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Ratios & Rates: Definitions & Examples

If we have two items, or two numbers, and we want to compare them, what language can we use? How do we write the comparison? Find out as we learn about ratios and rates in this lesson.

Let's Compare

Did you ever watch a zombie movie and wonder about the ratio of zombies to people? I mean, if there were billions of people in the world and almost all of them are now zombies, isn't the long-term survival outlook for the humans pretty bleak? Ok, maybe that's just how I think.

Or maybe you've found yourself in a monster movie, driving away from some nasty creatures. How do you describe how fast you're going? You need some frame of reference. Maybe you're going 60. 60 what? 60 feet per year? That's crazy slow. Those monsters are totally going to catch you. Or maybe you're going 60 miles per hour. That's more like it.

All of these are issues of comparison. How do we compare these things? What's the language we can use? That's what we'll learn here as we discuss ratios and rates.

Ratios

Let's start with ratios. A **ratio** is a comparison between two terms. Maybe you're in a town with 500 zombies and 1 of you. The ratio of zombies to people is 500 to 1. We can write ratios in a few different ways. For example, we can write it just as we say it: 500 to 1. We can also write it like this: 500:1, with a colon that stands in for 'to.'

Since that ratio is kind of intimidating, let's focus on something else. This style of writing ratios is the way you might see the odds of something happening, like the odds your favorite football team winning on Sunday. Maybe the odds are 6:1. That means that if you bet one dollar on your team, and they won, you'd totally go to jail. Betting is illegal. Well, in most places. Let's say you're in Las

Vegas, so it's okay. So the odds are 6:1, and you bet one dollar. So, if they win, you'd get six dollars. If you bet five dollars, you'd win 5 * 6, or $30.

The third way to write ratios is as a fraction, like 1/2. I know, it looks like just a fraction, but a fraction is really a ratio. If you say a glass is 1/2 full, you're comparing how full it is to how full it could be; that's 1 to 2.

Ratio Problems

Let's look at some sample ratio questions. Sometimes, you need to identify a ratio from a given set of information. Let's say you're going through your clothes and you have eight shirts, 12 skirts and 37 pairs of shoes. Wow, you really like shoes, huh? Here's the question: What's the ratio of shirts to skirts? 8:12. Sadly, the ratio doesn't rhyme like the clothes names.

You might see a question like this: At a sci-fi convention, the ratio of Star Wars fans to Trekkies is 5:4. If there are 130 Star Wars fans, how many Trekkies are there?

To solve this, just set up an equation like this: Star Wars/Trekkies = 5/4 = 130/x, where x is the number of Trekkies.

- Let's cross multiply to get 5x = 4 * 130
- 4 *130 = 520
- 520/5 = 104

So there are 104 Trekkies. By the way, aside from being outnumbered, I think they prefer to be called 'Trekkers.'

Rates

Despite their costumes, Star Wars fans and Trekkers are all humans. What if we want to compare different units? That's where rates come in. A **rate** is a special kind of ratio. It's a comparison of two terms that use different units.

Let's say I can do 20 pull-ups in three minutes. We could write that like this: 20 pull-ups/3 minutes. Since we're comparing different units, pull-ups and minutes, this is a rate. Again, this is just a subset of ratios.

You're probably familiar with this rate: mph. What's that stand for? Miles per hour - that's a particular kind of rate that's called a unit rate. A **unit rate** is a rate with a denominator of 1. Remember when you were speeding away from monsters? Oh, I'm sorry. Were you trying to forget that? Well, let's say you were going 60 miles per hour. We write that like this: 60 miles/1 hour. Since that denominator is 1, it's a unit rate. We can rewrite it like this: 60 miles/hour.

Rate Problems

With rates, you may be asked to simplify a fraction like this: At a local warehouse store, an 18-pound bag of potato chips costs 42 dollars. Express this in its simplest form. That's a lot of potato chips. What's the rate? 18 lbs/42 dollars. To make it simpler, we just simplify the fraction. The greatest common factor here is 6. Divide both numbers by 6, and we get 3 lbs/7 dollars. That's not a bad deal on chips.

You might also need to use unit rates to figure something out, like this: Susan rides her bicycle at a speed of 12 miles per hour. If she rides for four hours, how far does she go? We can set this up like the sci-fi one. 12 miles/1 hour = *x* miles/4 hours. Be sure to match the correct units when setting up your fractions. We then cross multiply to get 12 * 4 = *x*. So *x* = 48. She goes 48 miles. Not bad, Susan.

You can also encounter rates in the kitchen. Maybe I'm making pancakes and the recipe calls for using cups of flour and milk in a ratio of 3:2. That's fine for most days. But I'm really hungry today. I want to make triple the normal amount. How do I adjust the ratio? I just need to multiply both terms by three. Remember that in a ratio you must use the same value. So, that 3:2 becomes 9:6. And there will be pancakes for all! Okay, no. They're all for me.

Lesson Summary

To summarize, a **ratio** is a comparison between two terms. We can write it like this: 5 to 1; with a colon, like 100:3; or as a fraction, like 3/4.

A **rate** is a special type of ratio in which the two terms are measured using different units. This is like paying for something by weight, where you're comparing pounds to dollars.

A **unit rate** is a rate where the denominator is one. An example of this is miles per hour, where we're talking about a certain number of miles in one hour.

Learning Outcomes

Once you have completed this lesson you should be able to:

- Distinguish between a ratio, a rate, and a unit rate
- Recall the different ways in which ratios can be written

- Solve ratio or rate math problems