

Solution Manual for Beginning Algebra 7th Edition by Martin Gay ISBN 0134208803 9780134208800

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Chapter 2

Section 2.1 Practice Exercises

1. a. The numerical coefficient of t is 1, since t is $1t$.

b. The numerical coefficient of $7x$ is 7.

c. The numerical coefficient of $\frac{w}{5}$ is $\frac{1}{5}$,

since $\frac{w}{5}$ means $\frac{1}{5}w$.

d. The numerical coefficient of $43x^4$ is 43.

e. The numerical coefficient of b is 1, since b is $1b$.

2. a. $4xy$ and $5yx$ are like terms, since $xy = yx$ by the commutative property.

b. $5q$ and $3q^2$ are unlike terms, since the exponents on q are not the same.

c. $3ab^2$, $2ab^2$, and $43ab^2$ are like terms, since each variable and its exponent match.

d. y^5 and $\frac{y}{2}$ are like terms, since the

4. a. $3y - 8y - 7 - 2(3 - 8)y - (7 - 2) - 11y - 5$

b. $6x - 3x + 3 - 6x - 1x - (3 - 3) - (6 - 1)x - (3 - 3) - 5x - 6$

c. $\frac{3}{4}t - t - \frac{3}{4}t - 1t - \frac{3}{4}t - 1$

d. $9y - 3.2y - 10 - 3(9 - 3.2)y - (10 - 3) - 12.2y - 13$

e. $5z - 3z^4$
exponents on y are the same.

3. a. $3y + 11y = (3 + 11)y = 8y$

These two terms cannot be combined because they are unlike terms.

$$\begin{aligned} & yz + 2 + 1(2x) \\ & yz + 2 \\ & 1(2x) + 1(y) + 1(z) + 1(2) \\ & 2x + yz + 2 \end{aligned}$$

5. a. $3(2x + 7) = 3(2x) + 3(7) = 6x + 21$

b. $5(x + 0.5z + 5)$
 $= 5(x) + (5)(0.5z) + (5)(5)$
 $= 5x + 2.5z + 25$

c. $(2x$

6. a. $4(9x + 1) + 6 = 36x + 4 + 6 = 36x + 10$

b. $7(2x + 1) + (6 + 3x) - 14x + 7 + 6 + 3x$
 $14x + 7 + 6 + 3x - 14x + 7 + 6 + 3x$



b. $4x^2 \cdot x^2 \cdot 4x^2 \cdot 1x^2 = (4 \cdot 1)x^2 \cdot 5x^2$

c. $5x \cdot 3x^2 \cdot 8x^2 \cdot 5x = (3 \cdot 8)x^2 \cdot 5x \cdot 5x^2$

d. $20y^2 \cdot 2y^2 \cdot y^2 = 20y^2 \cdot 2y^2 \cdot 1y^2$
 $(20 \cdot 2 \cdot 1)y^2$
 $21y^2$

c. $8 \cdot 5(6x + 5) = 8 \cdot 30x + 25 = 30x + 17$

7. "Subtract 7x + 1 from 2x + 3" translates to
 $(2x + 3) - (7x + 1) = 2x + 3 - 7x - 1 = 5x + 4$

8. a.

Three	added to	double a number
3 or 2x + 3	+	2x

b.

the sum of 5 and a number

subtract

six

$$(5 + x) - 6 = 5 + x - 6$$

c.

two

times

the sum of 3 and a number

increased by

4

d.

a number

added to

half the number

added to

5 times the number

$$x + \frac{1}{2}x + 5x = \frac{13}{2}x$$

Vocabulary, Readiness & Video Check 2.1

1. $23y^2 - 10y + 6$ is called an expression while $23y^2$, $10y$, and 6 are each called a term.
2. To simplify $x + 4x$, we combine like terms.
3. The term y has an understood numerical coefficient of 1.
4. The terms $7z$ and $7y$ are unlike terms and the terms $7z$ and z are like terms.
5. For the term $\frac{1}{2}xy^2$, the number $\frac{1}{2}$ is the numerical coefficient.
6. $5(3x - y)$ equals $15x - 5y$ by the distributive property.
7. Although these terms have exactly the same variables, the exponents on each are not exactly the same; the exponents on x differ in each term.
8. distributive property
9. 1
10. The sum of 5 times a number and 2, added to 7 times the number; $5x + (2) + 7x$; because there are like terms.

Exercise Set 2.1

2. The numerical coefficient of $3x$ is 3.

4. The numerical coefficient of y is 1, since $y = 1y$.

6. The numerical coefficient of $1.2xyz$ is 1.2.

8. $2x^2y$ and $6xy$ are unlike terms, since the exponents on x are not the same.

10. ab^2 and $7ab^2$ are like terms, since each variable and its exponent match.

12. $7.4p^3q^2$ and $6.2p^3q^2r$ are unlike terms, since the exponents on r are not the same.

14. $3x + 2x = (3 + 2)x = 5x$

16. $c - 7c + 2c = (1 - 7 + 2)c = 4c$

18. $6g - 5 - 3g + 7 - 6g + 3g + 5 - 7$
 $(6 - 3 - 6 + 3)g + 2 - 2$
 $3g + 0 = 3g$

20. $a - 3a + 2 - 7a + a - 3a + 7a - 2$
 $(1 - 3 + 2 - 7 + 1 - 3 + 7 - 2)a + 2 - 2$
 $3a + 0 = 3a$

22. $8p - 4 - 8p + 15 - (8p - 8p) - (4 - 15)$
 $(8 - 8 - 8 + 8)p + 11 - 11$
 $0p + 0 = 0$

24. $7.9y - 0.7y + 0.2 - 7.9y + y + 0.7 - 0.2$
 $(7.9 - 0.7 - 7.9 + 1)y + 0.5 - 0.5$
 $6.9y - 0.5 + 0.5 = 6.9y$

26. $8h - 13h + 6 - 7h + h - 8h + 13h - 7h + h - 6$
 $(8 - 13 + 6 - 7 + 1 - 8 + 13 - 7 + 1)h + 6 - 6$
 $27h + 0 = 27h$

28. $8x^3 - x^3 + 11x^3 - (8 - 1 + 11)x^3 - 2x^3$

30. $0.4y - 6.7 + y + 0.3 - 2.6y$
 $= 0.4y + y - 2.6y - 6.7 + 0.3$

36. $9(z + 7) - 15 = 9z + 63 - 15 = 9z + 48$

38. $2(4x - 3z) - 1 + 2(4x) - (2) - (3z) - (2) - (1)$
 $8x - 6z - 2 + 8x - 2 - 3z - 2 - 1$
 $16x - 9z - 7$

40. $(y + 5z) - 7 = y + 5z - 7$

42. $4(2x - 3) - 2(x - 1) - 8x + 12 - 2x + 2$
 $8x - 12 - 2x + 2 - 8x + 12 - 2x + 2$
 $-4x + 4$

44. $3y - 5$ added to $y - 16$
 $(3y - 5) + (y - 16) = 3y + y - 5 - 16$
 $4y - 21$

46. $12x - 7$ minus $4x - 7$
 $(12x - 7) - (4x - 7) = 12x - 4x - 7 + 7$
 $8x + 0 = 8x$

48. $2m - 6$ minus $m - 3$
 $(2m - 6) - (m - 3) = 2m - m - 6 + 3$
 $m - 3$

50. $7c - 8 - c = 7c - c - 8 = (7 - 1)c - 8 = 6c - 8$

52. $5y - 14 - 7y + 20y - 5 + 7y - 20y + 14$
 $(5 - 7 + 20 - 20)y - 14 + 14$
 $8y + 0 = 8y$

54. $3(2x - 5) - 6x - 3(2x) - (3) - (5) - 6x$
 $6x - 15 - 6x - 6x - 3 - 5 - 6x$
 $-12x - 19$

56. $2(6x - 1) - (x - 7) - 12x + 2x - 7$
 $12x - 2 - x + 7 - 12x + 2x - 7$
 $= (12 - 1 - 12 + 2)x - 2 + 7 - 7$
 $= 1.2x - 2$

32. $7(r - 3) = 7(r) - 7(3) = 7r - 21$

34. $4(y + 6) = 4(y) + (4)(6) = 4y + 24$

58. $8y - 2 - 3(y - 4) = 8y - 2 - 3y + 12 = 5y + 10$

60. $11c - (4 - 2c) = 11c - 4 + 2c = 13c - 4$

62. $(8 - 5y) - (4 - 3y) = 8 - 5y - 4 + 3y = 4 - 2y$

64. $2.8w - 0.9 - 0.5(2.8w - 2.8w) = 2.8w - 0.9 - 0.5(0) = 2.8w - 0.9$

$$66. \frac{1}{5}(9y-2) - \frac{1}{10}(2y-1) - \frac{9}{5}y - \frac{2}{5}y - \frac{1}{10}$$

$$\frac{9}{5}y - \frac{2}{5}y - \frac{2}{5}y - \frac{1}{10}$$

$$\frac{10}{5}y - \frac{4}{10}$$

$$2y - \frac{3}{10}$$

68. $8 + 4(3x - 4) = 8 + 12x - 16 = 8 + 12x$

70. $0.2(k - 8) - 0.1k - 0.2k - 1.6 - 0.1k - 0.1k - 1.6$

72. $14 - 11(5m + 3n) = 14 - 55m - 33n$

74. $7(2x - 5) - 4(x - 2) - 20x - 14x - 35 - 4x - 8 - 20x$
 $14x - 4x - 20x - 35 - 8$
 $10x - 27$

76. $\frac{1}{3}(9x - 6) - (x - 2) - 3x - 2 - x - 2$
 $2x$

78. The difference of a number and 2 divided by 5

$$\frac{(x - 2)}{5} = \frac{x - 2}{5}$$

80. 8 more than triple a number

82. Eleven increased by two-thirds of a number

$$11 + \frac{2}{3}x$$

84. 9 times a number subtract 3 times the number and 10

$$9x - (3x + 10) = 9x - 3x - 10 = 6x - 10$$

86. Six times the difference of a number and 5

$$6(x - 5) = 6x - 30$$

88. Half a number minus the product of the number and 8

$$\frac{1}{2}x - 8x = 7.5x$$

90. Twice a number added to 1 added to 5 times the number added to 12

$$2x + (1) + 5x + (12) = 7x + 13$$

92. $gh^2 - 0(4) - (4)^2 = 0 - 16 = -16$

94. $x^3 - x^2 - 4(3)^3 - (3)^2 - 4$
 $27 - 9 - 4 = 14$

96. $x^3 - x^2 - x(2)^3 - (2)^2 - (2)$
 $8 - 4 - 2 - 4 - 2 = 0$

98. $5(3x + 1) - (2x + 5) = 5(3x + 1) - 2x - 5$
 $15x + 5 - 2x - 5 = 13x$

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

100. 2 cylinders 0 3 cubes
 2 cubes 2 cubes 0 3 cubes

4 cubes 3 cubes: Not balanced

102. 1 cylinder 0 1 cone 1 cube
 2 cubes 0 1 cube 1 cube

2 cubes 2 cubes: Balanced

104. answers may vary

106. $5x - 10(3x) - 25(30x - 1) - 5x - 30x - 750x - 25$
 $785x - 25$

The total value is $(785x - 25)$ ¢.

108. no; answers may vary

110. $4m^4 p^2 m^4 p^2 5m^2 p^4 5m^4 p^2 5m^2 p^4$

112. $9y^2 (6xy^2 5y^2) 8xy^2$
 $9y^2 6xy^2 5y^2 8xy^2$
 $14y^2 14xy^2$

114. $(7c^3 d 8c) 5c 4c^3 d$
 $7c^3 d 8c 5c 4c^3 d$
 $11c^3 d 3c$

Section 2.2 Practice Exercises

1. $x 3 5$
 $x 3 3 5 3$
 $x 8$

Check: $x 3 5$
 $8 3 0 5$
 $5 5$
 The solution is 8.

2. $y 0.3 2.1$
 $y 0.3 0.3 2.1 0.3$
 $y 1.8$

Check: $y 0.3 2.1$
 $1.8 0.3 0 2.1$
 $2.1 2.1$
 The solution is 1.8.

3. $\frac{2}{5} x \frac{3}{10}$
 $\frac{2}{5} \frac{3}{10} x \frac{3}{10}$
 $\frac{2}{5} \frac{2}{5} \frac{3}{10} x$
 $\frac{4}{10} \frac{3}{10} x$
 $\frac{1}{10} x$

Check: $\frac{2}{5} x \frac{3}{10}$
 $\frac{2}{5} 0 \frac{1}{10} \frac{3}{10}$
 $\frac{2}{5} \frac{2}{5}$
 $5 5$

4. $4t 7 5t 3$
 $4t 7 4t 5t 3 4t$
 $7 t 3$
 $7 3 t 3 3$
 $10 t$

Check: $4t 7 5t 3$
 $4(10) 7 0 5(10) 3$
 $40 7 0 50 3$
 $47 47$

The solution is 10.

5. $8x 5x 3 9 x x 3 7$

$3x 6 2x 4$
 $3x 6 2x 2x 4 2x x 6 4$
 $x 6 6 4 6$
 $x 10$

Check:

$8x 5x 3 9 x x 3 7$
 $8(10) 5(10) 3 9 0 10 (10) 3 7$
 $80 50 3 9 0 10 (10) 3 7$

$24 24$

The solution is 10.

6. $4(2a 3) (7a 4) 2$

$4(2a) 4(3) 7a 4 2$
 $8a 12 7a 4 2$

The solution is $\frac{1}{2}$.

a
1
6
2

a
1
6
1
6
2
1
6

a
1
8

Check by replacing a with 18 in the original equation.

7. $12x + 20 = 12x + 20$

x
8

Check: $12x + 20$

1
2
(
8
)
0
2
0

20 20

The solution is 8.

8. a. The other number is $9 - 2 = 7$.

b. The other number is $9 - x$.

c. The other piece has length $(9 - x)$ feet.

9. The speed of the French TGV is $(s + 67.2)$ mph.

Vocabulary, Readiness & Video Check 2.2

- The difference between an equation and an expression is that an equation contains an equal sign, whereas an expression does not.
- Equivalent equations are equations that have the same solution.
- A value of the variable that makes the equation a true statement is called a solution of the equation.
- The process of finding the solution of an equation is called solving the equation for the variable.
- By the addition property of equality, $x = 2$ and $x + 10 = 2 + 10$ are equivalent equations.

6. The equations $x = \frac{1}{2}$ and $\frac{1}{2}x = \frac{1}{2}$ are equivalent

equations. The statement is true.

- The addition property of equality means that if we have an equation, we can add the same real number to both sides of the equation and have an equivalent equation.
- To confirm our solution, we replace the variable with the solution in the original equation to make sure we have a true statement.

9. $\frac{1}{7}x = 11$

Exercise Set 2.2

2. $x + 14 = 25$
 $x + 14 + 11 = 25 + 11$
 $x + 25 = 36$

Check: $x + 14 = 25$

$11 + 14 = 25$

6. $17x + 3 = 20x$
 $17x + 3 - 17x = 20x - 17x$
 $3 = 3x$

Check: $17x + 3 = 20x$

$17(0) + 3 = 20(0)$
 $17(0) + 3 = 0$

The solution is 0.

8. $t + 9.2 = 6.8$
 $5.9 + 9.2 = 6.8 + 9.2$
 $t + 15.1 = 16.0$

Check: $t + 9.2 = 6.8$

$5.9 + 9.2 = 15.1$

$6.8 + 9.2 = 16.0$

The solution is 5.9.

10. $\frac{3}{c} - 1 = 8$
 $\frac{3}{c} - 1 + 1 = 8 + 1$
 $\frac{3}{c} = 9$

$\frac{3}{24} = \frac{9}{24}$
 $\frac{3}{24} = \frac{9}{24}$

Check: $\frac{3}{c} - 1 = 8$

$\frac{3}{8} - 1 = 8$
 $\frac{3}{8} - \frac{8}{8} = 8$

$\frac{3}{8} - \frac{5}{8} = \frac{4}{8}$
 $\frac{3}{8} - \frac{5}{8} = -\frac{2}{8}$

$\frac{3}{8} - \frac{9}{8} = -\frac{6}{8}$

$\frac{3}{8} - \frac{24}{8} = -\frac{21}{8}$

$\frac{3}{8} - \frac{3}{8} = 0$

$\frac{3}{8} - \frac{8}{8} = -\frac{5}{8}$

The solution is $\frac{5}{24}$.

12. $9x + 5.5 = 10x$

$9x + 9x + 5.5 = 10x + 9x$

25 25
 The solution is 11.

4. $y - 9 = 1$
 $y - 9 + 9 = 1 + 9$
 $y = 10$

Check: $y - 9 = 1$
 $10 - 9 = 1$
 $1 = 1$
 The solution is 10.

5.5 x
 Check: $9x - 5.5 = 10x$
 $9(5.5) - 5.5 = 10(5.5)$
 $49.5 - 5.5 = 55$
 $44 = 55$
 The solution is 5.5.

14.
$$\begin{array}{r} 18x \ 9 \ 19x \\ 18x \ 18x \ 9 \ 19x \ 18x \\ \quad \quad \quad 9 \ x \\ \hline \text{Check: } 18x \ 9 \ 19x \\ 18(9) \ 9 \ 0 \ 19(9) \\ \\ 162 \ 9 \ 0 \quad 171 \\ \quad 171 \ 171 \\ \hline \end{array}$$

The solution is 9.

16.
$$\begin{array}{r} \quad \quad \quad \frac{9}{19} \ \frac{2}{19} \\ \quad \quad \quad \underline{9 \ 9 \ 2 \ 9} \\ \\ 19 \ 19 \quad 19 \ 19 \\ \quad \quad \quad \frac{11}{19} \\ \hline \text{Check: } z \ \frac{9}{19} \ \frac{2}{19} \\ \quad \quad 19 \quad 19 \\ \underline{11 \ 9} \ 0 \quad \underline{2} \\ \\ 19 \ 19 \quad 19 \\ \quad \quad \underline{2} \ \underline{2} \\ \\ 19 \quad 19 \\ \hline \end{array}$$

The solution is $\frac{11}{19}$.

18.
$$\begin{array}{r} 5n \ 7 \ 4n \\ 5n \ 4n \ 7 \ 4n \ 4n \ n \ 7 \\ \hline \text{Check: } 3n \ 2n \ 7 \ 4n \\ 3(7) \ 2(7) \ 0 \ 7 \ 4(7) \\ \\ 21 \ 14 \ 0 \ 7 \ 28 \\ \quad \quad \quad 35 \ 35 \\ \hline \end{array}$$

The solution is 7.

20.
$$\begin{array}{r} 13 \ y \ \frac{2}{y} \ y \ 3 \\ \\ 11 \quad 11 \\ \quad \underline{11} \ y \ 3 \\ \\ 11 \\ \quad \quad \quad y \ 3 \ \underline{13} \ \underline{2} \\ \hline \text{Check: } 11 \ y \ 11 \ y \ 3 \end{array}$$

22.
$$\begin{array}{r} 4x \ 4 \ 10x \ 7x \\ 4x \ 4 \ 3x \\ 4x \ 3x \ 4 \ 3x \ 3x \ x \ 4 \\ \quad \quad \quad 0 \\ \hline x \ 4 \ 4 \ 0 \ 4 \\ \\ x \ 4 \\ \hline \text{Check: } 4x \ 4 \ 10x \ 7x \\ 4(4) \ 4 \ 0 \ 10(4) \ 7(4) \\ \\ 16 \ 4 \ 0 \ 40 \ 28 \end{array}$$

The solution is 4.

24.
$$\begin{array}{r} 4(z \ 3) \ 2 \ 3z \\ 4z \ 12 \ 2 \ 3z \\ 4z \ 4z \ 12 \ 2 \ 3z \ 4z \\ \quad \quad \quad 12 \ 2 \ z \\ \\ 12 \ 2 \ 2 \ 2 \ z \\ \quad \quad 10 \ z \\ \hline \text{Check: } 4(z \ 3) \ 2 \ 3z \\ 4(10 \ 0 \ 3) \ 2 \ 3(10) \\ \\ 4(7) \ 0 \ 2 \ 30 \\ \\ 28 \ 28 \\ \hline \end{array}$$

The solution is 10.

26.
$$\begin{array}{r} \frac{1}{5} \ x \ 1 \ \frac{4}{5} \ x \ 13 \\ \\ \frac{1}{5} \ \frac{5}{x} \ 1 \ \frac{4}{5} \ x \ \frac{5}{x} \ 13 \ x \ 5 \\ \quad \quad \quad \frac{5}{5} \ x \ 1 \ 13 \\ \quad \quad \quad \underline{\frac{5}{5} \ x \ 1 \ 13} \\ \quad \quad \quad x \ 1 \ 1 \ 13 \ 1 \quad \quad - \\ \quad \quad \quad \quad \quad \quad x \ 12 \\ \hline \text{Check: } \frac{1}{5} \ x \ 1 \ \frac{4}{5} \ x \ 13 \\ \\ 5 \quad \quad 5 \\ \frac{1}{5} (12) \ 1 \ 0 \ \frac{4}{5} (12) \ 13 \\ \\ \underline{\frac{12}{5} \ 5} \ 0 \ \underline{\frac{48}{5} \ 65} \\ \\ 5 \quad 5 \quad 5 \\ \frac{13}{11} (3) \ \frac{2}{11} (3) \ 0 \ 3 \quad 11 \\ \\ \frac{39}{11} \ \frac{6}{11} \ 0 \ 3 \end{array}$$

$$\frac{1}{7} - \frac{1}{7}$$

$$3 - 3$$

The solution is 3.

$$\frac{5}{5} - \frac{5}{5}$$

The solution is 12.

28.
$$\frac{2x - 7}{x - 10} = \frac{x + 10}{x - 7}$$

$$x - 10 \cdot \frac{2x - 7}{x - 10} = x - 10 \cdot \frac{x + 10}{x - 7}$$

$$2x - 7 = \frac{x(x + 10)}{x - 7}$$

$$(2x - 7)(x - 7) = x(x + 10)$$

$$2x^2 - 17x + 49 = x^2 + 10x$$

$$x^2 - 27x + 49 = 0$$

$$x = 17$$

Check: $2x + 7 = x + 10$
 $2(17) + 7 = 0 + (17) + 10$

$$\begin{array}{r} 34 + 7 = 0 + 27 \\ 27 = 27 \end{array}$$

The solution is 17.

30. $4p + 11 = p + 2 + p + 20$

$$3p + 11 = 2p + 18$$

$$3p + 2p + 11 = 2p + 2p + 18$$

$$\begin{array}{r} p + 11 = 18 \\ p + 11 - 11 = 18 - 11 \\ p = 7 \end{array}$$

Check: $4p + 11 = p + 2 + p + 20$

$$\begin{array}{r} 4(7) + 11 = (7) + 0 + 2 + 2(7) + 20 \\ 28 + 11 = 7 + 0 + 2 + 14 + 20 \end{array}$$

$$32 = 32$$

The solution is 7.

32. $2(x + 1) = 3x$
 $2x + 2 = 3x$

$$\begin{array}{r} 2x + 2 - 2x = 3x - 2x \\ 2 = x \end{array}$$

Check: $2(x + 1) = 3x$

$$\begin{array}{r} 2(2 + 1) = 0 + 3(2) \\ 2(3) = 0 + 6 \\ 6 = 6 \end{array}$$

The solution is 2.

34. $5 \left(\frac{2}{5}x - \frac{1}{12} \right) = x + \frac{3}{5} - 4$

$$\frac{2}{5}x - \frac{1}{12} = x + \frac{3}{5} - 4$$

$$\begin{array}{r} 5 \left(\frac{2}{5}x - \frac{1}{12} \right) = 5 \left(x + \frac{3}{5} - 4 \right) \\ \frac{2}{5}x - \frac{1}{12} = x + \frac{3}{5} - 4 \end{array}$$

$$\begin{array}{r} 5 \left(\frac{2}{5}x - \frac{1}{12} \right) = 5 \left(x + \frac{3}{5} - 4 \right) \\ x - \frac{5}{12} = x + \frac{3}{5} - 4 \end{array}$$

$$\begin{array}{r} 12 \left(x - \frac{5}{12} \right) = 12 \left(x + \frac{3}{5} - 4 \right) \\ 12x - 5 = 12x + \frac{36}{5} - 48 \end{array}$$

Check: $\frac{2}{5}x - \frac{1}{12} = x + \frac{3}{5} - 4$
 $\frac{2}{5}(12) - \frac{1}{12} = 12 + \frac{3}{5} - 4$

$$\begin{array}{r} \frac{2}{5}(12) - \frac{1}{12} = 12 + \frac{3}{5} - 4 \\ \frac{24}{5} - \frac{1}{12} = 12 + \frac{3}{5} - 4 \\ \frac{288}{60} - \frac{5}{60} = 12 + \frac{3}{5} - 4 \\ \frac{283}{60} = 12 + \frac{3}{5} - 4 \end{array}$$

$$\frac{283}{60} = \frac{240}{60} + \frac{36}{60} - \frac{48}{60}$$

$$\frac{283}{60} = \frac{283}{60}$$

The solution is $\frac{2}{5}$.

36. $3(y + 7) = 2y + 5$
 $3y + 21 = 2y + 5$

$$\begin{array}{r} 3y + 2y + 21 = 2y + 2y + 5 \\ y + 21 = 5 \\ y + 21 - 21 = 5 - 21 \\ y = -16 \end{array}$$

Check: $3(y + 7) = 2y + 5$
 $3(-16 + 7) = 2(-16) + 5$
 $3(-9) = -32 + 5$
 $-27 = -27$

$$-27 = -27$$

The solution is -16.

38. $5(3z) = (8z + 9) + 4z$
 $15z = 8z + 9 + 4z$

$$\begin{array}{r} 6z = 9 + 4z \\ 6z - 4z = 9 + 4z - 4z \\ 2z = 9 \end{array}$$

$$z = \frac{9}{2}$$

Check: $5(3z) = (8z + 9) + 4z$
 $5\left(3 \left(\frac{9}{2}\right)\right) = \left(8\left(\frac{9}{2}\right) + 9\right) + 4\left(\frac{9}{2}\right)$

$$\begin{array}{r} 5(3(9/2)) = (8(9/2) + 9) + 4(9/2) \\ 5(27/2) = (36 + 9) + 18 \\ 135/2 = 45 + 18 \\ 135/2 = 63 \end{array}$$

$$135/2 = 63$$

Check: $5(x-1)4(2x-3)2(x-2)8$
 $5(13-1)4(2(13)-3)02(13-2)8$
 $5(14)4(26-3)02(15)8$
 $704(23)0308$
 7092022
 2222

The solution is 13.

42. $\frac{88z}{888z8}$
 $\frac{16z}{16z}$

44. $y^{\frac{43}{7}}$
 $\frac{7}{4} \frac{4}{7} \frac{3}{14} \frac{4}{7}$
 $y^{\frac{38}{14}}$
 $y^{\frac{5}{14}}$

46. $\frac{7y26y2}{7y6y26y6y2}$
 $\frac{y22}{y2222}$
 $y0$

48. $15x2010x925x821x7$
 $5x114x1$
 $5x114x4x14xx111$
 $x1111111$
 $x10$

50. $6(5c)5(c4)$
 $306c5c20$
 $306c5c5c5c20$
 $30c20$
 $3030c2030$
 $c50$

52. $m27.1$
 $m227.12$
 $m5.1$

54. $15(67k)26k$
 $1567k26k$
 $97k26k$
 $97k6k26k6k$
 $9k2$
 $99k29$
 $k7$

56. $\frac{1}{11y} \frac{10}{11}$
 $\frac{1}{11} \frac{10}{11} y$
 $\frac{10}{11} \frac{10}{11}$
 $\frac{9}{y}$

11

58. $1.47x3.62x8x4.4$
 $9x5.08x4.4$
 $9x9x5.08x9x4.4$
 $5.0x4.4$
 $5.04.4x4.44.4$
 $9.4x$

60. $\frac{1}{2x} \frac{3x}{7}$
 $2x^2 \frac{3x}{7}$
 $2x3x^2 \frac{3x}{7}$
 $x^2 = 0$
 $\frac{2}{7} \frac{2}{7} 0^2$
 $x^2 = 7$

62. $4(x-1)5(2-x)6$
 $4x4105x6$
 $x66$
 $x6666$
 $x0$

64. $0.6v0.4(0.3v)2.34$
 $0.6v0.120.4v2.34$
 $1v0.122.34$
 $v0.120.122.340.12$
 $v2.22$

66. The other number is 13 y.

68. The length of the other piece is $(5x)$ feet.

70. The complement of the angle x° is $(90 - x)$.
72. If the length of I-80 is m miles and the length of I-90 is 178.5 miles longer than I-80, the length of I-90 is $m + 178.5$.

74. The weight of the Hoba West meteorite is $3y$ kilograms.

76. The reciprocal of $\frac{7}{6}$ is $\frac{6}{7}$ since $\frac{7}{6} \cdot \frac{6}{7} = 1$.

78. The reciprocal of $5\frac{1}{5}$ is $\frac{5}{31}$ since $5\frac{1}{5} \cdot \frac{5}{31} = 1$.

80. The reciprocal of $\frac{3}{5}$ is $\frac{5}{3}$ since $\frac{3}{5} \cdot \frac{5}{3} = 1$.

82. $\frac{2y}{2} = y$

84. $7\frac{1}{7}r = r$

86. $\frac{9x}{2} = 4.5x$

88. $360(x + 3x + 5x) = 360(9x) = 360 \cdot 9x$
The fourth angle is $(360 - 9x)$.

90. answers may vary

92. answers may vary

94. $100 + 250 + 500 + x = 1000$
 $850 + x = 1000$

$850 + x = 1000$
 $x = 150$

The fluid needed by the patient is 150 ml.

96. answers may vary.

98. $a + 9 = 15$
 $a + 9 - 9 = 15 - 9$
 $a = 6$

The answer is 9.

102. Check $y = 1.2$: $8.13 + 5.85y = 20.05y + 8.91$
 $8.13 + 5.85(1.2) = 20.05(1.2) + 8.91$
 $8.13 + 7.02 = 24.06 + 8.91$
 $15.15 = 15.15$

Solution

104. Check $z = 4.8$:
 $7(z - 1.7) + 9.5 = 5(z - 3.2) + 9.2$
 $7(4.8 - 1.7) + 9.5 = 5(4.8 - 3.2) + 9.2$
 $7(3.1) + 9.5 = 5(8.0) + 9.2$

$21.7 + 9.5 = 40.0 + 9.2$
 $31.2 \neq 30.8$

Not a solution

Section 2.3 Practice Exercises

1. $\frac{4}{5}x = 16$

$\frac{5}{4} \cdot \frac{4}{5}x = \frac{5}{4} \cdot 16$

$\frac{5}{4}x = \frac{5}{4} \cdot 16$

$4 \cdot \frac{5}{4}x = 4 \cdot \frac{5}{4} \cdot 16$

$1x = 20$

$x = 20$

Check: $\frac{4}{5}x = 16$

$\frac{4}{5} \cdot 20 = 16$
 $16 = 16$

The solution is 20.

2. $8x = 96$

$\frac{8x}{8} = \frac{96}{8}$

$x = 12$

Check: $8x = 96$

$8(12) = 96$

$96 = 96$

The solution is 12.

3. $\frac{x}{5} = 13$
 $5 \cdot \frac{x}{5} = 5 \cdot 13$
 $x = 65$

100. answers may vary

Check: $\frac{x}{5} = 13$

$$\frac{65}{5} = 13$$

The solution is 65.

4. $2.7x = 4.05$

$$\frac{2.7x}{2.7} = \frac{4.05}{2.7}$$

$$x = 1.5$$

The solution is 1.5.

Check by replacing x with 1.5 in the original equation.

5. $\frac{5}{3}x = \frac{4}{3}$

$$\frac{5}{3}x = \frac{4}{3}$$

$$5x = 4$$

$$x = \frac{4}{5}$$

Check by replacing x with $\frac{4}{5}$ in the original

equation. The solution is $\frac{4}{5}$.

6. $y - 3 = 8$

$$y = 11$$

$$y = 11$$

To check, replace y with 11 in the original equation. The solution is 11.

7. $6b - 11b = 18 - 2b$

$$-5b = 18 - 2b$$

$$-3b = 18$$

$$b = -6$$

$$b = -6$$

$$b = -6$$

Check by replacing b with -6 in the original equation. The solution is -6.

8. $10x - 4 = 7x + 14$

$$10x - 4 = 7x + 14$$

$$3x - 4 = 14$$

$$3x = 18$$

$$x = 6$$

$$x = 6$$

$$x = 6$$

9. $4(3x - 2) = 14$

$$4(3x) - 4(2) = 14$$

$$12x - 8 = 14$$

$$12x = 22$$

$$x = \frac{11}{6}$$

$$12x = 22$$

$$x = \frac{11}{6}$$

To check, replace x with $\frac{11}{6}$ in the original

equation to see that a true statement results. The solution is $\frac{11}{6}$.

