2-9 Weighted Averages

1. **FOOD** Tasha ordered soup and salad for lunch. The soup cost 15 cents per ounce, and the salad cost 20 cents per ounce. If Tasha ordered 10 ounces of soup for lunch and the total cost was $3.30, how many ounces of salad did Tasha order?

   **SOLUTION:**
   Let \( x \) represent the number of ounces of salad Tasha ordered. Make a table to organize the information.

<table>
<thead>
<tr>
<th>Number of Ounces</th>
<th>Price per Unit ($)</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soup</td>
<td>10</td>
<td>0.15(10)</td>
</tr>
<tr>
<td>Salad</td>
<td>( x )</td>
<td>0.20x</td>
</tr>
<tr>
<td>Soup and Salad</td>
<td>( 10 + x )</td>
<td>3.30</td>
</tr>
</tbody>
</table>

   We can use the last column to set up an equation involving total price in order to solve for \( x \).

   \[
   0.15(10) + 0.20(x) = 3.30 \quad \text{Original}
   \]

   \[
   1.50 + 0.20x = 3.30 \quad \text{Distribute}
   \]

   \[
   0.20x = 1.80 \quad \text{Subtract}
   \]

   \[
   \frac{0.20x}{0.20} = \frac{1.80}{0.20} \quad \text{Divide}
   \]

   \[
   x = 9 \quad \text{Simplify}
   \]

   Tasha ordered 9 ounces of salad.

2. **CHEMISTRY** A chemistry experiment calls for a 30% solution of sodium chloride. Margo has 40 milliliters of 25% solution. How many milliliters of 60% solution should she add to obtain the required 30% solution?

   **SOLUTION:**
   Let \( x \) represent the number of milliliters of 60% solution.

<table>
<thead>
<tr>
<th>Amount of solution</th>
<th>Concentration</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>60% Solution</td>
<td>( x )</td>
<td>0.60</td>
</tr>
<tr>
<td>25% Solution</td>
<td>40</td>
<td>0.25</td>
</tr>
<tr>
<td>30% Solution</td>
<td>( 40 + x )</td>
<td>0.30</td>
</tr>
</tbody>
</table>

   \[
   0.25(40) + 0.60x = 0.30(40 + x) \quad \text{Original}
   \]

   \[
   10 + 0.60x = 12 + 0.30x \quad \text{Distribute}
   \]

   \[
   0.60x = 2 + 0.30x \quad \text{Subtract 10.}
   \]

   \[
   0.30x = 2 \quad \text{Subtract 0.30x}
   \]

   \[
   \frac{0.30x}{0.30} = \frac{2}{0.30} \quad \text{Divide}
   \]

   \[
   x \approx 6.67 \quad \text{Simplify}
   \]

   Margo should add about 6.67 mL of 60% solution.
3. **TRAVEL** A boat travels 16 miles due north in 2 hours and 24 miles due west in 2 hours. What is the average speed of the boat?

**SOLUTION:**
The average speed is the total distance traveled divided by the total time.

\[
\frac{16 + 24}{2 + 2} = \frac{40}{4} = 10
\]

The boat’s average speed is 10 miles per hour.

4. **EXERCISE** Felisa jogged 3 miles in 25 minutes and then jogged 3 more miles in 30 minutes. What was her average speed in miles per minute?

**SOLUTION:**
The average speed is the total distance traveled divided by the total time.

\[
\frac{3 + 3}{25 + 30} = \frac{6}{55} \approx 0.109
\]

Felisa’s average speed is about 0.11 miles per minute.

5. **CYCLING** A cyclist begins traveling 18 miles per hour. At the same time and at the same starting point, an inline skater follows the cyclist’s path and begins traveling 6 miles per hour. After how much time will they be 24 miles apart?

**SOLUTION:**
Let \(x\) represent the time it will take for the two people to be 24 miles apart.

<table>
<thead>
<tr>
<th></th>
<th>Rate</th>
<th>Time</th>
<th>Distance (d = rt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyclist</td>
<td>18</td>
<td>(x)</td>
<td>18(x)</td>
</tr>
<tr>
<td>Skater</td>
<td>6</td>
<td>(x)</td>
<td>6(x)</td>
</tr>
</tbody>
</table>

\[18x - 6x = 24\]  \(\text{Original equation}\)

\[12x = 24\]  \(\text{Simplify}\).

\[\frac{12x}{12} = \frac{24}{12}\]  \(\text{Divide}\).

\[x = 2\]  \(\text{Simplify}\).

