WORD PROBLEMS

Part One: Setting up a Word Problem Involving Translations

There are five steps in solving a word problem involving translations:

a) Define your variable.
   i) Write down the names of the subjects or the quantities used in the word problem.
   ii) Assign a variable to one of the subjects and algebraic expressions to the others.

b) Form an equation.

c) Solve the equation.

d) State your answers using a complete sentence. Include units.

e) Make sure your answer makes sense in the context of the word problem.

Part Two: Assigning a Variable

Look for a translation that is describing a subject in terms of another subject.
OR
Look for a common subject that is used to describe other subjects.

Problem 1: If the length is 4 feet more than the width, express the length and width using one variable.

The length is being described in terms of the width, so the width = W.

The length is 4 ft. more than \( W \).

The length = \( 4 + W \)

Answer:
The width = \( W \) AND The length = \( 4 + W \)

Problem 2: There are 4 times as many apples as pears in a bowl. Express the number of apples and pears using one variable.

The number of apples is being described in terms of the number of pears, so the number of pears = \( P \).

There are 4 times as many apples as pears. \( \rightarrow \) The number of apples is 4 times the number of pears.

\[ \text{Number of apples} = 4 \times \text{Number of pears} = 4 \times P \]

Answer:
The number of pears = \( P \) The number of apples = \( 4P \)

The descriptions of our subjects must be very thorough. Notice that I did not use just pears, but the number of pears. For example, if we are asked to find the speed of the car, then we must define our variable to be the speed of the car and not just the car.
Practice. Fill in the shaded boxes.

Practice 1: The daily listening audience of an AM radio station is four times as large as that of its FM sister station. Express the number of daily listeners of the AM and FM stations in terms of one variable.

The number of daily listeners of the FM station = \( X \)
The number of daily listeners of the AM station = 

Practice 2: (Three or more subjects.) A fertilizer for avocado trees uses iron, nitrogen, and mulch. If the amount of mulch is 20 lbs. more than the amount of iron, and the amount of nitrogen is three times the amount of iron, express the amount of mulch, nitrogen, and iron in terms of one variable?

The amount of iron is being used to describe the amount of the other two subjects, so the amount of iron = \( X \).

The amount of mulch is 20 lbs. more than the amount of iron.
The amount of mulch = 

The amount of nitrogen is three times the amount of iron.
The amount of nitrogen = 

Practice 3: The lab time is 50 minutes shorter than the lecture time. Express the lab and lecture time using one variable.

The lab time = 

The lecture time = 

Practice 4: The width of a rectangular garden is one-third its length. Express the width and length using one variable.
Part Three: Forming an Equation

Problem 3: The number of listeners of an AM radio station is four times as large as that of its FM sister station. If 100,000 people listen to these two radio stations, how many listeners does the FM station have?

a) Define your variable.
   i) Write down the names of the subjects or the quantities used in the word problem.
   ii) Assign a variable to one of the subjects and algebraic expressions to the others.

   The number of FM station listeners = __________.

   The number of listeners of an AM radio station is four times as large as that of its FM sister station

   The number of AM station listeners = ________________.

b) Form an equation.

   If 100,000 people listen to these two radio stations, how many listeners does the FM station have?

   The number of AM station listeners + the number of FM station listeners = 100,000

   (__________) + (__________) = ________________

c) Solve the equation.

   Answer:
   The number of FM station listeners = x = ________________

   The number of AM station listeners = 4x = 4(__________) = ________________

   d) State your answers using a complete sentence. Include units.

   Complete sentence: The number of AM station listeners is ________________.

   Complete sentence: The number of FM station listeners is ________________.

   e) Make sure your answer makes sense in the context of the word problem.

   Is the number of listeners of an AM radio station four times as large as that of its FM sister station?