10. Let $x =$ first integer.

$x + 2 =$ second even integer.

$x + 4 =$ third even integer.

$$x + (x + 2) + (x + 4) = 3x + 6$$

Vocabulary, Readiness & Video Check 2.3

1. By the multiplication property of equality, $y = \frac{1}{2}$

and $5y = \frac{5}{2}$ are equivalent equations.

2. The equations $\frac{z}{4} = 10$ and $4z = 10$ are not

equivalent equations. The statement is false.

3. The equations $7x = 30$ and $\frac{7x}{7} = \frac{30}{7}$ are not

equivalent equations. The statement is false.

4. By the multiplication property of equality,

$9x = 63$ and $\frac{9x}{9} = \frac{63}{9}$ are equivalent

To check, replace x with 7 in the original equation to see that a true statement results. The solution is 7.

equations.

5. We can multiply both sides of an equation by the same nonzero number and have an equivalent equation.
6. addition property; multiplication property; answers may vary
7. $(x + 1) + (x + 3) = 2x + 4$

Exercise Set 2.3

2. $7x = 49$

$$\frac{7x}{7} = \frac{49}{7}$$

Check: $7x = 49$

$$7(7) = 49$$

$$49 = 49$$

The solution is 7.

4. $2x = 0$

$$\frac{2x}{2} = \frac{0}{2}$$

Check: $2x = 0$

$$2(0) = 0$$

The solution is 0.

6. $y = 8$

$$y = 8$$

Check: $y = 8$

$$(8) = 8$$

The solution is 8.

8. $\frac{3}{4}n = 15$

$$\frac{4}{4} \cdot \frac{3}{4}n = \frac{4}{4} \cdot 15$$

Check: $\frac{3}{4}n = 15$

$$\frac{3}{4}(20) = 15$$

The solution is 20.

10. $\frac{1}{4}v = 8$

Check: $\frac{1}{4}v = 8$

$$\frac{1}{4} \cdot 4v = \frac{1}{4} \cdot 32$$

The solution is 32.

12. $\frac{d}{15} = 2$

$$15 \cdot \frac{d}{15} = 15 \cdot 2$$

Check: $\frac{d}{15} = 2$

$$\frac{30}{15} = 2$$

The solution is 30.

14. $\frac{f}{5} = 0$

$$5 \cdot \frac{f}{5} = 5 \cdot 0$$

Check: $\frac{f}{5} = 0$

The solution is 0.

16. $\frac{19.55}{8.5} = \frac{8.5}{8.5}y$

Check: $\frac{19.55}{8.5} = \frac{8.5}{8.5}y$

$$\frac{4}{8} = \frac{4}{8}v$$

19.55 0 8.5(2.3)
19.55 19.55

T
h
e

2 v

solution is 2.3.

18. $3x - 1 = 26$
 $3x - 1 - 1 = 26 - 1$
 $3x = 27$

$\frac{3x}{3} = \frac{27}{3}$

$x = 9$

Check: $3x + 1 = 26$
 $3(9) + 1 = 26$
 $27 + 1 = 26$

The solution is 9.

20. $x + 4 = 24$
 $x + 4 - 4 = 24 - 4$

$x + 28$
 $x + 28$

Check: $x + 4 = 24$

$(28) + 4 = 24$
 $28 + 4 = 24$

The solution is 28.

22. $8t + 5 = 5$

$8t + 5 = 5$
 $8t + 5 - 5 = 5 - 5$

$8t = 0$

$8 = 8$
 $t = 0$

Check: $8t + 5 = 5$

$8(0) + 5 = 5$
 $0 + 5 = 5$
 $5 = 5$

The solution is 0.

24. $\frac{-b}{4} + 1 = 7$
 $\frac{b}{4} + 1 = 7$
 $\frac{b}{4} + 1 - 1 = 7 - 1$

$\frac{b}{4} = 6$

$4 \cdot \frac{b}{4} = 4 \cdot 6$

$b = 24$

Check: $\frac{b}{4} + 1 = 7$

$\frac{24}{4} + 1 = 7$

26. $4a + 1 = 3a + 12$
 $5a = 3a + 4$
 $5a - 3a = 3a - 3a + 4$

$2a = 4$

$\frac{2a}{2} = \frac{4}{2}$

$a = 2$

Check: $4a + 1 = 3a + 12$

$4(2) + 1 = 3(2) + 12$
 $8 + 1 = 6 + 12$

$10 = 10$

The solution is 2.

28. $19 - 0.4x = 0.9x - 6$
 $19 - 0.5x = 6$
 $19 - 6 - 0.5x = 6 - 6 - 0.5x$
 $13 - 0.5x = -0.5x$

$-25 = 0.5x$
 $0.5 = 0.5$

$50 = x$

Check: $19 - 0.4x = 0.9x - 6$
 $19 - 0.4(50) = 0.9(50) - 6$

$19 - 20 = 45 - 6$

$-1 = -1$

The solution is 50.

30. $\frac{3}{5}x + 14 = 8$
 $\frac{3}{5}x + 14 - 14 = 8 - 14$

$\frac{3}{5}x = -6$

$\frac{5}{3} \cdot \frac{3}{5}x = \frac{5}{3} \cdot -6$

$x = -10$

Check: $\frac{3}{5}x + 14 = 8$

$\frac{3}{5}(-10) + 14 = 8$
 $-6 + 14 = 8$

$8 = 8$

610 7

8 8

The solution is 10.

7 7

The solution is 24.

$$32. \begin{array}{r} \underline{2} \quad \underline{1} \quad \underline{1} \\ z \quad 5 \quad 2 \\ 7 \quad \underline{2} \quad \underline{1} \quad \underline{1} \quad \underline{1} \\ \quad 5 \quad 5 \quad 2 \quad 5 \end{array}$$

$$\underline{2} \quad \underline{7} \\ z \quad z$$

$$7 \quad 10$$

$$\begin{array}{r} \underline{7} \quad \underline{2} \quad \underline{7} \quad \underline{7} \\ 2 \quad 7 \quad z \quad 2 \quad 10 \\ \quad \quad \quad \quad \quad \underline{49} \\ \quad \quad \quad \quad \quad z \end{array}$$

Check:
$$\begin{array}{r} 20 \\ \underline{2} \quad \underline{1} \quad \underline{1} \\ z \quad 5 \quad 2 \\ 7 \quad 5 \quad 2 \end{array}$$

$$\underline{2} \quad \underline{49} \quad \underline{1} \quad \underline{0} \quad \underline{1}$$

$$7 \quad 20 \quad 5 \quad 2$$

$$\underline{7} \quad \underline{1} \quad \underline{0} \quad \underline{1}$$

$$\begin{array}{r} 10 \quad 5 \quad 2 \\ \underline{5} \quad \underline{0} \quad \underline{1} \end{array}$$

$$\begin{array}{r} 10 \quad 2 \\ \underline{1} \quad \underline{1} \\ 2 \quad 2 \end{array}$$

The solution is $\frac{49}{20}$.

$$34. \quad 11x \quad 13 \quad 9x \quad 9$$

$$\begin{array}{r} 11x \quad 13 \quad 9x \quad 9x \quad 9x \\ 2x \quad 13 \quad 9 \\ 2x \quad 13 \quad 13 \quad 9 \quad 13 \\ \quad 2x \quad 4 \\ \quad \underline{2x} \quad \underline{4} \\ \quad 2 \quad 2 \\ \quad \quad x \quad 2 \end{array}$$

$$36. \quad 2(4x - 1) - 12 = 6$$

$$\begin{array}{r} 8x \quad 2 \quad 6 \\ 8x \quad 2 \quad 2 \quad 6 \quad 2 \\ \quad 8x \quad 8 \\ \quad \underline{8x} \quad \underline{8} \\ \quad 8 \quad 8 \\ \quad \quad x \quad 1 \end{array}$$

$$38. \quad \begin{array}{r} 6x \quad 4 \quad 2x \quad 10 \\ 6x \quad 4 \quad 2x \quad 2x \quad 10 \quad 2x \end{array}$$

$$\begin{array}{r} 8x \quad 4 \quad 10 \\ 8x \quad 4 \quad 4 \quad 10 \quad 4 \end{array}$$

$$\begin{array}{r} 8x \quad 6 \\ \underline{8x} \quad \underline{6} \end{array}$$

$$40. \quad \begin{array}{r} 8 \quad 4 \quad 6(5x - 2) \\ \quad \quad 12 \quad 30x \quad 12 \\ 12 \quad 12 \quad 30x \quad 12 \quad 12 \\ \quad \quad \quad 0 \quad 30x \end{array}$$

$$\underline{0} \quad \underline{30x}$$

$$30 \quad 30$$

$$0 \quad x$$

$$42. \quad 17z - 4 = 16z + 20$$

$$\begin{array}{r} 17z - 4 = 17z - 16z + 20 + 17z \\ \quad \quad \quad 4 - z = 20 \\ 4 - 20 = z - 20 + 20 \\ \quad \quad \quad -16 = z \end{array}$$

$$44. \quad \frac{1}{3} = (3x - 1) \left(\frac{1}{10} - \frac{2}{10} \right)$$

$$x = \frac{1}{3} - \frac{3}{10}$$

$$x = \frac{1 + 3 - 1}{3} = \frac{3}{3} = 1$$

$$\begin{array}{r} x \quad \frac{1}{30} - \frac{2}{30} \\ x \quad \underline{\frac{1}{30}} \end{array}$$

$$46. \quad \begin{array}{r} 14y - 1.8 = 24y + 3.9 \\ 14y - 1.8 - 24y = 24y + 3.9 - 24y \\ -10y - 1.8 = 3.9 \\ -10y = 3.9 + 1.8 \\ -10y = 5.7 \\ \underline{\frac{10y}{-10}} \quad \underline{\frac{5.7}{-10}} \\ y = 0.57 \end{array}$$

$$48. \quad \begin{array}{r} 3x - 15 = 3x - 15 \\ 3x - 15 - 3x = 3x - 15 - 3x \\ -15 = 6x - 15 \\ 15 - 15 = 6x - 15 + 15 \\ 0 = 6x \\ \frac{0}{6} = \frac{6x}{6} \\ 0 = x \end{array}$$

$$50. \quad \begin{array}{r} 81 - 3x \\ 81 - 3x \end{array}$$

$$3 - 3 = 0$$

$$x \frac{3}{4}$$

$$27 x$$

52.
$$\begin{array}{r} 6.3 \ 0.6x \\ \underline{6.3 \ 0.6x} \end{array}$$

$$\begin{array}{r} 0.6 \ 0.6 \\ 10.5 \ x \end{array}$$

54.
$$\begin{array}{r} 10 \ y \ 15 \ 5 \\ 10 \ y \ 15 \ 5 \ 15 \\ \underline{10 \ y \ 20} \\ \underline{10 \ y \ 20} \end{array}$$

$$\begin{array}{r} 10 \ 10 \\ \ y \ 2 \end{array}$$

56.
$$\begin{array}{r} 2 \ 0.4 \ p \ 2 \\ 2 \ 2 \ 0.4 \ p \ 2 \ 2 \\ \underline{0.4 \ p \ 0} \\ \underline{0.4 \ p \ 0} \end{array}$$

$$\begin{array}{r} 0.4 \ 0.4 \\ \ p \ 0 \end{array}$$

58.
$$\begin{array}{r} 20x \ 20 \ 16x \ 40 \\ 20x \ 20 \ 16x \ 16x \ 40 \ 16x \\ \underline{4x \ 20 \ 40} \\ 4x \ 20 \ 20 \ 40 \ 20 \\ \underline{4x \ 20} \\ \underline{4x \ 20} \\ 4 \ 4 \end{array}$$

$$x \ 5$$

60.
$$\begin{array}{r} 7(2x \ 1) \ 18x \ 19x \\ 14x \ 7 \ x \\ 14x \ 7 \ 14x \ x \ 14x \\ \underline{7 \ 15x} \\ \underline{7 \ 15x} \end{array}$$

$$15 \ 15$$

$$\frac{7}{15} \ x$$

62.
$$\begin{array}{r} \frac{4}{r} \ 5 \\ \frac{5}{4} \ \frac{4}{5} \ \frac{5}{4} \ (5) \\ 4 \ 5 \ \frac{4}{r} \ \frac{5}{4} \\ \underline{r \ \frac{25}{4}} \end{array}$$

64.
$$\frac{10}{3} \ x \ 30$$

66.
$$3n \ \frac{18}{3} \ 3$$

$$\begin{array}{r} 3n \ \frac{18}{3} \ 3 \\ \underline{3 \ 3 \ 3 \ 3} \\ 3n \ \frac{9}{3} \\ \underline{3n \ 3} \\ \underline{3n \ 3} \\ 3 \ 3 \end{array}$$

$$n \ 1$$

68.
$$\begin{array}{r} 12 \ 3 \ j \ 4 \\ 12 \ 4 \ 3 \ j \ 4 \ 4 \\ \underline{16 \ 3 \ j} \\ \underline{16 \ 3 \ j} \\ 3 \ 3 \end{array}$$

$$16$$

$$\frac{j}{3}$$

70.
$$\begin{array}{r} 12x \ 30 \ 8x \ 6 \ 10 \\ 20x \ 24 \ 10 \\ 20x \ 24 \ 24 \ 10 \ 24 \\ \underline{20x \ 14} \\ \underline{20x \ 14} \\ 20 \ 20 \\ \underline{7} \end{array}$$

$$x \ 10$$

72.
$$\begin{array}{r} t \ 6t \ 13 \ t \ 3t \\ 5t \ 2t \ 13 \\ 5t \ 2t \ 2t \ 2t \ 13 \\ \underline{3t \ 13} \\ \underline{3t \ 13} \end{array}$$

$$3 \ 3$$

$$t \ \frac{13}{3}$$

$$\frac{3}{10} \frac{10}{3} x \frac{3}{10} (30)$$

$x = 9$

74.
$$\begin{array}{r} x^{\frac{3}{7}} x^{\frac{14}{7}} \\ \phantom{x^{\frac{3}{7}}} 3 \phantom{x^{\frac{14}{7}}} 7 \\ \hline x^{\frac{3}{7}} x^{\frac{19}{7}} \\ \phantom{x^{\frac{3}{7}}} 21 \\ \hline x^{\frac{3}{7}} x x^{\frac{19}{7}} x \\ \phantom{x^{\frac{3}{7}}} 7 21 \\ \hline 2x^{\frac{3}{7}} \frac{19}{7} \\ \hline 7 21 \\ \hline 2x^{\frac{3}{7}} \frac{3}{7} \frac{19}{7} \frac{3}{7} \\ \phantom{2x^{\frac{3}{7}}} 7 21 7 \\ \hline 2x^{\frac{10}{21}} \\ \hline \frac{1}{2} 2x^{\frac{1}{2}} \frac{10}{2} 21 \\ \phantom{\frac{1}{2}} x^{\frac{5}{21}} \end{array}$$

76.
$$\begin{array}{r} 19 74 5(x 3) \\ 55 5x 15 \\ 55 15 5x 15 15 \\ 70 5x \\ \hline 70 5x \end{array}$$

$$\begin{array}{r} 5 5 \\ \hline 14 \end{array}$$

78. Sum = first integer + second integer + third integer + fourth integer.

$$\begin{array}{r} \text{Sum } x (x 2) (x 4) (x 6) \\ \phantom{\text{Sum}} x 2 x 4 x 6 \end{array}$$

$$4x 12$$

80. Sum = 20 + second integer.

$$\begin{array}{r} \text{Sum } 20 (x 1) \\ \phantom{\text{Sum}} 20 x 1 \end{array}$$

$$x 21$$

82. Let x be an odd integer.

Then $x + 2$ is the next odd integer.

$$x + (x + 2) + x + (x + 2) = 4x + 4$$

84.
$$\begin{array}{r} 7 2 3(y 1) 7 2 3 3 31 \\ y 2 y 3y 3 \\ 8 y 3 \end{array}$$

86.
$$\begin{array}{r} 8(z 6) 7z 1 8 z 8 (6) 7 z 1 \\ z 48 7z 1 \\ 15z 49 \end{array}$$

90.
$$\begin{array}{r} (2)^4 (2)(2)(2)(2) 16 \\ 2^4 2 2 2 2 16 \\ (2)^4 2^4 \end{array}$$

92.
$$\begin{array}{r} (4)^3 (4)(4)(4) 64 \\ 4^3 4 4 4 64 \\ (4)^3 4^3 \end{array}$$

94.
$$\begin{array}{r} x 10 \\ \frac{1}{10} \\ 2 \\ \frac{1}{2} 10 2 \\ 2 20 \end{array}$$

96. answers may vary

98. answers may vary

100.
$$\begin{array}{r} 9x 13.5 \\ 9x 13.5 \end{array}$$

$$\begin{array}{r} 9 9 \\ x 1.5 \end{array}$$

Each dose should be 1.5 milliliters.

102.
$$4.95 31.185$$

$$\begin{array}{r} 4.95 31.185 \\ 4.95 4.95 \end{array}$$

$$y 6.3$$

104.
$$\begin{array}{r} 0.06 2.63 2.5562 \\ 0.06 2.63 2.63 2.5562 2.63 \\ y 0.0738 \end{array}$$

$$0.06 0.0738$$

$$\begin{array}{r} 0.06 0.06 \\ y 1.23 \end{array}$$

Section 2.4 Practice Exercises

1.
$$\begin{array}{r} 2(4a 9) 3 5a 6 \\ 8a 18 3 5a 6 \\ 8a 15 5a 6 \\ 8a 15 5a 5a 6 5a \\ 3a 15 6 \\ 3a 15 15 6 15 \\ 3a 9 \end{array}$$

88. $(x + 1)(x - 1)(x + 1)(x - 1)$

$$\frac{3a - 9}{3a}$$

Check: $2(4a - 9) - 3(5a - 6)$
 $2[4(3) - 9] - 3[0 - 5(3) - 6]$
 $2(12 - 9) - 3(0 - 15 - 6)$
 $2(3) - 3(0 - 9)$

$$\begin{array}{r} 6 - 3 - 0 - 9 \\ 9 - 1 \end{array}$$

The solution is 3 or the solution set is {3}.

2. $7(x - 3) - 6x$
 $7x - 21 - 6x$
 $7x - 21 - 7x + 6x - 7x$
 $21 - 13x$
 $\underline{21} \quad \underline{13x}$

$$13 \quad 13$$

$$\frac{21}{13}x$$

Check: $7(x - 3) - 6x$

$$7 \frac{21}{13} - 3(0) \quad 6 \frac{21}{13}$$

$$13 \quad 13$$

$$7 \frac{21}{13} - \frac{39}{13} - 0 \quad \frac{126}{13}$$

$$7 \frac{18}{13} - 0 \quad \frac{126}{13}$$

$$13 \quad 13$$

$$\underline{126} \quad \underline{126}$$

The solution is $\frac{21}{13}$.

3. $5 \frac{3}{5}x - 2 \frac{2}{3}x - 1$
 $15 \frac{3}{5}x - 2 \frac{2}{3}x - 1$
 $5 \frac{3}{5}x - 2 \frac{2}{3}x - 1$

$$1 \frac{5}{5}x - 15(2) - 15 \frac{2}{3}x - 15(1)$$

$$5 \quad 3$$

$$9x - 30 - 10x - 15$$

$$9x - 30 - 9x - 10x - 15 - 9x$$

$$30 - x - 15$$

$$30 - 15 - x - 15 - 15$$

$$15 - x$$

Check: $5 \frac{3}{5}x - 2 \frac{2}{3}x - 1$
 $5 \quad 3$

4. $4(y - 3) - 5y - 7$
 $3 \frac{4(y - 3)}{3} - 3(5y - 7)$

$$4(y - 3) - 3(5y - 7)$$

$$4y - 12 - 15y + 21$$

$$4y - 12 - 4y - 15y + 21 - 4y$$

$$12 - 11y + 21$$

$$12 - 21 - 11y + 21 - 21$$

$$33 - 11y$$

$$\underline{33} \quad \underline{11y}$$

$$11 \quad 11$$

$$3 - y$$

To check, replace y with 3 in the original equation. The solution is 3.

5. $0.35x - 0.09(x - 4) = 0.30(12)$

$$100[0.35x - 0.09(x - 4)] = 100[0.30(12)]$$

$$35x - 9(x - 4) = 3(12)$$

$$35x - 9x + 36 = 36$$

$$44x + 36 = 36$$

$$44x + 36 - 36 = 36 - 36$$

$$44x = 0$$

$$\underline{\quad} \quad \underline{\quad}$$

$$44x = 0$$

$$44 \quad 44$$

$$x = 0$$

To check, replace x with 0 in the original equation. The solution is 0.

6. $4(x - 4) - x + 2(x - 1) = x$
 $4x - 16 - x + 2x - 2 = x$

$$3x - 16 - 3x + 22 = x$$

$$3x - 16 - 3x + 22 = x$$

$$16 - 22$$

There is no solution.

7. $12x - 18 = 9(x - 2) - 3x$

$$12x - 18 = 9x - 18 - 3x$$

$$12x - 18 = 12x - 18$$

$$12x - 18 - 12x + 18 = 12x - 18 - 12x + 18$$

$$12x - 12x$$

$$12x - 12x = 12x - 12x$$

$$0 = 0$$

3

$$\frac{15}{5} = \frac{20}{9} = \frac{2}{3} = \frac{15}{10} = 1$$

The solution is 15.

The solution is all real numbers.

Calculator Explorations

1. Solution (24 = 24)
2. Solution (4 = 4)
3. Not a solution (19.4 < 10.4)

- 4. Not a solution (11.9 60.1)
- 5. Solution (17,061 = 17,061)
- 6. Solution (316 = 316)

Vocabulary, Readiness & Video Check 2.4

- 1. $x = 7$ is an equation.
- 2. $x + 7$ is an expression.
- 3. $4y + 6 + 9y + 1$ is an expression.
- 4. $4y + 6 = 9y + 1$ is an equation.
- 5. $\frac{1}{x} + 1$ is an expression.

$$x + 8$$

- 6. $\frac{1}{x} + 1 = 6$ is an equation.

$$x + 8$$

- 7. $0.1x + 9 = 0.2x$ is an equation.
- 8. $0.1x^2 + 9y + 0.2x^2$ is an expression.
- 9. 3; distributive property, addition property of equality, multiplication property of equality
- 10. Because both sides have more than one term, you need to apply the distributive property to make sure you multiply every single term in the equation by the LCD.
- 11. The number of decimal places in each number helps you determine what power of 10 you can multiply through by so you are no longer dealing with decimals.
- 12. When solving a linear equation and all variable terms, subtract out:
 - a. If you have a true statement, then the equation has all real numbers as a solution.
 - b. If you have a false statement, then the equation has no solution.

Exercise Set 2.4

2.
$$\begin{array}{r} 3x + 1 - 2(4x + 2) \\ 3x + 1 - 8x - 4 \\ 3x + 1 - 8x - 4 - 1 \\ 3x - 8x - 5 \\ 3x - 8x - 5 - 8x \\ 5x - 5 \\ \underline{5x} \quad \underline{5} \\ 5 \quad 5 \\ x + 1 \end{array}$$

4.
$$\begin{array}{r} 15x + 5 + 7 + 12x \\ 15x + 5 + 7 + 12x + 5 \\ 15x + 12 + 12x \\ 15x + 12x + 12 + 12x + 12x \end{array}$$

$$3x + 12$$

$$\frac{3x + 12}{3} = 3$$

6.
$$\begin{array}{r} x + 4 \\ (5x + 10) + 5x \\ 5x + 10 + 5x \\ 5x + 10 + 5x + 5x + 5x \\ 10 + 10x \\ 10 + 10x \\ \frac{10}{10} + \frac{10x}{10} \\ 1 + x \end{array}$$

8.
$$\begin{array}{r} 3(2 + 5x) + 4(6 + x) + 12 \\ 6 + 15x + 24 + 4x + 12 \\ 6 + 9x + 12 + 6 \\ 9x + 6 \\ 9x + 6 \\ \underline{9} \quad \underline{6} \\ 9 \quad 2 \end{array}$$

$$x + 3$$

10.
$$\begin{array}{r} 4(n + 4) + 23 + 7 \\ 4n + 16 + 23 + 7 \\ 4n + 7 + 7 \\ 4n + 7 + 7 + 7 \\ 4n + 0 \\ \underline{4n} \quad \underline{0} \\ 4 \quad 4 \\ n + 0 \end{array}$$

$$\begin{array}{r}
 12. \quad 5 \ 6 \ (2 \ b) \ b \ 14 \\
 \quad \quad 5 \ 12 \ 6 \ b \ b \ 14 \\
 \quad \quad \quad 7 \ 6 \ b \ b \ 14 \\
 \\
 \quad \quad 7 \ 6 \ b \ b \ b \ b \ 14 \\
 \quad \quad \quad 7 \ 7 \ b \ 14 \\
 \quad \quad \quad 7 \ 7 \ 7 \ b \ 14 \ 7 \\
 \quad \quad \quad \quad 7 \ b \ 7 \\
 \quad \quad \quad \quad \underline{7 \ b \ 7}
 \end{array}$$

$$\begin{array}{r}
 7 \quad 7 \\
 \quad b \ 1
 \end{array}$$

$$\begin{array}{r}
 14. \quad 6 \ y \ 8 \ 6 \ 3 \ y \ 13 \\
 \quad \quad 6 \ y \ 8 \ 3 \ y \ 7 \\
 \quad \quad 6 \ y \ 3 \ y \ 8 \ 3 \ y \ 3 \ y \ 7 \\
 \quad \quad \quad 3 \ y \ 8 \ 7 \\
 \quad \quad \quad 3 \ y \ 8 \ 8 \ 7 \ 8 \\
 \quad \quad \quad \quad 3 \ y \ 15 \\
 \quad \quad \quad \quad \underline{3 \ y \ 15} \\
 \quad \quad \quad \quad \quad 3 \quad 3 \\
 \quad \quad \quad \quad \quad \quad y \ 5
 \end{array}$$

$$\begin{array}{r}
 16. \quad 7n \ 5 \ 8n \ 10 \\
 \quad \quad 7n \ 5 \ 5 \ 8n \ 10 \ 5 \\
 \quad \quad \quad 7n \ 8n \ 15
 \end{array}$$

$$7n \ 8n \ 8n \ 15 \ 8n$$

$$\begin{array}{r}
 15n \ 15 \\
 \underline{15n \ 15}
 \end{array}$$

$$\begin{array}{r}
 15 \quad 15 \\
 \quad n \ 1
 \end{array}$$

$$\begin{array}{r}
 18. \quad \underline{4} \ x \ \underline{8} \ \underline{16} \\
 \\
 \quad \quad 5 \quad 5 \quad 5 \\
 \quad \quad 5 \ \underline{4} \ x \ \underline{8} \ 5 \ \underline{16} \\
 \\
 \quad \quad 5 \quad 5 \quad 5 \\
 \quad \quad \quad 4x \ 8 \ 16 \\
 \quad \quad \quad 4x \ 8 \ 8 \ 16 \ 8 \\
 \quad \quad \quad \quad 4x \ 8 \\
 \quad \quad \quad \quad \underline{4x \ 8} \\
 \quad \quad \quad \quad \quad 4 \quad 4 \\
 \quad \quad \quad \quad \quad \quad x \ 2
 \end{array}$$

$$20. \quad \begin{array}{r} 2 \ 1 \\ 9 \ x \ 3 \ 1 \end{array}$$

$$\begin{array}{r}
 9 \ 2 \ x \ \frac{1}{3} \ 9(1) \\
 9 \quad \quad 2x \ 3 \ 9 \\
 2x \ 3 \ 3 \ 9 \ 3 \\
 \quad \quad 2x \ 12 \\
 \quad \quad \underline{2x \ 12}
 \end{array}$$

$$\begin{array}{r}
 2 \quad 2 \\
 \quad x \ 6
 \end{array}$$

$$\begin{array}{r}
 22. \quad 0.40x \ 0.06(30) \ 9.8 \\
 100[0.40x \ 0.06(30)] \ 100(9.8) \\
 \quad \quad 40x \ 6(30) \ 980 \\
 \quad \quad \quad 40x \ 180 \ 980 \\
 \quad \quad \quad 40x \ 180 \ 180 \ 980 \ 180 \\
 \quad \quad \quad \quad 40x \ 800 \\
 \quad \quad \quad \quad \underline{40x \ 800} \\
 \quad \quad \quad \quad \quad 40 \quad 40 \\
 \quad \quad \quad \quad \quad \quad x \ 20
 \end{array}$$

$$24. \quad \frac{3(y \ 3)}{5} \ 2 \ y \ 6$$

$$\underline{3(y \ 3)}$$

$$5 \quad 5 \quad 5[2 \ y \ 6]$$

$$\begin{array}{r}
 3(y \ 3) \ 10 \ y \ 30 \\
 3y \ 9 \ 10 \ y \ 30
 \end{array}$$

$$3y \ 10 \ y \ 9 \ 10 \ y \ 10 \ y \ 30$$

$$\begin{array}{r}
 7 \ y \ 9 \ 30 \\
 7 \ y \ 9 \ 9 \ 30 \ 9 \\
 7 \ y \ 21
 \end{array}$$

$$\begin{array}{r}
 7y \ 21 \\
 7 \quad 7
 \end{array}$$

$$y \ 3$$

$$\begin{array}{r}
 26. \quad \frac{5}{2} \ x \ 1 \ x \ \frac{1}{4} \\
 \\
 \quad \quad \underline{5} \quad \quad \quad \underline{1} \\
 \quad \quad 2 \ 4 \ x \ 1 \ 4 \ x \ 4 \\
 \\
 \quad \quad 10x \ 4 \ 4x \ 1 \\
 \quad \quad 10x \ 4x \ 4 \ 4x \ 4x \ 1 \\
 \quad \quad \quad 6x \ 4 \ 1 \\
 \quad \quad \quad 6x \ 4 \ 4 \ 1 \ 4 \\
 \quad \quad \quad \quad 6x \ 5
 \end{array}$$

6

x

5
6

6
 x

5
6

28. $0.60(z - 300) - 0.05z = 0.70z - 205$
 $100[0.60(z - 300) - 0.05z] = 100[0.70z - 205]$
 $60(z - 300) - 5z = 70z - 20,500$
 $60z - 18,000 - 5z = 70z - 20,500$
 $65z - 18,000 = 70z - 20,500$
 $65z - 70z = -20,500 + 18,000$
 $-5z = -2,500$

$5z = 2500$

$z = \frac{2500}{5}$

$z = 500$

30. $14x - 7 = 7(2x - 1)$
 $14x - 7 = 14x - 7$
 $14x - 7 = 14x - 7$
 $7 = 7$

All real numbers are solutions.

32. $\frac{x}{3} - \frac{x}{3} = 3$
 $3 - 2 = 3$
 $3 = 3$
 $\frac{x - 6}{x - 6} = 3$
 $1 = 3$

$6 = 0$

There is no solution.

34. $2(x - 5) = 2x - 10$

$2x - 10 = 2x - 10$
 $2x - 10 = 2x - 10$
 $10 = 10$

There is no solution.

36. $5(4 - y) - 2 = 20 - y - 17$
 $20 - 5y - 2 = 20 - y - 17$

$20 - y - 17 = 20 - y - 17$

$20 - y - 17 = 20 - y - 17$
 $3 = 3$

All real numbers are solutions.