So, after 2 hours, they will be 24 miles apart.
2-9 Weighted Averages

6. **CANDY** A candy store wants to create a special mix using two hard candies. One is priced at $5.45 per pound, and the other is priced at $7.33 per pound. How many pounds of the $7.33 candy should be mixed with 11 pounds of the $5.45 candy to sell the mixture for $6.14 per pound?

**SOLUTION:**
Let \( x \) represent the number of pounds of the candy that costs $7.33 per pound.

<table>
<thead>
<tr>
<th>Number of Pounds Candy</th>
<th>Price per Pound ($)</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard Candy 1</td>
<td>11</td>
<td>5.45(11)</td>
</tr>
<tr>
<td>Hard Candy 2</td>
<td>( x )</td>
<td>7.33( x )</td>
</tr>
<tr>
<td>New Hard Candy Mixture</td>
<td>11 + ( x )</td>
<td>6.14(11 + ( x ))</td>
</tr>
</tbody>
</table>

\[
5.45(11) + 7.33x = 6.14(11 + x)
\]

Simplify.

\[
59.95 + 7.33x = 67.54 + 6.14x\]

Subtract 6.14\( x \).

\[
1.19x = 7.59
\]

Subtract 59.95.

\[
\frac{1.19x}{1.19} = \frac{7.59}{1.19}
\]

Divide.

\[
x \approx 6.38
\]

Simplify.

They should use about 6.38 pounds of the $7.33 candy.
2-9 Weighted Averages

7. **BUSINESS** Party Supplies Inc. sells metallic balloons for $2 each and helium balloons for $3.50 per bunch. Yesterday, they sold 36 more metallic balloons than the number of bunches of helium balloons. The total sales for both types of balloons were $281. Let \( b \) represent the number of metallic balloons sold.

a. Copy and complete the table representing the problem.

<table>
<thead>
<tr>
<th>Number</th>
<th>Price</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metallic Balloons</td>
<td>( b )</td>
<td></td>
</tr>
<tr>
<td>Bunches of Helium Balloons</td>
<td>( b - 36 )</td>
<td></td>
</tr>
</tbody>
</table>

b. Write an equation to represent the problem.

c. How many metallic balloons were sold?

d. How many bunches of helium balloons were sold?

**SOLUTION:**

a. Let \( b \) represent the number of metallic balloons sold. Metallic balloons cost $2.00 each, so the total price is \( 2.00b \). A bunch of helium balloons cost $3.50, so the total price is \( 3.50(b - 36) \).

b. To write an equation, find the sum of the total price for both types of balloons and set it equal to the total sales.

\[
2.00b + 3.50(b - 36) = 281.00
\]

c.\[
\begin{align*}
2.00b + 3.50b - 126 &= 281 \\
5.50b - 126 &= 281 \\
5.50b &= 407 \\
\frac{5.50b}{5.50} &= \frac{407}{5.50} \\
b &= \frac{407}{5.50} = 74
\end{align*}
\]

They sold 74 metallic balloons.

d. The number of bunches of helium balloons sold is equal to \( b - 36 \).

\[
b - 36 = 74 - 36
\]

\[
= 38
\]

38 bunches of helium balloons were sold.
8. **FINANCIAL LITERACY** Lakeisha spent $4.57 on color and black–and–white copies for her project. She made 7 more black–and–white copies than color copies. How many color copies did she make?

<table>
<thead>
<tr>
<th>Type of Copy</th>
<th>Cost per Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>color</td>
<td>$0.44</td>
</tr>
<tr>
<td>black-and-white</td>
<td>$0.07</td>
</tr>
</tbody>
</table>

**SOLUTION:**
Let \( x \) represent the number of color copies.

\[
\begin{array}{|c|c|c|}
\hline
\text{Type of Copy} & \text{Number of Copies} & \text{Cost per Page ($)} & \text{Total Cost} \\
\hline
\text{Black-and-White} & x + 7 & 0.07 & 0.07(x + 7) \\
\text{Color} & x & 0.44 & 0.44x \\
\text{Total} & & & 4.57 \\
\hline
\end{array}
\]

\[0.44x + 0.07(x + 7) = 4.57\]
\[0.44x + 0.07x + 0.49 = 4.57\] **Distribute.**
\[0.51x + 0.49 = 4.57\] **Simplify.**
\[0.51x + 0.49 - 0.49 = 4.57 - 0.49\] **Subtract.**
\[0.51x = 4.08\] **Simplify.**
\[
\frac{0.51x}{0.51} = \frac{4.08}{0.51}
\] **Divide.**
\[x = 8\] **Simplify.**

Lakeisha made 8 color copies.
2-9 Weighted Averages

9. **FISH** Rosamaria is setting up a 20-gallon saltwater fish tank that needs to have a salt content of 3.5%. If Rosamaria has water that has 2.5% salt and water that has 3.7% salt, how many gallons of the water with 3.7% salt content should Rosamaria use?

