2-1 Study Guide and Intervention (continued)

Writing Equations

Write Verbal Sentences You can translate equations into verbal sentences.

Example Translate each equation into a sentence.

a. $4n - 8 = 12$
   
   Four times $n$ minus eight equals twelve.

b. $a^2 + b^2 = c^2$
   
   The sum of the squares of $a$ and $b$ is equal to the square of $c$.

Exercises

Translate each equation into a sentence.

1. $4a - 5 = 23$
   
   4 times $a$ minus 5 is equal to 23.

2. $10 + k = 4k$
   
   The sum of 10 and $k$ is equal to 4 times $k$.

3. $6x - y = 24$
   
   6 times the product of $x$ and $y$ is equal to 24.

4. $x^2 + y^2 = 8$
   
   The sum of the squares of $x$ and $y$ is equal to 8.

5. $p + 3 = 2p$
   
   The sum of $p$ and 3 is equal to 2 times $p$.

6. $b = \frac{1}{3}(h - 1)$
   
   $b$ is $\frac{1}{3}$ of the difference of $h$ and 1.

7. $100 - 2x = 80$
   
   100 minus 2 times $x$ is equal to 80.

8. $3(g + h) = 12$
   
   3 times the sum of $g$ and $h$ is 12.

9. $p^2 - 2p = 9$
   
   The square of $p$ minus 2 times $p$ is equal to 9.

10. $C = \frac{5}{9}(F - 32)$
    
    $C$ is equal to $\frac{5}{9}$ of the difference of $F$ and 32.

11. $V = \frac{1}{3}Bh$
    
    $V$ is equal to $\frac{1}{3}$ of the product of $B$ and $h$.

12. $A = \frac{1}{2}bh$
    
    $A$ is equal to $\frac{1}{2}$ of the product of $h$ and $b$.

Translate each equation into a sentence.

11. $g + 10 = 3g$
    
    $g$ plus 10 is equal to $3g$.

12. $2p + 4t = 20$
    
    Twice $p$ plus 4 times $t$ is 20.

13. $4(a + b) = 9c$
    
    4 times the sum of $a$ and $b$ is equal to 9 times $c$.

14. $8 - 6x = 4 + 2x$
    
    8 minus 6 times $x$ is 4 plus 2 times $x$.

15. $\frac{1}{2}(f + g) = f - 5$
    
    Half of the sum of $f$ and $g$ is equal to $f$ minus 5.

16. $k^2 - n^2 = 2b$
    
    $k$ squared minus $n$ squared is equal to twice $b$.

Write a problem based on the given information.

17. $c = \text{cost per pound of plain coffee beans}$
    
    $c + 3 = \text{cost per pound of flavored coffee beans}$

Sample answer: The cost of two pounds of plain coffee beans plus one pound of flavored beans is $21. How much does 1 pound of plain beans cost?

18. $p = \text{cost of dinner}$
    
    $0.15p = \text{cost of a 15% tip}$

Sample answer: The cost of dinner plus a 15% tip was $23. How much was the dinner?
2-1 Practice

Writing Equations

Translate each sentence into an equation.
1. Fifty-three plus four times \( b \) is as much as 21. 
   \[ 53 + 4b = 21 \]
2. The sum of five times \( h \) and twice \( g \) is equal to 23. 
   \[ 5h + 2g = 23 \]
3. One fourth the sum of \( r \) and ten is identical to \( r \) minus 4. 
   \[ \frac{1}{4}(r + 10) = r - 4 \]
4. Three plus the sum of the squares of \( w \) and \( x \) is 32. 
   \[ 3 + (w^2 + x^2) = 32 \]

Translate each sentence into a formula.
5. Degrees Kelvin \( K \) equals 273 plus degrees Celsius \( C \). 
   \[ K = 273 + C \]
6. The total cost \( C \) of gas is the price \( p \) per gallon times the number of gallons \( g \). 
   \[ C = pg \]
7. The sum \( S \) of the measures of the angles of a polygon is equal to 180 times the difference of the number of sides \( n \) and 2. 
   \[ S = 180(n - 2) \]

Translate each equation into a sentence.
8. \[ r = (4 + p) - \frac{1}{3} r \text{ minus the sum of 4 and } p \] 
   Two more than \( \frac{3}{5} \) of \( r \) equals \( t \). 
9. \[ 9(y^2 + x) = 18 \] 
   9 times the sum of \( y \) squared and \( x \) is 18. 
10. \[ 2(m - n) = x + 7 \] 
    Twice the quantity \( m \) minus \( n \) is \( x \) plus 7.

