-24y) \\ &= -3y^2 - 24y \end{aligned}$$

50. a. $\frac{1}{2}(500 - 2x)$; *Sample answer:* The perimeter is a sum that includes twice the length, so I subtracted twice the length from the perimeter to find an expression for the distance remaining around the pen. I knew that the remaining distance is twice the width, so I multiplied the entire expression by $\frac{1}{2}$ to find the width.

—CONTINUED—

Chapter 2 *continued*

50. —CONTINUED—

$$b. A = \ell w = x(250 - x) = x(250) - (x)(x) = 250x - x^2$$

$$c. \text{ When } x = 160; w = 250 - x = 250 - 160 = 90$$

The width of the pen is 90 feet.

$$\begin{aligned} \text{When } x = 160; A &= 250x - x^2 \\ &= 250(160) - (160)^2 \\ &= 40,000 - 25,600 \\ &= 14,400 \end{aligned}$$

The area of the pen is 14,400 square feet.

2.2 Mixed Review (p. 77)

$$51. 20 + (-9) = 11 \qquad 52. -34 + 16 = -18$$

$$53. -81 - 58 = -81 + (-58) = -139$$

$$54. 65 - (-27) = 65 + 27 = 92$$

$$55. \text{ Mean: } \frac{-15 + (-7) + 8 + 3 + (-9)}{5} = \frac{-20}{5} = -4$$

The mean of the temperatures is -4°F .

$$56. (x + 5y) + 2 = x + (5y + 2) \quad \text{Associative property of addition}$$

$$57. 3m + 2n = 2n + 3m \quad \text{Commutative property of addition}$$

$$58. r^2s = sr^2 \quad \text{Commutative property of multiplication}$$

$$59. c^7 \cdot 1 = c^7 \quad \text{Identity property of multiplication}$$

2.2 Standardized Test Practice (p. 77)

$$\begin{aligned} 60. A; -3(-7 + 2x) &= -3(-7) + (-3)(2x) \\ &= 21 + (-6x) \\ &= 21 - 6x \end{aligned}$$

$$61. I; A = \ell w = (4y + 8)5 = 4y(5) + 8(5) = 20y + 40$$

62. *Sample answer:*

Method 1

Find the cost of one ticket and one popcorn-and-drink combo. Then multiply the result by 2.

$$2(9.00 + 5.25) = 2(14.25) = 28.50$$

Method 2

Find the cost of two tickets and the cost of two popcorn-and-drink combos. Then add the costs.

$$2(9.00) + 2(5.25) = 18.00 + 10.50 = 28.50$$

The total amount spent was \$28.50.

Lesson 2.3

2.3 Checkpoint (p. 79)

$$1. 3x + 2 + 5x$$

Terms: $3x$, 2 , $5x$

Like terms: $3x$ and $5x$

Coefficients: 3 , 5

Constant term: 2

$$3x + 2 + 5x = 3x + 5x + 2 = (3 + 5)x + 2 = 8x + 2$$

$$2. -7b + 3 + b - 10 = -7b + 3 + b + (-10)$$

Terms: $-7b$, 3 , b , -10

Like terms: $-7b$ and b ; 3 and -10

Coefficients: -7 , 1

Constant terms: 3 , -10

$$\begin{aligned} -7b + 3 + b + (-10) &= -7b + b + 3 + (-10) \\ &= (-7 + 1)b + 3 + (-10) \\ &= -6b + (-7) \\ &= -6b - 7 \end{aligned}$$

$$3. 5 + 8w - 6 - w = 5 + 8w + (-6) + (-w)$$

Terms: 5 , $8w$, -6 , $-w$

Like terms: $8w$ and $-w$; 5 and -6

Coefficients: 8 , -1

Constant terms: 5 , -6

$$\begin{aligned} 5 + 8w + (-6) + (-w) &= 5 + (-6) + 8w + (-w) \\ &= 5 + (-6) + [8 + (-1)]w \\ &= -1 + 7w \\ &= 7w - 1 \end{aligned}$$

$$\begin{aligned} 4. 4(x + 1) + 2x + 5 &= 4x + 4 + 2x + 5 \\ &= 4x + 2x + 4 + 5 \\ &= 6x + 9 \end{aligned}$$

$$\begin{aligned} 5. 10y - 3(6 - y) &= 10y - 18 + 3y \\ &= 10y + 3y - 18 \\ &= 13y - 18 \end{aligned}$$