**SOLUTION:**
Let \( x \) represent the number of gallons of the water with 3.7% salt content.

<table>
<thead>
<tr>
<th>Gallons of Water</th>
<th>Salt Content</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water 1 ( 20 - x )</td>
<td>0.025</td>
<td>0.025((20 - x))</td>
</tr>
<tr>
<td>Water 2 ( x )</td>
<td>0.037</td>
<td>0.037(x)</td>
</tr>
<tr>
<td>Water 1 + Water 2 ( 20 )</td>
<td>0.035</td>
<td>0.035(20)</td>
</tr>
</tbody>
</table>

\[
20(0.035) = 0.025(20 - x) + 0.037x
\]

\[
0.7 = 0.5 - 0.025x + 0.037x \quad \text{Distribute}
\]

\[
0.7 = 0.5 + 0.012x \quad \text{Simplify.}
\]

\[
0.7 - 0.5 = 0.5 - 0.5 + 0.012x \quad \text{Subtract.}
\]

\[
0.2 = 0.012x \quad \text{Simplify.}
\]

\[
\frac{0.2}{0.012} = \frac{0.012x}{0.012} \quad \text{Divide.}
\]

\[
16.67 \approx x \quad \text{Simplify.}
\]

Rosamaria should use about 16.67 gallons of water with 3.7% salt content.
2-9 Weighted Averages

10. CHEMISTRY Hector is performing a chemistry experiment that requires 160 milliliters of 40% sulfuric acid solution. He has a 25% sulfuric acid solution and a 50% sulfuric acid solution. How many milliliters of each solution should he mix to obtain the needed solution?

SOLUTION:
Let \( x \) represent the number of milliliters of 25% solution. Then \( 160 - x \) will represent the number of milliliters of 50% solution.

<table>
<thead>
<tr>
<th>Solution 1</th>
<th>Solution 2</th>
<th>Solution 1 + Solution 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of Acid</td>
<td>% Sulfuric Acid</td>
<td>Total</td>
</tr>
<tr>
<td>Solution 1</td>
<td>( x )</td>
<td>0.25</td>
</tr>
<tr>
<td>Solution 2</td>
<td>( 160 - x )</td>
<td>0.50</td>
</tr>
<tr>
<td>Solution 1 + Solution 2</td>
<td>160</td>
<td>0.40</td>
</tr>
</tbody>
</table>

\[
0.25x + 0.50(160 - x) = 0.40(160)
\]

\[
0.25x + 80 - 0.50x = 64 \\
-0.25x + 80 = 64 \\
-0.25x = -16 \\
\frac{-0.25x}{-0.25} = \frac{-16}{-0.25} \\
x = 64
\]

Hector needs 64 mL of 25% solution and \( 160 - 64 \) or 96 mL of 50% solution.

11. TRAVEL A boat travels 36 miles in 1.5 hours and then 14 miles in 0.75 hour. What is the average speed of the boat?

SOLUTION:
To calculate the average speed of the boat, divide the total distance by the total time. Let \( s \) represent the average speed.

\[
s = \frac{36 + 14}{1.5 + 0.75} = \frac{50}{2.25} = 22.2
\]

The average speed of the boat is about 22.2 miles per hour.
12. **CCSS MODELING** A person walked 1.5 miles in 28 minutes and then jogged 1.2 more miles in 10 minutes. What was the average speed in miles per minute?

**SOLUTION:**
To calculate the average speed of the walker, divide the total distance by the total time. Let \( s \) represent the average speed.

\[
\frac{1.5 + 1.2}{28 + 10} = \frac{2.7}{38} = 0.07
\]

The average speed of the walker is about 0.07 miles per minute.

13. **AEROLINERS** Two airliners are 1600 miles apart and heading toward each other at different altitudes. The first plane is traveling north at 620 miles per hour, while the second is traveling south at 780 miles per hour. When will the planes pass each other?

**SOLUTION:**
\[
620x + 780x = 1600 \quad \text{Original equation}
\]

\[
1400x = 1600 \quad \text{Simplify.}
\]

\[
\frac{1400x}{1400} = \frac{1600}{1400} \quad \text{Divide.}
\]

\[
x = \frac{8}{7} \quad \text{Simplify.}
\]

\[
x = 1 \frac{1}{7}
\]

The planes will pass each other in \( 1 \frac{1}{7} \) hour or 1 hour 8 minutes 34 seconds.
14. **SAILING** A ship is sailing due east at 20 miles per hour when it passes the lighthouse. At the same time a ship is sailing due west at 15 miles per hour when it passes a point. The point is 175 miles east of the lighthouse. When will these ships pass each other?