Write a problem based on the given information.
11. If \( p \) represents the number of miles Pietra walked, write an equation that represents the total number of miles that the two girls walked. 
    \[ T = p + (p + 7) \]
12. About 15\% of all federally-owned land in the 48 contiguous states of the United States is in Nevada. If \( F \) represents the area of federally-owned land in these states, and \( N \) represents the portion in Nevada, write an equation for this situation.
    \[ 0.15F = N \]
13. Fitness
   Deanna and Pietra each go for walks around a lake a few times per week. Last week, Deanna walked 7 miles more than Pietra.
   a. If \( p \) represents the number of miles Pietra walked, write an equation that represents the total number of miles \( T \) the two girls walked.
      \[ T = p + (p + 7) \]
   b. If Pietra walked 9 miles during the week, how many miles did Deanna walk?
      16 mi
   c. If Pietra walked 11 miles during the week, how many miles did the two girls walk together?
      29 mi

Answers

1. \( 53 + 4b = 21 \)
2. \( 5h + 2g = 23 \)
3. \( \frac{1}{4}(r + 10) = r - 4 \)
4. \( 3 + (w^2 + x^2) = 32 \)
5. \( K = 273 + C \)
6. \( C = pg \)
7. \( S = 180(n - 2) \)
8. \( r = (4 + p) - \frac{1}{3} r \text{ minus the sum of 4 and } p \) 
   Two more than \( \frac{3}{5} \) of \( r \) equals \( t \).
9. \( 9(y^2 + x) = 18 \) 
   9 times the sum of \( y \) squared and \( x \) is 18.
10. \( 2(m - n) = x + 7 \) 
    Twice the quantity \( m \) minus \( n \) is \( x \) plus 7.
11. \( T = p + (p + 7) \)
12. \( 0.15F = N \)
13. \( a = cost \text{ of one adult's ticket to zoo} \)
    \( 2a + 4(a - 4) = 38 \)
    Sample answer: The cost of two adult's tickets and 4 children's tickets to the zoo is $38. How much is an adult's ticket? 
14. About 15\% of all federally-owned land in the 48 contiguous states of the United States is in Nevada. If \( F \) represents the area of federally-owned land in these states, and \( N \) represents the portion in Nevada, write an equation for this situation. 
    \[ 0.15F = N \]
15. Fitness
   Deanna and Pietra each go for walks around a lake a few times per week. Last week, Deanna walked 7 miles more than Pietra.
   a. If \( p \) represents the number of miles Pietra walked, write an equation that represents the total number of miles \( T \) the two girls walked. 
      \[ T = p + (p + 7) \]
   b. If Pietra walked 9 miles during the week, how many miles did Deanna walk?
      16 mi
   c. If Pietra walked 11 miles during the week, how many miles did the two girls walk together?
      29 mi
2-3 Practice
Solving Multi-Step Equations

Solve each problem by working backward.

1. Three is added to a number, and then the sum is multiplied by 4. The result is 16. Find the number. 1

2. A number is divided by 4, and the quotient is added to 3. The result is 24. What is the number? 8

3. Two is subtracted from a number, and then the difference is multiplied by 5. The result is 30. Find the number. 8

4. BIRD WATCHING While Michelle sat observing birds at a bird feeder, one fourth of the birds flew away when they were startled by a noise. Two birds left the feeder to go to another stationed a few feet away. ... flew into the branches of a nearby tree. Four birds remained at the feeder. How many birds were at the feeder initially? 12

Solve each equation. Check your solution.

5. \(-12n - 19 = 77\) \(-8\)

6. \(17 + 3f/4 = 14 - 1\) 7. \(15t + 4 = 48\) 3

8. \(5 3/4 + 6 = 2 - 20\) 9. \(-35/6 + 3 = 15 - 48\) 10. \(5/3 - 6 = -2\) 12

11. \(2y - 1 3/8 = 2\) 12. \(-32 - 3/5f = -17 - 25\) 13. \(8 - 3\sqrt{a} = -4\) 32

14. \(n + 10\) \(12\) = 1 \(-1\) 15. \(15 - a/3 = -9\) 42 16. \(3b - 7/5 = 16\) 29

17. \(9/7 - 0.5 = 2.5\) \(21\) 18. \(2.5f + 0.45 = 0.95\) 0.2 19. \(0.4m - 0.7 = 0.22\) 2.3

Write an equation and solve each problem.