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

2.3 Guided Practice (p. 80)

- The terms that have a number but no variable are called constant terms.
- The coefficient of y in the expression $8 - 3y + 1$ is -3 .
- $6x + x + 2 + 4$
Terms: $6x$, x , 2 , 4
Like terms: $6x$ and x ; 2 and 4
Coefficients: 6 , 1
Constant terms: 2 , 4
 $6x + x + 2 + 4 = (6 + 1)x + 2 + 4 = 7x + 6$

Chapter 2 continued

4. $-4k - 12 + 3k = -4k + (-12) + 3k$

Terms: $-4k, -12, 3k$

Like terms: $-4k$ and $3k$

Coefficients: $-4, 3$

Constant term: -12

$$\begin{aligned} -4k + (-12) + 3k &= -4k + 3k + (-12) \\ &= (-4 + 3)k + (-12) \\ &= -k + (-12) \\ &= -k - 12 \end{aligned}$$

5. $5n + 1 - n - 8 = 5n + 1 + (-n) + (-8)$

Terms: $5n, 1, -n, -8$

Like terms: $5n$ and $-n$; 1 and -8

Coefficients: $5, -1$

Constant terms: $1, -8$

$$\begin{aligned} 5n + 1 + (-n) + (-8) &= 5n + (-n) + 1 + (-8) \\ &= [5 + (-1)]n + 1 + (-8) \\ &= 4n + (-7) \\ &= 4n - 7 \end{aligned}$$

6. $5x + 2 + 3(x - 1) = 5x + 2 + 3x - 3$

$$= 5x + 3x + 2 - 3$$

$$= 8x + (-1)$$

$$= 8x - 1$$

7. $-7(2r + 3) + 11r = -14r - 21 + 11r$

$$= -14r + 11r - 21$$

$$= -3r - 21$$

8. $p + 6 - 6(p - 2) = p + 6 - 6p + 12$

$$= p - 6p + 6 + 12$$

$$= -5p + 18$$

9. *Sample answer:* The distributive property was incorrectly applied. You can rewrite $5a - (3a - 7)$ as $5a + (-1)(3a - 7)$. Applying the distributive property gives $5a + (-1)(3a) - (-1)(7) = 5a - 3a + 7 = 2a + 7$.

2.3 Practice and Problem Solving (pp. 81–82)

10. $10x + 7 + 3x$

Terms: $10x, 7, 3x$

Like terms: $10x$ and $3x$

Coefficients: $10, 3$

Constant term: 7

$$\begin{aligned} 10x + 7 + 3x &= 10x + 3x + 7 \\ &= (10 + 3)x + 7 \\ &= 13x + 7 \end{aligned}$$

11. $4y + 23 - y - 6 = 4y + 23 + (-y) + (-6)$

Terms: $4y, 23, -y, -6$

Like terms: $4y$ and $-y$; 23 and -6

Coefficients: $4, -1$

Constant terms: $23, -6$

$$\begin{aligned} 4y + 23 + (-y) + (-6) &= 4y + (-y) + 23 + (-6) \\ &= [4 + (-1)]y + 23 + (-6) \\ &= 3y + 17 \end{aligned}$$

12. $-19 - 11a + a + 16 = -19 + (-11a) + a + 16$

Terms: $-19, -11a, a, 16$

Like terms: $-11a$ and a ; -19 and 16

Coefficients: $-11, 1$

Constant terms: $-19, 16$

$$\begin{aligned} -19 + (-11a) + a + 16 &= -11a + (-19) + a + 16 \\ &= -11a + a + (-19) + 16 \\ &= (-11 + 1)a + (-19) + 16 \\ &= -10a + (-3) \\ &= -10a - 3 \end{aligned}$$