38. $\frac{4(5 - w)}{3} = w$
 $3 \cdot \frac{4(5 - w)}{3} = 3 \cdot w$

40. $(4a - 7) - 5a = 10a - 4a$
 $4a - 7 - 5a = 10a - 4a$
 $-a - 7 = 6a$
 $-a - 6a = 7$
 $-7a = 7$
 $7a = -7$
 $a = -1$

$10 = 10$

$a = -1$

10

42. $9x - 3(x - 4) = 10(x - 5) - 7$
 $9x - 3x + 12 = 10x - 50 - 7$
 $6x + 12 = 10x - 57$
 $12x - 12 = 10x - 57$
 $12x - 10x = -57 + 12$
 $2x = -45$
 $x = -22.5$

$\frac{2x}{2} = \frac{31}{2}$

$\frac{31}{2}$

x

2

44. $\frac{5(x - 1)}{4} = \frac{3(x - 1)}{2}$
 $4 \cdot \frac{5(x - 1)}{4} = 4 \cdot \frac{3(x - 1)}{2}$
 $5(x - 1) = 6(x - 1)$

$5(x - 1) = 6(x - 1)$

$5x - 5 = 6x - 6$

$5x - 6x = -6 + 5$

$-x = -1$

$x = 1$

$x = 1$

$x = 1$

$1 = 1$

$x = 1$

46. $0.9x - 4.1 = 0.4$
 $10(0.9x - 4.1) = 10(0.4)$
 $9x - 41 = 4$
 $9x - 41 = 4$
 $9x = 45$
 $\frac{9x}{9} = \frac{45}{9}$

$$\begin{aligned} &4(5w - 3w) \\ &20 - 4w - 3w \\ &20 - 4w - 4w - 3w - 4w \\ &20 - w \end{aligned}$$

$$\begin{aligned} &9 - 9 \\ &x - 5 \end{aligned}$$

$$48. \frac{3(2x-1) + 5(6x-2)}{6x-3} = \frac{5(6x-2)}{6x-2}$$

$$\frac{6x-2 + 30x-10}{6x-3} = \frac{30x-10}{6x-2}$$

$$\frac{36x-12}{6x-3} = \frac{30x-10}{6x-2}$$

$$\frac{12x-4}{2x-1} = \frac{15x-5}{3x-1}$$

All real numbers are solutions.

$$50. \frac{4(4y-2) + 2(16y-8)}{16y-8} = \frac{2(16y-8)}{12y-8}$$

$$\frac{16y-8 + 32y-16}{16y-8} = \frac{32y-16}{12y-8}$$

$$\frac{48y-24}{16y-8} = \frac{32y-16}{12y-8}$$

$$\frac{12y-6}{4y-2} = \frac{8y-4}{3y-2}$$

$$\frac{4y-2}{4y-2} = \frac{4y-2}{3y-2}$$

$$\frac{4y-2}{4y-2} = \frac{4y-2}{3y-2}$$

$$\frac{4}{4} = \frac{4}{3}$$

$$y = \frac{1}{2}$$

$$52. \frac{\frac{7}{8}x + \frac{1}{4}x}{8} = \frac{\frac{3}{4}x}{8}$$

$$\frac{7x + 2x}{32} = \frac{3x}{32}$$

$$\frac{9x}{32} = \frac{3x}{32}$$

$$\frac{9x}{1} = \frac{3x}{1}$$

$$9x = 3x$$

$$54. \frac{\frac{x}{5} - 7}{15} = \frac{\frac{x}{3} - 5}{75}$$

$$\frac{x - 35}{75} = \frac{x - 15}{15}$$

$$\frac{x - 35}{3x - 105} = \frac{x - 15}{3x - 15}$$

$$\frac{105 - 35x}{3x - 105} = \frac{15x - 45}{3x - 15}$$

$$\frac{30 - 2x}{30 - 2x} = \frac{5x - 15}{5x - 15}$$

$$\frac{30 - 2x}{2} = \frac{5x - 15}{2}$$

$$15 - x = \frac{5x - 15}{2}$$

$$56. 4(2-x) + 1 = 7x + 3(x-2)$$

$$58. \frac{0.01(5x-4) + 0.04 + 0.01(x-4)}{100[0.01(5x-4)]} = \frac{0.04 + 0.01(x-4)}{100[0.04 + 0.01(x-4)]}$$

$$\frac{(5x-4) + 4 + (x-4)}{5x-4} = \frac{4 + (x-4)}{4 + (x-4)}$$

$$\frac{5x-4 + 4 + x - 4}{5x-4} = \frac{4 + x - 4}{4 + x - 4}$$

$$\frac{6x-4}{5x-4} = \frac{x}{x}$$

$$\frac{6x-4}{5x-4} = 1$$

$$60. \frac{3x + 5x - 8}{2} = 2 + \frac{1}{2}x + 2(5x - 8)$$

$$\frac{6x - 8}{2} = 2 + \frac{1}{2}x + 10x - 16$$

$$3x - 4 = 2 + \frac{1}{2}x + 10x - 16$$

$$3x - 4 = 10\frac{1}{2}x - 14$$

$$3x - 4 = 22\frac{1}{2}x - 14$$

$$3x - 22\frac{1}{2}x = -14 + 4$$

$$-20\frac{1}{2}x = -10$$

$$x = \frac{10}{20\frac{1}{2}} = \frac{10}{41}$$

$$62. \frac{7n - 5 + 10n - 10}{7n - 5 + 10n - 10} = \frac{7n - 10n + 15}{7n - 10n + 15}$$

$$\frac{17n - 15}{17n - 15} = \frac{7n - 10n + 15}{7n - 10n + 15}$$

$$\frac{3n - 15}{3n - 15} = \frac{7n - 10n + 15}{7n - 10n + 15}$$

$$\frac{3}{3} = \frac{7n - 10n + 15}{7n - 10n + 15}$$

$$1 = \frac{7n - 10n + 15}{7n - 10n + 15}$$

$$64. \frac{0.2x + 0.1}{10(0.2x + 0.1)} = \frac{0.6x + 2.1}{10(0.6x + 2.1)}$$

$$\frac{2x + 1}{2x + 1} = \frac{6x + 21}{6x + 21}$$

$$\frac{2x + 1}{4x + 1} = \frac{6x + 21}{4x + 1}$$

$$\frac{4x + 1}{4x + 1} = \frac{6x + 21}{4x + 1}$$

$$\frac{4x + 1}{4x + 1} = \frac{6x + 21}{4x + 1}$$

$$84x + 1 = 7x + 3x - 6$$

$$\begin{aligned} &9 - 4x < 4x - 6 \\ &9 - 4x < 4x - 4x - 6 \\ &9 < -6 \end{aligned}$$

There is no solution.

$$\begin{aligned} &4 < 4 \\ &x < 5 \end{aligned}$$

66. $0.03(2m - 7) + 0.06(5m) + 0.09$
 $100[0.03(2m - 7)] + 100[0.06(5m) + 0.09]$
 $3(2m - 7) + 6(5m) + 9$
 $6m - 21 + 30 + 6m + 9$

$6m - 21 + 21 + 6m$
 $6m + 6m - 21 + 21 + 6m + 6m$
 $21 + 21$

All real numbers are solutions.

68. 3 times a number

$3x$
 twice

70. 8 minus a number

$8 - 2x$
 the difference

72. the quotient

and of a number
 of 12 and 3

$12 \div (x - 3) = \frac{12}{x - 3}$

74. $x + (7x - 9) = x + 7x - 9 = 8x - 9$
 The total length is $(8x - 9)$ feet.

76. a. $x - 3 = 5$
 $x - 3 + 3 = 5 + 3$
 $x = 8$
 There is no solution.

b. answers may vary

c. answers may vary

78. $3x - 1 = 3x - 2$
 $3x - 1 - 3x = 3x - 2 - 3x$

$-1 = -2$
 There is no solution. The answer is B.

80. $x - 11x + 3 = 10x - 12$
 $10x - 3 = 10x - 3$
 $10x - 3 - 10x = 10x - 3 - 10x$
 $-3 = -3$

All real numbers are solutions. The answer is A.

82. $x - 15 = x - 15$
 $x - 15 + 15 = x - 15 + 15$
 $0 = 0$
 $15 - 15 = 15 - 15$

$0 = 2x$
 $\frac{0}{2} = \frac{2x}{2}$
 $0 = x$

The answer is C.

84. answers may vary

86. a. Since the perimeter is the sum of the lengths of the sides, $x + (2x + 1) + (3x - 2) = 35$.

b. $x - 2 = 1 - 3x - 2 = 35$

$6x - 1 = 35$

$6x - 1 + 1 = 35 + 1$
 $6x = 36$

$\frac{6x}{6} = \frac{36}{6}$

$x = 6$

c. $2x + 1 = 2(6) + 1 = 13$
 $3x - 2 = 3(6) - 2 = 16$
 The lengths are $x = 6$ meters,
 $2x + 1 = 13$ meters and $3x - 2 = 16$ meters.

88. answers may vary

90. $1000(x - 40) = 100(167x)$
 $1000x - 40,000 = 16,700x$
 $1000x - 40,000 - 16,700x = 16,700x - 16,700x$
 $-15,700x - 40,000 = 0$
 $-15,700x - 40,000 + 40,000 = 0 + 40,000$
 $-15,700x = 40,000$
 $\frac{-15,700x}{-15,700} = \frac{40,000}{-15,700}$
 $x = -2,547.77$

92. $0.127x - 2.685 = 0.027x - 2.38$
 $1000(0.127x - 2.685) = 1000(0.027x - 2.38)$
 $127x - 2685 = 27x - 2380$
 $127x - 27x - 2685 = 27x - 2380 - 27x$
 $100x - 2685 = -2380$
 $100x - 2685 + 2685 = -2380 + 2685$
 $100x = 305$
 $\frac{100x}{100} = \frac{305}{100}$
 $x = 3.05$

1
0
0

1
0
0

x

3

.

0

5

$$\begin{array}{r}
 6x \quad 77 \quad 257 \\
 6x \quad 18 \\
 \underline{6x} \quad \underline{18} \\
 6 \quad 6 \\
 x \quad 3
 \end{array}$$

$$\begin{array}{r}
 x^2 \\
 12. \quad 5 \quad 6y \quad 6 \quad 19 \\
 \quad \quad 6y \quad 1 \quad 19 \\
 \quad \quad 6 \quad y \quad 1 \quad 1 \quad 19 \quad 1 \\
 \quad \quad \quad 6y \quad 18 \\
 \quad \quad \quad \underline{6y} \quad \underline{18} \\
 \quad \quad \quad 6 \quad 6 \\
 \quad \quad \quad \quad y \quad 3
 \end{array}$$

13.
$$\frac{2x-7}{2x-7} = \frac{2x-27}{2x-27}$$

$$\frac{7-27}{7-27}$$

 There is no solution.

14.
$$\frac{3-8y}{3-8y} = \frac{8y-2}{8y-2}$$

$$\frac{8y-2}{8y-2}$$

 There is no solution.

15.
$$\frac{3a-6}{2a-6} = \frac{5a-7}{2a-6}$$

$$\frac{2a-6}{2a-6} = \frac{5a-7}{2a-6}$$

$$\frac{6-3a}{6-3a}$$

$$\frac{3-3}{2a}$$

16.
$$\frac{4b-8}{3b-8} = \frac{b-10b}{3b-8}$$

$$\frac{3b-8}{3b-8} = \frac{8-4b}{3b-8}$$

$$\frac{8-4b}{8-4b}$$

$$\frac{4-4}{2b}$$

17.
$$\frac{2}{3}x = \frac{5}{9}$$

$$\frac{3}{2} \cdot \frac{2}{3}x = \frac{3}{2} \cdot \frac{5}{9}$$

$$\frac{2}{3} \cdot 3 = \frac{2}{3} \cdot 3 \cdot \frac{5}{9}$$

$$x = \frac{5}{6}$$

18.
$$\frac{3}{8}y = \frac{1}{16}$$

$$\frac{8}{3} \cdot \frac{3}{8}y = \frac{8}{3} \cdot \frac{1}{16}$$

$$\frac{3}{8} \cdot 8 = \frac{3}{8} \cdot 8 \cdot \frac{1}{16}$$

$$y = \frac{1}{6}$$

19.
$$\frac{10-6n}{10-6n} = \frac{16}{16}$$

$$\frac{6-6n}{6-6n}$$

$$\frac{6-6n}{6-6n}$$

$$\frac{6-6}{1n}$$

20.
$$\frac{5-2m}{5-2m} = \frac{7}{7}$$

$$\frac{12-2m}{12-2m}$$

$$\frac{2-2}{6m}$$

21.
$$\frac{3(5c-1)}{15c-3} = \frac{2-13c}{3-13c}$$

$$\frac{15c-5}{15c-3} = \frac{5-13c}{3-13c}$$

$$\frac{2c-5}{2c-5} = \frac{3-13c}{3-13c}$$

$$\frac{2c-8}{2c-8}$$

$$\frac{2-2}{c-4}$$

22.
$$\frac{(3t-4)}{12t-16} = \frac{20-3t}{20-3t}$$

$$\frac{12t-4}{12t-16} = \frac{4-3t}{4-3t}$$

$$\frac{7t-4}{7t-4} = \frac{3-5t}{3-5t}$$

$$\frac{7t-7}{7t-7}$$

$$\frac{7t-7}{7t-7}$$

$$t=1$$

23.
$$\frac{2(z-3)}{3} = \frac{5z}{2(z-3)}$$

$$3 \cdot \frac{2(z-3)}{3} = 3 \cdot \frac{5z}{2(z-3)}$$

$$\frac{2z-6}{2z-6} = \frac{15z}{2z-6}$$

$$\frac{5z-6}{5z-6} = \frac{15z}{5z-6}$$

$$\frac{5z-9}{5z-9}$$

$$\frac{5z}{z} = \frac{9}{5}$$

$$24. \frac{3(w-2)}{4} \geq 2w-3$$

$$4 \frac{3(w-2)}{4} \geq 4(2w-3)$$

$$3w-6 \geq 8w-12$$

$$3w-8w \geq -6+8w-12$$

$$-5w \geq 6-12$$

$$-5w \geq -6$$

$$\underline{5w \leq 6}$$

$$w \leq \frac{6}{5}$$

$$25. \frac{2(2x-5)}{4x-10} \leq \frac{3x-7}{4x-10}$$

$$4x-10 \leq 4x-10$$

$$10 \leq 10$$

All real numbers are solutions.

$$26. 4(5x-2) \geq 12x-4$$

$$20x-8 \geq 12x-4$$

$$20x-12x \geq -4+8$$

$$8x \geq 4$$

All real numbers are solutions.

$$27. \frac{0.02(6t-3)}{100[0.02(6t-3)]} \leq \frac{0.04(t-2)}{100[0.04(t-2) \cdot 0.02]}$$

$$\frac{2(6t-3)}{12t-6} \leq \frac{4(t-2)}{12t-6}$$

$$12t-6 \leq 4t-6$$

$$12t-4t \leq -6+4t-6$$

$$8t \leq -12$$

$$8t \leq -12$$

$$\underline{8t \leq -12}$$

$$\frac{8}{8} \leq \frac{-12}{8}$$

$$t \leq -1.5$$

$$28. \frac{0.03(m-7)}{100[0.03(m-7)]} \leq \frac{0.02(5m)}{100[0.02(5m) \cdot 0.03]}$$

$$\frac{3(m-7)}{3m-21} \leq \frac{2(5m)}{3m-21}$$

$$3m-21 \leq 10m-21$$

$$3m-10m \leq -21+10m-21$$

$$-7m \leq 8m-42$$

$$-7m-8m \leq -42$$

$$-15m \leq -42$$

$$\underline{5m \geq 14}$$

$$m \geq \frac{14}{5} = 2.8$$

$$29. 3y \leq \frac{4(y-1)}{5}$$

$$5(3y) \leq 4(y-1)$$

$$15y \leq 4y-4$$

$$15y-4y \leq -4$$

$$11y \leq -4$$

$$\frac{11y}{11} \leq \frac{-4}{11}$$

$$y \leq -\frac{4}{11}$$

$$30. 4x \leq \frac{5(1-x)}{6}$$

$$6(4x) \leq 5(1-x)$$

$$24x \leq 5-5x$$

$$24x+5x \leq 5$$

$$29x \leq 5$$

$$\underline{19x \leq 5}$$

$$\frac{19x}{19} \leq \frac{5}{19}$$

$$x \leq \frac{5}{19}$$

$$31. \frac{5}{3}x \leq \frac{7}{3}x$$

$$3 \frac{5}{3}x \leq 3 \frac{7}{3}x$$

$$5x \leq 7x$$

$$5x-7x \leq 7x-7x$$

$$-2x \leq 0$$

$$\underline{7 \leq 2x}$$

$$\frac{2}{2} \frac{2}{x}$$

$$32. \quad \frac{7}{5}n - \frac{3}{5}n$$

$$= \frac{7n}{5} - \frac{3n}{5}$$

$$= \frac{7n - 3n}{5}$$

$$= \frac{4n}{5}$$

$$\frac{3}{12} - \frac{12n}{12}$$

$$\frac{3}{12} - \frac{12n}{12}$$

$$\frac{1}{4} - n$$

$$33. \quad 9(3x - 1) - 4(49 - 27x)$$

$$= 27x - 9 - 196 + 108x$$

$$= 135x - 205$$

$$= \frac{135x}{27} - \frac{205}{27}$$

$$= 5x - \frac{205}{27}$$

$$34. \quad 12(2x - 1) - 6(66 - 24x)$$

$$= 24x - 12 - 396 + 144x$$

$$= 168x - 408$$

$$= \frac{168x}{24} - \frac{408}{24}$$

$$= 7x - 17$$

$$\frac{24x}{24} - \frac{48}{24}$$

$$= x - 2$$

$$35. \quad \frac{1}{10}(3x - 7) - \frac{3}{10}x + 5$$

$$= \frac{3x - 7}{10} - \frac{3x}{10} + 5$$

$$= \frac{3x - 7 - 3x}{10} + 5$$

$$= \frac{-7}{10} + 5$$

$$= 5 - \frac{7}{10}$$

$$= \frac{50}{10} - \frac{7}{10}$$

$$= \frac{43}{10}$$

$$\frac{3x - 7 - 3x}{10} + 5$$

$$= \frac{-7}{10} + 5$$

There is no solution.

$$36. \quad \frac{1}{7}(2x - 5) - \frac{2}{7}x + 1$$

$$= \frac{2x - 5}{7} - \frac{2x}{7} + 1$$

$$= \frac{2x - 5 - 2x}{7} + 1$$

$$= \frac{-5}{7} + 1$$

$$= 1 - \frac{5}{7}$$

$$= \frac{7}{7} - \frac{5}{7}$$

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

$$\frac{7}{7} - \frac{5}{7}$$

$$\frac{2x - 5 - 2x}{7} + 1$$

$$= \frac{-5}{7} + 1$$

$$= 1 - \frac{5}{7}$$

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

There is no solution.

$$37. \quad 5(2(3x - 6) - 4(6x - 7))$$

$$= 5(6x - 12 - 24x + 28)$$

$$= 5(-18x + 16)$$

$$= -90x + 80$$

$$= \frac{-90x}{30} + \frac{80}{30}$$

$$= -3x + \frac{8}{3}$$

$$30x - 35$$

$$30x - 35$$

$$x - \frac{7}{6}$$

$$38. \quad 3(5(2x - 4) - 7(5x - 2))$$

$$= 3(10x - 20 - 35x + 14)$$

$$= 3(-25x - 6)$$

$$= -75x - 18$$

$$= \frac{-75x}{45} - \frac{18}{45}$$

$$= -\frac{5x}{3} - \frac{2}{5}$$

$$45x - 3$$

$$45x - 3$$

$$x - \frac{1}{15}$$

Section 2.5 Practice Exercises

1. Let $x =$ the number.

$$3x - 6 = 2x + 3$$

$$3x - 2x - 6 = 3 - 3$$

$$x - 6 = 0$$

$$x - 6 + 6 = 0 + 6$$

$$x = 6$$

$$x = 9$$

The number is 9.

2. Let $x =$ the number.

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

$$3x - 4 = 2x - 2$$

$$3x - 2x - 4 = -2 + 2$$

$$x - 4 = 0$$

$$x - 4 + 4 = 0 + 4$$

$$x = 4$$

The number is 2.

3. Let x = the length of short piece,
 then $4x$ = the length of long piece.
- $$\begin{array}{r} x \ 4x \ 45 \\ 5x \ 45 \\ \underline{5x \ 45} \\ 5 \ 5 \\ x \ 9 \\ 4x = 4(9) = 36 \\ \text{The short piece is 9 inches and the long piece is} \\ \text{36 inches.} \end{array}$$

4. Let x = number of Republican governors, then
 x 7 = number of Democratic governors.

$$\begin{array}{r} x \ x \ 7 \ 49 \\ 2x \ 7 \ 49 \\ 2x \ 7 \ 49 \end{array}$$

- $$\begin{array}{r} 2x \ 56 \\ \underline{2x \ 56} \\ 2 \ 2 \\ x \ 28 \\ x \ 7 = 28 \ 7 = 21 \\ \text{There were 28 Republican and 21 Democratic} \\ \text{governors.} \end{array}$$

5. x = degree measure of first angle
 $3x$ = degree measure of second angle
 $x + 55$ = degree measure of third angle
- $$\begin{array}{r} x \ 3x \ (x \ 55) \ 180 \\ 5x \ 55 \ 180 \\ 5x \ 55 \ 55 \ 180 \ 55 \\ 5x \ 125 \\ \underline{5x \ 125} \\ 5 \ 5 \\ x \ 25 \\ 3x = 3(25) = 75 \\ x + 55 = 25 + 55 = 80 \\ \text{The measures of the angles are 25, 75, and 80.} \end{array}$$

6. Let x = the first even integer, then
 $x + 2$ = the second even integer, and
 $x + 4$ = the third even integer.
- $$\begin{array}{r} x \ (x \ 2) \ (x \ 4) \ 144 \\ 3x \ 6 \ 144 \\ 3x \ 6 \ 6 \ 144 \ 6 \\ 3x \ 138 \\ \underline{3x \ 138} \\ 3 \ 3 \\ x \ 46 \\ x + 2 = 46 + 2 = 48 \\ x + 4 = 46 + 4 = 50 \\ \text{The integers are 46, 48, and 50.} \end{array}$$

Vocabulary, Readiness & Video Check 2.5

1. $2x$; $2x \ 31$
2. $3x$; $3x + 17$
3. $x + 5$; $2(x + 5)$
4. $x \ 11$; $7(x \ 11)$
5. $20 \ y$; $\frac{20 \ y}{3}$ or $(20 \ y) \ 3$
6. $10 + y$; $\frac{10y}{9}$ or $(10 + y) \ 9$
7. in the statement of the application
8. The original application asks for the measure of two supplementary angles. The solution of $x = 43$ only gives us the measure of one of the angles.
9. That the 3 angle measures are consecutive even integers and that they sum to 180.

Exercise Set 2.5

2. Let x = the number.
$$\begin{array}{r} 3x \ 1 \ 2x \\ 3x \ 1 \ 3x \ 2x \ 3x \\ 3x \ 1 \ 3x \ 2x \ 3x \\ 1 \ x \\ \underline{1 \ x} \\ 1 \ 1 \\ 1 \ x \\ \text{The number is 1.} \end{array}$$
4. Let x = the number.
$$\begin{array}{r} 4x \ (2) \ 5x \ (2) \\ 4x \ 2 \ 5x \ 2 \\ 4x \ 2 \ 2 \ 5x \ 2 \ 2 \\ 4x \ 5x \\ 4x \ 4x \ 5x \ 4x \\ 0 \ x \\ \text{The number is 0.} \end{array}$$

6. Let x = the number.

$$\begin{array}{r} 5[x(1)] 6(x 5) \\ 5x 5(1) 6x 6(5) \\ 5x 5 6x 30 \\ 5x 5x 5 6x 5x 30 \\ 5 x 30 \\ 5 30 x 30 30 \\ 25 x \end{array}$$

The number is 25.

8. Let x = the number.

$$\begin{array}{r} 2(x 4) x \frac{1}{4} \\ 2x 8 x \frac{1}{4} \\ 4(2x 8) 4 x \frac{1}{4} \\ 8x 32 4x 1 \\ 8x 4x 32 4x 4x 1 \\ 4x 32 1 \\ 4x 32 32 1 32 \\ 4x 31 \\ \underline{4x 31} \\ 4 \quad 4 \\ \quad \underline{31} \end{array}$$

The number is $\frac{1}{4}$.

10. The sum of the three lengths is 46 feet.

$$\begin{array}{r} x 3x 2 7 x 46 \\ 11x 2 46 \\ 11x 2 2 46 2 \\ 11x 44 \\ \underline{11x 44} \\ 11 \quad 11 \\ x \quad 4 \end{array}$$

$$3x = 3(4) = 12$$

$$2 + 7x = 2 + 7(4) = 2 + 28 = 30$$

The lengths are 4 feet, 12 feet, and 30 feet.

12. Let x be the length of the shorter piece. Then

$3x$ is the length of the 2nd piece and the 3rd piece. The sum of the lengths is 21 feet.

$$\begin{array}{r} x 3x 3x 21 \\ 7x 21 \\ \underline{7x 21} \\ 7 \quad 7 \\ x \quad 3 \end{array}$$

$$3x = 3(3) = 9$$

The shorter piece is 3 feet and the longer pieces are each 9 feet.

14.

$$\begin{array}{r} x x 39, 771 43, 265 \\ 2x 39, 771 43, 265 \\ 2x 39, 771 39, 771 43, 265 39, 771 \\ 2x 3494 \\ \underline{2x 3494} \\ 2 \quad 2 \\ x 1747 \end{array}$$

In 2014, 1747 screens were analog.

16. Let x be the measure of the smaller angle. Then $2x + 15$ is the measure of the larger angle. The sum of the four angles is 360.

$$\begin{array}{r} 2x 2(2x + 15) 360 \\ 2x 4x 30 360 \\ 6x 30 360 \\ 6x 30 30 360 30 \\ 6x 390 \\ \underline{6x 390} \\ 6 \quad 6 \\ x 65 \end{array}$$

$$2x + 15 = 2(65) + 15 = 130 + 15 = 145$$

Two angles measure 65 and two angles measure 115.

18. Three consecutive integers:

Integer: x

Next integers: $x + 1, x + 2$

Sum of the second and third consecutive integers,

$$\text{simplified: } (x + 1) + (x + 2) = 2x + 3$$

20. Three consecutive odd integers:

Odd integer: x

Next integers: $x + 2, x + 4$

Sum of the three consecutive odd integers,

$$\text{simplified: } x + (x + 2) + (x + 4) = 3x + 6$$

22. Four consecutive integers:

Integer: x

Next integers: $x + 1, x + 2, x + 3$

Sum of the first and fourth consecutive integers,

$$\text{simplified: } x + (x + 3) = 2x + 3$$

24. Three consecutive even integers:

Even integer: x

Next integers: $x + 2, x + 4$

Sum of the three consecutive even integers,

$$\text{simplified: } x + (x + 2) + (x + 4) = 3x + 6$$

26. Let x = the number of one room
and $x + 2$ = the number of the other.

$$\begin{array}{r} x \times 2 \ 654 \\ 2x \ 2 \ 654 \\ \hline 2x \ 2 \ 2 \ 654 \ 2 \end{array}$$

$$\begin{array}{r} 2x \ 652 \\ \underline{2x \ 652} \\ 2 \quad 2 \\ x \ 326 \\ x + 2 = 326 + 2 = 328 \\ \text{The room numbers are 326 and 328.} \end{array}$$

28. Let x = code for Mali Republic,
 $x + 2$ = code for Cote d'Ivoire,
and $x + 4$ = code for Niger.

$$\begin{array}{r} x \times 2 \ x \ 4 \ 675 \\ 3x \ 6 \ 675 \\ \hline 3x \ 6 \ 6 \ 675 \ 6 \\ 3x \ 669 \\ \underline{3x \ 669} \\ 3 \quad 3 \\ x \ 223 \end{array}$$

$$\begin{array}{l} x + 2 = 223 + 2 = 225 \\ x + 4 = 223 + 4 = 227 \\ \text{The codes are: 223 for Mali, 225 for Cote} \\ \text{d'Ivoire, 227 for Niger.} \end{array}$$

30. Let x represent the weight of the Armanty
meteorite. Then $3x$ represents the weight of the
Hoba West meteorite.

$$\begin{array}{r} x \ 3x \ 88 \\ 4x \ 88 \\ \underline{4x \ 88} \\ 4 \quad 4 \\ x \ 22 \end{array}$$

$$\begin{array}{l} 3x = 3(22) = 66 \\ \text{The Armanty meteorite weighs 22 tons and the} \\ \text{Hoba West meteorite weighs 66 tons.} \end{array}$$

32. Let x be the measure of the shorter piece. Then
 $5x + 1$ is the measure of the longer piece. The
measures sum to 25 feet.

$$\begin{array}{r} x \ 5x \ 1 \ 25 \\ 6x \ 1 \ 25 \\ \hline 6x \ 1 \ 1 \ 25 \ 1 \\ 6x \ 24 \\ \underline{6x \ 24} \\ 6 \quad 6 \\ x \ 4 \end{array}$$

$$\begin{array}{l} 5x + 1 = 5(4) + 1 = 20 + 1 = 21 \\ \text{The pieces measure 4 feet and 21 feet.} \end{array}$$

34. Let x = the number.

$$\begin{array}{r} 9 \ 2x \ 10 \\ 9 \ 10 \ 2x \ 10 \ 10 \\ 19 \ 2x \\ \hline 19 \quad 2x \end{array}$$

$$\begin{array}{r} \overline{2} \quad \overline{2} \\ \underline{19} \quad x \\ 2 \end{array}$$

The number is $\frac{19}{2}$.

36. Let x = species of grasshoppers,
then $20x$ = species of beetles.

$$\begin{array}{r} x \ 20x \ 420,000 \\ 21x \ 420,000 \\ \underline{21x \ 420,000} \\ 21 \quad 21 \\ x \ 20,000 \end{array}$$

$$\begin{array}{l} 20x = 20(20,000) = 400,000 \\ \text{There are 400,000 species of beetles and} \\ \text{20,000 species of grasshoppers.} \end{array}$$

38. Let x = the measure of the smallest angle,
 $x + 2$ = the measure of the second,
 $x + 4$ = the measure of the third, and
 $x + 6$ = the measure of the fourth.

$$\begin{array}{r} x \ x \ 2 \ x \ 4 \ x \ 6 \ 360 \\ 4x \ 12 \ 360 \\ \hline 4x \ 12 \ 12 \ 360 \ 12 \\ 4x \ 348 \\ \underline{4x \ 348} \\ 4 \quad 4 \\ x \ 87 \end{array}$$

$$\begin{array}{l} x + 2 = 87 + 2 = 89 \\ x + 4 = 87 + 4 = 91 \\ x + 6 = 87 + 6 = 93 \\ \text{The angles are 87, 89, 91, and 93.} \end{array}$$

40. Let x = first odd integer,
then $x + 2$ = next odd integer,
and $x + 4$ = third consecutive odd integer.

$$\begin{array}{r} x \ (x + 2) \ (x + 4) \ 51 \\ 3x \ 6 \ 51 \\ \hline 3x \ 6 \ 6 \ 51 \ 6 \\ 3x \ 45 \\ \underline{3x \ 45} \\ 3 \quad 3 \\ x \ 15 \end{array}$$

$$\begin{array}{l} x + 2 = 15 + 2 = 17 \\ x + 4 = 15 + 4 = 19 \\ \text{The code is 15, 17, 19.} \end{array}$$

$$x = 20$$

$$4x = 4(20) = 80$$

The angles measure 20, 80,
and 80.

58. Let x = length of first piece,
then $5x$ = length of second piece,
and $6x$ = length of third piece.

$$\begin{array}{r} x \quad 5x \quad 6x \quad 48 \\ 12x \quad 48 \\ \underline{12x} \quad \underline{48} \\ 12 \quad 12 \\ \quad x \quad 4 \end{array}$$

$$5x = 5(4) = 20$$

$$6x = 6(4) = 24$$

The first piece is 4 feet, the second piece is 20 feet, and the third piece is 24 feet.

60. The bars ending between 3 and 5 represent the games Destiny and Grand Theft Auto V, so those games sold between 3 and 5 million copies in 2014.

62. Let x represent the sales of Minecraft, in millions. Then $x + 0.6$ represents the sales of Grand Theft Auto V.

$$\begin{array}{r} x \quad x \quad 0.6 \quad 6 \\ 2x \quad 0.6 \quad 6 \\ 2x \quad 0.6 \quad 0.6 \quad 6 \quad 0.6 \\ 2x \quad 5.4 \\ \underline{2x} \quad \underline{5.4} \\ 2 \quad 2 \\ \quad x \quad 2.7 \end{array}$$

$$x + 0.6 = 2.7 + 0.6 = 3.3$$

Minecraft sold 2.7 million copies and Grand Theft Auto V sold 3.3 million copies.

64. answers may vary

66. Replace B by 14 and h by 22.

$$\frac{1}{2} Bh = \frac{1}{2} (14)(22) = 7(22) = 154$$

68. Replace r by 15 and t by 2.

$$r t = 15 \cdot 2 = 30$$

70. Let x be the measure of the first angle. Then $2x$ is the measure of the second angle and $5x$ is the measure of the third angle. The measures sum to 180.

$$\begin{array}{r} x \quad 2x \quad 5x \quad 180 \\ 8x \quad 180 \\ \underline{8x} \quad \underline{180} \\ 8 \quad 8 \end{array}$$

$$x = 22.5$$

$$2x = 2(22.5) = 45$$

$$5x = 5(22.5) = 112.5$$

Yes, the triangle exists and has angles that

measure 22.5, 45, and 112.5.

72. One blink every 5 seconds is $\frac{1 \text{ blink}}{5 \text{ sec}}$.

There are $60 \cdot 60 = 3600$ seconds in one hour.

$$\frac{1 \text{ blink}}{5 \text{ sec}} \cdot 3600 \text{ sec} = 720 \text{ blinks}$$

The average eye blinks 720 times each hour.

$$16 \cdot 720 = 11,520$$

The average eye blinks 11,520 times while awake for a 16-hour day.

$$11,520 \cdot 365 = 4,204,800$$

The average eye blinks 4,204,800 times in one year.