20. Seven less than four times a number equals 13. What is the number? \(4n - 7 = 13\); 5

21. Find two consecutive odd integers whose sum is 116. \(n + (n + 2) = 116; 57, 59\)

22. Find two consecutive even integers whose sum is 126. \(n + (n + 2) = 126; 62, 64\)

23. Find three consecutive odd integers whose sum is 117. \(n + (n + 2) + (n + 4) = 117; 37, 39, 41\)

24. COIN COLLECTING Jung has a total of 92 coins in his coin collection. This is 8 more than three times the number of quarters in the collection. How many quarters does Jung have in his collection? 28

2-3 Word Problem Practice
Solving Multi-Step Equations

1. TEMPERATURE The formula for converting a Fahrenheit temperature to a Celsius temperature is \(C = \frac{F - 32}{1.8}\).

Find the equivalent Celsius temperature for 68°F.

20°C

2. HUMAN HEIGHT It is a commonly used guideline that for the average American child, their maximum adult height will be about twice their height at age 2. Suppose that Micah's adult height is 2.5 feet. Find the height at age 2. 19 inches

3. CHEMISTRY The half-life of a radioactive substance is the time required for half of a sample to undergo radioactive decay, or for the quantity to fall to half its original amount. Carbon 14 has a half-life of 5730 years. Suppose given samples of carbon 14 weigh \(0.45\) pounds and \(5\) pounds of a pound and \(7\) pounds of a pound. What was the total weight of the samples 11,460 years ago?

\(w = \left(\frac{5}{18} + \frac{7}{12}\right) \times 2 \times 2\)

\(w = 6\) pounds

4. NUMBER THEORY Write and solve an equation to find three consecutive odd integers whose sum is 3.

\(n + (n + 2) + (n + 4) = 3\)

3n + 6 = 3

n = -1

n + 2 = 1

n + 4 = 3

5. GEOMETRY A rectangular swimming pool is surrounded by a concrete sidewalk that is 3 feet wide. The dimensions of the rectangle created by the sidewalk are 21 feet by 31 feet.

Find the length and width of the pool.

\(\ell = 21 - 3 = 3\)

\(w = 31 - 3 = 28\)

\(\ell = 15\) feet

\(w = 25\) feet

b. Find the area of the pool.

\(A = \ell \cdot w\)

\(A = 15 \cdot 25\)

\(A = 375\) square feet

c. Write and solve an equation to find the area of the sidewalk in square feet.

\(A = \ell \cdot w - 375\)

\(A = (21 \cdot 31) - 375\)

\(A = 651 - 375\)

\(A = 276\) square feet
**2-4 Study Guide and Intervention (continued)**

**Solving Equations with the Variable on Each Side**

**Grouping Symbols** When solving equations that contain grouping symbols, first use the Distributive Property to eliminate grouping symbols. Then solve.

**Example** Solve $4(2a - 1) = -10(a - 5)$.

- $4(2a - 1) = -10(a - 5)$ Original equation
- $8a - 4 = -10a + 50$ Distributive Property
- $8a - 4 + 10a = -10a + 50 + 10a$ Add 10a to each side.
- $18a - 4 + 50 = 54$ Simplify.
- $18a = 54$ Add 4 to each side.
- $a = 3$ Simplify.
- $18 = 54$ Divide each side by 18.

The solution is 3.

**Exercises**

Solve each equation. Check your solution.

1. $-3(x + 5) = 3(x - 1)$
   - $-2$ all numbers
2. $2/7 + 3/7 = -t$
   - $-2$
3. $3(a + 1) - 5 = 3a - 2$
   - $a = 3$
4. $75 - 9g = 5(-4 + 2g)$
   - $5$
5. $(f/2 + 2) = (3 - f)$
   - $4$
6. $4(p + 3) = 36$
   - $6$
7. $18 = 3(2x + 2)$
   - $2$ no solution
8. $3(d - 8) = 3d$
   - $7$
9. $5(p + 3) - 9 = 3(p - 2) + 6$
   - $-12$
10. $4(b - 2) = 2(5 - b)$
    - $3$
11. $2(x - 2) = 2 - x$
    - $2$
12. $3/4 = -x/8$
    - $-2$
13. $a - 8/12 = 2a + 5/3$
    - $-4$
14. $2(k + 2k) + 10 = 3k$
    - $2$
15. $2(w - 1) + 4 = 4(w + 1)$
    - $-6$
16. $6n - 1) = 2(2n + 4)$
    - $7$
17. $2[2 + 3(y - 1)] = 22$
    - $4$
18. $-4(r + 2) = 4(2 - 4r)$
    - $1/3$
19. $-3(x - 8) = 24$
    - $0$
20. $4(4 - 4k) = -10 - 16k$
    - no solution

