P.8 Modeling with Equations

Strategy for Solving Word Problems
Step 1: Read the problem carefully.
Attempt to state the problem in your own words
and state what the problem is asking for.
Let any variable represent one of the quantities in the problem.
Step 2: If necessary, write expressions for any other unknown quantities
in the problem in terms of x.
Step 3: Write an equation in x that models the verbal conditions of the problem.
Step 4: Solve the equation and answer the problem’s question.
Step 5: Check the solution in the original wording of the problem, not in the
equation obtained from the words.

Write an equation that models the problem.
Spice Drops candy calorie count exceeds Smarties candy calorie count by 70 calories per serving. If the sum of one
serving of each candy equals 170 calories, find the calorie count of each kind of candy.

\[ \text{let } x = \text{Smarties} \]
\[ \text{let } x + 70 = \text{Spice Drops} \]
\[ x + x + 70 = 170 \]
\[ 2x + 70 = 170 \]
\[ 2x = 100 \]
\[ x = 50 \text{ Smarties} \]
\[ 50 + 70 = 120 \text{ Spice Drops} \]

Write an equation that models the problem.
In 2002, the median annual income for people with an advanced college degree was $73,000. This is a 170% increase over the median income in 1982 of people with an advanced degree. What were people with an advanced college degree making in 1982?

\[ 1982 \times 1.7 = 2002 \]
\[ x \times 1.7 = 73,000 \]
\[ x = 42,941.18 \]

The percentage of women in the labor force and the percentage of men in the labor force is illustrated in the graph below.
The decrease yearly of men in the labor force is 1/4% and the increase in women in the labor force is 1/2%.
Presently there are 70% of men and 60% of women in the labor force, when will the number of both sexes be equal?

Men $70 - .25 y$
Women $60 + .5 y$

$70 - .25y = 60 + .5y$
$10 = .75y$
$13.33 = y$
The rectangular swimming pool in the figure shown measures 30 feet by 50 feet and includes a concrete path of uniform width around four edges. The perimeter of the rectangle formed by the pool and the surrounding path is 204 feet. Determine the width of the concrete path.

\[ P = 2l + 2w \]

204 = 2(50 + 2x) + 2(30 + 2x)

204 = 100 + 4x + 60 + 4x

4x = 8

5.5 \text{ feet} = x

The rectangular swimming pool in the figure shown measures 30 feet by 50 feet and includes a concrete path of uniform width around four edges. The area of the rectangle formed by the pool and the surrounding path is 2016 square feet. Determine the width of the concrete path.

\[ A = l \cdot w \]

2016 = (50 + 2x)(30 + 2x)

2016 = 1500 + 100x + 60x + 4x^2

0 = 4x^2 + 160x + 516

0 = (x + 43)(x - 3)

x = -43 or x = 3

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**Homework**

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A group of friends agrees to share the cost of a $50,000 yacht equally. Before the purchase is made, one more person joins the group and enters the agreement. As a result, each person’s share is reduced by $2500. How many people were in the original group?
A passenger train can travel 240 miles in the same amount of time it takes a freight train to travel 160 miles. If the average velocity of the freight train is 20 miles per hour slower than the average velocity of the passenger train, find the average velocity of each.

An engine pulls a train 140 miles. Then a second engine whose average velocity is 5 miles per hour faster than the first engine, takes over and pulls the train 200 miles. The total time required for both engines is 9 hours. Find the average velocity of each engine.

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**Homework**

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