74. answers may vary

76. answers may vary

78. Measurements may vary. Rectangle (b) best approximates the shape of a golden rectangle.

Section 2.6 Practice Exercises

1. Let $d = 580$ and $r = 5$.

$$\begin{array}{r} d \quad r \quad t \\ 580 \quad 5t \\ \underline{580} \quad \underline{5t} \\ 5 \quad 5 \\ 116 \quad t \end{array}$$

It takes 116 seconds or 1 minute 56 seconds.

2. Let $l = 40$ and $P = 98$.

$$\begin{array}{r} P \quad 2l \quad 2w \\ 98 \quad 2 \cdot 40 \quad 2w \\ 98 \quad 80 \quad 2w \\ 98 \quad 80 \quad 80 \quad 2w \quad 80 \\ 18 \quad 2w \\ \underline{18} \quad \underline{2w} \\ 2 \quad 2 \\ \quad 9 \quad w \end{array}$$

The dog run is 9 feet wide.

3. Let $C = 8$.

$$\begin{array}{r} F \quad \frac{9}{5} C \quad 32 \\ 5 \\ F \quad \frac{9}{5} \cdot 8 \quad 32 \\ 5 \\ \underline{72} \quad \underline{160} \end{array}$$

$$\begin{array}{r} F \\ 5 \quad 5 \\ F \quad \frac{232}{5} \quad 46.4 \end{array}$$

The equivalent temperature is 46.4F.

4. Let w = width of sign, then
 $5w + 3$ = length of sign.
 $P \ 2l \ 2w$
 $66 \ 2(5w + 3) \ 2w$
 $66 \ 10w + 6 \ 2w$
 $66 \ 12w + 6$
 $66 \ 6 \ 12w + 6 \ 6$
 $60 \ 12w$
 $\underline{60} \ \underline{12w}$
 $12 \ 12$
 $5 \ w$
 $5w + 3 = 5(5) + 3 = 28$
 The sign has length 28 inches and width 5 inches.

5. $I \ PRT$
 $\frac{I \ PRT}{PT} \frac{I \ PRT}{PT}$
 $\frac{I}{PT} R \text{ or } R \frac{I}{PT} \quad PT$

6. $H \ 5as \ 10a$
 $H \ 10a \ 5as \ 10a \ 10a$
 $H \ 10a \ 5as$
 $\underline{H \ 10a} \ \underline{5as}$
 $\frac{5a}{H \ 10a} \ \frac{5a}{s \text{ or } s} \ \frac{H \ 10a}{5a} \ 5a$

7. $N \ F \ d(n \ 1)$
 $N \ F \ F \ d(n \ 1) \ F \ N \ F$
 $d(n \ 1)$
 $\underline{N \ F} \ \underline{d(n \ 1)}$
 $n \ 1 \quad n \ 1$
 $\frac{N \ F}{n \ 1} \ d \text{ or } d \ \frac{N \ F}{n \ 1} \quad n \ 1$

8. $A \ \frac{1}{2} a(b \ B)$
 $2 \ A \ 2 \ \frac{1}{2} a(b \ B)$
 $2 \ A \ a(b \ B)$
 $2 \ A \ ab \ aB$
 $2 \ A \ ab \ ab \ aB \ ab$
 $2 \ A \ ab \ aB$
 $\underline{2 \ A \ ab} \ \underline{aB}$
 $a \quad a$

Vocabulary, Readiness & Video Check 2.6

1. A formula is an equation that describes known relationships among quantities.
2. This is a distance, rate, and time problem. The distance is given in miles and the time is given in hours, so the rate that we are finding must be in miles per hour (mph).
3. To show that the process of solving this equation for x dividing both sides by 5, the coefficient of x is the same process used to solve a formula for a specific variable. Treat whatever is multiplied by that specific variable as the coefficient the coefficient is all the factors except that specific variable.

Exercise Set 2.6

2. Let $d = 195$ and $t = 3$.
 $d \ rt$
 $195 \ r(3)$
 $\underline{195} \ \underline{3r}$
 $3 \ 3$
 $65 \ r$

4. Let $l = 14$, $w = 8$, and $h = 3$.
 $V \ lwh$
 $V \ 14(8)(3)$
 $V \ 336$

6. Let $A = 60$, $B = 7$, and $b = 3$.
 $\frac{1}{2} h(B \ b)$
 $A \ \frac{1}{2} h(B \ b)$
 $60 \ \frac{1}{2} h(7 \ 3)$
 2
 $2(60) \ 2 \ \frac{1}{2} h(10)$
 2

$\frac{120 \ 10h}{120 \ 10h}$
 $\underline{2 \ A \ ab} \ B \ \text{or} \ B \ \underline{2 \ A \ ab} \ a$
 a

1
0

1
0
1
2

h

8. Let $V = 45$, and $h = 5$.

$$V = \frac{1}{3}Ah$$

$$45 = \frac{1}{3}A(5)$$

$$3(45) = 5A$$

$$135 = 5A$$

$$\frac{135}{5} = \frac{5A}{5}$$

$$27 = A$$

10. Let $r = 4.5$, and 3.14 .

$$A = r^2$$

$$A = 3.14(4.5)^2$$

$$A = 3.14(20.25)$$

$$A = 63.6$$

12. Let $I = 1,056,000$, $R = 0.055$, and $T = 6$.

$$I = PRT$$

$$1,056,000 = P(0.055)(6)$$

$$1,056,000 = 0.33P$$

$$\frac{1,056,000}{0.33} = \frac{0.33P}{0.33}$$

$$3,200,000 = P$$

14. Let $r = 3$ and 3.14 .

$$V = \frac{4}{3}r^3$$

$$V = \frac{4}{3}(3.14)(3)^3$$

$$V = \frac{4}{3}(3.14)(27)$$

$$V = \frac{4}{3}(84.78)$$

$$V = 113.0$$

($V = 113.1$ using a calculator.)

16. $A = ab$

$$\frac{A}{a} = \frac{ab}{a}$$

$$a = a$$

$$\frac{A}{a} = b$$

18. $T = mn$

$$\frac{T}{mn} = \frac{mn}{mn}$$

20. $xy = 13$

$$\frac{xy}{x} = \frac{13xy}{x}$$

22. $\frac{AP}{A} = \frac{PRT}{PPRTA}$

$$\frac{AP}{A} = \frac{PRT}{PR}$$

$$\frac{AP}{A} = T$$

24. $D = \frac{1}{4}fk$

$$4D = 4 \cdot \frac{1}{4}fk$$

$$4D = fk$$

$$\frac{4Dfk}{f} = \frac{fkf}{f}$$

$$4Dk = k$$

26. $PRxyzw$

$$PR(xyzw) = (xyzw)PR$$

$$PRxyzw = PRxyzw$$

$$PRxyzw = PRxyzw$$

28. $S = 4lw + 2wh$

$$S - 4lw = 4lw + 2wh - 4lw$$

$$S - 4lw = 2wh$$

$$\frac{S - 4lw}{2w} = \frac{2wh}{2w}$$

$$\frac{S - 4lw}{2w} = h$$

30. Use $A = lw$ when $A = 52,400$ and $l = 400$.

$$A = lw$$

$$52,400 = 400w$$

$$\frac{52,400}{400} = \frac{400w}{400}$$

$$131 = w$$

The width of the sign is 131 feet.

32. $\frac{1}{a}$

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

$$n = n$$

$$\frac{A}{2} = \frac{bh}{2}$$

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

2
A 486

mr

P l_1
 l_2 l_3
P 27
36 45
P 108

The area is 486 square feet and the perimeter is 108 feet.

b. The fence has to do with perimeter because it is located around the edge of the property. The grass seed has to do with area because it is located in the middle of the property.

34. a. $A bh$ $P 2l_1 2l_2$
 $A 9.3(7)$ $P 2(11.7) 2(9.3)$
 $A 65.1$ $P 23.4 18.6$
 $P 42$

The area is 65.1 square feet and the perimeter is 42 feet.

b. The border has to do with the perimeter

because it surrounds the edge. The paint has to do with the area because it covers the wall.

36. Let $C = 5$.
 $F \frac{9}{5} (5) 32 9 32 23$

The equivalent temperature is 23F.

38. Let $P = 400$ and $l = 2w + 10$.

$P 2l 2w$
 $400 2(2w + 10) 2w$
 $400 4w + 20 2w$
 $400 6w + 20$
 $400 20 6w + 20 20$
 $420 6w$
 $420 6w$

$6 6$
 $70 w$
 $l 2w + 10 2(70) + 10 140 + 10 150$
 The length is 150 meters.

40. Let x = the measure of each of the two equal sides, and $x + 2$ = the measure of the third.

$x x x + 2$
 $3x + 2$
 $3x + 2 + 2 + 2$
 $3x + 24$
 $3x + 24$
 $3 3$
 $x + 8$

$x + 2 = 8 + 2 = 10$
 The shortest side is 6 feet.

42. Let $d = 700$ and $r = 55$.

$d rt$
 $700 55t$
 $700 55t$

$55 55$
 700
 $55 t$
 $t \frac{700 140}{55} 12 \frac{8}{11}$

$55 11 11$

The trip will take $12 \frac{8}{11}$ hours.

44. Let $r = 4$ and $h = 3$. Use 3.14.

$V r^2 h$
 $V (3.14)(4)^2 (3)$
 $(3.14)(16)(3)$
 150.72

Let x = number of goldfish and volume per fish = 2.

$150.72 2x$
 $\frac{150.72 2x}{2}$

$75.36 x$
 75 goldfish can be placed in the tank.

46. Use $N = 94$.

$T 50 \frac{N + 40}{4}$
 $94 + 40$
 134

$T 50 \frac{134}{4}$
 54
 $T 50 13.5$

$T 63.5$
 The temperature is 63.5 Fahrenheit.

48. Use $T = 65$.

$T 50 \frac{N + 40}{4}$
 $65 50 \frac{N + 40}{4}$
 4
 $65 50 50 \frac{N + 40}{4}$

$15 \frac{N + 40}{4}$

$415 4 \frac{N + 40}{4}$
 4
 $60 N + 40$

$$60 + 40N + 40$$

$$100N$$

There are 100 chirps per minute.

50. As the air temperature of their environment decreases, the number of cricket chirps per minute decreases.

52. Let $A = 20$, and $b = 5$.

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

$$20 = \frac{1}{2}(5)h$$

$$2(20) = 2 \cdot \frac{5}{2}h$$

$$40 = 5h$$

$$\frac{40}{5} = \frac{5h}{5}$$

$$8 = h$$

The height is 8 feet.

54. Let $r = 4000$. Use 3.14.

$$C = 2r = 2(3.14)(4000)$$

$$C = 25,120$$

The length of rope is 25,120 miles.

56. $x(2x + 8) = (3x + 12) \cdot 8$

$$6x^2 + 8x = 24x + 96$$

$$6x^2 + 8x - 24x - 96 = 0$$

$$6x^2 - 16x - 96 = 0$$

$$\frac{6x^2 - 16x - 96}{6} = \frac{0}{6}$$

$$x^2 - \frac{8}{3}x - 16 = 0$$

$$x = 17$$

$$2x + 8 = 2(17) + 8 = 26$$

$$3x + 12 = 3(17) + 12 = 39$$

The lengths are 17 feet, 26 feet, and 39 feet.

58. $A = 3990$ and $w = 57$.

$$A = lw$$

$$3990 = l \cdot 57$$

$$\frac{3990}{57} = \frac{l \cdot 57}{57}$$

$$70 = l$$

The length is 70 feet.

60. Let $x =$ the length of a side of the square and $2x + 15 =$ the length of a side of the triangle.

$$P(\text{triangle}) = P(\text{square})$$

$$3(2x + 15) = 4x^2$$

$$6x + 45 = 4x^2$$

$$6x + 45 - 4x^2 = 0$$

$$-4x^2 + 6x + 45 = 0$$

$$4x^2 - 6x - 45 = 0$$

$$\frac{4x^2 - 6x - 45}{4} = \frac{0}{4}$$

$$x^2 - \frac{3}{2}x - \frac{45}{4} = 0$$

$$2x = 45$$

$$\frac{2}{x} = \frac{45}{22.5}$$

$$2x + 15 = 2(22.5) + 15 = 45 + 15 = 30$$

The side of the triangle is 30 units and the side of the square is 22.5 units.

62. Let $d = 150$ and $r = 45$.

$$d = rt$$

$$150 = 45t$$

$$150 = 45t$$

$$\frac{150}{45} = \frac{45t}{45}$$

$$t = \frac{150}{45}$$

$$t = \frac{150}{45} = \frac{10}{3}$$

The trip will take $\frac{10}{3}$ hours or 3 hours 20 minutes.

He should arrive at 7:20 A.M.

64. Let $F = 78$.

$$F = \frac{9}{5}C + 32$$

$$78 = \frac{9}{5}C + 32$$

$$78 - 32 = \frac{9}{5}C + 32 - 32$$

$$46 = \frac{9}{5}C$$

$$5(46) = 5 \cdot \frac{9}{5}C$$

$$230 = 9C$$

$$\frac{230}{9} = \frac{9C}{9}$$

$$25\frac{5}{9} = C$$

$$C = \frac{230}{9} = 25\frac{5}{9}$$

$$C = \frac{230}{9} = 25\frac{5}{9}$$

The equivalent temperature is $25\frac{5}{9}$ C.

66. Let $C = 10$.

$$F = \frac{9}{5}C + 32$$

$$\frac{9}{5}(10) + 32$$

$$18 + 32$$

$$50$$

The equivalent temperature is 50F

68. Let $F = 227$.

$$C = \frac{5}{9}(F - 32)$$

$$C = \frac{5}{9}(227 - 32) = 144$$

The equivalent temperature is 144C.

70. Use $V = \frac{4}{3}r^3$ when $r = 15$ and $\pi = 3.14$.

$$V = \frac{4}{3}r^3 = \frac{4}{3}(3.14)(15)^3 = 14,130$$

The volume of the sphere is 14,130 cubic inches.

- 72. $8\% = 0.08$
- 74. $0.5\% = 0.005$
- 76. $0.03 = 0.03(100\%) = 3\%$
- 78. $5 = 5(100\%) = 500\%$

80. Use $A = bh$. If the base is doubled, the new base is $2b$. If the height is doubled, the new height is $2h$.

$$A = (2b)(2h) = 2 \cdot 2 \cdot b \cdot h = 4bh$$
 The area is multiplied by 4.

82. Let x be the temperature. Use $F = \frac{9}{5}C + 32$
 when $F = C = x$.

$$x = \frac{9}{5}x + 32$$

$$x - \frac{9}{5}x = 32$$

$$\frac{5}{5}x - \frac{9}{5}x = 32$$

$$-\frac{4}{5}x = 32$$

$$x = -\frac{5}{4} \cdot 32$$

$$x = -40$$

They are the same when the temperature is 40.

84.
$$B = \frac{F}{P \cdot V}$$

$$B(P \cdot V) = \frac{F}{P \cdot V} \cdot (P \cdot V)$$

$$B(P \cdot V) \cdot F = BP \cdot BV \cdot F$$

$$BP \cdot BV \cdot BP \cdot F \cdot BP$$

$$\frac{BV \cdot F \cdot BP}{BP \cdot BV \cdot BP} = \frac{F \cdot BP}{BP}$$

$$V = \frac{BP \cdot F \cdot B}{BP}$$

$$V = \frac{BP \cdot F \cdot B}{BP}$$

$$V = \frac{F}{P} \cdot B$$

86.

Title: f3.eps
Creator: Adobe Illustrator(R) 11
Preview:

88. Let $d = 238,860$ and $r = 186,000$.

$$d = rt$$

$$238,860 = 186,000t$$

$$\frac{238,860}{186,000} = \frac{186,000t}{186,000}$$

$$1.284193548386562 = t$$
 It will take 1.3 seconds.

90. $20 \frac{\text{miles}}{\text{hour}}$

$$20 \frac{\text{miles}}{\text{hour}} \cdot \frac{5280 \text{ feet}}{1 \text{ mile}} \cdot \frac{1 \text{ hour}}{3600 \text{ seconds}}$$

$\frac{100}{3}$ feet/second

Let $d = 1300$ and $r = \frac{88}{3}$.

$$\frac{d}{r} = \frac{1300}{\frac{88}{3}} = \frac{1300 \cdot 3}{88} = \frac{3900}{88} = 44.3 t$$

It will take about 44.3 seconds.

92. Use $d = rt$ when $d = 25,000$ and $r = 3800$.

$$\frac{d}{r} = \frac{25,000}{3800} = \frac{25,000}{3800} t = 6.58 t$$

6 hr and 0.58(60) 35 min
It would take the Boeing X-51 6 hours 35 minutes to travel around Earth.

94. Let $d = 2$ then $r = 1$.

15 feet $\frac{15 \text{ feet}}{1} \cdot \frac{12 \text{ inches}}{1 \text{ foot}} = 180$ inches, so

3. a. From the circle graph, we see that 41% of pets owned are freshwater fish and 3% are saltwater fish; thus $41\% + 3\% = 44\%$ of pets

owned are freshwater fish or saltwater fish.

b. The circle graph percents have a sum of 100%; thus the percent of pets that are equines is $100\% - 3\% = 97\%$.

c. To find the number of dogs owned, we find 19% of 396.12
 $= (0.19)(396.12)$
 $= 75.2628$
 75.3
 Thus, about 75.3 million dogs are owned in the United States.

4. Let $x =$ discount.
 $x = 85\% \cdot 480$
 $= 0.85 \cdot 480$
 $= 408$
 The discount is \$408.
 New price = $\$480 - \$408 = \$72$

5. Increase = $2710 - 1900 = 810$
 Let $x =$ percent of increase.
 $810 = x \cdot 1900$
 $810 = 1900x$
 $1900 = 1900x$
 $0.426 = x$
 The percent of increase is 42.6%.

$$h = 180.$$

$$V = r^2 h$$

$$V = (1)^2 (180) = 180$$

The volume of the column is 565.5 cubic inches.

Section 2.7 Practice Exercises

1. Let x = the unknown percent.

$$35 = x \cdot 56$$

$$\frac{35}{56} = \frac{56x}{56}$$

$$0.625 = x$$

The number 35 is 62.5% of 56.

2. Let x = the unknown number.

$$198 = 55\% x$$

$$198 = 0.55x$$

$$\frac{198}{0.55} = \frac{0.55x}{0.55}$$

$$360 = x$$

The number 198 is 55% of 360.

6. Let x = number of digital 3D screens in 2007.

$$x + 0.07x = 15,782$$

$$1.07x = 15,782$$

$$\frac{1.07x}{1.07} = \frac{15,782}{1.07}$$

$$x = 14,750$$

There were 14,750 digital 3D screens in 2007.

7. Let x = number of liters of 2% solution.

Eyewash	No. of gallons	Acid Strength	=	Amt. of Acid
---------	----------------	---------------	---	--------------

2%	x	2%	$0.02x$
5%	$6x$	5%	$0.05(6x)$
Mix: 3%	6	3%	$0.03(6)$

$$\begin{array}{r}
 0.02x + 0.05(6x) = 0.03(6) \\
 0.02x + 0.30x = 0.18 \\
 0.32x = 0.18 \\
 0.32x \div 0.32 = 0.18 \div 0.32 \\
 x = 0.5625
 \end{array}$$

$$6x = 6 \cdot 0.5625 = 3.375$$

She should mix 3.375 liters of 2% eyewash with 2 liters of 5% eyewash.

Vocabulary, Readiness & Video Check 2.7

1. No, $25\% + 25\% + 40\% = 90\%$ 100% .
2. No, $30\% + 30\% + 30\% = 90\%$ 100% .
3. Yes, $25\% + 25\% + 25\% + 25\% = 100\%$.
4. Yes, $40\% + 50\% + 10\% = 100\%$.
5. a. equals; =
 b. multiplication;
 c. Drop the percent symbol and move the decimal point two places to the left.
6. a. You also find a discount amount by multiplying the (discount) percent by the original price.
 b. For discount, the new price is the original price minus the discount amount, so you *subtract* from the original price rather than *add* as with mark-up.
7. You must first find the actual amount of increase in price by subtracting the original price from the new price.

Alloy	Ounces	Copper Strength	Amount of Copper
10%	x	0.10	$0.10x$
30%	400	0.30	$0.30(400)$
20%	$x + 400$	0.20	$0.20(x + 400)$

$$0.10x + 0.30(400) = 0.20(x + 400)$$

Exercise Set 2.7

2. Let x be the unknown number.

$$x = 88\% \ 1000$$

$$x = 0.88 \ 1000$$

$$x = 880$$

880 is 88% of 1000.

4. Let x be the unknown percent.

$$87.2 \ x \ 436$$

$$\frac{87.2}{436} = \frac{436x}{436}$$

$$0.2 \ x$$

$$20\% \ x$$

The number 87.2 is 20% of 436.

6. Let x be the unknown number.

$$126 \ 35\% \ x$$

$$126 \ 0.35 \ x$$

$$\frac{126}{0.35} = \frac{0.35x}{0.35}$$

$$360 \ x$$

126 is 35% of 360.

8. $21\% + 10\% + 20\% = 51\%$
51% of Earth's land area is in Asia, Antarctica, or Africa.

10. The land area of Africa is 20% of Earth's land area.
20% of 56.4 = 11.28
The land area of Africa is 11.28 million square areas.

12. Let x = amount of discount.

$$x = 25\% \ 12.50$$

$$x = 0.25 \ 12.50$$

$$x = 3.125 \ 3.13$$

$$\text{New price} = 12.50 - 3.13 = 9.37$$

The discount was \$3.13 and the new price is \$9.37.

14. Let x = tip.

$$x = 20\% \ 65.40$$

$$x = 0.2 \ 65.4$$

$$x = 13.08$$

$$\text{Total} = 65.40 + 13.08 = 78.48$$

The total cost is \$78.48.

16. Decrease = 314 - 290 = 24

Let x = percent.

$$24 \ x \ 314$$

$$\frac{24}{314} = \frac{314x}{314}$$

$$0.076 \ x$$

The percent of decrease is 7.6%.

18. Decrease = 100 - 81 = 19

Let x = percent.

$$19 \ x \ 100$$

$$\frac{19}{100} = \frac{100x}{100}$$

$$0.19 \ x$$

$$19\% \ x$$

The percent of decrease is 19%.

20. Let x = original price and $0.25x$ = increase.

$$x \ 0.25x \ 80$$

$$1.25x \ 80$$

$$\frac{1.25x}{1.25} = \frac{80}{1.25}$$

$$x \ 64$$

The original price was \$64.

22. Let x = last year's salary, and $0.03x$ = increase.

$$x \ 0.03x \ 55,620$$

$$1.03x \ 55,620$$

$$\frac{1.03x}{1.03} = \frac{55,620}{1.03}$$

$$x \ 54,000$$

$$x \ 54,000$$

Last year's salary was \$54,000.

24. Let x = the amount of 25% solution.

No. of Strength = Amt. of
cu cm Antibiotic

25%	x	0.25	$0.25x$
60%	10	0.6	$10(0.6)$
30%	$x + 10$	0.3	$0.3(x + 10)$

$$0.25x \ 10(0.6) \ 0.3(x + 10)$$

$$0.25x \ 6 \ 0.3x \ 3$$

$$0.25x \ 0.25x \ 6 \ 0.3x \ 0.25x \ 3$$

$$6 \ 0.05x \ 3$$

$$6 \ 3 \ 0.05x \ 3 \ 3$$

$$3 \ 0.05x$$

3

0

:

0

5

x

0

0

0

0

5

6

0

x

Add 60 cc of 25% solution.

26. Let x = the pounds of cashew nuts.

	No. of lb	Cost/lb	=	Value
Peanuts	20	3		$3(20)$
Cashews	x	5		$5x$
Mix	$x + 20$	3.50		$3.50(x + 20)$

$$\begin{array}{r}
 3(20) + 5x + 3.50(x + 20) \\
 60 + 5x + 3.5x + 70 \\
 60 + 5x + 3.5x + 3.5x + 70 \\
 60 + 1.5x + 70 \\
 60 + 60 + 1.5x + 70 + 60 \\
 1.5x + 10 \\
 \underline{1.5x} \quad \underline{10} \\
 1.5 \quad 1.5 \\
 x + 6 \frac{2}{3} \\
 \quad \quad \quad 3
 \end{array}$$

Add $6 \frac{2}{3}$ pounds of cashews.

28. Let x = the number.

$$\begin{array}{l}
 x = 140\% \cdot 86 \\
 x = 1.4 \cdot 86 \\
 x = 120.4 \\
 140\% \text{ of } 86 \text{ is } 120.4.
 \end{array}$$

30. Let x = the number.

$$\begin{array}{l}
 56.25 = 45\% \cdot x \\
 56.25 = 0.45x \\
 \underline{56.25} \quad \underline{0.45x} \\
 0.45 \quad 0.45 \\
 125 \quad x \\
 56.25 \text{ is } 45\% \text{ of } 125.
 \end{array}$$

32. Let x = the percent.

$$\begin{array}{l}
 42 = x \cdot 35 \\
 \underline{42} \quad \underline{35x} \\
 35 \quad 35 \\
 1.2 \quad x \\
 42 \text{ is } 120\% \text{ of } 35.
 \end{array}$$

34. From the graph, the height of the bar is about 23. Therefore, the average American spends about 23 minutes on Internet browsers.

36. 17 is what percent of 162?

$$\begin{array}{l}
 17 = x \cdot 162 \\
 \underline{17} \quad \underline{162x} \\
 162 \quad 162 \\
 0.105 \quad x \\
 10.5\% \text{ of online time is spent following news.}
 \end{array}$$

38.

Unit Case Volume for Coca-Cola (in billions of cases)		
World Region	Case Volume	Percent of Total (rounded to nearest percent)
North America	5.9	$\frac{5.9}{28.2} \approx 21\%$
Latin America	8.2	$\frac{8.2}{28.2} \approx 29\%$
Europe	3.9	$\frac{3.9}{28.2} \approx 14\%$
Eurasia and Africa	4.3	$\frac{4.3}{28.2} \approx 15\%$
Pacific	5.9	$\frac{5.9}{28.2} \approx 21\%$
Total	28.2	100%

40. Let x = the decrease in price.
 $x = 0.15(0.95) = 0.1425 \approx 0.14$
 The decrease in price is \$0.14.
 The new price is $0.95 - 0.14 = \$0.81$.

42. Increase = $1.19 - 1.19 = 0.30$
 Let x = the percent.
 $0.3 = x \cdot 1.19$
 $\frac{0.3}{1.19} = \frac{1.19x}{1.19}$
 $0.252 = x$
 The percent of increase was 25.2%.

44. Let x represent the amount Charles paid for the car.
 $x + 20\%x = 4680$
 $x + 0.20x = 4680$
 $1.2x = 4680$
 $\frac{1.2x}{1.2} = \frac{4680}{1.2}$
 $x = 3900$
 Charles paid \$3900 for the car.

46. percent of increase = $\frac{\text{amount of increase}}{\text{original amount}}$
 $\frac{246}{6} = 41$
 $\frac{18}{6} = 3$
 The area increased by 300%.

48. Let x be the gallons of water.

	gallons	concentration	amount
water	x	0%	$0x = 0$
70% antifreeze	30	70%	$0.7(30)$
60% antifreeze	$x + 30$	60%	$0.6(x + 30)$

The amount of antifreeze being combined must be the same as that in the mixture.

$$\begin{array}{r}
 0.7(30) = 0.6(x + 30) \\
 21 = 0.6x + 18 \\
 21 - 18 = 0.6x + 18 - 18 \\
 3 = 0.6x \\
 \frac{3}{0.6} = \frac{0.6x}{0.6} \\
 5 = x
 \end{array}$$

Thus, 5 gallons of water should be used.

50. percent of increase = $\frac{\text{amount of increase}}{\text{original amount}}$

$$\begin{array}{r}
 \frac{88 - 72}{72} \\
 \frac{16}{72} \\
 0.222
 \end{array}$$

The number of decisions by the Supreme Court increased 22.2%.

52. Let x be the average number of children per woman in 1920.

$$\begin{array}{r}
 x + 0.44x = 1.9 \\
 1.44x = 1.9 \\
 \frac{1.44x}{1.44} = \frac{1.9}{1.44} \\
 x = 3.4
 \end{array}$$

There were 3.4 children per woman in 1920.

54. $64\% \cdot 9800 = 0.64 \cdot 9800 = 6272$

You would expect 6272 post-secondary institutions to have Internet access in their classrooms.

56. Let x be the pounds of chocolate-covered peanuts.

	pounds	cost (\$)	value
chocolate-covered	x	5	$5x$
granola bites	10	2	$2(10)$
trail mix	$x + 10$	3	$3(x + 10)$

The value of those being combined must be the same as the value as the mixture.

$$\begin{array}{r}
 5x - 2(10) = 3(x - 10) \\
 5x - 20 = 3x - 30 \\
 5x - 20 - 3x + 30 = 3x - 30 + 3x \\
 2x + 10 = 6x - 30 \\
 2x + 10 - 2x = 6x - 30 - 2x \\
 10 = 4x - 30 \\
 10 + 30 = 4x - 30 + 30 \\
 40 = 4x \\
 \frac{40}{4} = \frac{4x}{4} \\
 10 = x
 \end{array}$$

Therefore, 5 pounds of chocolate-covered peanuts should be used.

58. Let x be the length of Christian's throw.

$$\begin{array}{r}
 x + 148.00 = 0.689(148.00) \\
 x + 148.00 = 101.972 \\
 x + 148.00 - 148.00 = 101.972 - 148.00 \\
 x = -46.028
 \end{array}$$

Christian Sandstrom's world record throw was 250 meters.

60. $\frac{12}{3} = 2^2$

62. $3^3 = (3)^3$

64. $|2| = 2$; $|-2| = 2$
 $|2| > |-2|$

66. answers may vary

68. a. yes; answers may vary

b. no; answers may vary

70. 23 g is what percent of 300 g? Let y represent the unknown percent.

$$\begin{array}{r}
 y \cdot 300 = 23 \\
 \frac{300y}{300} = \frac{23}{300} \\
 y = 0.076
 \end{array}$$

This food contains 7.7% of the daily value of total carbohydrate in one serving.

72. $6 \text{ g} \cdot 9 \text{ calories/gram} = 54 \text{ calories}$

54 of the 280 calories come from fat.

$$\frac{54}{280} = 0.193$$

19.3% of the calories in this food come from fat.

74. answers may vary

Section 2.8 Practice Exercises

1. Let $x =$ time down, then $x + 1 =$ time up.

	Rate	Time	= Distance
Up	1.5	$x + 1$	$1.5(x + 1)$
Down	4	x	$4x$

$$\begin{array}{r}
 1.5(x + 1) + 4x \\
 1.5x + 1.5 + 4x \\
 5.5x + 1.5 \\
 \underline{1.5} \quad \underline{2.5x} \\
 2.5 \quad 2.5 \\
 0.6x
 \end{array}$$

Total Time = $x + 1 + x = 0.6 + 1 + 0.6 = 2.2$
 The entire hike took 2.2 hours.

2. Let $x =$ speed of eastbound train, then
 $x + 10 =$ speed of westbound train.

	r	t	= d
East	x	1.5	$1.5x$
West	$x + 10$	1.5	$1.5(x + 10)$

$$\begin{array}{r}
 1.5x + 1.5(x + 10) = 171 \\
 1.5x + 1.5x + 15 = 171 \\
 3x + 15 = 171 \\
 3x = 156 \\
 \underline{3x} \quad \underline{186} \\
 3 \quad 3 \\
 x = 62
 \end{array}$$

$x + 10 = 62 + 10 = 72$
 The eastbound train is traveling at 62 mph and the westbound train is traveling at 72 mph.

3. Let $x =$ the number of \$20 bills, then
 $x + 47 =$ number of \$5 bills.

Denomination	Number	Value
\$5 bills	$x + 47$	$5(x + 47)$
\$20 bills	x	$20x$

$$\begin{array}{r}
 5(x + 47) + 20x = 1710 \\
 5x + 235 + 20x = 1710 \\
 25x + 235 = 1710 \\
 25x = 1475 \\
 x = 59
 \end{array}$$

$x + 47 = 59 + 47 = 106$
 There are 106 \$5 bills and 59 \$20 bills.