**Answers**

1. $a = 3$
2. $-2$
3. $a = 3$
4. $5$
5. $4$
6. $6$
7. $2$ no solution
8. $7$
9. $-12$
10. $3$
11. $2$
12. $-2$
13. $-4$
14. $2$
15. $-6$
16. $7$
17. $4$
18. $1/3$
19. $0$
20. no solution

**2-4 Skills Practice**

**Solving Equations with the Variable on Each Side**

Justify each step.

1. $4k - 3 = 2k + 5$
   - a. Subtract $2k$ from each side.
   - b. Simplify.
   - c. Add 3 to each side.
   - d. Simplify.
   - e. Divide each side by 2.
   - f. Simplify.

2. $2(8u + 2) = 3(2u - 7)$
   - a. Distributive Property
   - b. Subtract $6u$ from each side.
   - c. Simplify.
   - d. Subtract 4 from each side.
   - e. Simplify.
   - f. Divide each side by 10.

Solve each equation. Check your solution.

3. $2m + 12 = 3m - 31$
   - $43$
4. $2k - 8 = k + 17$
   - $25$
5. $7a - 3 = 3 - 2a$
   - $2/3$
6. $4n - 12 = 12 - 4n$
   - $3$
7. $4x - 9 = 7x + 12$
   - $-7$
8. $-6y - 3 = 3 - 6y$
   - no solution
9. $5 + 3r = 5r - 19$
   - $12$
10. $-9 + 8k = 7 + 4k$
    - $4$
11. $8q + 12 = 4(3 + 2q)$
    - $all numbers$
12. $3(5y + 2) = 2(3y - 6)$
    - $-2$
13. $6(-3c + 1) = 5(-2c - 2) - 2$
    - $2$
14. $-7(2b - 4) = 5(-2b + 6)$
    - $0.5 or 1/2$
15. $3b - 3(5b + 2) = 1$
16. $2(3u + 7) = 4(3 - 2u)$
    - $13$
17. $8(2y - 2) = 7(3y + 2)$
    - $-6$
18. $5(6 - 3c) = 3(8 + 7d)$
    - $-1.5 or 1.5$
19. $6w + 1) = 3(3w + 5)$
    - $7$
20. $7(-3y + 2) = 8(3y - 2)$
    - $2/3$
21. $\frac{3}{2}v - 6 = 6 - \frac{3}{2}v$
    - $9$
22. $\frac{3}{2} - \frac{3}{2}x = \frac{3}{2}x + \frac{3}{2}$
    - $-2$
2-4 Word Problem Practice

Solving Equations with the Variable on Each Side

1. **Olympics** In the 2010 Winter Olympic Games in Vancouver, Canada, the United States athletes won 1 more than 4 times the number of gold metals won by the French athletes. The United States won 7 more gold metals than the French. Solve the equation \( 7 + F = 4F + 1 \) to find the number of gold metals won by the French athletes.

2. **Age** Diego’s mother is twice as old as he is. She is also as old as the sum of the ages of Diego and both of his younger twin brothers. The twins are 11 years old. Solve the equation \( 2d = d + 11 + 11 \) to find the age of Diego.

22 years old

3. **Geometry** Supplementary angles are angles whose measures have a sum of 180°. Complementary angles are angles whose measures have a sum of 90°. Find the measure of an angle whose supplement is 10° more than twice its complement. Let \( 90 - x \) equal the degree measure of its complement and \( 180 - x \) equal the degree measure of its supplement. Write and solve an equation.

\[ 180 - x = 10 + 2(90 - x); 10 \]

4. **Nature** The table shows the current heights and average growth rates of two different species of trees. How long will it take for the two trees to be the same height?

<table>
<thead>
<tr>
<th>Tree Species</th>
<th>Current Height</th>
<th>Annual growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>38 inches</td>
<td>4 inches</td>
</tr>
<tr>
<td>B</td>
<td>45.5 inches</td>
<td>2.5 inches</td>
</tr>
</tbody>
</table>

\[ 38 + 4x = 45.5 + 2.5x \]

\[ 1.5x + 7.5 \]

\[ x = 5 \text{ years} \]

5. **Number Theory** Mrs. Simms told her class to find two consecutive even integers such that twice the lesser of two integers is 4 less than two times the greater integer.

a. Write and solve an equation to find the integers.

