

MATH DOESN'T SUCK



Solution Guide – Chapter 18 Proportions

Doing the Math from p. 219

2) First, we find the cross products:

$$\begin{array}{c} 72 \quad \quad \quad 3 \times m \\ \frac{8}{3} \quad \times \quad \frac{m}{9} \end{array}$$

Next, we set the cross products equal to each other, because we know cross products are equal in proportions: $72 = 3 \times m$

So, what is m equal to? Well, divide $72 \div 3 = 24$, so $m = 24$.

Let's check our proportion with our new missing number:

$$\begin{array}{c} 72 \quad \quad \quad 72 \\ \frac{8}{3} \quad \times \quad \frac{24}{9} \end{array}$$

Cross multiply and we see that both cross products = 72. Yep! We found the right m .

Answer: $m = 24$

3) First, we find the cross products:

$$\begin{array}{c} 72 \qquad \qquad 6 \times m \\ \frac{8}{6} \times \frac{m}{9} \end{array}$$

Next, we set the cross products equal to each other, so we can find the value of m that will *make* the cross products equal: $72 = 6 \times m$

So what is m equal to?

Well, we divide $72 \div 6 = 12$, and discover that in order for “ $72 = 6 \times m$ ” to be true, then it must be the case that $m = 12$.

Let’s check that value of m in the proportion, to make sure we have two equivalent fractions:

$$\begin{array}{c} 72 \qquad \qquad 72 \\ \frac{8}{6} \times \frac{12}{9} \end{array}$$

Cross multiply and we see that both cross products = 72. Yep! The two fractions are equivalent, so we found the right m .

Answer: $m = 12$

4) First, let’s find the cross product:

$$\begin{array}{c} 1 \times m \qquad \qquad 20 \\ \frac{1}{2} \times \frac{10}{m} \end{array}$$

Next, we set the cross products equal to each other, knowing that we will then find a value of m that will make the equality “true”: $1 \times m = 20$

So what does m equal? In this case, there’s no division necessary: $m = 20$

Let’s double check this value of m in the proportion:

$$\begin{array}{c} 20 \qquad \qquad 20 \\ \frac{1}{2} \times \frac{10}{20} \end{array}$$

Cross multiplying shows us that both cross products = 20, and yes, we found the right value of m to make these fractions equivalent!

Answer: $m = 20$

Doing the Math from p. 224

2) We can say to ourselves, “36 pages is to 30 minutes, as 15 pages is to *what?*” The fractions will look like: $\frac{\text{pages}}{\text{minutes}}$. So let’s set it up, and fill in “*m*” for the missing number of minutes. Here’s the proportion and their cross products:

$$\begin{array}{r} 36 \times m \qquad \qquad \qquad 30 \times 15 \\ \frac{36 \text{ pages}}{30 \text{ min}} \quad \times \quad \frac{15 \text{ pages}}{m \text{ min}} \end{array}$$

Now let’s set the cross products equal to each other: $36 \times m = 30 \times 15$
We can simplify the right side: $30 \times 15 = 450$.

Now our equation looks like: $36 \times m = 450$. What does *m* equal?

Well, we can divide $450 \div 36$ to find out. $36 \overline{)450.0}$.

This means $m = 12.5$ Now let’s put our number in the proportion to check it:

$$\begin{array}{r} 450 \qquad \qquad \qquad 450 \\ \frac{36 \text{ pages}}{30 \text{ min}} \quad \times \quad \frac{? \text{ pages}}{12.5 \text{ min}} \end{array}$$

And doing the cross products, we see that $450 = 450$, so we’ve found the right *m*!

It will take you 12.5 minutes to read the 30 pages you have left.

And what is 0.5 of a minute? 30 seconds, of course.

Answer: It will take 12 minutes and 30 seconds to finish the reading assignment.
(That is, if you keep reading at *exactly* the same pace!)

