Further Applications of Linear Equations

These are the steps we used to solve applied problems in the previous section.

1. **Read** the problem carefully.
2. **Assign a variable** to represent the unknown value. Generally the variable represents the quantity asked for in the question.
3. **Write an equation.**
4. **Solve** the equation.
5. **State the answer** in a complete sentence.
6. **Check** to see if your answer seems reasonable.

**Money Denomination Problems**

Use the fact:

\[ \text{[number of monetary units of the same kind]} \times \text{[denomination]} = \text{total monetary value} \]

\[ 15 \text{ dimes} \times \$0.10 = \$1.50 \]

**Example 1:** Mohammed has a box of coins containing only dimes and nickels. There are 49 coins and the total value is $3.30. How many of each type of coin does he have?

**Assign a variable:**

<table>
<thead>
<tr>
<th></th>
<th>Number of coins</th>
<th>Denomination</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>dimes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>nickels</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Write an equation:** Look at the value column to write the equation.

**Solve the equation:**

**Write the solution in a complete sentence including any appropriate units.** Be sure your answer is reasonable.
Uniform Motion Problems
Use the formula $d = rt$. Be sure when the rate (or speed) is given in miles per hour, the time is given in hours. Sometimes drawing a sketch helps to visualize the problem and setting up a table helps to summarize the given information.

**Examples 2**: Two cars leave the same town at the same time. One travels north at 60 miles per hour and the other south at 45 miles per hour. In how many hours will they be 420 miles apart?

**Draw a picture:**

**Assign a variable:**

<table>
<thead>
<tr>
<th></th>
<th>Rate</th>
<th>Time</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northbound car</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Southbound car</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Write an equation**: Look at the distance column to write the equation.

**Solve the equation:**

**Write the solution in a complete sentence including any appropriate units**: Be sure your answer is reasonable.
Uniform Motion Problem (in the same direction)

**Example 3:** When Michael drives his car to work, the trip takes \( \frac{1}{2} \) hour. When he rides the bus, it takes \( \frac{3}{4} \) hour. The average speed of the bus is 12 miles per hour less than his speed when driving the car. Find the distance he travels to work assuming the bus and car take the same route to work.

**Draw a picture:**

**Assign a variable:**

<table>
<thead>
<tr>
<th></th>
<th>rate</th>
<th>time</th>
<th>distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>car</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bus</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Write an equation:**

**Solve the equation:**

**Write the solution in a complete sentence including any appropriate units.** Be sure your answer is reasonable.
Solving Problems About Angles
One theorem from geometry that is frequently used in angle problems is the sum of the measures of the angles of a triangle is 180°.

**Example 4:** Find the measure of each angle shown in ΔABD:

![Diagram of triangle ABD with angles labeled x, 6x-50, and x-10]

**Assign a variable:**

**Write an equation:**

**Solve the equation:**

Write the solution in a complete sentence including any appropriate units. Be sure your answer is reasonable.
Consecutive Integer Problems
Consecutive integers are integers that follow each other in order like 2, 3, and 4 or -13, -12, and -11. If we let $x$ represent the first integer. The next consecutive integer is one more than the first so we represent it as $x + 1$. The next one is 2 larger than the first one so we represent it as $x + 2$.

Example 5: Find three consecutive integers such that the sum of the first and twice the second is 17 more than twice the third.

Assign a variable:

Write an equation:

Solve the equation:

Write the solution in a complete sentence including any appropriate units. Be sure your answer is reasonable.