**SOLUTION:**
Let $x$ represent the time the ships travel.

<table>
<thead>
<tr>
<th>Rate</th>
<th>Time</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ship Sailing East</td>
<td>20</td>
<td>$20x$</td>
</tr>
<tr>
<td>Ship Sailing West</td>
<td>15</td>
<td>$15x$</td>
</tr>
</tbody>
</table>

$20x + 15x = 175$  Original equation

$35x = 175$  Simplify.

$\frac{35x}{35} = \frac{175}{35}$  Divide.

$x = 5$  Simplify.

The ships will pass each other in 5 hours.

15. **CHEMISTRY** A lab technician has 40 gallons of a 15% iodine solution. How many gallons of a 40% iodine solution must he add to make a 20% iodine solution?

**SOLUTION:**
Let $x$ represent the number of gallons of 40% iodine solution.

<table>
<thead>
<tr>
<th>Number of Gallons</th>
<th>% of Iodine</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solution 1</td>
<td>40</td>
<td>0.15(40)</td>
</tr>
<tr>
<td>Solution 2</td>
<td>$x$</td>
<td>0.40$x$</td>
</tr>
<tr>
<td>Solution 1 + Solution 2</td>
<td>$40 + x$</td>
<td>0.20($40 + x$)</td>
</tr>
</tbody>
</table>

$0.20(40 + x) = 0.40x + 0.15(40)$

$8 + 0.20x = 0.40x + 6$  Distribute.

$8 = 0.20x + 6$  Subtract $0.20x$.

$8 - 6 = 0.20 + 6 - 6$  Subtract 6.

$2 = 0.20x$  Simplify.

$\frac{2}{0.20} = \frac{0.20x}{0.20}$  Divide.

$10 = x$  Simplify.

The lab technician must add 10 gallons of the 40% iodine solution.
2-9 Weighted Averages

16. **GRADES** At Westbridge High School, a student’s grade point average (GPA) is based on the student’s grade and the class credit rating. Brittany’s grades for this quarter are shown. Find Brittany’s GPA if a grade of A equals 4 and a B equals 3.

<table>
<thead>
<tr>
<th>Class</th>
<th>Credit Rating</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algebra 1</td>
<td>1</td>
<td>A</td>
</tr>
<tr>
<td>Science</td>
<td>1</td>
<td>A</td>
</tr>
<tr>
<td>English</td>
<td>1</td>
<td>B</td>
</tr>
<tr>
<td>Spanish</td>
<td>1</td>
<td>A</td>
</tr>
<tr>
<td>Music</td>
<td>( \frac{1}{2} )</td>
<td>B</td>
</tr>
</tbody>
</table>

**SOLUTION:**
To calculate her GPA, average the credit rating times the grade.

\[
\text{GPA} = \frac{1(4) + 1(4) + 1(3) + 1(4) + 0.5(3)}{1 + 1 + 1 + 1 + 0.5} \\
= \frac{4 + 4 + 3 + 4 + 1.5}{4.5} \\
= \frac{16.5}{4.5} \\
\approx 3.67
\]

Brittany’s GPA is 3.67.

17. **SPORTS** In a triathlon, Steve swam 0.5 mile in 15 minutes, biked 20 miles in 90 minutes, and ran 4 miles in 30 minutes. What was Steve’s average speed for the triathlon in miles per hour?

**SOLUTION:**
To calculate the average speed of the athlete, divide the total distance by the total time, in hours. Let \( s \) represent the average speed.

\[
s = \frac{0.5 + 20 + 4}{0.25 + 1.5 + 0.5} \\
s = \frac{24.5}{2.25} \\
s \approx 10.89
\]

Steve’s average speed for the triathlon was about 10.89 miles per hour.
2-9 Weighted Averages

18. **MUSIC** Amalia has 10 songs on her digital media player. If 3 songs are 5 minutes long, 3 are 4 minutes long, 2 are 2 minutes long, and 2 are 3.5 minutes long, what is the average length of the songs?

**SOLUTION:**
Let \( \ell \) represent the average length of the songs. Multiply the number of songs by the song length and divide by 10, the total number of songs.

\[
\ell = \frac{3(5) + 3(4) + 2(2) + 2(3.5)}{10}
\]
\[
= \frac{15 + 12 + 4 + 7}{10}
\]
\[
= \frac{38}{10}
\]
\[
= 3.8
\]

The average length of the songs in Amalia’s collection is 3.8 minutes.

19. **DISTANCE** Garcia is driving to Florida for vacation. The trip is a total of 625 miles.
   a. How far can he drive in 6 hours at 65 miles per hour?
   b. If Garcia maintains a speed of 65 miles per hour, how long will it take him to drive to Florida?

