▶ Word Problems

Many of the math problems on tests are word problems. A word problem can include any kind of math, including simple arithmetic, fractions, decimals, percentages, even algebra and geometry.

The hardest part of any word problem is translating English into math. When you read a problem, you can frequently translate it word for word from English statements into mathematical statements. At other times, however, a key word in the word problem hints at the mathematical operation to be performed. Here are the translation rules:

EQUALS key words: ***is, are, has***

English	Math
Bob **is** 18 years old.	$b = 18$
There **are** seven hats.	$h = 7$
Judi **has** five cats.	$c = 5$

ADDITION key words: ***sum; more, greater, or older than; total; altogether***

English	Math
The **sum** of two numbers is 10.	$x + y = 10$
Karen has $5 **more** than Sam.	$k = 5 + s$
The base is 3" **greater than** the height.	$b = 3 + h$
Judi is two years **older than** Tony.	$j = 2 + t$
The **total** of three numbers is 25.	$a + b + c = 25$
How much do Joan and Tom have **all together**?	$j + t = ?$

SUBTRACTION key words: ***difference, fewer, less or younger than, remain, left over***

English	Math
The **difference** between two numbers is 17.	$x - y = 17$
Mike has five **fewer*** cats than twice the number Jan has.	$m = 2j - 5$
Jay is two years **younger** than Brett.	$j = b - 2$
After Carol ate three apples, r apples **remained**.	$r = a - 3$

MULTIPLICATION key words: ***of, product, times***

English	Math
Twenty percent **of** Matthew's baseball caps are red.	$0.20 \times m$
Half **of** the boys will be there.	$\frac{1}{2} \times b$
The **product** of two numbers is 12.	$a \times b = 12$

DIVISION key word: ***per***

English	Math
Add 15 drops **per** teaspoon.	$\frac{15 \text{ drops}}{\text{teaspoon}}$
Her car gets 22 miles **per** gallon.	$\frac{22 \text{ miles}}{\text{gallon}}$

Note: Notice that the order of subtraction is flipped when "fewer than" is used: "8 less than 10" translates to "10 – 8," not "8 – 10."

Solving a Word Problem Using the Translation Table

Remember the problem at the beginning of this chapter about the jellybeans?

> Juan ate $\frac{1}{3}$ of the jellybeans. Maria then ate $\frac{3}{4}$ of the remaining jellybeans, which left 10 jellybeans. How many jellybeans were there to begin with?
>
> **a.** 60
>
> **b.** 80
>
> **c.** 90
>
> **d.** 120

We solved it by *working backward*. Now, let's solve it using our translation rules.

Assume Juan started with J jellybeans. Eating $\frac{1}{3}$ of them means eating $\frac{1}{3} \times J$ jellybeans. Maria ate a fraction of the remaining jellybeans, which means we must subtract to find out how many are left: $J - \frac{1}{3} \times J = \frac{2}{3} \times J$. Maria then ate $\frac{3}{4}$, leaving $\frac{1}{4}$ of the $\frac{2}{3} \times J$ jellybeans, or $\frac{1}{4} \times \frac{2}{3} \times J$ jellybeans. Multiplying out $\frac{1}{4} \times \frac{2}{3} \times J$ gives $\frac{1}{6}J$ as the number of jellybeans left. The problem states that there were 10 jellybeans left, meaning that we set $\frac{1}{6} \times J$ equal to 10: $\frac{1}{6} \times J = 10$.

Solving this equation for J gives $J = 60$. Thus, the right answer is **a** (the same answer we got when we *worked backward*). As you can see, both methods—working backward and translating from English to math—work. You should use whichever method is more comfortable for you.