13. $2b - 8 + 4b - 6b = 2b + (-8) + 4b + (-6b)$

Terms: $2b, -8, 4b, -6b$

Like terms: $2b, 4b$, and $-6b$

Coefficients: $2, 4, -6$

Constant term: -8

$$\begin{aligned} 2b + (-8) + 4b + (-6b) &= -8 + 2b + 4b + (-6b) \\ &= -8 + [2 + 4 + (-6)]b \\ &= -8 + 0b \\ &= -8 \end{aligned}$$

14. $9 + n - 1 - 7n = 9 + n + (-1) + (-7n)$

Terms: $9, n, -1, -7n$

Like terms: n and $-7n$; 9 and -1

Coefficients: $1, -7$

Constant terms: $9, -1$

$$\begin{aligned} 9 + n + (-1) + (-7n) &= 9 + (-1) + n + (-7n) \\ &= 9 + (-1) + [1 + (-7)]n \\ &= 8 + (-6n) \\ &= -6n + 8 \end{aligned}$$

15. $8p - 5p + 5 - p - 2 = 8p + (-5p) + 5 + (-p) + (-2)$

Terms: $8p, -5p, 5, -p, -2$

Like terms: $8p, -5p$, and $-p$; 5 and -2

Coefficients: $8, -5, -1$

Constant term: $5, -2$

$$\begin{aligned} 8p + (-5p) + 5 + (-p) + (-2) &= 8p + (-5p) + (-p) + 5 + (-2) \\ &= [8 + (-5) + (-1)]p + 5 + (-2) \\ &= 2p + 3 \end{aligned}$$

16. $4x + 2x = 6x$

17. $10a - 3a = 7a$

18. $b - 9b = -8b$

19. $x + 2x + 3x = 6x$

20. $9c^2 - 4c^2 + 2c^2 = 7c^2$

21. $3(2y + 5y) = 3(7y) = 21y$

22. $4(d + 3) + 7d = 4d + 12 + 7d$

$$\begin{aligned} &= 4d + 7d + 12 \\ &= 11d + 12 \end{aligned}$$

23. $5(k - 7) - k + 7 = 5k - 35 - k + 7$

$$\begin{aligned} &= 5k - k - 35 + 7 \\ &= 4k - 28 \end{aligned}$$

Chapter 2 *continued*

$$\begin{aligned} 24. \quad -2(2m - 1) + 4m &= -4m + 2 + 4m \\ &= -4m + 4m + 2 \\ &= 0 + 2 \\ &= 2 \end{aligned}$$

$$25. \quad 8n - (n - 3) = 8n - n + 3 = 7n + 3$$

$$26. \quad 20u - 6(u + 5) = 20u - 6u - 30 = 14u - 30$$

$$\begin{aligned} 27. \quad -w + 4 - (3w - 13) &= -w + 4 - 3w + 13 \\ &= -w - 3w + 4 + 13 \\ &= -4w + 17 \end{aligned}$$

$$\begin{aligned} 28. \quad p - 5(2 - 3p) + 1 &= p - 10 + 15p + 1 \\ &= p + 15p - 10 + 1 \\ &= 16p - 9 \end{aligned}$$

$$\begin{aligned} 29. \quad 3(q + 4) + 4q + 1 &= 3q + 12 + 4q + 1 \\ &= 3q + 4q + 12 + 1 \\ &= 7q + 13 \end{aligned}$$

$$\begin{aligned} 30. \quad -7(r^2 + 2) + 3r^2 &= -7r^2 - 14 + 3r^2 \\ &= -7r^2 + 3r^2 - 14 \\ &= -4r^2 - 14 \end{aligned}$$

31. Let s represent the time you spend swimming.

Calories burned	=	per minute jogging	•	Jogging time	+	per minute swimming	•	Swimming time

$$\begin{aligned} &= 14(45 - s) + 8s \\ &= 630 - 14s + 8s \\ &= 630 - 6s \\ &= -6s + 630 \end{aligned}$$

You burn $-6s + 630$ calories during your workout.