**SOLUTION:**
   a. Use the formula distance = rate \( \cdot \) time.

\[
d = r \cdot t
\]
\[
d = 65 \cdot 6
\]
\[
d = 390
\]

Garcia can travel 390 miles in 6 hours.

   b. Use the formula distance = rate \( \cdot \) time.

\[
d = r \cdot t
\]
\[
625 = 65 \cdot t
\]
\[
\frac{625}{65} = \frac{65t}{65}
\]
\[
9.6 \approx t
\]

The trip will take about 9.6 hours.
2-9 Weighted Averages

20. TRAVEL Two buses leave Smithville at the same time, one traveling north and the other traveling south. The northbound bus travels at 50 miles per hour, and the southbound bus travels at 65 miles per hour. Let \( t \) represent the amount of time since their departure.

a. Copy and complete the table representing the situation.

<table>
<thead>
<tr>
<th></th>
<th>( r )</th>
<th>( t )</th>
<th>( d = rt )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northbound bus</td>
<td>( ? )</td>
<td>( ? )</td>
<td>( ? )</td>
</tr>
<tr>
<td>Southbound bus</td>
<td>( ? )</td>
<td>( ? )</td>
<td>( ? )</td>
</tr>
</tbody>
</table>

b. Write an equation to find when the buses will be 345 miles apart.
c. Solve the equation. Explain how you found your answer.

**SOLUTION:**

a. When filling in the table write the corresponding rates for the buses in the "\( r \)" column. The northbound bus row should be 50 and the southbound bus should be 65. Since they leave at the same time, they should have the same value for the time since their departure. This value is unknown and given the variable \( t \). Both the northbound bus and southbound bus rows should have the value \( t \), for the "\( t \)" column.

Lastly, in the distance column, the formula is given "\( d = rt \)". For each row multiply the values for the "\( r \)" and "\( t \)" columns to determine this value. For the northbound bus we get \( 50 \times t = 50t \) and for the southbound bus we get \( 65 \times t = 65t \).

<table>
<thead>
<tr>
<th></th>
<th>( r )</th>
<th>( t )</th>
<th>( d = rt )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northbound bus</td>
<td>50</td>
<td>( t )</td>
<td>50t</td>
</tr>
<tr>
<td>Southbound bus</td>
<td>65</td>
<td>( t )</td>
<td>65t</td>
</tr>
</tbody>
</table>

d. The buses are traveling in opposite directions from the same starting point. The distance from the starting point to the Northbound bus is given by \( 50t \), and the distance from the starting point to the southbound bus is given by \( 65t \) in the opposite direction. The total distance between them is \( d = 50t + 65t \). We want an equation for when this distance is equal to 345: \( 50t + 65t = 345 \).

c. 
\[
50t + 65t = 345 \quad \text{Original equation}
\]
\[
115t = 345 \quad \text{Simplify.}
\]
\[
\frac{115t}{115} = \frac{345}{115} \quad \text{Divide each side by 115.}
\]
\[
t = 3 \quad \text{Simplify.}
\]

By adding the distance of the northbound (50t) and southbound bus (65t) and it equal to 345 and solve for \( t \), we can identify how long it will take to e 345 miles apart. The busses will be 345 miles apart after 3 hours.
2-9 Weighted Averages

21. **TRAVEL** A subway travels 60 miles per hour from Glendale to Midtown. Another subway, traveling at 45 miles per hour, takes 11 minutes longer for the same trip. How far apart are Glendale and Midtown?

**SOLUTION:**
Let $t$ represent the time it takes for the subway to travel from Glendale to Midtown.

\[
60t = 45\left(t + \frac{11}{60}\right) \quad \text{Original equation}
\]
\[
60t = 45t + 8.25 \quad \text{Distributive Property}
\]
\[
60t - 45t = 45t - 45t + 8.25 \quad \text{Subtract.}
\]
\[
15t = 8.25 \quad \text{Simplify.}
\]
\[
\frac{15t}{15} = \frac{8.25}{15} \quad \text{Divide.}
\]
\[
t = 0.55 \quad \text{Simplify.}
\]

It takes 0.55 hours for the first subway to travel the distance. Now use the formula distance = rate $\times$ time.

\[
d = r \cdot t
\]
\[
d = 60(0.55)
\]
\[
d = 33
\]

Therefore, Glendale and Midtown are 33 miles apart.

22. **OPEN ENDED** Write a problem that depicts motion in opposite directions.

