Title: Word Problems Involving One Variable
Class: Math 100
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Instructions to tutor: Read instructions under "Activity" and follow all steps for each problem exactly as given.
Keywords/Tags: word problems, applications, real-life, story problems, perimeter, tax, discount, mixture, motion, distance, rate, time.

Objective: Algebra is a language that can be used to represent real-life problems and answer questions. We need to learn to analyze word problems and translate them into algebraic language that would help us get to solutions of application problems.

Activity: Follow the given steps to solve the word problems. Do at least one example with a tutor first, then try the rest of the examples on your own. Take them to your tutor to make sure you're doing them correctly. Keep track of the steps listed in each example and use them to solve the word problems at the end of this activity.

Example 1. A manager wants to separate his 24 employees into two teams. One team has six fewer members than twice the other team. How many employees are there in each team?

1. Write the "question" here: (this one's done for you) _How many employees are there in each team?_

2. How many things are you being asked to find?   <u>One</u>   <u>two</u>   <u>more than two</u>

3. Which of the following would be an appropriate label for an unknown in this problem?
    (a) Let x represent: the employees
    (b) Let x represent: the number of employees in each team
    (c) Let x represent: the number of employees in one team
    (d) Let x represent: the total number of employees

Hopefully you picked (c) above. Make sure you understand why the other choices are not correct.

So now that x represents the number in one team, how can we represent the number in the other team?

The number in the other team: _____ (translate the phrase "**six fewer than twice a number**" into Algebra…. this will be an expression involving x.)

4. We know that total number of employees is 24. (What part of the problem tells us this?)

Translate "**total number of employees = 24**" into an algebraic equation:

_____

Hint: If you don't see it yet, use the statement "**number in one team + number in other team = 24**

5. Solve the equation.

6. Use your solution to the equation to answer the question you wrote in #1.

There are _____ employees in one team and _____ employees in the other team.

Example 2. The total cost (including tax) of a pair of tennis shoes is $48.65. If the sales tax rate is 6%, what is the cost of the shoes before tax?
1. Write the "question" here: _What is the ......_
2. How many things are you being asked to find?   One   two   more than two
3. Which of the following would be an appropriate label for an unknown in this problem?
    (a) Let x represent: the total cost including tax
    (b) Let x represent: cost of the shoes before tax
    (c) Let x represent: sales tax rate
    (d) Let x represent: sales tax amount

4. The quantities involved in this problem are: the total cost, the original cost, and the tax. Write the relationship between these quantities, and then translate it into an Algebraic equation.

        _____

Hint: When you buy something, how do you figure out what you have to pay at the register if you know what's on the price tag and what the tax rate is?

5.   Solve the equation:

6. Use your solution to the equation to answer the question you wrote in #1. (In English!)

Example 3. The width of a rectangular picture is five inches shorter than the length. The total amount of framing required to go around the edge of the picture is 54 inches. Find the length and width of the picture.
1. Write the "question" here: _Find the ..._
2. How many things are you being asked to find?   One   two   more than two
3. Which of the following would be an appropriate label for an unknown in this problem?
    (a) Let x represent: the picture
    (b) Let x represent: the perimeter
    (c) Let x represent: the length and the width
    (d) Let x represent: the length

Hopefully you picked (d) above. Make sure you understand why the other choices are not correct.
So now that x represents the length, how can we represent the width?
The width: _____ (translate the statement "**five inches shorter than the length**" into Algebra…. this will be an expression involving x.)

4. We know that perimeter is 54. (What part of the problem tells us this?) Translate "**perimeter = 24**" into an algebraic equation:

        _____

Hint: If you don't see it yet, use the statement **2(length) + 2(width) = 54**

5. Solve the equation.

6. Use your solution to the equation to answer the question you wrote in #1. (In English!)

Example 4. A woman invests $2250 more in an account that earns 6% simple interest than she does in an account that earns 4% simple interest. How much was invested in each account if the total interest after one year is $385?

1. Write the "question" here: _____

2. How many things are you being asked to find?　　 <u>One</u>　　　 <u>two</u>　　 <u>more than two</u>

3. Which of the following would be an appropriate label for an unknown in this problem?
　　(a) Let x represent: amount invested in each account
　　(b) Let x represent: amount invested in the 4% account
　　(c) Let x represent: total amount of investment
　　(d) Let x represent: total interest

Hopefully you picked (b) above. Make sure you understand why the other choices are not correct.

So now that x represents the amount in the 4% account, how can we represent the amount in the 6% account?

The amount in 6% account: _____ (translate the statement "**2250 more than the amount in the 4% account**" into Algebra…. this will be an expression involving x.)

4. We know that total interest is $385. Translate "**Total interest = 385**" into an algebraic equation:

　　　_____

Hint: If you don't see it yet, use the statement
(interest rate of one account)(amt. in account) + (interest rate of other account)(amt. in that account)=385

5. Solve the equation.

6. Use your solution to the equation to answer the question you wrote in #1. (In English!)

Example 5. During a bicycle race, Derrick rides 15 kilometers per hour faster than his friend Kirby. It takes Kirby 2 hours to finish the race, whereas Derrick finishes in only 1 hour and 15 minutes (1.25 hours). How fast is each rider traveling?

1. Write the "question" here: _____

2. How many things are you being asked to find?   <u>One</u>   <u>two</u>   <u>more than two</u>

3. Which of the following would be an appropriate label for an unknown in this problem?
    (a) Let x represent: speed of each rider
    (b) Let x represent: distance each rider traveled
    (c) Let x represent: time each rider traveled
    (d) Let x represent: Kirby's speed

Hopefully you picked (d) above. Make sure you understand why the other choices are not correct.

So now that x represents Kirby's speed, how can we represent Derrick's speed?

Derrick's speed: _____ (translate the statement "**15 kilometers per hour faster than his friend Kirby**" into Algebra…. this will be an expression involving x.)

4. We know that both riders rode the same race so they went the <u>same</u> distance. Translate
"**Kirby's distance = Derrick's distance**" into an algebraic equation:

        _____

Hint: Distance = (Rate)(Time)
A table really helps with this type of problem to organize all the information.

5. Solve the equation.

6. Use your solution to the equation to answer the question you wrote in #1. (In English!)

After you go over the previous problems with a tutor, try the following on your own, then check with a tutor to make sure you did them correctly.

For each of the following problems label the variable, set up an equation, solve it and interpret the result.
1. The sum of two numbers is 24. One is 6 less than twice the other. Find the two numbers.

2. The total cost of a dress (including tax) is $85.59. The sales tax rate is 7%. What is the original cost of the dress?

3. A dress is marked at 20% off. If the sale price is $55.99, what was the original price of the dress? (Label the variable, set up an equation, solve it and interpret the result.)

4. Shana invests some money in an account that earns 5% simple interest and three times that amount in an account that earns 7% simple interest. If the total interest is $390 at the end of one year, find the amount invested in each account.

5. Two families that live 270 miles apart plan to meet for an afternoon picnic. To share the driving, they want to meet somewhere between their two homes. Both families leave at 9:00 A.M. but one family averages 12 mph faster than the other family. If the families meet at the designated spot 2.5 hours later, determine the average rate of speed for each family

6. Two hundred eighty-two people attended a recent performance of Cinderella. Adult tickets sold for $5 and children's tickets sold for $3 each. Find the number of adults and the number of children that attended the play if the total revenue was $1046.