3) We can say to ourselves, “6 cups of flour are to $\frac{3}{4}$ teaspoon of salt, as 2 cups of flour are to *how many* teaspoons of salt?” Here’s the proportion and their cross products:

$$\begin{array}{r} 6 \times m \\ \hline \frac{6 \text{ cups flour}}{\frac{3}{4} \text{ tsp. salt}} = \frac{2 \text{ cups flour}}{m \text{ tsp. salt}} \end{array} \quad \frac{3}{2}$$

Since $\frac{3}{4} \times 2 = \frac{3}{2}$ (in reduced form), that’s the cross product on the right side. On the left side, we’ll leave it as $6 \times m$.

Now let’s set our cross products equal to each other, since cross products of equal fractions are always equal: $6 \times m = \frac{3}{2}$

So what would m have to be in order for this to be true?

As always, if we divide, we can find it! Be careful, you don’t always divide the bigger number by the smaller one. This is tricky - it’s always the number that’s *by itself* on one side of the equation that gets divided *into* – it’ll be the *dividend* - even if it’s a smaller number!

Since $6 \times m = \frac{3}{2}$, we need to divide $\frac{3}{2}$ by 6 in order to find m .

$$\begin{aligned} \text{So: } \frac{3}{2} \div 6 &= (\text{remember fraction division!}) \frac{3}{2} \div \frac{6}{1} = \frac{3}{2} \times \frac{1}{6} = \frac{3 \times 1}{2 \times 6} = \frac{3}{12} \text{ (now reduce)} \\ &= \frac{3 \div 3}{12 \div 3} = \frac{1}{4}. \text{ Phew! So, } m = \frac{1}{4}. \end{aligned}$$

Now let’s double check this value of m in the original proportion:

Cross multiply, and you’ll find that you get $\frac{3}{2}$ on both sides.

$$\begin{array}{r} \frac{3}{2} \\ \hline \frac{6 \text{ cups flour}}{\frac{3}{4} \text{ tsp. salt}} = \frac{2 \text{ cups flour}}{\frac{1}{4} \text{ tsp. salt}} \end{array} \quad \frac{3}{2}$$

Yep! We found the right value of m .

Answer: You should use $\frac{1}{4}$ tsp. in the smaller version of the recipe.

4) We can say to ourselves, “ 3 puppies are to $\frac{3}{4}$ of a bag of puppy food, as 5 puppies are to *how many* bags of puppy food?”

Here’s the proportion and their cross products:

$$\begin{array}{ccc} 3 \times m & & \frac{15}{4} \\ \frac{3 \text{ puppies}}{\frac{3}{4} \text{ bag}} & = & \frac{5 \text{ puppies}}{m \text{ bags}} \end{array}$$

Since $\frac{3}{4} \times 5 = \frac{15}{4}$, That’s the cross product on the right side. So, setting the two cross products equal to each other, we’d have: $3 \times m = \frac{15}{4}$.

How do we figure out what m should be? Divide $\frac{15}{4} \div 3$.

To do this, we need to write 3 as an improper fraction: $\frac{15}{4} \div \frac{3}{1}$ (remember fraction division!) = $\frac{15}{4} \times \frac{1}{3} = \frac{15}{12}$ (now reduce) $\frac{15 \div 3}{12 \div 3} = \frac{5}{4}$ So $m = \frac{5}{4}$.

Let’s test this value of m in our original proportion:

$$\begin{array}{ccc} \frac{15}{4} & & \frac{15}{4} \\ \frac{3 \text{ puppies}}{\frac{3}{4} \text{ bag}} & = & \frac{? \text{ puppies}}{\frac{5}{4} \text{ bags}} \end{array}$$

Cross multiply, and you’ll find that both products = $\frac{15}{4}$. Yep! We must have found the right value of m .

Answer: The puppies will eat $\frac{5}{4}$ bags – in other words $1\frac{1}{4}$ bags of puppy chow.