**SOLUTION:**
A common problem involving motion in opposite directions is when two people are meeting in the middle of their current locations. Since they are traveling along the same line and starting at opposite ends, they will always be traveling in opposite directions. For example: Miles and Tara live 15 miles apart. If Tara rides her bike towards Miles’s house at 10 miles per hour and Miles rides his bike at 12 miles per hour towards her, when will they meet?
2-9 Weighted Averages

23. CCSS ARGUMENTS Describe the conditions so that adding a 50% solution to a 100% solution would produce a 75% solution.

**SOLUTION:**
For a 50% solution being added to a 100% solution to produce a 75% resulting solution, the quantity of each must be the same.
Consider an example using 50% and 100% to obtain 10 of 75% solution.

<table>
<thead>
<tr>
<th>50% Solution</th>
<th>Quantity</th>
<th>%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 - x</td>
<td>0.50</td>
<td>0.50(10 - x)</td>
<td></td>
</tr>
<tr>
<td>100% Solution</td>
<td>x</td>
<td>1.00</td>
<td>1.00x</td>
</tr>
<tr>
<td>75% Solution</td>
<td>10</td>
<td>0.75</td>
<td>0.75(10)</td>
</tr>
</tbody>
</table>

\[
0.50(10 - x) + 1.00x = 0.75(10) \quad \text{Original equation}
\]

\[
5 - 0.50x + 1.00x = 7.5 \quad \text{Distributive Property}
\]

\[
5 + 0.50x = 7.5 \quad \text{Simplify.}
\]

\[
5 + 0.50x - 5 = 7.5 - 5 \quad \text{Subtract.}
\]

\[
0.50x = 2.5 \quad \text{Simplify.}
\]

\[
\frac{0.50x}{0.50} = \frac{2.5}{0.50} \quad \text{Divide.}
\]

\[
x = 5 \quad \text{Simplify.}
\]

24. CHALLENGE Find five consecutive odd integers from least to greatest in which the sum of the first and the fifth is one less than three times the fourth.

**SOLUTION:**
Let \(x, x + 2, x + 4, x + 6, \) and \(x + 8\) represent the odd consecutive integers.

\[
x + x + 8 = 3(x + 6) - 1 \quad \text{Original equation}
\]

\[
2x + 8 = 3x + 18 - 1 \quad \text{Distributive Property}
\]

\[
2x + 8 = 3x + 17 \quad \text{Simplify.}
\]

\[
2x - 2x + 8 = 3x - 2x + 17 \quad \text{Subtract.}
\]

\[
8 = x + 17 \quad \text{Simplify.}
\]

\[
8 - 17 = x - 17 \quad \text{Subtract.}
\]

\[
x = -9 \quad \text{Simplify.}
\]

If \(x = -9\), then \(x + 2 = -7, x + 4 = -5, x + 6 = -3, \) and \(x + 8 = -1\). The integers are \(-9, -7, -5, -3, \) and \(-1\).
2-9 Weighted Averages

25. **CHALLENGE** Describe a situation involving mixtures that could be represented by \(1.00x + 0.15(36) = 0.50(x + 36)\).

**SOLUTION:**
Let \(x\) represent the number of grams of a 100% salt solution. There are 36 grams of a 15% solution. The two solutions are mixed to create a \(x + 36\) grams of a 50% solution. How many grams of salt must be added to 36 grams of a 15% salt solution to obtain a 50% salt solution?

26. **WRITING IN MATH** Describe how a gallon of 25% solution is added to an unknown amount of 10% solution to get a 15% solution.

**SOLUTION:**
Multiply the 1 gallon times 0.25. Then multiply the unknown amount by 0.10. Add these results together. This should equal the total amount times 0.15.

<table>
<thead>
<tr>
<th>Amount</th>
<th>% solution</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25 solution</td>
<td>0.25</td>
<td>0.25(1)</td>
</tr>
<tr>
<td>0.10 solution</td>
<td>0.10</td>
<td>0.10x</td>
</tr>
<tr>
<td>0.15 solution</td>
<td>0.15</td>
<td>0.15(1 + x)</td>
</tr>
</tbody>
</table>

27. If \(2x + y = 5\), what is the value of \(4x\)?

A \(10 - y\)  
B \(10 - 2y\)  
C \(\frac{5 - y}{2}\)  
D \(\frac{10 - y}{2}\)

**SOLUTION:**
\[2x + y = 5\]
\[2x + y - y = 5 - y\]
\[2x = 5 - y\]

To find the value of \(4x\), multiply the equation by 2.

\[2(2x) = 2(5 - y)\]
\[4x = 10 - 2y\]

Choice B is correct.
2-9 Weighted Averages

28. Which expression is equivalent to \( 7x^23x^{-4} \)?

- F \( 21x^{-8} \)
- G \( 21x^2 \)
- H \( 21x^{-6} \)
- J \( 21x^{-2} \)

**SOLUTION:**

\[
7x^23x^{-4} = (7 \cdot 3)(x^2x^{-4})
\]
\[
= 21x^{2-4}
\]
\[
= 21x^{-2}
\]

Choice J is correct.