$$\begin{aligned} 32. \quad 2d + 11 - 5d - 4 \\ &= 2d + 11 + (-5d) + (-4) \\ &= 2d + (-5d) + 11 + (-4) \\ &= d(2 + (-5)) + 11 + (-4) \\ &= -3d + 7 \end{aligned}$$

- a. Write as a sum
- b. Commutative property of addition
- c. Distributive property of addition
- d. Simplify

$$\begin{aligned} 33. \quad P &= a + b + c \\ &= x + (x + 5) + (2x + 1) \\ &= x + x + 5 + 2x + 1 \\ &= x + x + 2x + 5 + 1 \\ &= 4x + 6 \end{aligned}$$

$$\begin{aligned} 34. \quad P &= a + b + c \\ &= a + 2a + (10 - 3a) \\ &= a + 2a + 10 - 3a \\ &= a + 2a - 3a + 10 \\ &= 0 + 10 = 10 \end{aligned}$$

$$\begin{aligned} 35. \quad P &= 2\ell + 2w \\ &= 2(7y - 5) + 2(2y) \\ &= 14y - 10 + 4y \\ &= 14y + 4y - 10 \\ &= 18y - 10 \end{aligned}$$

36. a. Let w = the width of the rug.

$$\begin{aligned} \ell &= 2w \\ P &= 2\ell + 2w = 2(2w) + 2w = 4w + 2w = 6w \end{aligned}$$

The perimeter of the rug is $6w$ feet.

b. $A = \ell w = 2w \cdot w = 2w^2$
The area of the rug is $2w^2$ square feet.

c.

Width (feet)	1	2	4	8	16
Perimeter (feet)	6	12	24	48	96
Area (square feet)	2	8	32	128	512

d. Doubling the width of the rug doubles the perimeter and multiplies its area by 4.

37. a. $A = \ell w = 500x$

The area of the tomato portion is $500x$ square feet.

$$A = \ell w = 500(800 - x) = 400,000 - 500x$$

The area of the cucumber portion is $400,000 - 500x$ square feet.

$$\begin{aligned} \text{b. Annual cost} &= \text{Tomato cost} \times \text{Tomato area} + \text{Cucumber cost} \\ &\quad \times \text{Cucumber area} \\ &= 0.27(500x) + 0.10(400,000 - 500x) \\ &= 135x + 40,000 - 50x \\ &= 135x - 50x + 40,000 \\ &= 85x + 40,000 \end{aligned}$$

$$\begin{aligned} \text{c. When } x &= 350; 85x + 40,000 = 85(350) + 40,000 \\ &= 29,750 + 40,000 \\ &= 69,750 \end{aligned}$$

The annual cost is \$69,750.

38. a. Let a = the number of angelfish.

Let s = the number of swordtails.

$$\text{Number of tetras} = 20 - a - s$$

$$\begin{aligned} \text{b. Total cost} &= \text{Cost of angelfish} \cdot \text{Number of angelfish} + \text{Cost of swordtails} \\ &\quad \cdot \text{Number of swordtails} + \text{Cost of tetras} \cdot \text{Number of tetras} \\ &= 5a + 2s + 3(20 - a - s) \\ &= 5a + 2s + 60 - 3a - 3s \\ &= 5a - 3a + 2s - 3s + 60 \\ &= 2a - s + 60 \end{aligned}$$

—CONTINUED—

Chapter 2 *continued*

38. —CONTINUED—

$$\begin{aligned} \text{c. When } a = 4 \text{ and } s = 10; \\ 2a - s + 60 &= 2(4) - 10 + 60 \\ &= 8 - 10 + 60 \\ &= -2 + 60 \\ &= 58 \end{aligned}$$

The total cost is \$58.

2.3 Mixed Review (p. 82)

39. (1) Read and Understand

(2) Make a Plan: Guess, Check, and Revise

(3) Solve the Problem: The cube of a number is that number multiplied by itself three times.

Try 10.

$$10(10)(10) = 1000, \text{ which is too low.}$$

Continue until you arrive at 14.

$$14(14)(14) = 2744$$

So, $x = 14$.

