**Key terminology for solving word problems**

|  |  |
| --- | --- |
| **Addition +** | **Subtraction -** |
| combined increased by  more than total of sum added to together plus | minus less than less fewer than difference decreased take away more than |
| **Multiplication x** | **Division ÷** |
| Multiplied by product of times of  Increased by/decreased by  (this type can involve both addition or   subtraction *and* multiplication!) | a  divided by into per quotient of percent (divided by 100) out of ratio of |

|  |  |
| --- | --- |
| **Equals** | is, are, was, were, will be, gives, yields, sold for |

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The hardest thing about doing word problems is taking the English words and translating them into mathematics. Usually, once you get the math equation, you're fine; the actual math involved is often fairly simple. But figuring out the actual equation can seem nearly impossible. What follows is a list of hints and helps. Be advised, however: To *really* learn "how to do" word problems, you will need to practice, practice, practice.

The first step to effectively translating and solving word problems is to read the problem entirely. Don't start trying to solve anything when you've only read half a sentence. Try first to get a feel for the whole problem; try first to see what information you have, and what you still need.

The second step is to work in an organized manner. Figure out what you need but don't have, and name things. Pick variables to stand for the unknows, clearly labelling these variables with what they stand for. Draw and label pictures neatly. Explain your reasoning as you go along. And make sure you know just exactly what the problem is actually asking for. You need to do this for two reasons:

1. Working clearly will help you think clearly, and
2. figuring out what you need will help you translate your final answer back into English.

Regarding (2) above: It can be really frustrating (and embarassing) to spend fifteen minutes solving a word problem on a test, only to realize at the end that you no longer have any idea what "*x*" stands for, so you have to do the whole problem over again. I did this on a calculus test -- thank heavens it was a short test! -- and, trust me, you don't want to do this to yourself!

The third step is to look for "key" words. Certain words indicate certain mathematical operations. Below is a partial list. Copyright © Elizabeth 2000-2011 All Rights Reserved

Note that "per" means "divided by", as in "I drove 90 miles on three gallons of gas, so I got 30 miles per gallon". Also, "a" sometimes means "divided by", as in "When I tanked up, I paid $12.36 for three gallons, so the gas was $4.12 a gallon".

Warning: The "less than" construction is backwards in the English from what it is in the math. If you need to translate "1.5 less than *x*", the temptation is to write "1.5 – *x*". *Do not do this!* You can see how this is wrong by using this construction in a "real world" situation: Consider the statement, "He makes $1.50 an hour less than me." You do not figure his wage by subtracting your wage from $1.50. Instead, you subtract $1.50 from your wage. So remember; **the "less than" construction is backwards.**

Also note that order is important in the "quotient/ratio of" and "difference between/of" constructions. If a problems says "the ratio of *x* and *y*", it means "*x* divided by *y*", not "*y* divided by *x*". If the problem says "the difference of *x* and *y*", it means "*x* – *y*", not "*y* – *x*".

**More vocabulary and key words:**

* **"Per" means "divided by"**  
  as "I drove 90 miles on three gallons of gas, so I got 30 miles per gallon."   
  (Also 30 miles/gallon)
* **"a" sometimes means "divided by"**  
  as in "When I filled up, I paid $10.50 for three gallons of gasoline,  
  so the gas was 3.50 a gallon, or $3.50/gallon
* **"less than"**  
  If you need to translate "1.5 less than x", the temptation is to write "1.5 - x". DON'T! Put a "real world" situation in, and you'll see how this is wrong: "He makes $1.50 an hour less than me." You do NOT figure his wage by subtracting your wage from $1.50.  
  Instead, you subtract $1.50 from your wage
* **"quotient/ratio of" constructions**  
  If a problems says "the ratio of *x* and *y*",  
  it means **"*x* divided by *y*"** or **x/y** or **x ÷ y**
* **"difference between/of" constructions**  
  If the problem says "the difference of *x* and *y*",  
  it means **"*x* - *y*"**

Now we need to learn to extract the keywords from the word problems

* **Translate "the sum of 8 and *y*" into an algebraic expression.**

This translates to "**8 + *y***"

* **Translate "4 less than *x*" into an algebraic expression.**

This translates to "***x* – 4**"

Remember? "Less than" is *backwards* in the math from how you say it in words!

* **Translate "*x* multiplied by 13" into an algebraic expression.**

This translates to "**13*x***"

* **Translate "the quotient of *x* and 3" into an algebraic expression.**

This translates to "***x*/3**"

* **Translate "the difference of 5 and *y*" into an algebraic expression.**