29. **GEOMETRY** What is the base of the triangle if the area is 56 square meters?

![Triangle Diagram]

- A 4 m
- B 8 m
- C 16 m
- D 28 m

**SOLUTION:**

\[
A = \frac{1}{2}bh
\]
\[
56 = \frac{1}{2}b(7)
\]
\[
56 = \frac{7}{2}b
\]
\[
\frac{2}{7}(56) = \frac{2}{7}\left(\frac{7}{2}b\right)
\]
\[
16 = b
\]

The base is 16 meters. Choice C is correct.
2-9 Weighted Averages

30. SHORT RESPONSE Brianne makes baby blankets for a baby store. She works on the blankets 30 hours per week. The store pays her $9.50 per hour plus 30% of the profit. If her hourly rate is increased by $0.75 and her commission is raised to 40%, how much will she earn for a $300 profit?

**SOLUTION:**
Let \( p \) represent the profit made from the blankets. Brianne’s new hourly rate is $9.50 + $0.75 or $10.25 per hour.

<table>
<thead>
<tr>
<th></th>
<th>Hrs</th>
<th>Pay Rate</th>
<th>Comm. Rate</th>
<th>Profit</th>
<th>Total Earnings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original</td>
<td>30</td>
<td>9.50</td>
<td>0.30</td>
<td>( p )</td>
<td>( 9.50(30) + 0.30p )</td>
</tr>
<tr>
<td>New</td>
<td>30</td>
<td>10.25</td>
<td>0.40</td>
<td>( p )</td>
<td>( 10.25(30) + 0.40p )</td>
</tr>
</tbody>
</table>

Evaluate when \( p = 300 \).

\[
10.25(30) + 0.40p \\
= 10.25(30) + 0.40(300) \\
= 307.50 + 120 \\
= 427.50
\]

Multiply.

Simplify.

Brianne makes $427.50 after her raises.

Solve each equation or formula for \( x \).
31. \( 2bx - b = -5 \)

**SOLUTION:**
\[
2bx - b = -5 \quad \text{Original} \\
2bx - b + b = -5 + b \quad \text{Subtract } b. \\
2bx = -5 + b \quad \text{Simplify.} \\
\frac{2bx}{2b} = \frac{-5 + b}{2b} \quad \text{Divide by } 2b. \\
x = \frac{-5 + b}{2b} \quad \text{Simplify.}
\]

32. \( 3x - r = r(-3 + x) \)

**SOLUTION:**
\[
3x - r = r(-3 + x) \quad \text{Original} \\
3x - r = -3r + rx \quad \text{Distribute.} \\
3x - rx = -3r \quad \text{Subtract } rx. \\
3x - rx = -3r + 2r \quad \text{Add } r. \\
x(3 - r) = -2r \quad \text{Distribute.} \\
\frac{x(3-r)}{(3-r)} = \frac{-2r}{(3-r)} \quad \text{Divide by } 3 - r. \\
x = \frac{-2r}{(3-r)} \quad \text{Simplify.}
\]
2-9 Weighted Averages

33. \[ A = 2\pi r^2 + 2\pi r x \]

**SOLUTION:**

\[
A = 2\pi r^2 + 2\pi r x \quad \text{Original}
\]

\[
A - 2\pi r^2 = 2\pi r x \quad \text{Subtract} \ 2\pi r^2.
\]

\[
\frac{A - 2\pi r^2}{2\pi r} = \frac{2\pi r x}{2\pi r} \quad \text{Divide by} \ 2\pi r.
\]

\[
\frac{A}{2\pi r} - r = \frac{x}{2\pi r} \quad \text{Rewrite.}
\]

\[
\frac{A}{2\pi r} - r = x \quad \text{Simplify.}
\]

34. **SKIING** Yuji is registering for ski camp. The cost of the camp is $1254, but there is a sales tax of 7%. What is the total cost of the camp including tax?

**SOLUTION:**

Find the tax.

\[0.07 \times 1254 = 87.78 \]

Add the tax and original amount to find the total cost.

\[87.78 + 1254 = 1341.78 \]

The total cost of the ski camp including tax is $1341.78.

**Translate each equation into a sentence.**

35. \[ \frac{n}{-6} = 2n + 1 \]

**SOLUTION:**

\[
\frac{n}{-6} = 2n + 1
\]

The quotient of \(n\) and \(-6\) is the sum of two and one.