Let integers be \( n \) and \((n + 2)\)

\[ 2n = 2(n + 2) - 4 \]

\[ 2n = 2n + 4 - 4 \]

\[ 2n = 2n \]

\[ 1 = n, n \neq 0 \]

b. Does the equation have one solution, no solutions, or is it an identity? Explain.

It is an identity because it is true for every pair of consecutive even integers.
2-5 Skills Practice

Solving Equations Involving Absolute Value

Evaluate each expression if \(a = 2\), \(b = -3\), and \(c = -4\).

1. \(|a - 5| - 1\) 2
2. \(|b + 1| + 8\) 10
3. \(5 - |c + 1|\) 2
4. \(|a + b| - c\) 5

Solve each equation. Then graph the solution set.

5. \(|w + 1| = 5\) \((-6, 4)\)
6. \(|c - 3| = 1\) \((2, 4)\)

7. \(|n + 2| = 1\) \((-3, -1)\)
8. \(|t + 6| = 4\) \((-10, -2)\)

9. \(|w - 2| = 2\) \((0, 4)\)
10. \(|k - 5| = 4\) \((1, 9)\)

Write an equation involving absolute value for each graph.

11. \(|x| = 1\)
12. \(|x + 3| = 2\)

13. \(|x - 4| = 1\)
14. \(|x| = 4\)

15. FITNESS Taisha uses the elliptical cross-trainer at the gym. Her general goal is to burn 280 Calories per workout, but she varies by as much as 25 Calories from this amount on any given day. Write and solve an equation to find the maximum and minimum numbers of Calories Taisha burns on the cross-trainer.

\(|c - 280| = 25; \text{min} = 255; \text{max} = 305\)

16. TEMPERATURE A thermometer is guaranteed to give a temperature no more than 1.2°F from the actual temperature. If the thermometer reads 28°F, write and solve an equation to find the maximum and minimum temperatures it could be.

\(|t - 28| = 1.2; \text{min} = 26.8°F; \text{max} = 29.2°F\)
State whether each percent of change is a percent of increase or a percent of decrease. Then find each percent of change. Round to the nearest whole percent.

1. original: 25
   new: 10
   decrease; 60%

2. original: 50
   new: 50
   increase; 50%

3. original: 55
   new: 50
   decrease; 9%

4. original: 25
   new: 28
   increase; 12%

5. original: 50
   new: 30
   decrease; 40%

6. original: 90
   new: 95
   increase; 6%

7. original: 48
   new: 60
   increase; 25%

Find the total price of each item.

9. dress: $69.00
tax: 5%
   $72.45

10. binder: $14.50
tax: 7%
    $15.52

11. hardcover book: $28.95
tax: 6%
    $30.69

12. shoes: $65.00
tax: 6.5%
    $67.60

13. basketball: $17.00
tax: 6%
    $18.02

Find the discounted price of each item.

17. backpack: $56.25
discount: 20%
   $45.00
18. monitor: $150.00
discount: 50%
   $75.00
19. CD: $15.99
discount: 20%
   $12.79
20. shirt: $25.50
discount: 40%
   $15.30
21. sleeping bag: $125
discount: 25%
   $93.75
22. coffee maker: $102.00
discount: 45%
   $56.10

INVESTMENTS The price per share of a stock decreased from $90 per share to $36 per share. By what percent did the price of the stock decrease?

23. heating costs Customers of a utility company received notices in their monthly bills that heating costs for the average customer had increased 125% over last year because of an unusually severe winter. In January of last year, the Garcia’s paid $120 for heating. What should they expect to pay this January if their bill increased by 125%?

24. investments The price per share of a stock decreased from $90 per share to $36 per share. By what percent did the price of the stock decrease?

25. heating costs Customers of a utility company received notices in their monthly bills that heating costs for the average customer had increased 125% over last year because of an unusually severe winter. In January of last year, the Garcia’s paid $120 for heating. What should they expect to pay this January if their bill increased by 125%?

26. investments The price per share of a stock decreased from $90 per share to $36 per share. By what percent did the price of the stock decrease?

27. heating costs Customers of a utility company received notices in their monthly bills that heating costs for the average customer had increased 125% over last year because of an unusually severe winter. In January of last year, the Garcia’s paid $120 for heating. What should they expect to pay this January if their bill increased by 125%?

28. investments The price per share of a stock decreased from $90 per share to $36 per share. By what percent did the price of the stock decrease?