   Are there a total of 100,000 people listening to these two radio stations?
Problem 4: A bag of fertilizer for avocado trees uses iron, nitrogen, and mulch. The amount of mulch is 20 lbs. more than the amount of iron, and the amount of nitrogen is three times the amount of iron. If the bag of fertilizer weighs 50 lbs., then how many pounds of each ingredient are there?

a) Define your variable.
   i) Write down the names of the subjects or the quantities used in the word problem.
   ii) Assign a variable to one of the subjects and algebraic expressions to the other subjects.

   The amount of iron is being used to describe the amount of the other two subjects, so
   \( \text{the amount of iron} = X \).

   The amount of mulch is 20 lbs. more than the amount of iron.
   The amount of mulch = \( X + 20 \).

   The amount of nitrogen is three times the amount of iron.
   The amount of nitrogen = \( 3X \).

b) Form an equation.
   If the bag of fertilizer weighs 50 lbs., then how many pounds of each ingredient are there?

   \( X + (X + 20) + 3X = 50 \)

   \( 5X + 20 = 50 \)

   \( 5X = 30 \)

   \( X = 6 \)

   The amount of iron = \( X = 6 \) lbs.

   The amount of mulch = \( X + 20 = 26 \) lbs.

   The amount of nitrogen = \( 3X = 18 \) lbs.

c) Solve the equation.

d) State your answers using a complete sentence. Include units.

   There are 6 lbs. of iron, 26 lbs. of mulch, and 18 lbs. of nitrogen in the bag of fertilizer.

   (Complete sentence with units)

e) Make sure your answer makes sense in the context of the word problem.

   Is there a total of 50 lbs. of ingredients?

   Is the amount of mulch 20 lbs. more than the amount of iron?

   Is the amount of nitrogen three times the amount of iron?
Part Four: Putting It All Together

Practice 3: In a biology course, students spend a total of 250 minutes in lab and lecture each week. The lab time is 50 minutes shorter than the lecture time. How many minutes do the students spend in lecture per week?

a) Define your variable.

____________________ =

The lab time is 50 minutes shorter than the lecture time.

____________________ =

b) Form an equation.

In a biology course, students spend a total of 250 minutes in lab and lecture each week.

__________________________________________________________


c) Solve the equation.

Answer:

____________________ =____________________ =

____________________ =

d) State your answers using a complete sentence. Include units.

______________________________________________________________


c) Make sure your answer makes sense in the context of the word problem.

______________________________________________________________

______________________________________________________________
Practice 4: The width of a rectangular garden is one-third its length, and its perimeter is 32 m. Find the dimensions of the garden.

a) Define your variable.

\[ \text{width} = \text{length} \]

The width of a rectangular garden is one-third its length.

\[ \frac{1}{3} \cdot \text{length} = \text{width} \]

b) Form an equation.

The perimeter is 32 m.

\( \text{Perimeter} = 2 \cdot \text{length} + 2 \cdot \text{width} \)

c) Solve the equation.

Answer:

\[ \text{length} = \text{width} = \]

\[ \text{width} = \]

d) State your answers using a complete sentence. Include units.

\[ \text{length} = \]

\[ \text{width} = \]

e) Make sure your answer makes sense in the context of the word problem.

\[ \text{length} = \]

\[ \text{width} = \]
Practice 5: The sum of two numbers is 83. One of the numbers is 11 more than the other. What are the numbers?

a) Define your variable.

____________________________ =  

____________________________ =  

b) Form an equation.

__________________________________________________________________

____________________________

c) Solve the equation.

Answer:

____________________________ =  

____________________________ =  

____________________________ =  

d) State your answers using a complete sentence. Include units.

__________________________________________________________________

__________________________________________________________________

e) Make sure your answer makes sense in the context of the word problem.

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Part Five: Reflection

a) Name one thing that you understand better about word problems involving translations as a result of completing this activity.

b) Name one thing that you still do not understand about word problems involving translations.

c) Do you feel more or less confident with word problems involving translations? Why?

d) What is the first step to solving a word problem?

e) What is the last step to solving a word problem?