4. Let x = amount invested at 11.5%, then
 $30,000 - x$ = amount invested at 6%.

	Principal	Rate	Time =	Interest
11.5%	x	0.115	1	$x(0.115)(1)$
6%	$30,000 - x$	0.06	1	$0.06(30,000 - x)(1)$
Total	30,000			2790

$$\begin{aligned}
 0.115x + 0.06(30,000 - x) &= 2790 \\
 0.115x + 1800 - 0.06x &= 2790 \\
 0.055x + 1800 &= 2790 \\
 0.055x &= 990 \\
 \underline{0.055x} & \quad \underline{990} \\
 0.055 & \quad 0.055 \\
 x &= 18,000 \\
 30,000 - x &= 30,000 - 18,000 = 12,000 \\
 \text{She invested } \$18,000 & \text{ at 11.5\% and } \$12,000 \text{ at 6\%.}
 \end{aligned}$$

Vocabulary, Readiness & Video Check 2.8

1. $r \quad t = \quad d$

bus	55	x	$55x$
car	50	$x + 3$	$50(x + 3)$

$$55x = 50(x + 3)$$

2. The important thing is to remember the difference between the *number* of bills you have and the *value* of the bills.

3. $P \quad R \quad T = \quad I$

x	0.06	1	$0.06x$
$36,000 - x$	0.04	1	$0.04(36,000 - x)$

$$0.06x = 0.04(36,000 - x)$$

Exercise Set 2.8

2. Let x = the time traveled by the bus.

	Rate	Time =	Distance
Bus	60	x	$60x$
Car	40	$x + 1.5$	$40(x + 1.5)$

$$\begin{array}{r}
 d \\
 60x = 40(x + 1.5) \\
 60x = 40x + 60 \\
 20x = 60 \\
 \underline{20x} \quad \underline{60} \\
 20 \quad 20 \\
 x = 3
 \end{array}$$

It will take the bus 3 hours to overtake the car.

4. Let x = the time to get to Disneyland and $7.2x$ = the time to return

	Rate	Time	= Distance
Going	50	x	$50x$
Returning	40	$7.2x$	$40(7.2x)$

$$\begin{array}{r}
 d \\
 50x = 40(7.2x)
 \end{array}$$

$$\begin{array}{r}
 50x = 288 \\
 90x = 288
 \end{array}$$

$$\begin{array}{r}
 90x = 288 \\
 90 \quad 90 \\
 x = 3.2
 \end{array}$$

It took 3.2 hours to get to Disneyland.

$$d = rt$$

$$d = 50(3.2) = 160$$

The distance to Disneyland is 160 miles.

6. The value of z quarters is $0.25z$.
8. The value of $(20z)$ half-dollars is $0.50(20z)$.
10. The value of $97z$ \$100 bills is $100(97z)$ or $9700z$.
12. The value of $(15y)$ \$10 bills is $10(15y)$.
14. Let x = number of \$50 bills, then
 $6x$ = number of \$20 bills.

	Number of Bills	Value of Bills
\$20 bills	$6x$	$20(6x)$
\$50 bills	x	$50x$
Total		3910

$$\begin{array}{r}
 20(6x) + 50x = 3910 \\
 120x + 50x = 3910 \\
 170x = 3910 \\
 x = 23
 \end{array}$$

$$6x = 6(23) = 138$$

There are 138 \$20 bills and 23 \$50 bills.

16. Let x = the amount invested at 9% for one year.

	Principal	Rate	= Interest
9%	x	0.09	$0.09x$
10%	$x + 250$	0.10	$0.10(x + 250)$
Total			101

$$0.09x + 0.10(x + 250) = 101$$

$$0.09x + 0.10x + 25 = 101$$

$$0.19x + 25 = 101$$

$$0.19x = 76$$

$$\frac{0.19x}{0.19} = \frac{76}{0.19}$$

$$x = 400$$

$$x + 250 = 400 + 250 = 650$$

She invested \$650 at 10% and \$400 at 9%.

18. Let x = the amount invested at 10% for one year.

	Principal	Rate	= Interest
10%	x	0.10	$0.10x$
12%	$2x$	0.12	$0.12(2x)$
Total			2890

$$0.10x + 0.12(2x) = 2890$$

$$0.10x + 0.24x = 2890$$

$$0.34x = 2890$$

$$\frac{0.34x}{0.34} = \frac{2890}{0.34}$$

$$x = 8500$$

$$2x = 2(8500) = 17,000$$

He invested \$17,000 at 12% and \$8500 at 10%.

20. Let x = number of adult tickets, then

$$732 - x = \text{number of child tickets.}$$

	Number	Rate	= Cost
Adult	x	22	$22x$
Child	$732 - x$	15	$15(732 - x)$

Total	732		12,912
-------	-----	--	--------

$$\begin{array}{r}
 22x + 15(732 - x) = 12,912 \\
 22x + 10,980 - 15x = 12,912 \\
 10,980 + 7x = 12,912 \\
 7x = 1932 \\
 x = 276 \\
 732 - x = 732 - 276 = 456
 \end{array}$$

Sales included 276 adult tickets and 456 child tickets.

22. Let x = the time traveled

	Rate	Time	= Distance
Car A	65	x	$65x$
Car B	41	x	$41x$

The total distance is 530 miles.

$$\begin{array}{r}
 65x + 41x = 530 \\
 106x = 530 \\
 \frac{106x}{106} = \frac{530}{106} \\
 x = 5
 \end{array}$$

The two cars will be 530 miles apart in 5 hours.

24. Let x = the amount invested at 12% for one year.

	Principal	Rate	=	Interest
12%	x	0.12		$0.12x$
4%	$20,000 - x$	0.04		$0.04(20,000 - x)$

$$\begin{array}{r}
 0.12x + 0.04(20,000 - x) = 1,500 \\
 0.12x + 800 - 0.04x = 1,500 \\
 0.08x + 800 = 1,500 \\
 0.08x = 700 \\
 \frac{0.08x}{0.08} = \frac{700}{0.08} \\
 x = 8,750
 \end{array}$$

$20,000 - x = 20,000 - 8,750 = 11,250$
 She invested \$11,250 at 4% and \$8,750 at 12%.

26. Let x = the time they are able to talk.

	Rate	Time	= Distance
Cade	5	x	$5x$
Kathleen	4	x	$4x$
Total			20

$$\begin{array}{r}
 5x - 4x = 2 \\
 9x = 20 \\
 \frac{9x}{9} = \frac{20}{9} \\
 x = \frac{20}{9}
 \end{array}$$

They can talk for $2\frac{2}{9}$ hours.

28. Let x = the speed of the slower train.

	Rate	Time	= Distance
Train A	x	1.5	$1.5x$
Train B	$x + 8$	1.5	$1.5(x + 8)$

The total distance is 162 miles.

$$\begin{array}{r}
 1.5x + 1.5(x + 8) = 162 \\
 1.5x + 1.5x + 12 = 162 \\
 3x + 12 = 162 \\
 3x = 150 \\
 \frac{3x}{3} = \frac{150}{3} \\
 x = 50
 \end{array}$$

$$x + 8 = 58$$

The speeds of the trains are 50 mph and 58 mph.

30. Let x = number of quarters, then
 $5x$ = number of dimes.

	Number	Value
Quarters	x	$0.25x$
Dimes	$5x$	$0.10(5x)$
Total		27.75

$$\begin{array}{r}
 0.25x + 0.10(5x) = 27.75 \\
 0.25x + 0.5x = 27.75 \\
 0.75x = 27.75 \\
 x = 37
 \end{array}$$

$$5x = 5(37) = 185$$

The collection has 37 quarters and 185 dimes.

32. Let x = the time traveled.

	Rate	Time	= Distance
Car A	65	x	$65x$
Car B	45	x	$45x$

The total distance is 330.

$$\begin{array}{r}
 65x + 45x = 330 \\
 110x = 330 \\
 \frac{110x}{110} = \frac{330}{110} \\
 x = 3
 \end{array}$$

They will be 330 miles apart in 3 hours.

34. Let x = the time traveled.

	Rate	Time	= Distance
Car A	40	x	$40x$
Car B	50	x	$50x$

If two cars are traveling in the same direction, so find the difference in their distances traveled.

$$\begin{array}{r}
 50x - 40x = 20 \\
 10x = 20 \\
 \frac{10x}{10} = \frac{20}{10} \\
 x = 2
 \end{array}$$

They will be 20 miles apart in 2 hours.

36. Let x = the amount invested at 9% for one year.

	Principal	Rate	= Interest
9%	x	0.09	$0.09x$
10%	$2x$	0.10	$0.1(2x)$
11%	$3x$	0.11	$0.11(3x)$
Total			2790

$$\begin{array}{r}
 0.09x + 0.1(2x) + 0.11(3x) = 2790 \\
 0.09x + 0.2x + 0.33x = 2790 \\
 0.62x = 2790 \\
 \frac{0.62x}{0.62} = \frac{2790}{0.62} \\
 x = 4500
 \end{array}$$

$$2x = 2(4500) = 9000$$

$$3x = 3(4500) = 13,500$$

She invested \$4500 at 9%, \$9000 at 10% and \$13,500 at 11%.

38. Let x = the time it takes them to meet.

	Rate	Time	= Distance
Nedra	3	x	$3x$
Latonya	4	x	$4x$
Total			12

$$\begin{array}{r}
 3x + 4x = 12 \\
 7x = 12 \\
 \frac{7x}{7} = \frac{12}{7} \\
 x = 1\frac{5}{7}
 \end{array}$$

They meet in $1\frac{5}{7}$ hours.

40. Let x = the time before getting stopped.

	Rate	Time	Distance
Before	70	x	$70x$
After	60	$4x$	$60(4x)$
Total			255

$$\begin{array}{r}
 70x + 60(4x) = 255 \\
 70x + 240 = 255 \\
 70x = 15 \\
 \frac{70x}{70} = \frac{15}{70} \\
 x = 1.5
 \end{array}$$

He drove 1.5 hours before getting stopped.

42. $(2) + (8) = 10$

44. $11 + 2.9 = 8.1$

46. $12 - 3 = 12 + (-3) = 9$

48. Let x = number of quarters, then
 $136 + x$ = number of dimes,
 $8x$ = number of nickels,
 $16x + 32$ = number of pennies.

	Number	Value
Quarters	x	$0.25x$
Dimes	$136 + x$	$0.10(136 + x)$
Nickels	$8x$	$0.05(8x)$
Pennies	$16x + 32$	$0.01(16x + 32)$
Total		44.86

$$\begin{array}{r}
 0.25x + 0.10(136 + x) + 0.05(8x) + 0.01(16x + 32) = 44.86 \\
 0.25x + 13.6 + 0.1x + 0.4x + 0.16x + 0.32 = 44.86 \\
 0.91x + 13.92 = 44.86 \\
 0.91x = 30.94 \\
 x = 34
 \end{array}$$

$136 + x = 136 + 34 = 170$
 $8x = 8(34) = 272$
 $16x + 32 = 16(34) + 32 = 576$
 There were 34 quarters, 170 dimes, 272 nickels,
 and 576 pennies.

50. $R \ C$

$$\begin{array}{r} 60x \\ 50x \\ 10x \\ \hline 10x \\ 10x \\ \hline x \end{array} \begin{array}{r} 5000 \\ 5000 \\ 5000 \\ 5000 \\ 5000 \\ 5000 \end{array}$$

Should sell 500 boards to break even.

$C = R = 60x = 60(500) = 30,000$
 It costs \$30,000 to produce the break-even
 number of boards.

52. $R \ C$

$$\begin{array}{r} 105x \\ 70x \\ 35x \\ \hline 35x \\ 35x \\ \hline x \end{array} \begin{array}{r} 875 \\ 875 \\ 875 \\ 875 \\ 875 \\ 875 \end{array}$$

They should sell 25 monitors to break even.

Section 2.9 Practice Exercises

1. $x < 5$
 Place a parenthesis at 5 since the inequality
 symbol is $<$. Shade to the left of 5. The solution
 set is $(, 5)$.

Title:
EMG-BA5-HC-02-09-P

2. $x \geq 11$

$$\begin{array}{r} 11 \\ 11 \\ \hline 11 \\ x \end{array}$$

The solution set is $[11, \infty)$.

Title:

3. $5x \leq 15$

$$\begin{array}{r} 5x \\ \hline 15 \end{array}$$

$$\begin{array}{r} 5 \\ \hline 5 \\ x \end{array}$$

The solution set is $(, 3]$.

Title:

4. $3x \geq 9$

$$\begin{array}{r} 3x \\ \hline 9 \\ 3 \end{array}$$

The solution set is $[3, \infty)$.

Title:
EMG-BA5-HC-02-09-P

5. $45 \leq 7x \leq 49$

$$\begin{array}{r} 45 \\ 45 \\ \hline 7x \\ \hline 49 \end{array}$$

$$\begin{array}{r} 7 \\ \hline 7 \end{array}$$

$$x \geq 7$$

The solution set is $[7, \infty)$.

Title:

6. $3x \geq 20$ and $2x \leq 13$

$$\begin{array}{r} 3x \\ 20 \\ \hline 2x \\ 13 \end{array}$$

$$\begin{array}{r} x \\ 20 \\ \hline 13 \end{array}$$

The solution set is $(\frac{20}{3}, \frac{13}{2}]$.

Title:

7. $6 \leq 5x \leq 3(x + 4)$

$$\begin{array}{r} 6 \\ 5x \\ \hline 3x \\ 12 \\ 6 \\ 8x \\ \hline 6 \\ 8x \\ \hline 18 \end{array}$$

$$\begin{array}{r} 8 \\ \hline 8 \end{array}$$

$$x \geq \frac{9}{4}$$

The solution set is $[\frac{9}{4}, \infty)$.

Title:
EMG-BA5-HC-02-09-P
Creator:

8. $3(x - 4) + 5(x - 1) = 12$
 $3x - 12 + 5x - 5 = 12$
 $3x + 5x - 17 = 12$
 $3x + 5x - 5x - 17 + 5x = 12 + 5x - 5x$
 $2x - 17 = 12$

$2x - 17 + 17 = 12 + 17$

$2x = 29$

$\frac{2x}{2} = \frac{29}{2}$

$x = 14.5$

$x = 0$

The solution set is $[0,)$.

Title:

9. $3x < 1$

Graph all numbers greater than or equal to 3 and less than 1. Place a bracket at 3 and a parenthesis at 1.

The solution set is $[3, 1)$.

Title:

EMG-BA5-HC-02-09

10. $4(2 - 3x) + 2(2 + 8) = 2$
 $8 - 12x + 4 + 16 = 2$
 $6 - 12x + 20 = 2$
 $26 - 12x = 2$
 $26 - 12x - 26 = 2 - 26$
 $-12x = -24$
 $\frac{-12x}{-12} = \frac{-24}{-12}$
 $x = 2$

The solution set is $(2, 2]$.

Title:

EMG-BA5-HC-02-09

11. $1\frac{3}{4}x + 5 = 6$
 $4(1\frac{3}{4}x + 5) = 4(6)$
 $4x + 20 = 24$
 $4x + 20 - 20 = 24 - 20$
 $4x = 4$
 $\frac{4x}{4} = \frac{4}{4}$
 $x = 1$

The solution set is $\frac{16}{3}, \frac{4}{3}$.

Title:

EMG-BA5-HC-02-09-P
 Creator:

12. Let $x =$ the number.

$35 - 2x = 15$

$35 - 2x + 2x = 15 + 2x$

$2x = 20$

$\frac{2x}{2} = \frac{20}{2}$

$x = 10$

$x = 10$

All numbers less than 10.

13. Let $x =$ number of classes.

$300 + 375x = 1500$

$300 + 375x - 300 = 1500 - 300$

$375x = 1200$

$\frac{375x}{375} = \frac{1200}{375}$

$x = 3.2$

$x = 3.2$

Kasonga can afford at most 3 community college classes this semester.

Vocabulary, Readiness & Video Check 2.9

1. $6x - 7(x + 9)$ is an expression.

2. $6x = 7(x + 9)$ is an equation.

3. $6x < 7(x + 9)$ is an inequality.

4. $5y - 2 = 38$ is an inequality.

5. 5 is not a solution to $x = 3$.

6. $|6| = 6$ is not a solution to $x < 6$.

7. The graph of Example 1 is shaded from to and including 1, as indicated by a bracket. To write interval notation, you write down what is

shaded for the inequality from left to right. A parenthesis is always used with , so from the graph, the interval notation is $(, 1]$.

8. Step 5 is where you apply the multiplication property of inequality. If a negative number is multiplied or divided when applying this property, you need to make sure you remember to reverse the direction of the inequality symbol.

9. You would divide the left, middle, and right by 3 instead of -3 , which would reverse the directions of both inequality symbols.

10. no greater than;

Exercise Set 2.9

2. $(3, \infty), x > 3$

Title:

EMG-BA5-HC-02-09-3

4. $(, 4], x \leq 4$

Title:

6. $y < 0, (, 0)$

Title:
EMG-BA5-HC-02-09-0

8. $z \geq \frac{2}{3}, z \geq \frac{2}{3}$

Title:
EMG-BA5-HC-02-09-0
Creator:

10. $x > 3, (3, \infty)$

Title:
EMG-BA5-HC-02-09-9

12. $3x \geq 9$
 $x \geq 3, [3, \infty)$

Title:

EMG-BA5-HC-02-09-0

14. $x \leq 4, (-\infty, 4]$

$x \leq 4, (-\infty, 4]$
Title:

16. $5x \geq 20$

$\frac{5x}{5} \geq \frac{20}{5}$
 $x \geq 4, [4, \infty)$

Title:

EMG-BA5-HC-02-09-1

18. $3x \geq 10$
 $8x$

$3x \geq 10$
 $x \geq \frac{10}{3}, [\frac{10}{3}, \infty)$

22. $3x \geq 5(x - 1)$
 $3x \geq 5x - 5$
 $2x \leq 5$
 $x \leq \frac{5}{2}$

$x \leq \frac{5}{2}, (-\infty, \frac{5}{2}]$

$x \geq 7, [7, \infty)$

Title:

24. $7x \geq 4 + 3(4 - x)$
 $7x \geq 4 + 12 - 3x$
 $4x \geq 16$
 $x \geq 4$

$x \geq 4, [4, \infty)$

$x \geq 2, [2, \infty)$

Title:

EMG-BA5-HC-02-09-2

26. $3(5x - 4) \geq 4(3x - 2)$
 $15x - 12 \geq 12x - 8$
 $3x \geq 4$
 $x \geq \frac{4}{3}$

$x \geq \frac{4}{3}, [\frac{4}{3}, \infty)$

Title:
EMG-BA5-HC-02-09-2
Creator:

28. $7(x - 2) \geq x - 4(5 - x) + 12$
 $7x - 14 \geq x - 20 + 4x + 12$
 $8x - 14 \geq 4x + 4$
 $4x \geq 18$

$x \geq \frac{9}{2}, [\frac{9}{2}, \infty)$

$x \geq \frac{9}{2}, [\frac{9}{2}, \infty)$

Title:
EMG-BA5-HC-02-09-2
Creator:

30. $7x \geq 21$

$x \geq 3, [3, \infty)$

Title:

$$\begin{matrix} 7x & 21 \\ 7 & 7 \end{matrix}$$

20. $7x - 3 < 9x - 3x$
 $7x - 3 < 6x$
 $3 < 0$

$x < 3, (-3)$

Title:
EMG-BA5-HC-02-09-2

$x < 3, (-3)$

Title:

EMG-BA5-HC-02-09-3

32. $y < 4$
 $y < 5, (-5]$

Title:

34. $2x + 14x + 5$
 $2x + 15$
 $2x + 4$
 $\underline{2x + 4}$

$2 + 2$
 $x + 2, (, 2]$

Title:

36. $4x + 8x + 2x$

$4x + 10x$
 $4 + 11x + 0$
 $11x + 4$
 $\underline{11x + 4}$

$11 + 11$
 $x + \frac{4}{11}, \frac{4}{11}$

Title:
 EMG-BA5-HC-02-09-3
 Creator:

38. $\frac{5}{6}x + 8$

$x + \frac{48}{5}, \frac{48}{5}$

Title:

EMG-BA5-HC-02-09-2
 Creator:

40. $5(x + 4) + 4(2x + 3)$
 $5x + 20 + 8x + 12$
 $3x + 20 + 12$

$3x + 8$
 $\underline{3x + 8}$
 $3 + 3$
 $x + \frac{8}{3}, \frac{8}{3}$

$3 + 3$

Title:

EMG-BA5-HC-02-09-3
 Creator:

42. $6(2x + 12)$
 $12 + 6x + 12$

44. $6x + 23(x + 4)$
 $6x + 23x + 12$
 $3x + 12$
 $3x + 14$

$\underline{3x + 14}$

$3 + 3$
 $x + \frac{14}{3}, \frac{14}{3}$

$3 + 3$

Title:

EMG-BA5-HC-02-09-4
 Creator:

46. $5(1x + x) + 6(2x) + 6$
 $5x + 5x + 6 + 2x + 6$

$5 + 6 + 2x$

$5 + 4 + x + 0$
 $4x + 5$

$x + \frac{5}{4}, \frac{5}{4}$

4

Title:

EMG-BA5-HC-02-09-4
 Creator:

48. $\frac{1}{3}(3x + 1) + \frac{1}{2}(x + 4)$
 $\frac{1}{6}(3x + 1) + \frac{1}{6}(x + 4)$

$3 + 2$
 $2(3x + 1) + 3(x + 4)$
 $6x + 2 + 3x + 12$
 $6x + 2 + 3x + 12 + 2$
 $6x + 3x + 14$
 $6x + 3x + 3x + 14$
 $3x + 14$
 $\underline{3x + 14}$

$3 + 3$

$\underline{14}$

$\underline{14}$

$6x + 0$

$\underline{6x + 0}$

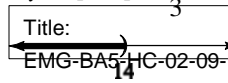
$6 + 6$

$x \geq 3$

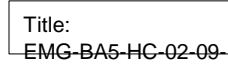
$x \geq 0$

Title:

50. $2 \leq y \leq 3$, [2, 3]



52. $1 \leq x \leq 4$, [1, 4]



54. $5 \times 2 \times 2$
 $\frac{5}{2} \times 1, \frac{5}{2}, 1$
 $2 \quad 2$

Title:
 EMG-BA5-HC-02-09-5
 Creator:

56. $4 \times 5 \times 6 \times 19$
 $10 \times 5 \times 25$
 $2 \times 5, [2, 5]$

Title:
 EMG-BA5-HC-02-09-

58. $0 \times 4 \times (5) \times 8$
 $0 \times 4 \times 20 \times 8$
 $20 \times 4 \times 12$
 $5 \times 3, (5, 3]$

Title:
 EMG-BA5-HC-02-09-6

60. $1 \times 4 \times 2 \times 7$
 $3 \times 2 \times 3$
 $\frac{3}{x} \times \frac{3}{x}, \frac{3}{x}, \frac{3}{x}$

$2 \quad 2 \quad 2 \quad 2$
 Title:
 EMG-BA5-HC-02-09-6
 Creator:

62. $5 \times 2 \times (x \times 4) \times 8$
 $5 \times 2 \times 8 \times 8$
 $13 \times 2 \times 0$

$\frac{13}{2} \times 0, \frac{13}{2}, 0 \quad 2$

Title:
 EMG-BA5-HC-02-09-6
 Creator:

64. Let x be the number.
 $5 \times 1 \times 10$
 $5 \times 1 \times 1 \times 10 \times 1$
 5×9
 $\frac{5 \times 9}{5}$

$5 \quad 5$
 $x \frac{9}{5}$

All numbers less than or equal to $\frac{9}{5}$ make this statement true.

66. Use $P = a + b + c$ when $a = x, b = 3x, c = 12$, and $P = 32$.
 $x + 3x + 12 = 32$

$4x + 12 = 32$
 $4x + 12 - 12 = 32 - 12$

$4x = 20$

$4x = 20$
 $4 \quad 4$
 $x \quad 5$

$3x + 3(5) = 15$
 The maximum lengths of the other two sides are 5 inches and 15 inches.

68. Convert heights to inches.

$6' 8" = 6 \times 12 + 8 = 80$
 $6' 6" = 6 \times 12 + 6 = 78$
 $6' 0" = 6 \times 12 + 0 = 72$
 $5' 9" = 5 \times 12 + 9 = 69$
 $6' 5" = 6 \times 12 + 5 = 77$

Let x be the height of the center.

$\frac{x + 80 + 78 + 72 + 69}{5} = 77$
 $x + 299 = 385$
 $x = 86$

77

$5 \times 77 = 385$
 $5 \times 299 = 1495$

$5 \times 299 = 1495$
 $x + 299 + 385 = 1495$
 $x + 684 = 1495$
 $x = 811$

$86" = 7' 2"$

The center should be at least 7' 2".

70. Let x represent the number of people. Then the cost is $40 + 15x$.

$40 + 15x = 860$
 $40 + 15x - 40 = 860 - 40$
 $15x = 820$
 $\frac{15x}{15} = \frac{820}{15}$
 $x = \frac{820}{15} \approx 54.7$

They can invite at most 54 people.

72. Let x represent the number of minutes.

$5.3x = 200$
 $\frac{5.3x}{5.3} = \frac{200}{5.3}$
 $x = \frac{200}{5.3}$

$x = \frac{200}{5.3} \approx 37.7$

5

3

The person must bicycle at least 38 minutes.

74. Let x = the unknown number.

$$2 \frac{1}{2}x + 4 = 3$$

$$6 \frac{1}{2}x + 7 = 12$$

All numbers between 12 and 14

76. $(3)^3 = (3)(3)(3) = 27$

78. $0^5 = (0)(0)(0)(0)(0) = 0$

80. $\frac{2}{3} \times \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3} = \frac{16}{27}$

82. Since $m < n$, then $2m < 2n$.

84. If $x < y$, then $x > y$.

86. Yes; answers may vary

88. Let x be the score on her final exam. Since the final counts as two tests, her final course average

is $\frac{85 + 95 + 92 + 3x}{6}$.

$$\frac{85 + 95 + 92 + 3x}{6} = 90$$

$$\frac{272 + 3x}{6} = 90$$

$$272 + 3x = 540$$

$$272 + 3x = 540$$

$$3x = 268$$

$$\frac{3x}{3} = \frac{268}{3}$$

$$x = 89.3$$

Her final exam score must be at least 89.3 for her to get an A.

90. answers may vary

92. answers may vary

94. $C = 3.14d$

$$118 = 3.14d$$

96. $x(x - 3) = x^2 - 3x$

$$x^2 - 3x = x^2 - 5x + 8$$

$$3x = 5x + 8$$

$$2x = 8$$

$$x = 4, [4,)$$

Title:

98. $x^2 - 4x + 8 = x(x - 8) + 8x$

$$x^2 - 4x + 8 = x^2 - 8x + 8x$$

$$4x + 8 = 8x$$

$$12x + 8 = 0$$

$$12x = -8$$

$$\frac{12x}{12} = \frac{-8}{12}$$

$$x = \frac{-2}{3}$$

$$x = \frac{-2}{3}, \frac{-2}{3}, \dots$$

$$x = \frac{-2}{3}$$

Title:

EMG-BA5-HC-02-09-4

Creator:

Chapter 2 Vocabulary Check

- Terms with the same variables raised to exactly the same powers are called like terms.
- If terms are not like terms, they are unlike terms.
- A linear equation in one variable can be written in the form $ax + b = c$.
- A linear inequality in one variable can be written $ax + b < c$ or $ax + b > c$.
The diameter must be between 37.58 mm and 38.85 mm.

in the form $ax + b < c$, (or $>$, $=$).

5. Inequalities containing two inequality symbols are called compound inequalities.
6. An equation that describes a known relationship among quantities is called a formula.
7. The numerical coefficient of a term is its numerical factor.
8. Equations that have the same solution are called equivalent equations.
9. The solutions to the equation $x + 5 = x + 5$ are all real numbers.
10. The solution to the equation $x + 5 = x + 4$ is no solution.

11. If both sides of an inequality are multiplied or divided by the same positive number, the direction of the inequality symbol is the same.
12. If both sides of an inequality are multiplied by the same negative number, the direction of the inequality symbol is reversed.

Chapter 2 Review

1. $5x + 2x = 6x$

2. $0.2z + 4.6x + 7.4z = 4.6x + 7.2z$

3. $\frac{1}{2}x + 3\frac{7}{2}x + 5\frac{8}{2}x = 24x + 2$

4. $\frac{4}{5}y + 1\frac{6}{5}y + 2\frac{10}{5}y = 3 + 2y + 3$

5. $2(n + 4) + n + 10 = 2n + 8 + n + 10 = 3n + 18$

6. $3(w + 2) + (12w) + 3w + 6 + 12w + 4w + 6$

7. $(x + 5) + (7x + 2) = x + 5 + 7x + 2 = 6x + 7$

8. $(y + 0.7) + (1.4y + 3) + y + 0.7 + 1.4y + 3 = 0.4y + 2.3$

9. Three times a number decreased by 7 is $3x - 7$.

10. Twice the sum of a number and 2.8 added to 3 times the number is $2(x + 2.8) + 3x$.

11. $8x + 4 + 9x = 8x + 4 + 9x + 8x = 4x$

12. $5y + 3 + 6y = 5y + 3 + 5y + 6y + 5y = 3y$

13. $\frac{4}{7}x + \frac{2}{7}x + 6 = \frac{7}{7}x + 6 = x + 6$

14. $3x + 5 + 4x + 1 = 5x + 6 = 6x$

15. $2x + 6 + x + 6 = x + 0$

16. $4(x + 3) + 3(1 + x) = 4x + 12 + 3 + 3x = 12 + 3 = x + 9$

17. $6(3n) + 5(n + 1) = 18n + 5n + 5 = 18n + 5 = n + 23$

18. $5(2x + 3) + 3(3x + 2) + 5(x + 6) + 2 = 10x + 15 + 9x + 6 + 5x + 30 + 2 = 4x + 5x + 32 = x + 28$

19. $x + 5 + 3 = x + 5 + 3 + 5 = x + 8$

20. $x + 9 + 2 = x + 9 + 2 + 9 = x + 11$

21. $10x$; choice b.

22. $x + 5$; choice a.

23. Complementary angles sum to 90. $(90 - x)$; choice b.

24. Supplementary angles sum to 180. $180 - (x + 5) = 180 - x - 5 = 175 - x = (175 - x)$; choice c.

25. $\frac{3}{4}x + 9 = \frac{4}{4}x + \frac{3}{4}x + 9 = 3 + 4 + 3 = x + 12$

26. $\frac{x}{6} + \frac{2}{3} = \frac{x}{6} + \frac{4}{6} = \frac{x + 4}{6} = \frac{x}{6} + \frac{2}{3} = x + 4$

27.
$$\begin{array}{r} 5x \ 0 \\ \underline{5x \ 0} \end{array}$$

$$\begin{array}{r} 5 \ 5 \\ x \ 0 \end{array}$$

28.
$$\begin{array}{r} y \ 7 \\ y \ \underline{7} \end{array}$$

$$\begin{array}{r} 1 \ 1 \\ y \ 7 \end{array}$$

29.
$$\begin{array}{r} 0.2x \ 0.15 \\ \underline{0.2x \ 0.15} \\ 0.2 \ 0.2 \\ x \ 0.75 \end{array}$$

30.
$$\begin{array}{r} \frac{x}{3} \ 1 \\ 3 \ \frac{x}{3} \ 31 \\ \underline{3 \ 3} \\ x \ 3 \end{array}$$

31.
$$\begin{array}{r} 3x \ 1 \ 19 \\ \underline{3x \ 18} \\ 3 \ 3 \\ x \ 6 \end{array}$$

32.
$$\begin{array}{r} 5x \ 25 \ 20 \\ \underline{5x \ 5} \\ \underline{5x \ 5} \end{array}$$

$$\begin{array}{r} 5 \ 5 \\ x \ 1 \end{array}$$

33.
$$\begin{array}{r} 7(x \ 1) \ 9 \ 5x \\ \underline{7x \ 7} \ 9 \ 5x \\ \underline{7x \ 2} \ 5x \\ \ 2 \ 2x \\ \underline{ \ 2} \ \underline{2x} \end{array}$$

$$\begin{array}{r} 2 \ 2 \\ 1 \ x \end{array}$$

34.
$$\begin{array}{r} 7x \ 6 \ 5x \ 3 \\ \underline{2x \ 6} \ 3 \\ \underline{2x \ 3} \\ \underline{2x \ 3} \\ 2 \ 2 \\ x \ \underline{3} \end{array}$$

35.
$$\begin{array}{r} 5x \ 3 \ 10 \ _ \\ \underline{7 \ 7} \end{array}$$

$$\begin{array}{r} 7 \ 5x \ 3 \ 10 \\ \underline{7 \ 7} \end{array}$$

$$\begin{array}{r} 35x \ 3 \ 10 \\ \underline{35x \ 7} \\ \ 7 \\ x \ \underline{35} \\ x \ \underline{1} \\ 5 \end{array}$$

36.
$$\begin{array}{r} 5x \ x \ 9 \ 4x \ 1 \ 6 \\ \underline{6 \ x} \ 4x \ 14 \\ \underline{2 \ x} \ 14 \\ x \ 7 \end{array}$$

37. Let x = the first integer, then
 $x + 1$ = the second integer, and
 $x + 2$ = the third integer.
 sum = $x + (x + 1) + (x + 2) = 3x + 3$

38. Let x = the first integer, then
 $x + 2$ = the second integer
 $x + 4$ = the third integer
 $x + 6$ = the fourth integer.
 sum = $x + (x + 6) = 2x + 6$

39.
$$\begin{array}{r} \frac{5}{3} \ x \ 4 \ \frac{2}{3} \ x \\ \underline{3 \ 3} \\ 3 \ \frac{5}{3} \ x \ 4 \ 3 \ \frac{2}{3} \ x \\ \underline{3 \ 3} \\ 5x \ 12 \ 2x \\ \underline{12 \ 3x} \\ 4x \end{array}$$

40.
$$\begin{array}{r} \frac{7}{8} \ x \ 1 \ \frac{x}{8} \\ \underline{ \ 7} \ \underline{ \ 8} \\ 8 \ x \ 1 \ 8 \ x \\ \underline{2 \ 8} \ \underline{8} \end{array}$$

41.

