

## A word about cross products and "the butterfly".

1. These methods are a quick short cut to determine the equivalency of a pair of fractions, or to determine if one fraction is bigger than another.
2. These methods are very useful on timed tests or when you simply need to find an answer.
3. Using these methods correctly, does not show that you understand the equivalency of two fractions or two ratios.
4. The new standards are centered around your ability to show you *understand* these ideas and communicate that.
5. If you are able to show the answer using one of these methods, but cannot explain it, you are not showing that you have mastered that standard.

What you are really doing:

Look at this mathematical statement:

$$\frac{3}{17} = \frac{4}{53}$$

If you were asked if these two ratios formed a proportion, you could simply multiply 17 by 4 and 53 by 3 and say, "no". But what are you doing? Why does that work?

$$\frac{3}{17} = \frac{4}{53}$$

17 and 53 are not "friendly" numbers. Finding a least common denominator for them would be cumbersome (a really big pain). So, the easiest thing to do is make a common denominator by multiplying 17 and 53. I don't have a calculator handy, and don't feel like doing double digit multiplication, so I am just going to write it as  $17 \times 53$ . I must make my equivalent fractions now:

$$\frac{3}{17} \times \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}} = \frac{\phantom{000}}{17 \times 53}$$

 Remember! That fraction = 1

$$\frac{3}{17} \times \boxed{\frac{\quad}{\quad}} = \frac{\quad}{17 \times 53}$$

What do I need to multiply 17 by to get  $17 \times 53$ ? Yes, it is that simple, 53. So the fraction inside the box must be equal to . . . . .

$$\frac{3}{17} \times \boxed{\frac{53}{53}} = \frac{159}{17 \times 53}$$

Following the same process, the other equivalency equation would be:

$$\frac{4}{53} \times \boxed{\frac{17}{17}} = \frac{68}{17 \times 53}$$

$$\frac{3}{17} = \frac{4}{53}$$

$$\frac{3}{17} \times \frac{\boxed{53}}{\boxed{53}} = \frac{159}{17 \times 53}$$

$$\frac{4}{53} \times \frac{\boxed{17}}{\boxed{17}} = \frac{68}{17 \times 53}$$

So you end up multiplying 4 and 17, and 3 and 43, just like we remember to do with "the butterfly".

So, we have proven the ratios do not form a proportion, and have done it by proving we understand how to work with fractions and understand the properties of fractions.

So, how do you use the same method to find the missing value in a proportion?

$$\frac{7}{12} = \frac{\text{😊}}{8}$$

The easiest way to solve this is to look at the relationship between 7 and 12 or 8 and 12.

I can set up a ratio square or two equivalent fraction statements.

$$\frac{7}{12} = \frac{\text{😊}}{8}$$

7	😊
12	8

I know that  $12 \times (8/12) = 8$

So,  $7 \times (8/12) = \text{😊}$

$$56/12 = 4 \frac{8}{12} = 4 \frac{2}{3}$$

$$\text{😊} = 4 \frac{2}{3}$$

Remember if I don't know the answer to a multiplication problem, I divide.  
So,  $12 \times \underline{\quad} = 8$ . I divide 8 by 12 to find my answer. Life stays simpler if I keep my division problem as a fraction (8/12).



The reasons this way is no fun:

1. You have to think about how fractions work and very few people like to think about fractions.
2. You have to use lots and lots of steps and know how to move from one step to another. It's just easier to butterfly and be done.
3. Your calculator doesn't always help. You often get repeating decimals that are a little ugly.

## What is the expectation?

7.RP.2- Recognize and represent proportional relationships between quantities.

2.a – Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.

2.b – Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships

Unfortunately, they want to know how you look at ratios as fractions or graphs, not as butterflies.

So, understanding how the butterfly works is very important, and being able to communicate that through words and your work, also important. Just using the butterfly is a good way to check work or complete problems quickly.