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Calculations with Ratios and Proportions

Even if only 99 out of 100 people need to know how to work with ratios, the odds that they'll be useful to you are very high. In this lesson, we'll practice performing calculations with ratios and proportions.

Let's Compare

Comparisons can get kind of a bad rap. I might say my favorite football team is better than yours. Or, I could say that I'm better-looking than you. Or, maybe I tell you that my dog is smarter than yours.

First of all, my dog is sweet, but I don't think he's winning any IQ contests. And, aside from their possible lack of accuracy, these kinds of comparisons are kind of mean.

But comparisons can serve useful purposes - math purposes. And, I don't mean abstract, make-you-nervous, pop quiz math purposes; I mean legitimately useful math purposes. Let's look at how this works.

Definitions

First, let's get some definitions on the table to give us a framework. When we're talking about comparisons, we mean ratios and proportions.

A **ratio** is a comparison between two things. For example, a soccer team may need 5 soccer balls for every 10 players during practice. The ratio of soccer balls to players if 5:10.

A **proportion** is a pair of ratios that are equal to each other. It's like this: $a/b = c/d$ or $a:b = c:d$. For example, let's say you save \$5 out of every \$100 you earn, so you save at a ratio of 5:100. If you earn \$500, you'll save \$25. The proportion can be written as 5/100 = 25/500.

Ratio Problems

Okay, now let's try some math. Let's start with ratio problems.

Here's a bowl of fruit:

What is the ratio of apples to oranges? There are 3 apples and 4 oranges, so the ratio is 3:4. Now, I like apples way more than oranges, so this ratio just won't do. I'm more of an all-apples-to-no-oranges ratio kind of guy.

Let's talk about milk. You can buy milk in quarts or gallons or other sizes not relevant to this question. What's the ratio of quarts to gallons? This question is really asking how many quarts are in a gallon. If you know your milk, you know it's 4. So, the ratio of quarts to gallons is 4:1. Incidentally, this ratio holds true for chocolate milk; it's just tastier that way.

Also, always pay attention to the order of the ratio. 4:1 is not the same as 1:4.

RATIO PROBLEMS

The ratio of apples to oranges is 3:4.

How about this? In a town with 400 commuters, 120 people drive to work. The rest ride their bikes. What is the ratio of drivers to cyclists? We just need to know the number of each. We know there are 120 drivers. And, if there are a total of 400 commuters, then the cyclists must be 400 - 120, or 280. So, the ratio of drivers to cyclists is 120:280. This is one bike-loving town.
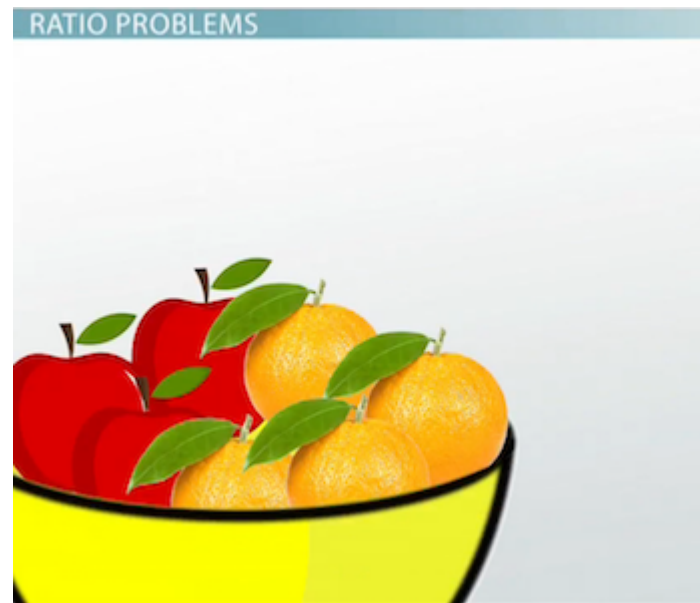
Proportion Problems

Let's get more complicated. What if Angie's Car Batteries and Decorative Garden Gnomes sells car batteries and gnomes in a ratio of 35:2? By the time Angie has sold 280 car batteries, how many gnomes did she sell?

We just need to set this up as a proportion. Again, that's two ratios that are equal to each other. Our first ratio is 35:2. Our second ratio is 280:g, where g is the number of gnomes. Just cross-multiply, and we find that Angie has sold 16 gnomes. We also learned that Angie should probably stick to car batteries, as those gnomes just aren't moving very well.

What about this? In the annals of garage rock band history, guitar players outnumber drummers 13:3. In Rockville, which is your typical garage rock-loving town, there are 12 drummers. How many guitar players are there?

We set this up as 13:3 = g:12, where 12 is our Ringos and g is our number of aspiring Eddie Van Halens. Just solve for g. We get $3g$ = 13*12. So, $3g$ = 156, and g = 52. So, Rockville has 52 guitarists. Some of those people are really going to need to learn bass.

Here's another. Little Timmy is up late watching the weather. He knows that if 12 inches of snow falls overnight, school will be canceled. If snow is falling at a rate of 2 inches per hour, how many hours will it take for 12 inches to fall?

So, the rate of snow to hours is 2:1. Our proportion is 2:1 = 12:h, where h is the number of hours it will take. We cross-multiply and find that it will take 6 hours for school to get canceled. Little Timmy looks at the clock, sees that it's already 4 AM, and knows that the snow better speed up - or he better get started on that big English paper due today.

Let's try a space-themed problem. If 1 in 10,000 planets in the universe could possibly support life, and there are an estimated 3 trillion planets in the universe, how many planets might support life? These numbers are big, but the math is the same. 1:10,000 = p:3,000,000,000,000, where p represents all the Tatooines, Capricas and Gallifreys out there. If we cross-multiply, we'll find that 300 million planets could support life. That's a lot.

Lesson Summary

In summary, there's probably life somewhere else in the universe. More pertinent, though, a ratio is simply a comparison of two things. It could be apples and oranges or drummers and guitarists. A proportion is a set of ratios that are equal to each other. With proportions, you can find out all sorts of fun things. As long as you know the ratio of two things or events, you can determine the details of things that are directly proportional.

Learning Outcomes

After you've completed this lesson, you'll have the ability to:

- Define ratio and proportion
- Solve problems comparing items using proportions