7

x

8

5

x

$82x$

4

x

(

5

x

1

)

7

x

3

5

x

1

7

x

3

$2x + 3$

2

x

4

x

2

42.
$$\frac{4(2x - 1) - 5x + 5}{8x - 4} = \frac{5x + 5}{3x - 4}$$

$$\frac{3x - 4}{3x - 9} = \frac{x + 3}{x - 3}$$

43.
$$6(2x - 5) - 3(9 - 4x)$$

$$\frac{12x - 30}{30} = \frac{27 - 12x}{27}$$

There is no solution.

44.
$$3(8y - 1) - 6(5 - 4y)$$

$$\frac{24y - 3}{3} = \frac{30 - 24y}{30}$$

There is no solution.

45.
$$\frac{3(2z)}{5} = z$$

$$\frac{3(2z) - 5z}{6} = \frac{5z}{6}$$

$$\frac{8z}{4} = z$$

46.
$$\frac{4(n - 2)}{5} = n$$

$$\frac{4(n - 2) - 5n}{4n - 8} = \frac{5n}{8n}$$

$$\frac{8}{9} = n$$

47.
$$0.5(2n - 3) - 0.1 = 0.4(6 - 2n)$$

$$10[0.5(2n - 3) - 0.1] = 10[0.4(6 - 2n)]$$

$$\frac{5(2n - 3) - 1}{10n - 15} = \frac{4(6 - 2n)}{10n - 15}$$

$$\frac{2n - 16}{2n - 40} = \frac{n - 20}{n - 20}$$

48.
$$\frac{9 - 5a}{9 - 5a} = \frac{3(6a - 1)}{18a - 3}$$

$$\frac{9 - 5a}{9 - 23a} = \frac{6 - 23a}{6 - 23a}$$

$$\frac{6}{23} = \frac{6}{23}$$

49.
$$\frac{5(c - 1)}{6} = 2c - 3$$

$$\frac{5(c - 1) - 6(2c - 3)}{7c - 5} = \frac{6(2c - 3) - 12c + 18}{7c - 5}$$

$$\frac{23}{23}$$

$$\frac{c}{7}$$

50.
$$\frac{2(8 - a)}{4} = 4a$$

$$3$$

$$\frac{2(8 - a) - 3(4 - 4a)}{16 - 2a} = \frac{3(4 - 4a) - 12 + 12a}{16 - 2a}$$

$$\frac{10a - 4}{10a - 4}$$

$$\frac{4}{10}$$

$$\frac{2}{5}$$

51.
$$200(70x - 3560) - 179(150x - 19,300)$$

$$\frac{14,000x - 712,000}{40,850x - 712,000} = \frac{26,850x - 3,454,700}{40,850x - 4,166,700}$$

52.
$$1.72y - 0.04y = 0.42$$

$$1.68y = 0.42$$

$$y = 0.25$$

53. Let x = length of a side of the square, then
 $50.5 + 10x$ = the height.
 $x(50.5 + 10x) = 7327$

$$\frac{11x - 50.5}{11x} = \frac{7327}{7276.5}$$

$$50.5 + 10x = 50.5 + 10(661.5) = 6665.5$$

The height is 6665.5 inches.

54. Let x = the length of the shorter piece and
 $2x$ = the length of the other.
 $x + 2x = 12$

$$\frac{3x}{x} = \frac{12}{4}$$

$$2x = 2(4) = 8$$

The lengths are 4 feet and 8 feet.

55. Let x = the number of Target Canada stores, then
 $14x - 69$ = the number of Target US stores.
 $x(14x - 69) = 1926$

$$\begin{array}{r} 15x - 69 = 1926 \\ 15x = 1995 \\ x = 133 \end{array}$$

$14x - 69 = 14(133) - 69 = 1862 - 69 = 1793$
 There were 133 Target Canada stores and 1793

Target US stores.

56. Let x = first integer, then
 $x + 1$ = second integer, and
 $x + 2$ = third integer.
 $x(x + 1)(x + 2) = 114$

$$\begin{array}{r} 3x^3 + 3x^2 + 2x = 114 \\ 3x^3 + 3x^2 + 2x - 114 = 0 \\ x = 39 \end{array}$$

$x + 1 = 39 + 1 = 40$
 $x + 2 = 39 + 2 = 41$
 The integers are 39, 40, 41.

57. Let x = the unknown number.

$$\begin{array}{r} \frac{x}{3} = x + 2 \\ x = 3(x + 2) \\ x = 3x + 6 \\ 2x = 6 \\ x = 3 \end{array}$$

The number is 3.

58. Let x = the unknown number.

$$\begin{array}{r} 2(x - 6) = x \\ 2x - 12 = x \\ 12 = 3x \\ 4 = x \end{array}$$

The number is 4.

59. Let $P = 46$ and $l = 14$.

$$\begin{array}{r} P = 2l + 2w \\ 46 = 2(14) + 2w \\ 46 = 28 + 2w \\ 18 = 2w \\ 9 = w \end{array}$$

60. Let $V = 192$, $l = 8$, and $w = 6$.

$$\begin{array}{r} V = lwh \\ 192 = 8(6)h \\ 192 = 48h \\ 4 = h \end{array}$$

61. $y = mx + b$
 $b = mx - y$
 $\frac{y}{m} = x - \frac{b}{m}$

$$x = \frac{y}{m} + \frac{b}{m}$$

62. $r = vst + 5$

$$\begin{array}{r} r - 5 = vst \\ \frac{r - 5}{v} = st \end{array}$$

$$st = \frac{r - 5}{v}$$

63. $2y = 5x + 7$

$$\begin{array}{r} 5x + 2y = 7 \\ x = \frac{7 - 2y}{5} \end{array}$$

64. $3x + 6y = 2$

$$\begin{array}{r} 6y + 3x = 2 \\ y = \frac{2 - 3x}{6} \end{array}$$

65. $\frac{C}{D} = \frac{C}{D}$

66. $C = 2r$

$$\frac{C}{2r} = r$$

67. Let $V = 900$, $l = 20$, and $h = 3$.

$$\begin{array}{r} V = lwh \\ 900 = 20w(3) \\ 900 = 60w \\ 15 = w \end{array}$$

The width is 15 meters.

68. Let x = width, then $x + 6$ = length.

$$\begin{array}{r} 60 = 2x(x + 6) \\ 60 = 2x^2 + 12x \\ 60 = 4x^2 + 12x \\ 48 = 4x^2 + 12x \\ 12 = x^2 + 3x \end{array}$$

$$x + 6 = 12 + 6 = 18$$

The dimensions are 18 feet by 12 feet.

69. Let $d = 10,000$ and $r = 125$.

$$\frac{d}{rt} = 10,000 \cdot \frac{1}{125t}$$

$$80t = 10,000$$

$$t = 125$$

It will take 80 minutes or 1 hour and 20 minutes.

70. Let $F = 104$.

$$C = \frac{5}{9}(F - 32)$$

$$C = \frac{5}{9}(104 - 32)$$

$$C = \frac{5}{9}(72)$$

$$C = 40$$

The temperature was 40C.

71. Let $x =$ the percent.

$$\frac{9}{45} = \frac{x}{45}$$

$$9 = 0.2x$$

9 is 20% of 45.

72. Let $x =$ the percent.

$$\frac{59.5}{85} = \frac{x}{85}$$

$$59.5 = 0.7x$$

59.5 is 70% of 85.

73. Let $x =$ the number.

$$137.5 = 125\% x$$

$$137.5 = 1.25x$$

$$\frac{137.5}{1.25} = \frac{1.25x}{1.25}$$

$$110 = x$$

137.5 is 125% of 110.

74. Let $x =$ the number.

$$768 = 60\% x$$

$$768 = 0.6x$$

$$\frac{768}{0.6} = \frac{0.6x}{0.6}$$

$$1280 = x$$

768 is 60% of 1280.

75. Let $x =$ mark-up.

$$x = 11\% \cdot 1900$$

$$x = 0.11 \cdot 1900$$

$$x = 209$$

New price = $1900 + 209 = 2109$

The mark-up is \$209 and the new price is \$2109.

76. Find 79% of 76,000.
 $0.79 \cdot 76,000 = 60,040$
 We would expect 60,040 people in that city to use the Internet.

77. Let x = gallons of 40% solution.

Strength	gallons	Concentration	
40%	x	0.4	$0.4x$
10%	$30x$	0.1	$0.1(30x)$
20%	30	0.2	$0.2(30)$

$0.4x + 0.1(30x) + 0.2(30)$
 $0.4x + 3.0x + 6$
 $3.4x + 6$
 $3.4x + 6 = 10$
 $3.4x = 4$
 $x = 1.176$
 $30x = 35.28$
 $30 - 35.28 = -5.28$
 Mix 10 gallons of 40% acid solution with 20 gallons of 10% acid solution.

78. Increase = $21.0 - 20.7 = 0.3$
 Let x = percent.
 $0.3 = x \cdot 20.7$
 $\frac{0.3}{20.7} = \frac{20.7x}{20.7}$
 $0.0145 = x$
 The percent of increase is 1.45%.

79. From the graph, the height of 'Almost hit a car' is 18%.

80. Choose the tallest bar. The most common effect is swerving into another lane.

81. Find 21% of 4600.
 $0.21 \cdot 4600 = 966$
 We would expect 966 customers to have cut someone off.

82. Find 41% of 4600.
 $0.41 \cdot 4600 = 1886$
 We would expect 1886 customers to have sped up.

83. percent of decrease $\frac{\text{amount of decrease}}{\text{original amount}}$
 $\frac{250 - 170}{250}$
 $\frac{80}{250}$
 0.32
 The percent of decrease is 32%.

84. Let x = original price.

$$\begin{array}{r}
 x \\
 0.20x \\
 0.80x \\
 \hline
 0.80x \\
 0.80 \\
 x
 \end{array}$$

The original price was \$24.

85. Let x = time up, then $3x$ = time down.

Rate Time = Distance

Up	10	x	$10x$
Down	50	$3x$	$50(3x)$

$$\begin{array}{r}
 10x \\
 10x \\
 60x \\
 x \\
 \hline
 10x \\
 10(2.5) \\
 25 \\
 25 \\
 50
 \end{array}$$

The distance traveled was 50 km.

86. Let x = the amount invested at 10.5% for one year.

	Principal	Rate =	Interest
10.5%	x	0.105	$0.105x$
8.5%	$50,000 - x$	0.085	$0.085(50,000 - x)$
Total	50,000		4550

$$\begin{array}{r}
 0.105x \\
 0.105x \\
 0.02x \\
 0.02x \\
 x \\
 50,000 - x \\
 50,000 - 15,000 = 35,000
 \end{array}$$

Invest \$35,000 at 8.5% and \$15,000 at 10.5%.

87. Let x = the number of dimes,
 $2x$ = the number of quarters, and
 $500 - 3x$ the number of nickels.

	No. of Coins	Value	= Amt. of Money
Dimes	x	0.1	$0.1x$
Quarters	$2x$	0.25	$0.25(2x)$
Nickels	$500 - 3x$	0.05	$0.05(500 - 3x)$
Total	500		88

$$0.1x + 0.25(2x) + 0.05(500 - 3x) = 88$$

$$0.1x + 0.5x + 25 - 0.15x = 88$$

$$0.45x + 25 = 88$$

$$0.45x = 63$$

$$x = 140$$

$$500 - 3x = 500 - 3(140) = 500 - 420 = 80$$

There were 80 nickels in the pay phone.

88. Let x = the time traveled by the Amtrak train.

	Rate	Time	= Distance
Amtrak	60	x	$60x$
Freight	45	$x + 1.5$	$45(x + 1.5)$

$d = d$

$$60x = 45(x + 1.5)$$

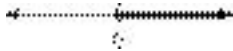
$$60x = 45x + 67.5$$

$$15x = 67.5$$

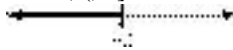
$$x = 4.5$$

It will take 4.5 hours.

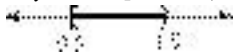
89. $x > 0$, $(0, \infty)$



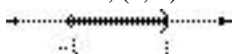
90. $x \leq 2$, $(-\infty, 2]$



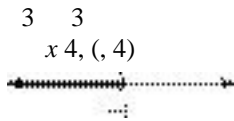
91. $0.5 < y < 1.5$, $(0.5, 1.5)$



92. $1 < x < 1$, $(1, 1)$

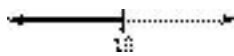


93. $\frac{3x}{3x} \geq \frac{12}{12}$



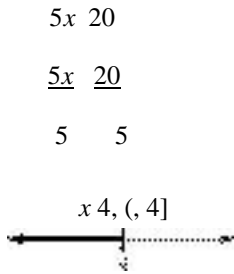
94. $\frac{2x}{2x} \leq \frac{20}{20}$

$x \leq 10, (-\infty, 10]$



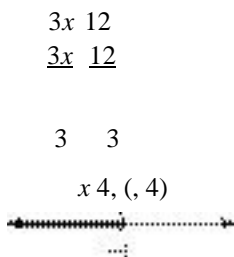
95. $\frac{x}{5x} \leq \frac{4}{4}$

$x \leq 4, (-\infty, 4]$



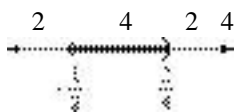
96. $\frac{5x}{3x} \geq \frac{7}{7}$

$x \geq 4, (4, \infty)$



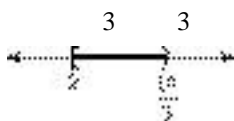
97. $\frac{3}{x} \leq \frac{4}{4}$

$x \geq 3, [3, \infty)$



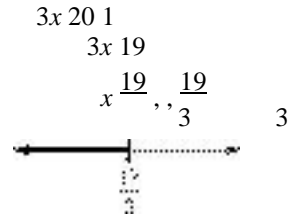
98. $\frac{2}{2x} \leq \frac{3}{3}$

$x \geq 2, [2, \infty)$



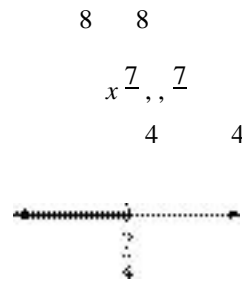
99. $\frac{4(2x)}{8x} \leq \frac{5}{5}$

$x \geq 1, [1, \infty)$



100. $\frac{2(x)}{2x} \leq \frac{2(3x)}{6x}$

$x \geq 4, [4, \infty)$



101. Let x = the amount of sales then $0.05x$ = her commission.

$175 + 0.05x \geq 300$

$0.05x \geq 125$

$x \geq 2500$

Sales must be at least \$2500.

102. Let x = her score on the fourth round.

$\frac{76 + 82 + 79 + x}{4} \leq 80$

$237 + x \leq 320$

$x \leq 83$

Her score must be less than 83.

103. $6x + 2x + 1 \leq 5x + 11$

$8x + 1 \leq 5x + 11$

$3x + 1 \leq 11$

$3x \leq 10$

$x \leq \frac{10}{3}$

104. $2(3y + 4) \leq 6 + 7y$

$6y + 8 \leq 6 + 7y$

$8 - 6 \leq 7y - 6y$

$$105. \begin{array}{r} 4(3a) + (6a - 9) = 12a \\ 12a + 6a - 9 = 12a \\ 3(10a) - 12a \\ \quad 3(2a) \\ \quad \quad \frac{3}{2}a \end{array}$$

$$106. \frac{x}{3} = 2 + 5$$

$$\frac{x}{3} = 7 \\ 3 \cdot \frac{x}{3} = 3 \cdot 7 \\ x = 21$$

$$107. \begin{array}{r} 2(y - 5) = 2y - 10 \\ 2y - 10 = 2y - 10 \end{array}$$

$$10 = 10$$

All real numbers are solutions.

$$108. \begin{array}{r} 7x - 3x = 2 + 2(2x - 1) \\ 4x = 2 + 4x - 2 \\ \quad 0 = 0 \end{array}$$

There is no solution.

$$109. \text{ Let } x = \text{the number.} \\ 6 + 2x = x + 7$$

$$6 + x = 7$$

$$x = 13$$

The number is 13.

$$110. \text{ Let } x = \text{length of shorter piece, then} \\ 4x + 3 = \text{length of longer piece.}$$

$$\begin{array}{r} x + (4x + 3) = 23 \\ 5x + 3 = 23 \\ 5x = 20 \\ x = 4 \end{array}$$

$$4x + 3 = 4(4) + 3 = 19$$

The shorter piece is 4 inches and the longer piece is 19 inches.

$$111. V = \frac{1}{3}Ah$$

$$3V = 3 \cdot \frac{1}{3}Ah$$

$$112. \text{ Let } x = \text{the number.}$$

$$x = 26\% \text{ of } 85$$

$$x = 0.26 \cdot 85$$

$$x = 22.1$$

22.1 is 26% of 85.

$$113. \text{ Let } x = \text{the number.}$$

$$72 = 45\% \text{ of } x$$

$$72 = 0.45x$$

$$\frac{72}{0.45} = \frac{0.45x}{0.45}$$

$$160 = x$$

$$160 = x$$

72 is 45% of 160.

$$114. \text{ Increase} = 282 - 235 = 47$$

Let $x =$ percent.

$$47 = x \cdot 235$$

$$\frac{47}{235} = \frac{235x}{235}$$

$$0.2 = x$$

$$0.2 = x$$

The percent of increase is 20%.

$$115. \begin{array}{r} 4x + 7 = 3x + 2 \\ x + 7 = 2 \\ x = 9, (9,) \end{array}$$

Title:

EMG-BA5-HC-02-09-1

$$116. \begin{array}{r} 5x + 20 \\ \frac{5x}{5} + \frac{20}{5} \\ x + 4 \end{array}$$

$$x + 4, (4,)$$

Title:

EMG-BA5-HC-02-RE

$$117. \begin{array}{r} 3(1 - 2x) = x(3 - x) \\ 3 - 6x = 3x - x^2 \\ 3 - 5x + x^2 \\ 0 = x^2 - 5x + 3 \end{array}$$

$$3 - 6x = 3x - x^2$$

$$3 - 5x + x^2$$

$$5x - x$$

$$6x - 0$$

$$6x - 0 =$$

$$6 = 6$$

$$x = 0, (0,]$$

Title:

$$\frac{3V}{A} \frac{Ah}{A}$$

$$\frac{3V}{A} \frac{Ah}{A}$$

$$\frac{3V}{A} \frac{Ah}{A}$$

$$\frac{3V}{A} h$$

$$\frac{3V}{A} h$$

Chapter 2 Getting Ready for the Test

1. There is no equal sign, so this is not an equation that can be solved. Also, there is only one term that cannot be further simplified. Thus the best direction is to identify the numerical coefficient; C.

2. This is an equation that can be solved; A.
3. Two terms are given, so the best direction is to determine whether the given terms are like or unlike terms; D.
4. There is no equal sign, so this is not an equation that can be solved; it is an expression that can be simplified; B.
5. Subtracting $100z$ from $8m$ translates to $8m - 100z$; B.
6. Subtracting $7x - 1$ from $9y$ translates to $9y - (7x - 1)$; C.
7.
$$\begin{array}{r} 7x - 6 - 7x + 9 \\ 7x - 7x - 6 + 7x + 9 \\ \hline 6 + 9 \end{array}$$
 False
The equation has no solution; B.
8.
$$\begin{array}{r} 2y - 5 - 2y + 5 \\ 2y - 2y - 5 + 2y + 5 \end{array}$$

$$5 - 5 \text{ True}$$

The equation has all real numbers as solutions; A.

9.
$$\begin{array}{r} 11x - 13 - 10x + 13 \\ 11x - 10x - 13 + 10x + 13 \\ \hline x + 13 - 13 \\ x + 13 - 13 - 13 + 13 \\ \hline x + 0 \end{array}$$

The solution is 0; C.

10.
$$\begin{array}{r} x - 15 - x + 15 \\ x - x - 15 + x + 15 \\ \hline 2x - 15 + 15 \\ 2x - 15 + 15 + 15 - 15 \\ \hline 2x + 0 \\ \frac{2x}{2} = \frac{0}{2} \\ x = 0 \end{array}$$

The solution is 0; C.

11. $5(3x - 2) = 5 \cdot 3x - 5 \cdot 2 = 15x - 10$
 $(x - 20) - 1(x - 20)$

$$\begin{array}{r} 1 \cdot x - 1 \cdot 20 \\ x - 20 \end{array}$$

The resulting equation is $15x - 10 = x - 20$; B.

12.
$$\begin{array}{r} 8x \qquad 8x \\ 30 \quad 1 \quad 30 \quad 30 \quad 1 \\ \hline 3 \qquad \qquad \qquad 3 \\ \hline 10 \quad 8x \quad 30 \\ \hline 80x - 30 \end{array}$$

$$30 \frac{x - 2}{10} = 3(x - 2) = 3x - 6$$

The simplified equation is $80x + 30 = 3x - 6$; D.

Chapter 2 Test

1. $2y - 6 - y + 4 = y - 2$
2. $2.7x + 6.1 + 3.2x - 4.9 = 5.9x + 1.2$
3. $4(x - 2) - 3(2x - 6) = 4x - 8 - 6x + 18 = -2x + 10$
4. $7 + 2(5y - 3) = 7 + 10y - 6 = 10y + 1$

5.
$$\begin{array}{r} 4 \\ \hline 5 \end{array} \frac{x - 4}{5}$$

6. $4(n - 5) - 4(2n) = 4n - 20 - 8n = -4n - 20$

7. $5y - 7 - y + 3y = 7y - 7$

8.
$$\begin{array}{r} 6y - 7 - 4y \\ 7 - 10 - y \\ \hline \frac{7}{10}y \end{array}$$

9.
$$\begin{array}{r} 4z - 1 - z + 1 - z \\ 3z - 1 - 1 - z \\ \hline 2z - 2 \\ 2z - 0 \\ \hline z - 0 \end{array}$$

$$\frac{2(x - 6)}{x - 5}$$

9.
$$\begin{array}{r} 3 \\ 2(x - 6) - 3(x - 5) \\ 2x - 12 - 3x + 15 \\ \hline -x + 3 \\ \hline 27 - x \end{array}$$

10.
$$\frac{1}{2}x - \frac{3}{2}x + 4$$

$$\frac{1}{2}x - \frac{3}{2}(x + 4)$$

$$\frac{1}{2}x - \frac{3}{2}x - \frac{3}{2} \cdot 4$$

$$\frac{1}{2}x - \frac{3}{2}x - 6$$

$$-\frac{2}{2}x - 6$$

$$-x - 6$$

11. $0.3(x + 4) + 0.5(3x)$

$$10[0.3(x + 4) + 0.5(3x)]$$

$$3(x + 4) + 10 \cdot 0.5(3x)$$

$$3x + 12 + 10 \cdot 1.5x$$

$$3x + 12 + 15x$$

$$12x + 12 + 15$$

$$12x + 27$$

$$x + \frac{27}{12} = 0.25x + 2.25$$

12. $4(a + 1) + 3a + 7(2a + 3)$

$$4a + 4 + 3a + 14a + 21$$

$$7a + 4 + 14a + 21$$

$$21a + 25$$

$$a + \frac{25}{7}$$

13. $2(x + 3) + 5 + 3x$

$$2x + 6 + 5 + 3x$$

$$5x + 11$$

There is no solution.

14. Let $y = 14$, $m = 2$, and $b = 2$.

$$y = mx + b$$

$$14 = 2x + 2$$

$$12 = 2x$$

$$6 = x$$

15. $V = r^2 h$

$$\frac{V}{r^2} = \frac{r^2 h}{r^2}$$

$$\frac{V}{r^2} = h$$

16. $3x + 4y = 10$

$$4y + 3x = 10$$

$$y = \frac{3x + 10}{4}$$

$$y = \frac{3x + 10}{4}$$

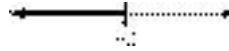
17. $3x + 5 = 7x + 3$

$$4x + 5 = 3$$

$$4x = 8$$

$x = 2$

$(2, 2)$



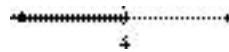
18. $x + 6 = 4x + 6$

$$3x = 0$$

$$x = 0$$

$x = 0$

$(0, 4)$

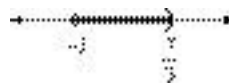


19. $2 + 3x = 1 + 8$

$$3x = 7$$

$$x = \frac{7}{3}$$

$x = \frac{7}{3}$



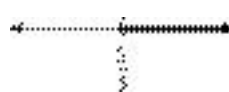
20. $\frac{2(5x + 1)}{3} = 2$

$$2(5x + 1) = 6$$

$$10x + 2 = 6$$

$$10x = 4$$

$x = \frac{4}{10} = \frac{2}{5}$



21. Let $x =$ the number.

$$x \frac{2}{3} x 35$$

$$3x \frac{2}{3} x 3(35)$$

$$3x 2x 105$$

$$5x 105$$

$$x 21$$

The number is 21.

22. Let $x =$ width, then $x + 2 =$ length.

$$P 2w 2l$$

$$252 2x 2(x + 2)$$

$$252 2x 2x 4$$

$$252 4x 4$$

$$252 4 4x 4 4$$

$$248 4x$$

$$\frac{248}{4} \frac{4x}{4}$$

$$62 x$$

$$64 = x + 2$$

The dimensions of the deck are 62 feet by 64 feet.

23. Let $x =$ one area code, then

$2x =$ other area code.

$$x 2x 1203$$

$$3x 1203$$

$$\frac{3x}{3} \frac{1203}{3}$$

$$x 401$$

$$2x = 2(401) = 802$$

The area codes are 401 and 802.

24. Let $x =$ the amount invested at 10% for one year.

Principal Rate = Interest

10%	x	0.10	$0.1x$
12%	$2x$	0.12	$0.12(2x)$
Total			2890

$$0.1x 0.12(2x) 2890$$

$$0.1x 0.24x 2890$$

$$0.34x 2890$$

$$x 8500$$

$$2x = 2(8500) = 17,000$$

He invested \$8500 at 10% and \$17,000 at 12%.

25. Let $x =$ the time they travel.

Rate Time = Distance

Train 1	50	x	$50x$
Train 2	64	x	$64x$
Total			285

$$50x 64x 285$$

$$114x 285$$

$$x 2$$

They must travel for $2\frac{1}{2}$ hours.

26. From the graph, 69% are classified as weak. Find 69% of 800.

$$69\% 800 = 0.69 800 = 552$$

You would expect 552 of the 800 to be classified as weak.

27. Let x be the unknown percent.

$$72x 180$$

$$\frac{72}{180} \frac{180x}{180}$$

$$0.4x$$

72 is 40% of 180.

28. percent of decrease $\frac{\text{amount of decrease}}{\text{original amount}}$

$$\frac{225}{225} \frac{189}{189}$$

$$225$$

$$\frac{36}{225}$$

$$0.16$$

The percent of decrease is 16%.

Chapter 2 Cumulative Review

- The natural numbers are 11 and 112.
- The whole numbers are 0, 11, and 112.
- The integers are 3, 2, 0, 11, and 112.
- The rational numbers are 3, 2, 1.5, 0, $\frac{1}{4}$, 11, and 112.
- The irrational number is $\sqrt{2}$.
- All the numbers in the given set are real numbers.

2. a. The natural numbers are 2, 7, and 8.
 b. The whole numbers are 0, 2, 7, and 8.
 c. The integers are 185, 0, 2, 7, and 8.
 d. The rational numbers are $185, \frac{1}{5}, 0, 2, 7,$
 and 8.
 e. The irrational number is $\sqrt{3}$.
 f. All the numbers in the given set are real numbers.

3. a. $|4| = 4$
 b. $|5| = 5$
 c. $|0| = 0$
 d. $\left| \frac{1}{2} \right| = \frac{1}{2}$
 e. $|5.6| = 5.6$
 4. a. $|5| = 5$
 b. $|8| = 8$
 c. $\left| \frac{2}{3} \right| = \frac{2}{3}$

5. a. $40 = 2 \cdot 2 \cdot 2 \cdot 5$
 b. $63 = 3 \cdot 3 \cdot 7$
 6. a. $44 = 2 \cdot 2 \cdot 11$
 b. $90 = 2 \cdot 3 \cdot 3 \cdot 5$

7. $\frac{2}{5} \cdot \frac{2}{5} \cdot \frac{4}{4} \cdot \frac{8}{20}$
 8. $\frac{2}{3} \cdot \frac{2}{3} \cdot \frac{8}{8} \cdot \frac{16}{24}$

9. $3[4 \cdot 2(10 \cdot 1)] \cdot 3[4 \cdot 2(9)]$
 $3[4 \cdot 18]$
 $3[22]$
 66

10. $5[16 \cdot 4(2 \cdot 1)] \cdot 5[16 \cdot 4(3)]$
 $5[16 \cdot 12]$
 $5[4]$
 20

11. Let $x = 2$.
 $3x - 10 = 8x$
 $3(2) - 10 = 8(2)$
 $6 - 10 = 16$
 $-4 = 16$
 2 is a solution of the equation.

12. Let $x = 3$.
 $5x - 2 = 4x$
 $5(3) - 2 = 4(3)$
 $15 - 2 = 12$
 $13 = 12$
 3 is not a solution of the equation.

13. $1 + (2) = 3$

14. $(2) + (8) = 10$

15. $4 + 6 = 2$

16. $3 + 10 = 7$

17. a. $(-10) = 10$

b. $\frac{1}{2} = \frac{1}{2}$

c. $(2x) = 2x$

d. $|6| = (6) = 6$

18. a. $(5) = 5$

b. $\frac{2}{3} = \frac{2}{3}$

c. $(a) = a$

d. $|3| = (3) = 3$

19. a. $5.3(4.6) = 5.3 + 4.6 = 9.9$

b. $\frac{3}{10} \frac{5}{10} \frac{3}{10} \frac{5}{10}$

$$\frac{\frac{3}{10} \frac{5}{10}}{\frac{8}{10}} = \frac{3}{4}$$

5

c. $\frac{2}{3} \frac{4}{5} \frac{3}{5} \frac{4}{5}$

$$\frac{\frac{2}{3} \frac{4}{5} \frac{3}{5} \frac{4}{5}}{\frac{10}{15}} = \frac{2}{15}$$

20. a. $2.7 \cdot 8.4 = 2.7 + (8.4) = 11.1$

b. $\frac{4}{5} \frac{3}{5} \frac{4}{5} \frac{3}{5} \frac{4}{5} \frac{3}{5}$

c. $\frac{1}{4} \frac{1}{2} \frac{1}{4} \frac{2}{2} \frac{1}{4} \frac{2}{4} \frac{3}{4}$

21. a. $x = 90 - 38 = 90 + (-38) = 52$
The complementary angle is 52.

b. $y = 180 - 62 = 180 + (-62) = 118$
The supplementary angle is 118.

22. a. $x = 90 - 72 = 90 + (-72) = 18$
The complementary angle is 18.

b. $y = 180 - 47 = 180 + (-47) = 133$
The supplementary angle is 133.