29. heating costs Customers of a utility company received notices in their monthly bills that heating costs for the average customer had increased 125% over last year because of an unusually severe winter. In January of last year, the Garcia’s paid $120 for heating. What should they expect to pay this January if their bill increased by 125%?

30. investments The price per share of a stock decreased from $90 per share to $36 per share. By what percent did the price of the stock decrease?
2-8 Skills Practice

Literal Equations and Dimensional Analysis

Solve each equation or formula for the variable indicated.

1. 7t = x, for t  \quad t = \frac{x}{7}
2. r = \frac{w}{p}, for p  \quad p = \frac{r}{w}
3. q - r = r, for r  \quad r = \frac{q}{2}
4. 4m - t = m, for m  \quad m = \frac{t}{3}
5. 7a - b = 15a, for a  \quad a = \frac{b}{8}
6. -5c + d = 2c, for c  \quad c = \frac{d}{7}
7. x - 2y = 1, for y  \quad y = \frac{x - 1}{2}
8. d + 3n = 1, for n  \quad n = \frac{1 - d}{3}
9. 7f + g = 5, for f  \quad f = \frac{5 - g}{7}
10. ax - c = b, for x  \quad x = \frac{b + c}{a}; a \neq 0
11. rt - 2n = y, for t  \quad t = \frac{2n + y}{r}; r \neq 0
12. bc + 3g = 2kc, for c  \quad c = \frac{2k - 3g}{b}; b \neq 0
13. kn + 4f = 9c, for n  \quad n = \frac{9v - 4f}{k}; k \neq 0
14. 8c + 6d = 5p, for c  \quad c = \frac{5p - 6d}{8}
15. \frac{8 - c}{2} = d, for x  \quad x = c + 2d
16. \frac{8 - c}{2} = d, for c  \quad c = x - 2d
17. \frac{p + 9}{b} = r, for p  \quad p = 5b - 9
18. \frac{b - 4a}{7} = a, for b  \quad b = 7a + 4z
19. The volume of a box is given by the formula \( V = \ell w h \), where \( \ell \) is the length, \( w \) is the width, and \( h \) is the height.
   a. Solve the formula for \( h \).  \quad h = \frac{V}{\ell w}
   b. What is the height of a box with a volume of 50 cubic meters, length of 10 meters, and width of 2 meters?  \quad 2.5 \text{ m}
20. Trent purchases 44 euros worth of souvenirs while on vacation in France.
   If $1 U.S. = 0.678 euros, find the cost of the souvenirs in United States dollars.
   Round to the nearest cent.  \quad $64.90
Literal Equations and Dimensional Analysis

Solve each equation or formula for the variable indicated.

1. \( d = rt \), for \( r \) = \( \frac{d}{t} \)  
2. \( 6w - y = 2s \), for \( w \) = \( \frac{2x + y}{6} \)  
3. \( mx + 4y = 3t \), for \( x \)= \( \frac{3t - 4y}{m} \); \( m \neq 0 \)  
4. \( \frac{9}{4}a - 5g = -4u \), for \( s \) = \( \frac{-4u + 5g}{9} \)  
5. \( ab + 3c = 2x \), for \( b \) = \( \frac{2x - 3c}{a} \); \( a \neq 0 \)  
6. \( 2p = kx - t \), for \( x \) = \( \frac{2p + t}{k} \); \( k \neq 0 \)  
7. \( \frac{2}{3}m + a = a + r \), for \( m \) = \( \frac{3}{2}r \)  
8. \( \frac{2}{3}h + g = d \), for \( h \) = \( \frac{5}{2}(d - g) \)  
9. \( \frac{3}{5}y + v = x \), for \( y \) = \( \frac{3}{2}(x - v) \)  
10. \( \frac{3}{4}a - q = k \), for \( a \) = \( \frac{4}{3}(k + q) \)  
11. \( \frac{3x + 9}{5} = h \), for \( x \) = \( \frac{5h - 9}{r} \); \( r \neq 0 \)  
12. \( \frac{3b - 4}{2} = c \), for \( b \) = \( \frac{2c + 4}{3} \)  
13. \( 2w - y = 7u - 2 \), for \( w \) = \( \frac{2 - y}{5} \)  
14. \( 3\ell + y = 5 + 5\ell \), for \( \ell \) = \( \frac{y - 5}{2} \)  

15. **ELECTRICITY** The formula for Ohm’s Law is \( E = IR \), where \( E \) represents voltage measured in volts, \( I \) represents current measured in amperes, and \( R \) represents resistance measured in ohms.