36. \[ 18 - 5h = 13h \]

**SOLUTION:**

\[
18 - 5h = 13h
\]

Eighteen decreased by five times \(h\) is the same as thirteen times \(h\).
2-9 Weighted Averages

37. \(2x^2 + 3 = 21\)

\[SOLUTION:\]
\[
\begin{align*}
2x^2 & \quad + \quad 3 \\
\text{The sum of} & \quad \text{and} & \quad \text{is equal to} & \quad \text{twenty-one.}
\end{align*}
\]

Refer to the graph.

38. Name the ordered pair at point A and explain what it represents.

\[SOLUTION:\]
The ordered pair at A is (2, 15). Answers may vary as to what it represents, but a sample answer is: If two cars are washed, $15 is earned.

39. Name the ordered pair at point B and explain what it represents.

\[SOLUTION:\]
The ordered pair at B is (4, 25). Answers may vary as to what it represents, but a sample answer is: If four cars are washed, $25 is earned.

40. Identify the independent and dependent variables for the function.

\[SOLUTION:\]
The independent variable is on the x-axis. So the independent variable is the number of cars washed. The dependent variable, which is the amount earned, is on the y-axis.
2-9 Weighted Averages

41. **BASEBALL** Tickets to a baseball game cost $18.95, $12.95, or $9.95. A hot dog and soda combo costs $5.50. The Madison family is having a reunion. They buy 10 tickets in each price category and plan to buy 30 combos. What is the total cost for the tickets and meals?

**SOLUTION:**
Let \( t \) represent the total cost of the tickets and meals.

\[
t = 18.95(10) + 12.95(10) + 9.95(10) + 5.50(30)
\]
\[
t = 189.5 + 129.5 + 99.5 + 165
\]
\[
t = 583.5
\]

So, their total cost is $583.50.

**Solve each equation.**

42. \( a - 8 = 15 \)

**SOLUTION:**
\[
a - 8 = 15 \quad \text{Original equation}
\]
\[
a - 8 + 8 = 15 + 8 \quad \text{Add 8 to each side.}
\]
\[
a = 23 \quad \text{Simplify.}
\]

43. \( 9m - 11 = -29 \)

**SOLUTION:**
\[
9m - 11 = -29 \quad \text{Original}
\]
\[
9m - 11 + 11 = -29 + 11 \quad \text{Add 11.}
\]
\[
9m = -18 \quad \text{Simplify.}
\]
\[
\frac{9m}{9} = \frac{-18}{9} \quad \text{Divide by 9.}
\]
\[
m = -2 \quad \text{Simplify.}
\]

44. \( 18 - 2k = 24 \)

**SOLUTION:**
\[
18 - 2k = 24 \quad \text{Original}
\]
\[
18 - 18 - 2k = 24 - 18 \quad \text{Subtract 18.}
\]
\[
-2k = 6 \quad \text{Simplify.}
\]
\[
\frac{-2k}{-2} = \frac{6}{-2} \quad \text{Divide by \(-2\).}
\]
\[
k = -3 \quad \text{Simplify.}
\]
2-9 Weighted Averages

45. \( 5 - 8y = 61 \)

**SOLUTION:**

\[
5 - 8y = 61 \quad \text{Original}
\]

\[
5 - 5 - 8y = 61 - 5 \quad \text{Subtract 5.}
\]

\[
-8y = 56 \quad \text{Simplify.}
\]

\[
\frac{-8y}{-8} = \frac{56}{-8} \quad \text{Divide by -8.}
\]

\[
y = -7 \quad \text{Simplify.}
\]

46. \( 7 = \frac{h}{2} + 3 \)

**SOLUTION:**

\[
7 = \frac{h}{2} + 3 \quad \text{Original}
\]

\[
7 - 3 = \frac{h}{2} + 3 - 3 \quad \text{Subtract 3.}
\]

\[
4 = \frac{h}{2} \quad \text{Simplify.}
\]

\[
2(4) = 2\left(\frac{h}{2}\right) \quad \text{Multiply by 2.}
\]

\[
8 = h \quad \text{Simplify.}
\]

47. \( \frac{n}{6} + 1 = 5 \)

**SOLUTION:**

\[
\frac{n}{6} + 1 = 5 \quad \text{Original}
\]

\[
\frac{n}{6} + 1 - 1 = 5 - 1 \quad \text{Subtract 1.}
\]

\[
\frac{n}{6} = 4 \quad \text{Simplify.}
\]

\[
6\left(\frac{n}{6}\right) = 6(4) \quad \text{Multiply by 6.}
\]

\[
n = 24 \quad \text{Simplify.}
\]