(4) Look Back

40. Expression: $8x$

41. Expression: $x - 3$

42. Expression: $x + 10$

43. Expression: $\frac{x}{6}$

44. $4(a + 2) = 4(a) + 4(2) = 4a + 8$

45. $-2(x + 3) = -2(x) + (-2)(3)$
 $= -2x + (-6)$
 $= -2x - 6$

46. $7(p - 4) = 7(p) - 7(4) = 7p - 28$

47. $(m - 5)(-6) = m(-6) - 5(-6)$
 $= -6m - (-30)$
 $= -6m + 30$

48. $5(2q + 11) = 5(2q) + 5(11) = 10q + 55$

49. $8(3t - 7) = 8(3t) - 8(7) = 24t - 56$

50. $-4(1 - 5u) = -4(1) - (-4)(5u)$
 $= -4 - (-20u)$
 $= -4 + 20u$
 $= 20u - 4$

51. $(8w + 9)(-3) = 8w(-3) + 9(-3)$
 $= -24w + (-27)$
 $= -24w - 27$

2.3 Standardized Test Practice (p. 82)

52. C

53. I; $8t - 6(2t - 1) = 8t - 12t + 6 = -4t + 6$

54. *Sample answer:* Write a verbal model for the total weight of the canteen and water.

Let x = the number of fluid ounces you drink.

$$\begin{aligned} \text{Total weight} &= \text{Weight of canteen} + \text{Weight per fluid ounce} \times \text{Ounces remaining} \\ &= 0.25 + 0.065(32 - x) \\ &= 0.25 + 0.065(32) - 0.065(x) && \text{Distributive property} \\ &= 0.25 + 2.08 - 0.065x && \text{Multiply 0.065 and 32.} \\ &= 2.33 - 0.065x && \text{Combine like terms.} \end{aligned}$$

The weight of the canteen and water is $2.33 - 0.065x$ pounds.

2.3 Technology Activity (p. 83)

1. $7(x + 2) = 7x + 14$

2. $2x + 4x + 6x = 12x$

3. $3x - 9 - 8x + 5 = 3x - 8x - 9 + 5 = -5x - 4$

4. $-6(x - 3) + 5x = -6x + 18 + 5x$
 $= -6x + 5x + 18$
 $= -x + 18$

5. $11x - 3(x + 5) = 11x - 3x - 15 = 8x - 15$

6. $2(3x + 4) - 6x = 6x + 8 - 6x$
 $= 6x - 6x + 8$
 $= 0 + 8$
 $= 8$

7. When $x = 0$; $2(x - 1) + x = 2(0 - 1) + 0 = 2(-1) = -2$.

When $x = 0$; $4x - 2 = 4(0) - 2 = 0 - 2$.

No. *Sample answer:* Let $Y1 = 2(X - 1) + X$ and $Y2 = 4X - 2$. The pairs of values in each row of the table are not always the same, so the two expressions are not equivalent.

Mid-Chapter Quiz (p. 84)

1. $29 + 18 + 21$

$$= (29 + 18) + 21$$

Use order of operations.

$$= (18 + 29) + 21$$

Commutative property of addition

$$= 18 + (29 + 21)$$

Associative property of addition

$$= 18 + 50$$

Add 29 and 21.

$$= 68$$

Add 18 and 50.

2. $1.3 + 6.8 + 2.7$

$$= (1.3 + 6.8) + 2.7$$

Use order of operations.

$$= (6.8 + 1.3) + 2.7$$

Commutative property of addition

$$= 6.8 + (1.3 + 2.7)$$

Associative property of addition

$$= 6.8 + 4$$

Add 1.3 and 2.7.

$$= 10.8$$

Add 6.8 and 4.

Chapter 2 *continued*

3. $4(9)(-25) = [4(9)](-25)$ Use order of operations.
 $= [(9)4](-25)$ Commutative property of multiplication
 $= 9[4(-25)]$ Associative property of multiplication
 $= 9(-100)$ Multiply 4 and -25 .
 $= -900$ Multiply 9 and -100 .