   a. Solve the formula for \( R \). \( R = \frac{E}{I} \)
   
   b. Suppose a current of 0.25 amperes flows through a resistor connected to a 12-volt battery. What is the resistance in the circuit? \( 48 \) ohms

16. **MOTION** In uniform circular motion, the speed \( v \) of a point on the edge of a spinning disk is \( v = \frac{2\pi r}{t} \), where \( r \) is the radius of the disk and \( t \) is the time it takes the point to travel once around the circle.

   a. Solve the formula for \( r \). \( r = \frac{2\pi v}{2\pi} \)
   
   b. Suppose a merry-go-round is spinning once every 3 seconds. If a point on the outside edge has a speed of 12.56 feet per second, what is the radius of the merry-go-round? (Use 3.14 for \( \pi \)). \( 6 \) ft

17. **HIGHWAYS** Interstate 90 is the longest interstate highway in the United States, connecting the cities of Seattle, Washington and Boston, Massachusetts. The interstate is 4,987,000 meters in length. If 1 mile = 1.609 kilometers, how many miles long is Interstate 90? \( 3099 \) mi
**Weighted Averages**

**Uniform Motion Problems** Motion problems are another application of weighted averages. Uniform motion problems are problems where an object moves at a certain speed, or rate. Use the formula \( d = rt \) to solve these problems, where \( d \) is the distance, \( r \) is the rate, and \( t \) is the time.

**Example 1** DRIVING Bill Gutierrez drove at a speed of 65 miles per hour on an expressway for 2 hours. He then drove for 1.5 hours at a speed of 45 miles per hour on a state highway. What was his average speed?

\[
M = \frac{65 \cdot 2 + 45 \cdot 1.5}{2 + 1.5} \\
\approx 56.4 \text{ mph}
\]

Bill drove at an average speed of about 56.4 miles per hour.

**Exercises**

1. **TRAVEL** Mr. Anders and Ms. Rich each drove home from a business meeting. Mr. Anders traveled east at 100 kilometers per hour and Ms. Rich traveled west at 80 kilometers per hour. In how many hours were they 100 kilometers apart? \( \frac{5}{9} \) h

2. **AIRPLANES** An airplane flies 750 miles due west in 1 \( \frac{1}{2} \) hours and 750 miles due south in 2 hours. What is the average speed of the airplane? about 429 mph

3. **TRACK** Sprinter A runs 100 meters in 15 seconds, while sprinter B starts 1.5 seconds later and runs 100 meters in 14 seconds. If each of them runs at a constant rate, who is farther in 10 seconds after the start of the race? Explain.

Sprinter A; since sprinter A runs 100 m in 15 s, this sprinter runs at a rate of \( \frac{100}{15} \) m/s. In 10 seconds, sprinter A will have run \( \frac{100}{15} \cdot (10) = 66.7 \) m. Sprinter B’s rate is \( \frac{100}{16} \). In 10 seconds, with the delayed start, sprinter B has run \( \frac{100}{16} \cdot (10 - 1.5) = 60.7 \) m.

4. **TRAINS** An express train travels 90 kilometers per hour from Smallville to Megatown. A local train takes 2.5 hours longer to travel the same distance at 50 kilometers per hour. How far apart are Smallville and Megatown? 281.25 km

5. **CYCLING** Two cyclists begin traveling in the same direction on the same bike path. One travels at 15 miles per hour, and the other travels at 12 miles per hour. When will the cyclists be 10 miles apart? \( 3 \frac{1}{3} \) h

6. **TRAINS** Two trains leave Chicago, one traveling east at 30 miles per hour and one traveling west at 40 miles per hour. When will the trains be 210 miles apart? 3 h

**2.9 Skills Practice**

**Weighted Averages**

1. **SEASONING** A health food store sells seasoning blends in bulk. One blend contains 20% basil. Sheila wants to add pure basil to some 20% blend to make 16 ounces of her own 30% blend. Let \( b \) represent the amount of basil Sheila should add to the 20% blend.

a. Complete the table representing the problem.