23. a. $(1.2)(0.05) = 0.06$

b. $\frac{2}{3} \frac{7}{10} \frac{27}{30} \frac{14}{30} \frac{7}{15}$

c. $\frac{4}{(20)} \frac{4 \cdot 20 \cdot 80}{16}$

25. a. $\frac{24}{4} = 6$

b. $\frac{36}{3} = 12$

c. $\frac{25}{3} \frac{24}{4} \frac{8}{3} = 5 \cdot 15 = 75$

d. $\frac{3}{2} \frac{9}{2} \frac{3}{1} \frac{13}{9} \frac{1}{18} = 6$

26. a. $\frac{32}{8} = 4$

b. $\frac{108}{12} = 9$

c. $\frac{5}{7} \frac{9}{2} \frac{5}{7} \frac{2}{9} \frac{10}{63} = \frac{10}{63}$

27. a. $x + 5 = 5 + x$

b. $3x = x \cdot 3$

28. a. $y + 1 = 1 + y$

b. $y \cdot 4 = 4 \cdot y$

29. a. $8 \cdot 2 + 8 \cdot x = 8(2 + x)$

b. $7s + 7t = 7(s + t)$

30. a. $4 \cdot y \cdot 4 \cdot \frac{4}{3} y^1 \cdot 3^1 = 64 \cdot \frac{4}{3} y^1 \cdot 3 = 80y$

b. $0.10x + 0.10y = 0.10(x + y)$

31. $(2 \cdot x \cdot 3) (4 \cdot x \cdot 2) \cdot 2 \cdot x \cdot 3 \cdot 4 \cdot x \cdot 2 \cdot x \cdot 1 = 144x^6$

32. $(5x - 1)(10x - 3) = 50x^2 - 15x - 10x + 3 = 50x^2 - 25x + 3$

24. a. $(4.5)(0.08) = 0.36$

b. $\frac{3}{4} \frac{8}{17} \frac{38}{417} \frac{24}{68} \frac{6}{17}$

33. $\frac{1}{2} x \frac{3}{4}$
 $\frac{1}{4} 4(x) \frac{3}{4}$
 $\frac{2}{2} 4 x 3$
 $5 4x$
 $\frac{5}{4} x$

34.
$$\frac{5}{6}x - \frac{2}{3}$$

35.
$$\frac{6(2a-1) - (11a-6)}{12a-6} - \frac{7}{a-12} - \frac{7}{a-19}$$

36.
$$\frac{3x-1}{3x-1} - \frac{4x-6}{4x-6} - \frac{10}{x-7} - \frac{10}{x-3}$$

37.
$$\frac{y}{7} - 20$$

$$y - 140$$

38.
$$\frac{x}{4} - 18$$

$$x - 72$$

39.
$$\frac{4(2x-3) - 7 - 3x}{8x-12} - \frac{7 - 3x}{8x-12} - \frac{5x-5}{5x-5} - \frac{5x-10}{x-2}$$

40.
$$\frac{6x-5}{6x-5} - \frac{4(x-4)-1}{6x-5} - \frac{4x-15}{4x-15} - \frac{2x-5}{2x-5} - \frac{10}{x-5}$$

41. Let $x =$ a number.

$$\frac{2(x-4) - 4x - 12}{2x-8} - \frac{4x-12}{4x-12}$$

The number is 10.

42. Let $x =$ a number.

$$\frac{x-4}{4} - \frac{3x-8}{2x-8} - \frac{12-2x}{6x}$$

The number is 6.

43.
$$\frac{V}{wh} = \frac{lwh}{wh}$$

$$V = l$$

44.
$$\frac{C-2r}{2} = \frac{C}{2} - r$$

45. $x - 10, (-10]$

Title:

46. $x - 3, (3,)$

Title:

EMG-BA5-HC-02-REV

Mini-Lecture 2.9

Simplifying Algebraic Expressions

Learning Objectives:

1. Identify terms, like terms, and unlike terms.
2. Combine like terms.
3. Use the distributive property to remove parentheses.
4. Write word phrases as algebraic expressions.

Examples

1. Identify the numerical coefficient of each term.

a) $9x$

b) $-3y$

c) $-x$

d) $2.7x_2y$

Indicate whether the terms in each list are like or unlike.

e) $6x, -3x$

f) $-xy_2, -x_2y$

g) $5ab, -\frac{1}{2}ba$

h) $2x^3yz^2, -x^3yz^3$

2. Simplify each expression by combining any like terms.

a) $7x - 2x + 4$

b) $-9y + 2 - 1 + 6 + y - 7$

c) $1.6x_5 + 0.9x_2 - 0.3x_5$

3. Simplify each expression. Use the distributive property to remove any parentheses.

a) $3(x + 6)$

b) $-(-5m + 6n - 2p)$

c) $\frac{1}{3}(6x - 9)$

Remove parentheses and simplify each expression.

d) $14(2x + 6) - 4$

e) $10a - 5 - 2(a - 3)$

f) $3(2x - 5) - (x + 7)$

4. Write each phrase as an algebraic expression. Simplify if possible.

a) Add $-4y + 3$ to $6y - 9$

b) Subtract $2x - 1$ from $3x + 7$

c) Triple a number, decreased by six

d) Six times the sum of a number and two

Teaching Notes:

- Students will need repeated practice with identifying terms and like terms.
- Some students do not know that a variable without a numerical coefficient actually has a coefficient of 1.
- Some students will forget to distribute the minus sign in 3b), 3e), and 3f). Some students might need to write a 1 in front of the parentheses in 3b) and 3f).

Answers: 1a) 9; 1b) -3; 1c) -1; 1d) 2.7; 1e) like; 1f) unlike; 1g) like; 1h) unlike; 2a) $5x+4$; 2b) $-8y$; 2c) $1.3x_5+0.9x_2$; 3a) $3x+18$; 3b) $5m-6n+2p$; 3c) $2x-3$; 3d) $28x+80$; 3e) $8a+1$; 3f) $5x-22$;

Mini-Lecture

$$4a) (-4y+3) + (6y-9) = 2y-6; 4b) (3x+7) - (2x-1) = x + 8; 4c) 3x-6; 4d) 6(x + 2)$$

Mini-Lecture

The Addition Property of Equality

Learning Objectives:

1. Define linear equations and use the addition property of equality to solve linear equations.
2. Write word phrases as algebraic expressions.

Examples:

1. Solve each equation. Check each solution.

a) $y - 6 = 18$ b) $-18 = t - 5$ c) $8.1 + y = 13.9$ d) $a + \frac{2}{3} = -\frac{3}{4}$

Solve each equation. If possible, be sure to first simplify each side of the equation. Check each solution.

e) $5(y + 2) = 6(y - 3)$

f) $10x = 4x + 9 + 5x$

g) $-8z + 5 + 6z = -3z + 10$

h) $-5x + 4 + 6x = 15 - 28$

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

j) $-14.9 + 4a - 2.7 + 2a = 5.1 + 7a + 1.5$

2. Write each algebraic expression described.

a) Two numbers have a sum of 72. If one number is z , express the other number in terms of z .

b) During a recent marathon, Tom ran 8 more miles than Judy ran. If Judy ran x miles, how many miles did Tom run?

c) On a recent car trip, Raymond drove x miles on day one. On day two, he drove 170 miles more than he did on day one. How many miles, in terms of x , did Raymond drive for both days combined?

Teaching Notes:

- Some students need a quick review of “like terms.”
- Advise students to write out each step until they have mastered this concept. Avoid shortcuts!
- Some students need to be taught how to work a problem in sequential order showing each step.
- Encourage students to take their time and organize their work. This will help when the problems become more complex.

Answers: 1a) 24; 1b) -13; 1c) 5.8; 1d) -17/12; 1e) 28; 1f) 9; 1g) 5; 1h) -17; 1i) -5/6; 1j) 11;
2a) $72 - z$; 2b) $x + 8$; 2c) $2x + 170$

Mini-Lecture

2.11

The Multiplication Property of Equality

Learning Objectives:

1. Use the multiplication property of equality to solve linear equations.
2. Use both the addition and multiplication properties of equality to solve linear equations.
3. Write word phrases as algebraic expressions.

Examples:

1. Use the multiplication property of equality to solve the following linear equations. Check each solution.

a) $-8x = -24$

b) $7x = 0$

c) $-z = 19$

d) $3x = -22$

e) $\frac{2}{5}a = 12$

f) $\frac{y}{-11} = 2.5$

g) $\frac{-3}{8}b = 0$

h) $-10.2 = -3.4c$

2. Use the addition property of equality and the multiplication property of equality to solve the following linear equations. Check each solution.

a) $5x + 6 = 46$

b) $\frac{a}{9} - 7 = 11$

c) $-24 = -3x - 9$

d) $\frac{1}{3}y - \frac{1}{3} = -6$

e) $-5.8z + 1.9 = -32.5 - 1.5z$

f) $8y + 7 = 6 - 2y - 10y$

g) $4(4x - 1) = (-8) - (-24)$

3. Write each algebraic expression described. Simplify if possible.

- a) If z represents the first of two consecutive even integers, express the sum of the two integers in terms of z .
- b) If x represents the first of three consecutive even integers, express the sum of the first and third integer in terms of x .
- c) Houses on one side of a street are all numbered using consecutive odd integers. If the first house on the street is numbered x , write an expression in x for the sum of five house numbers in a row.

Teaching Notes:

- Review “like terms” with students.
- Many students do not combine like terms before using one of the properties.
- Encourage students to always take the time to check their solution.

Answers: 1a) 3; 1b) 0; 1c) -19; 1d) -22/3; 1e) 30; 1f) -27.5; 1g) 0; 1h) 3; 2a) 8; 2b) 162; 2c) 5;

Mini-Lecture 2.12

2d) -17 ; 2e) 8 ; 2f) $-1/20$; 2g) $5/4$; 3a) $2z+2$; 3b) $2x+4$; 3c) $5x+20$

Mini-Lecture

2.13

Solving Linear Equations

Learning Objectives:

1. Apply a general strategy for solving a linear equation.
2. Solve equations containing fractions.
3. Solve equations containing decimals.
4. Recognize identities and equations with no solution.

Examples:

1. Solve the following linear equations.

a) $6a - (5a - 1) = 4$

b) $4(3b - 1) = 16$

c) $4z = 8(2z + 9)$

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

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

f) $12(4c - 2) = 3c - 4$

2. Solve each equation containing fractions.

a) $\frac{y}{6} - 4 = 1$

b) $\frac{1}{4}x - \frac{3}{8}x = 5$

c) $\frac{-6x+5}{4} + 1 = -\frac{5x}{4}$

6

4 8

4

4

Solve each equation containing decimals.

d) $0.05x + 0.06(x - 1,500) = 570$

e) $0.4(x + 7) - 0.1(3x + 6) = -0.8$

3. Solve each equation. Indicate if it is an identity or an equation with no solution.

a) $6(z + 7) = 6z + 42$

b) $3 + 12x - 1 = 8x + 4x - 1$

c) $\frac{x}{3} - 3 = \frac{2x}{6} + 1$

3

6

Teaching Notes:

- Refer students to the beginning of this section in the textbook for steps: Solving Linear Equations in One Variable.
- Most students find solving equations with fractions or decimals difficult.
- Common error: When multiplying equations with fractions by the LCD, some students multiply only the terms with fractions instead of all terms.
- Common error: When solving equations with decimals and parentheses (examples 2d and 2e), some students multiply terms both inside parentheses and outside parentheses by a power of 10.

Answers: 1a) 3; 1b) 5/3; 1c) -6; 1d) 31; 1e) 29; 1f) 4/9; 2a) 30; 2b) -40; 2c) 9; 2d) 6,000 2e) -30; 3a) identity; 3b) no solution; 3c) no solution

Mini-Lecture

2.13

An Introduction to Problem Solving

Learning Objectives:

Apply the steps for problem solving as we

1. Solve problems involving direct translations.
2. Solve problems involving relationships among unknown quantities.
3. Solve problems involving consecutive integers.

Examples:

1. Solve.
 - a) Eight is added to a number and the sum is doubled, the result is 11 less than the number. Find the number.
 - b) Three times the difference of a number and 2 is equal to 8 subtracted from twice a number. Find the integers.
2. Solve.
 - a) A college graduating class is made up of 450 students. There are 206 more girls than boys. How many boys are in the class?
 - b) A 22-ft pipe is cut into two pieces. The shorter piece is 7 feet shorter than the longer piece. What is the length of the longer piece?
 - c) A triangle has three angles, A, B, and C. Angle C is 18° greater than angle B. Angle A is 4 times angle B. What is the measure of each angle?
(Hint: The sum of the angles of a triangle is 180°).
3. Solve.
 - a) The room numbers of two adjacent hotel rooms are two consecutive odd numbers. If their sum is 1380, find the hotel room numbers.
 - b) When you open a book, the left and right page numbers are two consecutive natural numbers. The sum of their page numbers is 349. What is the number of the page that comes first?

Teaching Notes:

- Many students find application problems challenging.
- Encourage students, whenever possible, to draw diagrams, charts, etc.
- Encourage students to use algebra to solve a problem even though they may be able to solve without it.
- Refer students to *General Strategy for Problem Solving* section 2.5, page 111.

Answers: 1a) -27; 1b) 21, 63; 2a) 122 boys; 2b) 14.5 feet; 2c) $A=108^\circ$, $B=27^\circ$, $C=45^\circ$; 3a) 689, 691;
3b) 174

Mini-Lecture 2.14

Formulas and Problem Solving

Learning Objectives:

1. Use formulas to solve problems.
2. Solve a formula or equation for one of its variables.

Examples:

1. Substitute the given values into each given formula and solve for the unknown variable. If necessary, round to one decimal place.

a) Distance Formula
 $d = rt; t = 9, d = 63$

b) Perimeter of a rectangle
 $P = 2l + 2w; P = 32, w = 7$

c) Volume of a pyramid
$$V = \frac{1}{3}Bh$$
 $230, r = 0.02$

d) Simple interest
 $I = prt; I = 23, p =$
 $Bh; V = 40, h = 8$

e) Convert the record high temperature of 102°F to Celsius. ($F = \frac{9}{5}C + 32$)

f) You have decided to fence an area of your backyard for your dog. The length of the area is 1 meter less than twice the width. If the perimeter of the area is 70 meters, find the length and width of the rectangular area.

g) For the holidays, Chris and Alicia drove 476 miles. They left their house at 7 a.m. and arrived at their destination at 4 p.m. They stopped for 1 hour to rest and re-fuel. What was their average rate of speed?

2. Solve each formula for the specified variable.

a) Area of a triangle
 $A = \frac{1}{2}bh$ for b

b) Perimeter of a triangle
 $P = s_1 + s_2 + s_3$ for s_3

c) Surface area of a special rectangular box
 $S = 4lw + 2wh$ for l

d) Circumference of a circle
 $C = 2\pi r$ for r

Teaching Notes:

- Most students will only need algebra reminders when working with a formula given values.
- Refer students to *Solving Equations for a Specified Variable* chart in the textbook, page 127.
- Most students have problems with applications. Refer them back to section 2.5 and the *General Strategy for Problem Solving* in the textbook, page 111.

Answers: 1a) 7; 1b) 9; 1c) 15; 1d) 5; 1e) 38.9°C; 1f) $l=23, w=12$; 1g) 59.5 mph; 2a) $b = \frac{2A}{h}$; $\frac{\quad}{h}$

Mini-Lecture 2.15

$$2b) s = P - s_1 - s_2; \quad 2c) \frac{S - 2wh}{4w}; \quad 2d) r = \frac{C}{2\pi}$$

Mini-Lecture 2.7

Percent and Mixture Problem Solving

Learning Objectives:

1. Solve percent equations.
2. Solve discount and mark-up problems.
3. Solve percent of increase and percent of decrease problems.
4. Solve mixture problems.

Examples:

1. Find each number described.

a) 5% of 300 is what number?	b) 207 is 90% of what number?
c) 15 is 1% of what number?	d) What percent of 350 is 420?

2. Solve the following discount and mark-up problems. If needed, round answers to the nearest cent.
 - a) A “Going-Out-Of-Business” sale advertised a 75% discount on all merchandise. Find the discount and the sale price of an item originally priced at \$130.
 - b) Recently, an anniversary dinner cost \$145.23 excluding tax. Find the total cost if a 15% tip is added to the cost.

3. Solve the following percent increase and decrease problems.
 - a) The number of minutes on a cell phone bill went from 1200 minutes in March to 1600 minutes in April. Find the percent increase. Round to the nearest whole percent.
 - b) In 2004, a college campus had 8,900 students enrolled. In 2005, the same college campus had 7,600 students enrolled. Find the percent decrease. Round to the nearest whole percent.
 - c) Find the original price of a pair of boots if the sale price is \$120 after a 20% discount.

4. How much pure acid should be mixed with 4 gallons of a 30% acid solution in order to get a 80% acid solution? Use the following table to model the situation.

	Number of Gallons · Acid Strength = Amount of Acid		
Pure Acid			
30% Acid Solution			
80% Acid Solution Needed			

Teaching Notes:

- Most students find problem solving challenging. Encourage students to make a list of all appropriate formulas.

Answers: 1a) 15; 1b) 230; 1c) 1500; 1d) 120%; 2a) discount - \$97.50, sale price - \$32.50; 2b) \$167.01; 3a) 33%; 3b) 15%; 3c) \$150; 4) 10 gallons

Mini-Lecture 2.7

Percent and Mixture Problem Solving Further Problem Solving

Learning Objectives:

Learning Objectives:

1. Solve problems involving distance.
2. Solve problems involving money.
3. Solve problems involving interest.

Examples:

1. How long will it take a car traveling 60 miles per hour to overtake an activity bus traveling 45-miles per hour if the activity bus left 2 hours before the car?

	<i>r</i>	<i>D</i>	<i>t</i>
Car	60 mph	$60x$	x
Activity Bus	45 mph	$45(x + 2)$	$x + 2$

2. A collection of dimes and quarters and nickels are emptied from a drink machine. There were four times as many dimes as quarters, and there were ten less nickels than there were quarters. If the value of the coins was \$19.50, find the number of quarters, the number of dimes, and the number of nickels.

	Number	Value of each	Total value	
Quarters	x	0.25	$0.25x$	40 @ 0.25=\$10.00
Dimes	$2x$	0.10	$0.10(2x)$	80 @ 0.10=\$8.00
Nickels	$x - 10$	0.05	$0.05(x - 10)$	30 @ 0.05=\$1.50
Entire Collection			\$19.50	\$19.50

3. Jeff received a year end bonus of \$80,000. He invested some of this money at 8% and the rest at 10%. If his yearly earned income was \$7,300, how much did Jeff invest at 10%? Use the following table to model the situation.

	Principal	Rate	Time	=	Interest
8% Fund	x	0.08	1		$0.08x$
10% Fund	$80,000 - x$	0.1	1		$0.01(80,000 - x)$
Total	80,000				7,300

Teaching Notes:

- Most students find problem solving challenging. Encourage students to make a list of all appropriate formulas.

Mini-Lecture 2.7

Percent and Mixture Problem Solving

Answers: 1) 6 hours; 2) Number of Quarters = 40, Number of dimes = 80, number of nickels = 303; 3) \$45,000

Learning Objectives:

Mini-Lecture 2.9

Solving Linear Inequalities

Learning Objectives:

1. Define linear inequality in one variable, graph solution sets on a number line, and use interval notation.
2. Solve linear inequalities.
3. Solve compound inequalities.
4. Solve inequality applications.

Examples:

1. Graph each inequality on a number line and write it in interval notation.

a) $x \geq -5$ b) $y < 7$ c) $-\frac{3}{2} \geq m$ d) $x > -\frac{2}{5}$

2. Using the addition property of inequality, solve each inequality. Graph the solution set and write it in interval notation.

a) $x + 7 \leq 12$ b) $x - 10 > -3$ c) $-4z - 2 > -5z + 1$ d) $18 - 2x \leq -3x + 24$

Using the multiplication property of inequality, solve each inequality. Graph the solution set and write it in interval notation.

e) $-8 \geq \frac{x}{3}$ f) $3x < 73$ g) $0 < \frac{y}{8}$ h) $-\frac{3}{5}z \leq 9$

Using both properties, solve each inequality.

i) $3(3x - 16) < 12(x - 2)$ j) $-18(z - 2) \geq -21z + 24$ k) $\frac{8}{21}(x + 2) > \frac{1}{7}(x + 3)$

3. Solve each inequality. Graph the solution set and write it in interval notation.

a) $-5 < t \leq 0$ b) $-12 \leq 2x < -8$ c) $3 \leq 4x - 9 \leq 7$

4. Solve the following.

a) Eight more than twice a number is less than negative twelve. Find all numbers that make this statement true.

b) One side of a triangle is six times as long as another side and the third side is 8 inches long. If the perimeter can be no more than 106 inches, find the maximum lengths of the other two sides.

Teaching Notes:

- Remind students to reverse the direction of the inequality symbol when multiplying or dividing by a negative number.
- Suggest students keep the coefficient of the variable positive whenever possible.

Answers: (For all graphs, see Mini-Lecture Graphing Answers starting on page M-63): 1a) $[-5, \infty)$; 1b) $(\infty, 7)$; 1c) $[-3/2, \infty)$; 1d) $(-2/5, \infty)$; 2a) $(-\infty, 5]$; 2b) $(7, \infty)$; 2c) $(3, \infty)$; 2d) $(-\infty, 6]$; 2e) $(-\infty, -24]$; 2f)

Mini-Lecture 2.9

$(-\infty, 24 \frac{1}{3})$; $2g) (0, \infty)$; $2h) [-15, \infty)$; $2i) (-8, \infty)$; $2j) [-4, \infty)$; $2k) (7/5, \infty)$; $3a) (-5, 0]$; $3b) [-6, 4)$;
 $3c) [3, 4]$; $4a) x < -10$; $4b) 14, 84$

Chapter 2

Section 2.1 Practice Exercises

1. a. The numerical coefficient of t is 1, since t is $1t$.

b. The numerical coefficient of $-7x$ is -7 .

c. The numerical coefficient of $-\frac{w}{5}$ is $-\frac{1}{5}$,

since $-\frac{w}{5}$ means $-\frac{1}{5} \cdot w$.

d. The numerical coefficient of $43x^4$ is 43.

e. The numerical coefficient of $-b$ is -1 , since $-b$ is $-1b$.

2. a. $-4xy$ and $5yx$ are like terms, since $xy = yx$ by the commutative property.

b. $5q$ and $-3q^2$ are unlike terms, since the exponents on q are not the same.

c. $3ab^2$, $-2ab^2$, and $43ab^2$ are like terms, since each variable and its exponent match.

d. y^5 and $\frac{y}{2}$ are like terms, since the exponents on y are the same.

3. a. $-3y + 11y = (-3 + 11)y = 8y$

b. $4x^2 + x^2 = 4x^2 + 1x^2 = (4+1)x^2 = 5x^2$

c. $5x - 3x^2 + 8x^2 = 5x + (-3+8)x^2 = 5x + 5x^2$

d. $20y^2 + 2y^2 - y^2 = 20y^2 + 2y^2 - 1y^2$
 $= (20 + 2 - 1)y^2$
 $= 21y^2$

4. a. $3y + 8y - 7 + 2 = (3 + 8)y + (-7 + 2) = 11y - 5$

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

c. $\frac{3}{4}t - t = \frac{3}{4}t - 1t = \left(\frac{3}{4} - 1\right)t = -\frac{1}{4}t$

d. $9y + 3.2y + 10 + 3 = (9 + 3.2)y + (10 + 3)$
 $= 12.2y + 13$

e. $5z - 3z^4$
 These two terms cannot be combined because they are unlike terms.

5. a. $3(2x - 7) = 3(2x) + 3(-7) = 6x - 21$

b. $-5(x - 0.5z - 5)$
 $= -5(x) + (-5)(-0.5z) + (-5)(-5)$
 $= -5x + 2.5z + 25$

c. $-(2x - y + z - 2)$
 $= -1(2x - y + z - 2)$
 $= -1(2x) - 1(-y) - 1(z) - 1(-2)$
 $= -2x + y - z + 2$

6. a. $4(9x + 1) + 6 = 36x + 4 + 6 = 36x + 10$

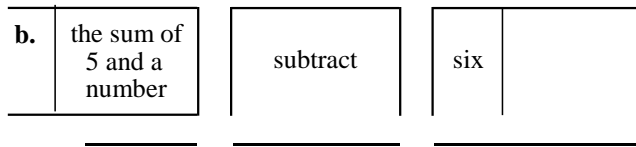
b. $-7(2x - 1) - (6 - 3x) = -14x + 7 - 6 + 3x$
 $= -11x + 1$

c. $8 - 5(6x + 5) = 8 - 30x - 25 = -30x - 17$

7. "Subtract $7x - 1$ from $2x + 3$ " translates to
 $(2x + 3) - (7x - 1) = 2x + 3 - 7x + 1 = -5x + 4$

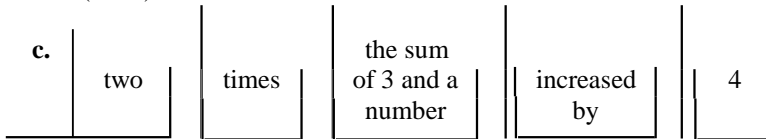
8. a.

Three	added to	double a number
↓	↓	↓
3	+	2x
or 2x + 3		



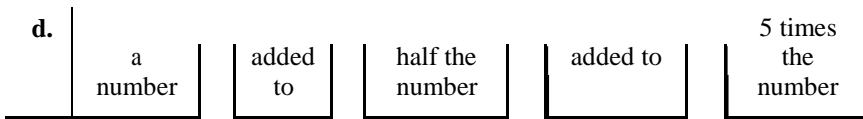
$$\begin{array}{ccccccc} \downarrow & & \downarrow & & \downarrow & & \\ (5 + x) & & - & & 6 & = & 5 + x - 6 \end{array}$$

$$(5 + x) - 6 = 5 + x - 6 = x - 1$$



$$\begin{array}{ccccccc} \downarrow & & \downarrow & & \downarrow & & \downarrow \\ 2 & & \cdot & & (3 + x) & & + & & 4 \end{array}$$

$$2(3 + x) + 4 = 6 + 2x + 4 = 2x + 10$$



$$\begin{array}{ccccccc} \downarrow & & \downarrow & & \downarrow & & \downarrow \\ x & & + & & \frac{1}{2}x & & + & & 5x \end{array}$$

$$x + \frac{1}{2}x + 5x = \frac{13}{2}x$$

Vocabulary, Readiness & Video Check 2.1

1. $23y^2 + 10y - 6$ is called an expression while $23y^2$, $10y$, and -6 are each called a term.
2. To simplify $x + 4x$, we combine like terms.
3. The term y has an understood numerical coefficient of 1.
4. The terms $7z$ and $7y$ are unlike terms and the terms $7z$ and $-z$ are like terms.
5. For the term $-\frac{1}{2}xy^2$, the number $-\frac{1}{2}$ is the numerical coefficient.
6. $5(3x - y)$ equals $15x - 5y$ by the distributive property.
7. Although these terms have exactly the same variables, the exponents on each are not exactly the same—the exponents on x differ in each term.
8. distributive property
9. -1
10. The sum of 5 times a number and -2 , added to 7 times the number; $5x + (-2) + 7x$; because there are like terms.

Exercise Set 2.1

2. The numerical coefficient of $3x$ is 3.

Chapter 2: Equations, Inequalities and Problem Solving

$$\begin{aligned} &= (0.4 + 1 - 2.6)y - 7.0 \\ &= -1.2y - 7 \end{aligned}$$

32. $7(r - 3) = 7(r) - 7(3) = 7r - 21$

34. $-4(y + 6) = -4(y) + (-4)(6) = -4y - 24$

Chapter 2: Equations, Inequalities and Problem Solving

58. $8y - 2 - 3(y + 4) = 8y - 2 - 3y - 12 = 5y - 14$

60. $-11c - (4 - 2c) = -11c - 4 + 2c = -9c - 4$

62. $(8 - 5y) - (4 + 3y) = 8 - 5y - 4 - 3y = -8y + 4$

64. $2.8w - 0.9 - 0.5 - 2.8w = 2.8w - 2.8w - 0.9 - 0.5$
 $= -1.4$

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

$$68. \quad 8 + 4(3x - 4) = 8 + 12x - 16 = -8 + 12x$$

$$70. \quad 0.2(k + 8) - 0.1k = 0.2k + 1.6 - 0.1k = 0.1k + 1.6$$

$$72. \quad 14 - 11(5m + 3n) = 14 - 55m - 33n$$

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

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

78. The difference of a number and 2 divided by 5

$$\begin{array}{ccc}
 \downarrow & \downarrow & \downarrow \\
 (x-2) & \div & 5 = \frac{x-2}{5}
 \end{array}$$

80. 8 more than triple a number

$$\begin{array}{ccc}
 \downarrow & \downarrow & \downarrow \\
 8 & + & 3x
 \end{array}$$

82. Eleven increased by two-thirds of a number

$$\begin{array}{ccc}
 \downarrow & \downarrow & \downarrow \\
 11 & + & \frac{2}{3}x
 \end{array}$$

84. 9 times a number subtract 5 times the number and 10

$$\begin{array}{ccc}
 \downarrow & \downarrow & \downarrow \\
 9x & - & (3x + 10)
 \end{array}$$

$$9x - (3x + 10) = 9x - 3x - 10 = 6x - 10$$

86. Six times the difference of a number and 5

$$\begin{array}{ccc} \downarrow & \downarrow & \downarrow \\ 6 & \cdot & (x - 5) \\ 6(x - 5) = 6x - 30 \end{array}$$

88. Half a number minus the product of the number and 8

$$\begin{array}{ccc} \downarrow & \downarrow & \downarrow \\ \frac{1}{2}x & - & 8x \\ \frac{1}{2}x - 8x = -7.5x \end{array}$$

90. Twice a number added to -1 added to 5 times the number added to -12

$$\begin{array}{ccccccc} \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ 2x & + & -1 & + & 5x & + & -12 \end{array}$$

$$2x + (-1) + 5x + (-12) = 7x - 13$$

92. $gh - h^2 = 0(-4) - (-4)^2 = 0 - 16 = -16$

94. $x^3 - x^2 + 4 = (-3)^3 - (-3)^2 + 4$
 $= -27 - 9 + 4$
 $= -32$

96. $x^3 - x^2 - x = (-2)^3 - (-2)^2 - (-2)$
 $= -8 - 4 + 2$
 $= -10$

98. $5 + (3x - 1) + (2x + 5) = 5 + 3x - 1 + 2x + 5$
 $= 5x + 9$

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

100. 2 cylinders 3 cubes
 2 cubes + 2 cubes 3 cubes
 4 cubes = 3 cubes: Not balanced

102. 1 cylinder 1 cone + 1 cube
 2 cubes 1 cube + 1 cube
 \cong cubes = 2 cubes: Balanced

104. answers may vary

106. $5x + 10(3x) + 25(30x - 1) = 5x + 30x + 750x - 25$
 $= 785x - 25$

The total value is $(785x - 25)\$$.

Chapter 2: Equations, Inequalities and Problem Solving **Chapter 2: Equations, Inequalities and Problem Solving**

108. no; answers may vary

110. $4m^4 p^2 + m^4 p^2 - 5m^2 p^4 = 5m^4 p^2 - 5m^2 p^4$

112. $9y^2 - (6xy^2 - 5y^2) - 8xy^2$
 $= 9y^2 - 6xy^2 + 5y^2 - 8xy^2$
 $= 14y^2 - 14xy^2$

114. $-(7c^3d - 8c) - 5c - 4c^3d$
 $= -7c^3d + 8c - 5c - 4c^3d$
 $= -11c^3d + 3c$

Section 2.2 Practice Exercises

1. $x + 3 = -5$
 $x + 3 - 3 = -5 - 3$
 $x = -8$

Check: $x + 3 = -5$
 $-8 + 3 = -5$

$-5 = -5$

The solution is -8 .

2. $y - 0.3 = -2.1$
 $y - 0.3 + 0.3 = -2.1 + 0.3$
 $y = -1.8$

Check: $y - 0.3 = -2.1$
 $-1.8 - 0.3 = -2.1$
 $-2.1 = -2.1$

The solution is -1.8 .

3. $\frac{2}{5} = x + \frac{3}{10}$
 $\frac{2}{5} - \frac{3}{10} = x + \frac{3}{10} - \frac{3}{10}$
 $\frac{2}{5} - \frac{3}{10} = x$
 $\frac{4}{10} - \frac{3}{10} = x$
 $\frac{1}{10} = x$

Check: $\frac{2}{5} = x + \frac{3}{10}$
 $\frac{2}{5} = \frac{1}{10} + \frac{3}{10}$
 $\frac{2}{5} = \frac{2}{5}$

The solution is $\frac{1}{10}$.

4. $4t + 7 = 5t - 3$
 $4t + 7 - 4t = 5t - 3 - 4t$
 $7 = t - 3$
 $7 + 3 = t - 3 + 3$
 $10 = t$

Check: $4t + 7 = 5t - 3$
 $4(10) + 7 = 5(10) - 3$
 $40 + 7 = 50 - 3$
 $47 = 47$

The solution is 10 .

5. $8x - 5x - 3 + 9 = x + x + 3 - 7$
 $3x + 6 = 2x - 4$
 $3x + 6 - 2x = 2x - 4 - 2x$
 $x + 6 = -4$
 $x + 6 - 6 = -4 - 6$
 $x = -10$

Check:

$8x - 5x - 3 + 9 = x + x + 3 - 7$

$8(-10) - 5(-10) - 3 + 9 = -10 + (-10) + 3 - 7$
 $-80 + 50 - 3 + 9 = -10 + (-10) + 3 - 7$
 $-24 = -24$

The solution is -10 .

6. $4(2a - 3) - (7a + 4) = 2$
 $4(2a) + 4(-3) - 7a - 4 = 2$
 $8a - 12 - 7a - 4 = 2$
 $a - 16 = 2$

$a - 16 + 16 = 2 + 16$

$a = 18$

Check by replacing a with 18 in the original equation.