4. $5(-7)(-12)$
 $= [5(-7)](-12)$ Use order of operations.
 $= [(-7)5](-12)$ Commutative property of multiplication
 $= (-7)[5(-12)]$ Associative property of multiplication
 $= (-7)(-60)$ Multiply 5 and -12 .
 $= 420$ Multiply -7 and -60 .

5. 5280 feet = 1 mile

Factor 1: $\frac{5280 \text{ feet}}{1 \text{ mile}}$ Factor 2: $\frac{1 \text{ mile}}{5280 \text{ feet}}$

Use factor 1.

$$122 \text{ miles} = 122 \cancel{\text{ miles}} \times \frac{5280 \text{ feet}}{1 \cancel{\text{ mile}}} = 644,160 \text{ feet}$$

She swam 644,160 feet.

6. $-3(8 + 5) = -3(8) + (-3)(5) = -24 + (-15) = -39$

7. $(11 - 4)6 = 11(6) - 4(6) = 66 - 24 = 42$

8. $5(98) = 5(100 - 2) = 5(100) - 5(2) = 500 - 10 = 490$

9. $7(4.03) = 7(4 + 0.03)$
 $= 7(4) + 7(0.03)$
 $= 28 + 0.21$
 $= 28.21$

10. $2(x - 3) = 2(x) - 2(3) = 2x - 6$

11. $-5(y + 4) = -5(y) + (-5)(4)$
 $= -5y + (-20)$
 $= -5y - 20$

12. $4(9p + 7) = 4(9p) + 4(7) = 36p + 28$

13. $(6 - 2m)(-3) = 6(-3) - 2m(-3)$
 $= -18 - (-6m)$
 $= -18 + 6m$
 $= 6m - 18$

14. $A = \frac{1}{2}bh$
 $= \frac{1}{2}(8)(3x + 1)$
 $= 4(3x + 1)$
 $= 4(3x) + 4(1)$
 $= (12x + 4) \text{ square units}$

15. $12x + 5 + 3x$

Terms: $12x$, 5 , $3x$

Like terms: $12x$ and $3x$

Coefficients: 12 , 3

Constant term: 5

$$12x + 5 + 3x = 12x + 3x + 5$$

$$= (12 + 3)x + 5$$

$$= 15x + 5$$

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

Terms: 9 , a , -2 , $-7a$

Like terms: a and $-7a$; 9 and -2

Coefficients: 1 , -7

Constant terms: 9 , -2

$$9 + a + (-2) + (-7a) = 9 + (-2) + a + (-7a)$$

$$= 9 + (-2) + [1 + (-7)]a$$

$$= 7 + (-6a)$$

$$= -6a + 7$$

17. $-8c + 3 - c + 1 = -8c + 3 + (-c) + 1$

Terms: $-8c$, 3 , $-c$, 1

Like terms: $-8c$ and $-c$; 3 and 1

Coefficients: -8 , -1

Constant terms: 3 , 1

$$-8c + 3 + (-c) + 1 = -8c + (-c) + 3 + 1$$

$$= [-8 + (-1)]c + 3 + 1$$

$$= -9c + 4$$

18. $6n - 4n - 2n = 6n + (-4n) + (-2n)$

Terms: $6n$, $-4n$, $-2n$

Like terms: $6n$, $-4n$, and $-2n$

Coefficients: 6 , -4 , -2

Constant terms: None

$$6n + (-4n) + (-2n) = [6 + (-4) + (-2)]n = 0n = 0$$

19. $3(x + 7) + 2x = 3x + 21 + 2x$

$$= 3x + 2x + 21$$

$$= 5x + 21$$

20. $y - 2(y - 6) = y - 2y + 12 = -y + 12$

21. $4(r - 1) + 5r + 3 = 4r - 4 + 5r + 3$

$$= 4r + 5r - 4 + 3$$

$$= 9r - 1$$

22. $8s - 4(2s + 3) = 8s - 8s - 12 = 0 - 12 = -12$

Brain Game (p. 84)

E D N S O Z

DOZENS

Lesson 2.4

2.4 Checkpoint (pp. 85–86)

1. $3 + z = -10$

2. $\frac{m}{6} = 4$