<table>
<thead>
<tr>
<th>Ounces</th>
<th>Amount of Basil</th>
</tr>
</thead>
<tbody>
<tr>
<td>20% Basil Blend</td>
<td>16 - ( b )</td>
</tr>
<tr>
<td>100% Basil</td>
<td>0.20(16 - ( b ))</td>
</tr>
<tr>
<td>30% Basil Blend</td>
<td>0.30(16)</td>
</tr>
</tbody>
</table>

b. Write an equation to represent the problem.

\[ 0.20(16 - b) + 1.00b = 0.30(16) \]

c. How many ounces of basil should Sheila use to make the 30% blend? 2 oz

d. How many ounces of the 20% blend should she use? 14 oz

2. **HIKING** At 7:00 A.M., two groups of hikers begin 21 miles apart and head toward each other. The first group, hiking at an average rate of 1.5 miles per hour, carries tents, sleeping bags, and cooking equipment. The second group, hiking at an average rate of 2 miles per hour, carries food and water. Let \( t \) represent the hiking time.

a. Copy and complete the table representing the problem.

<table>
<thead>
<tr>
<th>Time</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>First group of hikers</td>
<td>1.5</td>
</tr>
<tr>
<td>Second group of hikers</td>
<td>2</td>
</tr>
</tbody>
</table>

b. Write an equation using \( t \) that describes the distances traveled.

\[ 1.5t + 2t = 21 \]

c. How long will it be until the two groups of hikers meet? 6 h

3. **SALES** Sergio sells a mixture of Virginia peanuts and Spanish peanuts for $3.40 per pound. To make the mixture, he uses Virginia peanuts that cost $3.50 per pound and Spanish peanuts that cost $3.00 per pound. He mixes 10 pounds at a time.

a. How many pounds of Virginia peanuts does Sergio use? 8 lb

b. How many pounds of Spanish peanuts does Sergio use? 2 lb
1. **GRASS SEED** A nursery sells Kentucky Blue Grass seed for $5.75 per pound and Tall Fescue seed for $4.50 per pound. The nursery sells a mixture of the two kinds of seed for $5.25 per pound. Let \( k \) represent the amount of Kentucky Blue Grass seed the nursery uses in 5 pounds of the mixture.
   
   a. Complete the table representing the problem.

<table>
<thead>
<tr>
<th>Number of Pounds</th>
<th>Price per Pound</th>
<th>Cost</th>
</tr>
</thead>
</table>
   | Kentucky Blue Grass | \( k \)       | $5.75 \times k | \( 5.75k \)
   | Tall Fescue       | \( 5 - k \)    | $4.50 \times (5 - k) | \( 4.50(5 - k) \)
   | Mixture           | 5              | $5.25      | \( 5.25(5) \)

   b. Write an equation to represent the problem. \( 5.75k + 4.50(5 - k) = 5.25(5) \)

   c. How much Kentucky Blue Grass does the nursery use in 5 pounds of the mixture? 3 lb

   d. How much Tall Fescue does the nursery use in 5 pounds of the mixture? 2 lb

2. **TRAVEL** Two commuter trains carry passengers between two cities, one traveling east, and the other west, on different tracks. Their respective stations are 150 miles apart. Both trains leave at the same time, one traveling at an average speed of 55 miles per hour and the other at an average speed of 65 miles per hour for 6 hours. Let \( t \) represent the time until the trains pass each other.

   a. Copy and complete the table representing the problem.

<table>
<thead>
<tr>
<th>( r \times t )</th>
<th>( d )</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Train</td>
<td>55</td>
</tr>
<tr>
<td>Second Train</td>
<td>65</td>
</tr>
</tbody>
</table>

   b. Write an equation using \( t \) that describes the distances traveled. \( 55t + 65t = 150 \)

   c. How long after departing will the trains pass each other? 1.25 h

3. **TRAVEL** Two trains leave Raleigh at the same time, one traveling north, and the other south. The first train travels at 50 miles per hour and the second at 60 miles per hour. In how many hours will the trains be 275 miles apart? 2.5 h

4. **JUICE** A pineapple drink contains 15% pineapple juice. How much pure pineapple juice should be added to 8 quarts of the pineapple drink to obtain a mixture containing 50% pineapple juice? 5.6 qt

5. **BUSINESS** Mrs. Winship sells chocolate fudge for $7.50 per pound and peanut butter fudge for $7.00 per pound. The total number of pounds sold on Saturday was 146 and the total amount of money collected was $1065. How many pounds of each type of fudge were sold?

   a. Change 45 miles per hour and 24 miles per hour into feet per second. Train A: 66 feet per second, Train B: 35.2 feet per second

   b. About how far will each train travel before they meet? Round your answers to the nearest hundredth. Train A: 3260.87 feet, Train B: 1739.13 feet

   c. In how many seconds will Train A and Train B meet? 49.4 seconds