7. $12 - x = 20$
 $12 - x - 12 = 20 - 12$
 $-x = 8$
 $x = -8$

Check: $12 - x = 20$
 $12 - (-8) = 20$
 $20 = 20$

The solution is -8 .

8. a. The other number is $9 - 2 = 7$.

b. The other number is $9 - x$.

c. The other piece has length $(9 - x)$ feet.

9. The speed of the French TGV is $(s - 67.2)$ mph.

Vocabulary, Readiness & Video Check 2.2

- The difference between an equation and an expression is that an equation contains an equal sign, whereas an expression does not.
- Equivalent equations are equations that have the same solution.
- A value of the variable that makes the equation a true statement is called a solution of the equation.
- The process of finding the solution of an equation is called solving the equation for the variable.
- By the addition property of equality, $x = -2$ and $x + 10 = -2 + 10$ are equivalent equations.
- The equations $x = \frac{1}{2}$ and $\frac{1}{2} = x$ are equivalent equations. The statement is true.
- The addition property of equality means that if we have an equation, we can add the same real number to both sides of the equation and have an equivalent equation.
- To confirm our solution, we replace the variable with the solution in the original equation to make sure we have a true statement.

$$\frac{1}{2}$$

$$9. \quad 7^x$$

Exercise Set 2.2

$$2. \quad x + 14 = 25$$

$$x + 14 - 14 = 25 - 14$$

$$x = 11$$

Check: $x + 14 = 25$

$$11 + 14 = 25$$

$$25 = 25$$

The solution is 11.

$$4. \quad y - 9 = 1$$

$$6. \quad -17 = x + 3$$

$$-17 - 3 = x + 3 - 3$$

$$-20 = x$$

Check: $-17 = x + 3$

$$-17 = -20 + 3$$

$$-17 = -17$$

The solution is -20.

$$8. \quad t - 9.2 = -6.8$$

$$5 - 9.2 + 9.2 = -6.8 + 9.2$$

$$t = 2.4$$

Check: $t - 9.2 = -6.8$

$$2.4 - 9.2 = -6.8$$

$$-6.8 = -6.8$$

The solution is 2.4.

$$10. \quad \frac{3}{8} = c + \frac{1}{6}$$

$$\frac{3}{8} - \frac{1}{6} = c + \frac{1}{6} - \frac{1}{6}$$

$$+\frac{9}{24} - \frac{4}{24} = c + \frac{4}{24} - \frac{4}{24}$$

$$\frac{5}{24} = c$$

$$\frac{5}{24} = c$$

Check: $\frac{3}{8} = c + \frac{1}{6}$

$$\frac{3}{8} = \frac{5}{24} + \frac{1}{6}$$

$$\frac{3}{8} = \frac{5}{24} + \frac{4}{24}$$

$$\frac{3}{8} = \frac{9}{24}$$

$$\frac{8}{8} = \frac{24}{24}$$

$$\frac{3}{8} = \frac{3}{8}$$

The solution is $\frac{5}{24}$.

$$12. \quad 9x + 5.5 = 10x$$

$$9x - 9x + 5.5 = 10x - 9x$$

$$5.5 = x$$

Check: $9x + 5.5 = 10x$

$$y - 9 + 9 = 1 + 9$$

$$y = 10$$

$$9(5.5) + 5.5$$

$$10(5.5)$$

$$49.5 + 5.5 = 55$$

Check: $y - 9 = 1$

$$10 - 9 = 1$$

$$1 = 1$$

The solution is 10.

$$55 = 55$$

The solution is 5.5.

14. $18x - 9 = 19x$
 $18x - 18x - 9 = 19x - 18x$
 $-9 = x$
 Check: $18x - 9 = 19x$
 $18(-9) - 9 = 19(-9)$

$$\begin{array}{r} -162 - 9 \\ -171 = 171 \end{array}$$

The solution is -9.

16. $z + \frac{9}{19} = -\frac{2}{19}$

$$z + \frac{9}{19} - \frac{9}{19} = -\frac{2}{19} - \frac{9}{19}$$

$$z = -\frac{11}{19}$$

Check: $z + \frac{9}{19} = -\frac{2}{19}$

$$\begin{array}{r} -\frac{11}{19} + \frac{9}{19} \\ -\frac{2}{19} = -\frac{2}{19} \end{array}$$

The solution is $-\frac{11}{19}$.

18. $3n + 2n = 7 + 4n$
 $5n = 7 + 4n$
 $5n - 4n = 7 + 4n - 4n$
 $= 7$
 Check: $3n + 2n = 7 + 4n$

$$\begin{array}{r} 3(7) + 2(7) \\ 21 + 14 \\ 35 = 35 \end{array}$$

The solution is 7.

20. $\frac{13}{11}y - \frac{2}{11}y = -3$
 $\frac{13}{11}y - \frac{2}{11}y = -3$

$$\frac{11}{11}y = -3$$

Check: $\frac{13}{11}y - \frac{2}{11}y = -3$
 $\frac{13}{11}(-3) - \frac{2}{11}(-3) = -3$

22. $4x - 4 = 10x - 7x$
 $4x - 4 = 3x$
 $4x - 3x - 4 = 3x - 3x$
 $x - 4 = 0$
 $x - 4 + 4 = 0 + 4$

$$x = 4$$

Check: $4x - 4 = 10x - 7x$
 $4(4) - 4 = 10(4) - 7(4)$
 $16 - 4 = 40 - 28$
 $12 = 12$

The solution is 4.

24. $-4(z - 3) = 2 - 3z$

$$\begin{array}{r} -4z + 12 = 2 - 3z \\ -4z + 4z + 12 = 2 - 3z + 4z \\ 12 = 2 + z \\ 12 - 2 = 2 - 2 + z \\ 10 = z \end{array}$$

Check: $-4(z - 3) = 2 - 3z$
 $-4(10 - 3) = 2 - 3(10)$
 $-4(7) = 2 - 30$
 $-28 = -28$

The solution is 10.

26. $\frac{1}{5}x - 1 = -\frac{4}{5}x - 13$
 $-\frac{1}{5}x - 1 + \frac{4}{5}x = -\frac{4}{5}x - 13 + \frac{4}{5}x$
 $\frac{5}{5}x - 1 = -13$

$$\begin{array}{r} x - 1 + 1 = -13 + 1 \\ x = -12 \end{array}$$

Check: $\frac{1}{5}x - 1 = -\frac{4}{5}x - 13$

$$\begin{array}{r} \frac{1}{5}(-12) - 1 = -\frac{4}{5}(-12) - 13 \\ -\frac{12}{5} - \frac{5}{5} = \frac{48}{5} - \frac{65}{5} \\ -\frac{17}{5} = -\frac{17}{5} \end{array}$$

$$\begin{array}{r} 11 \quad 11 \\ 11 \quad 11 \\ -\frac{39}{11} + \frac{6}{11} = -3 \\ -3 = -3 \end{array}$$

The
solution
is

The solution is -3 .

$-12.$

28. $2x + 7 = x - 10$
 $2x + 7 - x = x - 10 - x$
 $+7 = -10$
 $x + 7 - 7 = -10 - 7$
 $x = -17$

Check: $2x + 7 = x - 10$
 $2(-17) + 7 \quad (-17) - 10$

$$-34 + 7 \quad -27$$

$$-27 = -27$$

The solution is -17.

30. $4p - 11 - p = 2 + 2p - 20$
 $3p - 11 = 2p - 18$

$$3p - 2p - 11 = 2p - 2p - 18$$

$$p - 11 = -18$$

$$p - 11 + 11 = -18 + 11$$

$$p = -7$$

Check: $4p - 11 - p = 2 + 2p - 20$
 $4(-7) - 11 - (-7) \quad 2 + 2(-7) - 20$
 $-28 - 11 + 7 \quad 2 - 14 - 20$
 $-32 = -32$

The solution is -7.

32. $-2(x - 1) = -3x$
 $-2x + 2 = -3x$
 $-2x + 2 + 2x = -3x + 2x$
 $2 = -x$
 $x = -2$

Check: $-2(x - 1) = -3x$
 $-2(-2 - 1) \quad -3(-2)$
 $-2(-3) \quad 6$
 $6 = 6$

The solution is -2.

34. $\frac{2}{5}x - \frac{1}{12} = -\frac{3}{5}x - \frac{3}{4}$
 $\frac{2}{5}x + \frac{3}{5}x - \frac{1}{12} = -\frac{3}{5}x + \frac{3}{5}x - \frac{3}{4}$
 $\frac{5}{5}x - \frac{1}{12} = -\frac{3}{4}$

$$x - \frac{1}{12} + \frac{1}{12} = -\frac{3}{4} + \frac{1}{12}$$

$$x = -\frac{9}{12} + \frac{1}{12}$$

$$x = -\frac{8}{12}$$

$$12$$

$$x = -\frac{2}{3}$$

Check: $\frac{2}{5}x - \frac{1}{12} = -\frac{3}{5}x - \frac{3}{4}$

$$\frac{2}{5} \left(-\frac{2}{3} \right) - \frac{1}{12} = -\frac{3}{5} \left(-\frac{2}{3} \right) - \frac{3}{4}$$

$$\frac{-4}{15} - \frac{1}{12} = \frac{2}{5} - \frac{3}{4}$$

$$\frac{-16}{60} - \frac{5}{60} = \frac{24}{60} - \frac{45}{60}$$

$$-\frac{21}{60} = -\frac{21}{60}$$

The solution is $-\frac{2}{3}$.

36. $3(y + 7) = 2y - 5$
 $3y + 21 = 2y - 5$
 $3y - 2y + 21 = 2y - 2y - 5$
 $y + 21 = -5$
 $y + 21 - 21 = -5 - 21$
 $y = -26$

Check: $3(y + 7) = 2y - 5$
 $3(-26 + 7) \quad 2(-26) - 5$
 $3(-19) \quad -52 - 5$

$$-57 = -57$$

The solution is -26.

38. $5(3 + z) - (8z + 9) = -4z$

$$15 + 5z - 8z - 9 = -4z$$

$$6 - 3z = -4z$$

$$6 - 3z + 4z = -4z + 4z$$

$$6 + z = 0$$

$$6 - 6 + z = -6$$

$$z = -6$$

Check: $5(3 + z) - (8z + 9) = -4z$
 $5(3 + (-6)) - (8(-6) + 9) \quad -4(-6)$

$$5(-3) - (-48 + 9) \quad 24$$

$$-15 - (-39) \quad 24$$

$$24 = 24$$

The solution is -6.

40. $-5(x + 1) + 4(2x - 3) = 2(x + 2) - 8$

$$-5x - 5 + 8x - 12 = 2x + 4 - 8$$

$$3x - 17 = 2x - 4$$

$$3x - 2x - 17 = 2x - 2x - 4$$

$$x - 17 = -4$$

x
 $-$
 1
 7
 $+$
 1
 7
 $=$
 $-$
 4
 $+$
 1
 7

x
=
1
3

Check: $-5(x+1)+4(2x-3)=2(x+2)-8$
 $-5(13+1)+4(2(13)-3) \quad 2(13+2)-8$
 $-5(14)+4(26-3) \quad 2(15)-8$
 $-70+4(23) \quad 30-8$
 $-70+92 \quad 22$
 $22=22$

The solution is 13.

42. $-8=8+z$
 $-8-8=8+z-8$
 $-16=z$

44. $y-\frac{4}{7}=-\frac{3}{14}$
 $y-\frac{4}{7}+\frac{4}{7}=-\frac{3}{14}+\frac{4}{7}$
 $14 \quad 7$
 $y=-\frac{3}{14}+\frac{8}{14}$
 $y=\frac{5}{14}$

46. $7y+2=6y+2$
 $7y-6y+2=6y-6y+2$
 $y+2=2$
 $y+2-2=2-2$
 $y=0$

48. $15x+20-10x-9=25x+8-21x-7$
 $5x+11=4x+1$
 $5x+11-4x=4x+1-4x$
 $+11=1$
 $x+11-11=1-11$
 $x=-10$

50. $6(5+c)=5(c-4)$
 $30+6c=5c-20$
 $30+6c-5c=5c-5c-20$
 $30+c=20$
 $30-30+c=-20-30$
 $c=-50$

52. $m+2=7.1$
 $m+2-2=7.1-2$
 $m=5.1$

54. $15-(6-7k)=2+6k$
 $15-6+7k=2+6k$
 $9+7k=2+6k$
 $9+7k-6k=2+6k-6k$
 $9+k=2$
 $9-9+k=2-9$

$k=-7$

56. $\frac{1}{11}=y+\frac{10}{11}$
 $\frac{-1}{11}-\frac{10}{11}=y+\frac{10}{11}-\frac{10}{11}$
 $-\frac{9}{11}=y$

58. $-1.4-7x-3.6-2x=-8x+4.4$
 $-9x-5.0=-8x+4.4$
 $-9x+9x-5.0=-8x+9x+4.4$
 $-5.0=x+4.4$
 $-5.0-4.4=x+4.4-4.4$
 $-9.4=x$

60. $-2\left(x-\frac{1}{7}\right)=-3x$
 $-2x+\frac{2}{7}=-3x$
 $-2x+3x+\frac{2}{7}=-3x+3x$
 $x+\frac{2}{7}=0$
 $2 \quad 2 \quad 2$
 $x+\frac{-2}{7}=\frac{0}{7}-\frac{2}{7}$
 $x=-\frac{2}{7}$

62. $-4(x-1)-5(2-x)=-6$
 $-4x+4-10+5x=-6$
 $x-6=-6$
 $x-6+6=-6+6$
 $x=0$

64. $0.6v+0.4(0.3+v)=2.34$
 $0.6v+0.12+0.4v=2.34$
 $1v+0.12=2.34$
 $v+0.12-0.12=2.34-0.12$
 $v=2.22$

66. The other number is $13 - y$.

68. The length of the other piece is $(5 - x)$ feet.

70. The complement of the angle x° is $(90 - x)^\circ$.

72. If the length of I-80 is m miles and the length of I-90 is 178.5 miles longer than I-80, the length of I-90 is $m + 178.5$.

74. The weight of the Hoba West meteorite is $3y$ kilograms.

76. The reciprocal of $\frac{7}{6}$ is $\frac{6}{7}$ since $\frac{7}{6} \cdot \frac{6}{7} = 1$.

78. The reciprocal of 5 is $\frac{1}{5}$ since $5 \cdot \frac{1}{5} = 1$.

80. The reciprocal of $-\frac{3}{5}$ is $-\frac{5}{3}$ since $-\frac{3}{5} \cdot -\frac{5}{3} = 1$.

82. $\frac{-2y}{7} = y$

84. $7 \left(\frac{1}{r} \right) = r$

86. $\frac{9}{2} \left(\frac{2}{9}x \right) = x$

88. $360 - (x + 3x + 5x) = 360 - (9x) = 360 - 9x$
The fourth angle is $(360 - 9x)^\circ$.

90. answers may vary

92. answers may vary

94. $100 + 250 + 500 + x = 1000$
 $850 + x = 1000$
 $850 + x - 850 = 1000 - 850$
 $x = 150$

The fluid needed by the patient is 150 ml.

96. answers may vary.

98. $a + 9 = 15$
 $a + 9 + (-9) = 15 + (-9)$
 $a = 6$
The answer is -9.

100. answers may vary

102. Check $y = 1.2$: $8.13 + 5.85y = 20.05y - 8.91$
 $8.13 + 5.85(1.2) = 20.05(1.2) - 8.91$
 $8.13 + 7.02 = 24.06 - 8.91$
 $15.15 = 15.15$

Solution

104. Check $z = 4.8$:
 $7(z - 1.7) + 9.5 = 5(z + 3.2) - 9.2$
 $7(4.8 - 1.7) + 9.5 = 5(4.8 + 3.2) - 9.2$
 $7(3.1) + 9.55 = 5(8.0) - 9.2$
 $21.7 + 9.55 = 40.0 - 9.2$
 $31.2 \neq 30.8$

Not a solution

Section 2.3 Practice Exercises

1. $\frac{4}{5}x = 16$
 $\left(\frac{5}{4} \cdot \frac{4}{5} \right) x = \frac{5}{4} \cdot 16$
 $\left(\frac{5}{4} \cdot \frac{4}{5} \right) x = \frac{5}{4} \cdot 16$

$1x = 20$

$x = 20$

Check: $\frac{4}{5}x = 16$

$\frac{4}{5} \cdot 20 = 16$

5

$16 = 16$

The solution is 20.

2. $8x = -96$

$\frac{8x}{8} = \frac{-96}{8}$

$x = -12$

Check: $8x = -96$

$8(-12) = -96$

$-96 = -96$

The solution is -12.

3. $\frac{x}{5} = 13$

$5 \cdot \frac{x}{5} = 5 \cdot 13$

$x = 65$

Check: $\frac{x}{5} = 13$

$$\frac{65}{5} = 13$$

The solution is 65.

4. $2.7x = 4.05$

$$\frac{2.7x}{2.7} = \frac{4.05}{2.7}$$

$$x = 1.5$$

The solution is 1.5.

Check by replacing x with 1.5 in the original equation.

5. $-\frac{5}{3}x = \frac{4}{5}$

$$-\frac{5}{3}x = -\frac{4}{5}$$

$$\frac{-5}{3}x = \frac{-4}{5}$$

$$x = -\frac{12}{35}$$

Check by replacing x with $-\frac{12}{35}$ in the original

equation. The solution is $-\frac{12}{35}$.

6. $-y + 3 = -8$

$$-y + 3 - 3 = -8 - 3$$

$$-y = -11$$

$$\frac{-y}{-1} = \frac{-11}{-1}$$

$$y = 11$$

To check, replace y with 11 in the original equation. The solution is 11.

7. $6b - 11b = 18 + 2b - 6 + 9$

$$-5b = 21 + 2b$$

$$-5b - 2b = 21 + 2b - 2b$$

$$-7b = 21$$

$$\frac{-7b}{-7} = \frac{21}{-7}$$

$$b = -3$$

Check by replacing b with -3 in the original equation. The solution is -3 .

8. $10x - 4 = 7x + 14$

$$10x - 4 - 7x = 7x + 14 - 7x$$

$$3x - 4 = 14$$

$$3x - 4 + 4 = 14 + 4$$

9. $4(3x - 2) = -1 + 4$

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

$$12x - 8 = 3$$

$$12x - 8 + 8 = 3 + 8$$

$$12x = 11$$

$$12x = 11$$

$$12 = \frac{11}{x}$$

$$x = \frac{11}{12}$$

To check, replace x with $\frac{11}{12}$ in the original

equation to see that a true statement results. The

solution is $\frac{11}{12}$.

10. Let $x =$ first integer.

$x + 2 =$ second even integer.

$x + 4 =$ third even integer.

$x + (x + 2) + (x + 4) = 3x + 6$

Vocabulary, Readiness & Video Check 2.3

1. By the multiplication property of equality,

$$y = \frac{1}{2} \text{ and } 5 \cdot y = 5 \cdot \frac{1}{2}$$

$\frac{1}{2}$ and $\frac{5}{2}$ are equivalent equations.

2. The equations $\frac{z}{4} = 10$ and $4 \cdot \frac{z}{4} = 10$ are not

equivalent equations. The statement is false.

3. The equations $-7x = 30$ and $\frac{-7}{7x} = \frac{30}{7}$ are not

equivalent equations. The statement is false.

4. By the multiplication property of equality,

$$9x = -63 \text{ and } \frac{9x}{9} = \frac{-63}{9} \text{ are equivalent}$$

equations.

$$3x =$$

$$18$$

$$\frac{3x}{3} =$$

$$18$$

Chapter 1: Equations, Inequalities and Problem Solving

$$\begin{array}{r} 3 \quad 3 \\ x = 6 \end{array}$$

To check, replace x with 6 in the original equation to see that a true statement results. The solution is 6.

Chapter 2: Equations, Inequalities and Problem Solving

5. We can multiply both sides of an equation by the same nonzero number and have an equivalent equation.
6. addition property; multiplication property; answers may vary
7. $(x + 1) + (x + 3) = 2x + 4$

Exercise Set 2.3

2. $-7x = -49$

$$\frac{-7x}{-7} = \frac{-49}{-7}$$

$$x = 7$$

Check: $-7x = -49$

$$\begin{aligned} -7(7) &= -49 \\ -49 &= -49 \end{aligned}$$

The solution is 7.

4. $2x = 0$

$$\frac{2x}{2} = \frac{0}{2}$$

$$x = 0$$

Check: $2x = 0$
 $2(0) = 0$
 $0 = 0$

The solution is 0.

6. $-y = 8$

$$\frac{-y}{-1} = \frac{8}{-1}$$

14.

$$\begin{aligned} -1 \cdot -1 \\ y &= -8 \end{aligned}$$

Check: $-y = 8$

$$\begin{aligned} -(-8) &= 8 \\ 8 &= 8 \end{aligned}$$

The solution is -8.

8. $\frac{3}{4}n = -15$

$$\frac{4}{3} \left(\frac{3}{4}n \right) = \frac{4}{3}(-15)$$

$$n = -20$$

Check: $\frac{3}{4}n = -15$

$$\begin{aligned} \frac{3}{4}(-20) &= -15 \\ -15 &= -15 \end{aligned}$$

The solution is -20.

Check: $\frac{1}{4} = \frac{1}{8}v$

$$\frac{1}{4} = \frac{1}{8}(2)$$

$$\frac{1}{4} = 1$$

$$\frac{4}{4} = \frac{4}{4}$$

The solution is 2.

12. $\left(\frac{d}{15} \right) = 2$
 $15 \left(\frac{d}{15} \right) = 15(2)$
 $d = 30$

Check: $\frac{d}{15} = 2$
 $\frac{30}{15} = 2$
 $2 = 2$

The solution is 30.

$$\frac{f}{-5} = 0$$

$$-5 \left(\frac{f}{-5} \right) = -5(0)$$

$$f = 0$$

Check: $\frac{f}{-5} = 0$
 $\frac{0}{-5} = 0$
 $0 = 0$

The solution is 0.

16. $19.55 = 8.5y$
 $\frac{19.55}{8.5} = \frac{8.5y}{8.5}$

$$2.3 = y$$

Check: $19.55 = 8.5y$
 $8 \left(\frac{1}{8} \right) = 8 \left(\frac{1}{8} \right)$

10. $\frac{1}{4} = \frac{1}{8}v$

Check: $3x - 1 = 26$
 $3(9) - 1 = 26$
 $27 - 1 = 26$
 $26 = 26$

The solution is 9.

20. $-x + 4 = -24$
 $-x + 4 - 4 = -24 - 4$
 $-x = -28$
 $x = 28$

Check: $-x + 4 = -24$
 $-(28) + 4 = -24$
 $-28 + 4 = -24$
 $-24 = -24$

The solution is 28.

22. $8t + 5 = 5$

$8t + 5 - 5 = 5 - 5$

$8t = 0$

$\frac{8t}{8} = \frac{0}{8}$
 $t = 0$

Check: $8t + 5 = 5$
 $8(0) + 5 = 5$
 $0 + 5 = 5$
 $5 = 5$

The solution is 0.

24. $\frac{b}{4} - 1 = -7$
 $\frac{b}{4} - 1 + 1 = -7 + 1$
 $\frac{b}{4} = -6$

$\frac{b}{4} = -6$
 $4\left(\frac{b}{4}\right) = 4(-6)$
 $b = -24$

Check: $\frac{b}{4} - 1 = -7$
 $\frac{-24}{4} - 1 = -7$
 $-6 - 1 = -7$
 $-7 = -7$

26. $4a + a = -1 + 3a - 1 - 2$
 $5a = 3a - 4$
 $5a - 3a = 3a - 4 - 3a$
 $2a = -4$

$\frac{2a}{2} = \frac{-4}{2}$

$a = -2$

Check: $4a + a = -1 + 3a - 1 - 2$
 $4(-2) + (-2) = -1 + 3(-2) - 1 - 2$
 $-8 - 2 = -1 - 6 - 1 - 2$

$-10 = -10$

The solution is -2.

28. $19 = 0.4x - 0.9x - 6$

$19 = -0.5x - 6$

$19 + 6 = -0.5x - 6 + 6$

$25 = -0.5x$

$\frac{25}{-0.5} = \frac{-0.5x}{-0.5}$

$-50 = x$

Check: $19 = 0.4x - 0.9x - 6$
 $19 = 0.4(-50) - 0.9(-50) - 6$
 $19 = -20 + 45 - 6$
 $19 = 19$

The solution is -50.

$\frac{3}{5}x - 14 = -8$

30. $\frac{3}{5}x - 14 + 14 = -8 + 14$

$\frac{3}{5}x = 6$

$\frac{5}{3} \cdot \frac{3}{5}x = \frac{5}{3} \cdot 6$

$x = 10$

Check:

$\frac{3}{5}x - 14 = -8$
 $\frac{3}{5} \cdot 10 - 14 = -8$
 $6 - 14 = -8$
 $-8 = -8$

The solution is 10.

The solution is -24 .

$$32. \quad \frac{2}{7}z - \frac{1}{5} = \frac{1}{2}$$

$$\frac{2}{7}z - \frac{1}{5} + \frac{1}{5} = \frac{1}{2} + \frac{1}{5}$$

$$\frac{2}{7}z = \frac{7}{10}$$

$$\frac{7}{2} \cdot \frac{2}{7}z = \frac{7}{2} \cdot \frac{7}{10}$$

$$z = \frac{49}{20}$$

Check: $\frac{2}{7} \left(\frac{49}{20} \right) - \frac{1}{5} = \frac{1}{2}$

$$\frac{2}{7} \left(\frac{49}{20} \right) - \frac{1}{5} = \frac{1}{2}$$

$$\frac{14}{20} - \frac{4}{20} = \frac{10}{20}$$

$$\frac{10}{20} = \frac{1}{2}$$

The solution is $\frac{49}{20}$.

$$34. \quad 11x + 13 = 9x + 9$$

$$11x + 13 - 9x = 9x + 9 - 9x$$

$$2x + 13 = 9$$

$$2x + 13 - 13 = 9 - 13$$

$$2x = -4$$

$$\frac{2x}{2} = \frac{-4}{2}$$

$$x = -2$$

$$36. \quad 2(4x + 1) = -12 + 6$$

$$8x + 2 = -6$$

$$8x + 2 - 2 = -6 - 2$$

$$8x = -8$$

$$\frac{8x}{8} = \frac{-8}{8}$$

$$x = -1$$

$$38. \quad 6x - 4 = -2x - 10$$

$$6x - 4 + 2x = -2x - 10 + 2x$$

$$8x - 4 = -10$$

$$8x - 4 + 4 = -10 + 4$$

$$40. \quad 8 + 4 = -6(5x - 2)$$

$$12 = -30x + 12$$

$$12 - 12 = -30x + 12 - 12$$

$$0 = -30x$$

$$\frac{0}{-30} = \frac{-30x}{-30}$$

$$-30 = -30$$

$$0 = x$$

$$42. \quad -17z - 4 = -16z - 20$$

$$-17z - 4 + 17z = -16z - 20 + 17z$$

$$-4 = z - 20$$

$$-4 + 20 = z - 20 + 20$$

$$16 = z$$

$$44. \quad \frac{1}{3}(3x - 1) = -\frac{1}{10} - \frac{2}{10}$$

$$x - \frac{1}{3} = -\frac{3}{10}$$

$$x - \frac{1}{3} + \frac{1}{3} = -\frac{3}{10} + \frac{1}{3}$$

$$x = -\frac{9}{30} + \frac{10}{30}$$

$$x = \frac{1}{30}$$

$$46. \quad -14y - 1.8 = -24y + 3.9$$

$$-14y - 1.8 + 24y = -24y + 3.9 + 24y$$

$$10y - 1.8 = 3.9$$

$$10y - 1.8 + 1.8 = 3.9 + 1.8$$

$$10y = 5.7$$

$$\frac{10y}{10} = \frac{5.7}{10}$$

$$y = 0.57$$

$$48. \quad -3x + 15 = 3x - 15$$

$$-3x + 15 + 3x = 3x - 15 + 3x$$

$$15 = 6x - 15$$

$$15 + 15 = 6x - 15 + 15$$

$$30 = 6x$$

$$\frac{30}{6} = \frac{6x}{6}$$

$$5 = x$$

$$50. \quad 81 = 3x$$

$$81 = 3x$$

$$8x = -6$$

$$\frac{8x}{8} = \frac{-6}{8}$$

$$x = -\frac{3}{4}$$

$$\frac{27}{3} = \frac{x}{3}$$

$$27 = x$$

52. $6.3 = -0.6x$

$$\frac{6.3}{0.6} = \frac{-0.6x}{0.6}$$

$$\begin{aligned} -0.6 & \quad -0.6 \\ -10.5 & = x \end{aligned}$$

54. $10y + 15 = -5$

$$\begin{aligned} 10y + 15 - 15 & = -5 - 15 \\ 10y & = -20 \\ \frac{10y}{10} & = \frac{-20}{10} \end{aligned}$$

$$y = -2$$

56. $2 - 0.4p = 2$

$$\begin{aligned} 2 - 2 - 0.4p & = 2 - 2 \\ -0.4p & = 0 \\ \frac{-0.4p}{-0.4} & = \frac{0}{-0.4} \end{aligned}$$

$$\begin{aligned} -0.4 & \quad -0.4 \\ p & = 0 \end{aligned}$$

58. $20x - 20 = 16x - 40$

$$\begin{aligned} 20x - 20 - 16x & = 16x - 40 - 16x \\ 4x - 20 & = -40 \\ 4x - 20 + 20 & = -40 + 20 \\ 4x & = -20 \\ \frac{4x}{4} & = \frac{-20}{4} \\ x & = -5 \end{aligned}$$

60. $7(2x + 1) = 18x - 19x$

$$\begin{aligned} 14x + 7 & = -x \\ 14x + 7 - 14x & = -x - 14x \\ 7 & = -15x \\ \frac{7}{-15} & = \frac{-15x}{-15} \end{aligned}$$

$$\begin{aligned} -15 & \quad -15 \\ -\frac{7}{15} & = x \end{aligned}$$

62. $-\frac{5}{4} \left(-\frac{4}{5}r \right) = -\frac{5}{4}(-5)$

66. $-3n - \frac{1}{3} = \frac{8}{3}$

$$\begin{aligned} -3n - \frac{1}{3} + \frac{1}{3} & = \frac{8}{3} + \frac{1}{3} \\ -3n & = \frac{9}{3} \\ -3n & = 3 \\ \frac{-3n}{-3} & = \frac{3}{-3} \\ n & = -1 \end{aligned}$$

68. $12 = 3j - 4$

$$\begin{aligned} 12 + 4 & = 3j - 4 + 4 \\ 16 & = 3j \\ \frac{16}{3} & = \frac{3j}{3} \end{aligned}$$

$$\frac{16}{3} = j$$

70. $12x + 30 + 8x - 6 = 10$

$$\begin{aligned} 20x + 24 & = 10 \\ 20x + 24 - 24 & = 10 - 24 \\ 20x & = -14 \\ \frac{20x}{20} & = \frac{-14}{20} \\ x & = -\frac{7}{10} \end{aligned}$$

72. $t - 6t = -13 + t - 3t$

$$\begin{aligned} -5t & = -2t - 13 \\ -5t + 2t & = -2t + 2t - 13 \\ -3t & = -13 \\ \frac{-3t}{-3} & = \frac{-13}{-3} \end{aligned}$$

$$\begin{aligned} -3 & \quad -3 \\ t & = \frac{13}{3} \end{aligned}$$

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$$\frac{25}{4}$$

$$r \left(-\frac{10}{3} \right)^x = 30$$

$$= \frac{3}{-10} \left| \left(\frac{10}{-3} x \right) \right|^{\frac{3}{-10}} = -\frac{3}{10} \quad (30)$$

$$x = -9$$

74.

$$7 \quad 3 \quad 7$$

$$x + \frac{3}{7} = -x + \frac{1}{7} + \frac{4}{7}$$

$$x + \frac{3}{7} = -x + \frac{19}{21}$$
$$x + \frac{3}{7} + x = -x + \frac{19}{21} + x$$

$$2x + \frac{3}{7} = \frac{19}{21}$$

$$2x + \frac{3}{7} - \frac{3}{7} = \frac{19}{21} - \frac{3}{7}$$
$$2x = \frac{10}{21}$$

$$\frac{1}{2} \cdot 2x = \frac{1}{2} \cdot \frac{10}{21}$$
$$x = \frac{5}{21}$$

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90.

92.

94.

$$(-2)^4 = (-2)(-2)(-2)(-2) = 16$$

$$-2^4 = -2 \cdot 2 \cdot 2 \cdot 2 = -16 \quad (-2)^4 > -2^4$$

$$(-4)^3 = (-4)(-4)(-4) = -64$$

$$-4^3 = -4 \cdot 4 \cdot 4 = -64 \quad (-4)^3 = -4^3$$