

Linear Equations and Word Problems

Often times in algebra (and beyond), you will be given a word problem where you are given no equations whatsoever and expected to come up with the equations yourself and solve them. So given the information in the problem, how do you derive an equation/equations from a problem?

Example 1:

Let's say you bought a shirt for \$12, and you bought a pair of shoes for \$6 more than twice the price of the shirt. How much did you spend on the shoes?

Before we do anything, **read the problem first** and see if the question has already solved the problem. Sometimes, the problems will be written to trick you to doing more work than you need to!

First, we identify the more complicated price (the price that's not a flat number), and see that it's the shoes. For simplicity's sake let's ignore everything that's not related to the price of the shoes, meaning that **we will treat the price of the shirt as an unknown for now**. Now we will set up an equation to represent it. \$6 more tells us there will be a "+ 6" in our equation, and twice the price of the shoes we will have a "2x" term in our equation, where x is the price of the shoes (remember, we represent and replace unknowns with variables to make things less wordy). These 2 parts contain everything relating to the price of shoes, so we're done and combine them to get:

$2x + 6$ as the price of our shoes

As previously stated, we used x to represent our unknown of the price of the shirt. Now we will reread the problem to find the price of the shirt. The price of the shirt has been stated to be \$12, so we have $x = 12$. Because this equation is simplified to the furthest extent and gives us the exact value that x represents, we will now replace x with 12, giving us:

$$2(12) + 6 = 24 + 6 = 30$$

Final answer: We have spent \$30 on a pair of shoes.

Example 2:

Bob bought a pack of binder paper for \$3. He bought a binder for \$4 less than three times the amount he spent on the binder paper. How much did his binder cost?

Identify the most complicated price: the binder

Identify unknown in the price and replace it with a variable: the binder paper

Identify components of that price: -4, $3x$ (x is the variable I used to represent the cost of the paper)

Combine components to get an equation: $3x - 4$

Reread the problem to get the value of x (binder paper price): 3

Replace x with 3: $3(3) - 4$

Solve: $3(3) - 4 = 9 - 4 = 5$ (FINAL ANSWER)

Example 3:

Fries at a restaurant cost \$2. A burger cost \$3 less than 4 times that amount. How much does the fries cost?

\$2. Read the problem carefully and notice what it's asking for

Example 4 (Age problem):

In 4 years, Alice will be twice as old as she is as of now. How old is Alice now?

For these types of problems, you will create two different equations that represent the same thing. Both equations share the same unknown (for example, in this problem the unknown is how old Alice is now), so when we set them equation to each other, we will end up with the number that represents the unknown.

The first part that we should immediately focus on is the part that says “in 4 years”. This tells us that we will add 4 to her current age. Her current age (as of right now), is an unknown, so we represent it as ‘x’. So we have:

$x + 4$ as her age in the future

Reading the problem again, it is shown that in the future of 4 years from now, her age will also be twice of what it is. So we also have:

$2x$ as her age in the future as well

How this problem works is it will provide you with 2 conditions that rely on the same unknown for you to set up and both these conditions are equivalent. So by setting the 2 conditions equal to each other, you will be able to solve for the unknown, which is what the problem is asking for.

Set both conditions equal to each other and simplify/solve:

$$x + 4 = 2x$$

$4 = x$ (subtract x from both sides)

x represents her current age, so this equation tells us that Alice's current age is **4**.