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How to Solve a One-Step Problem Involving Rates

One of the most useful aspects of math is the ability to take a rate and use it to solve questions of time or quantity. In this lesson, we'll learn how to use rates, time, and quantity to solve for each other.

What Is a Rate?

Surely you've seen speed limit signs before. In black, bold writing they proclaim that you cannot legally go faster than the speed listed. Speed limits are really rate limits, as they limit the pace at which you can drive. A **rate** is just that, it is a definition of pace between two quantities. If the speed limit is 45 miles per hour, you can only go 45 miles in one hour. There is no limit on how many hours you can drive, but instead, it is an expression of what you can do in that hour.

Still, it's not just while driving that you are likely to encounter rates. If you go to the deli counter at a supermarket, you order meat and cheese in terms of pounds with the price listed. The price per pound is a rate. Something that is really important to notice about rates, however, is that they are almost always in terms of one of something. Speed limit signs are not posted in terms of fours of hours, but in terms of one hour. Likewise, deli meat is sold at a price per one pound, not a price per nine pounds.

How Can We Use Them?

This means that rates are remarkably useful things. We can quickly calculate how long it will take us to reach a destination by just knowing the distance to the goal. In short, they can effectively put an end to the chorus of 'Are we there yet?' from the back seat. Not only can rates calculate distances, but they can calculate costs. We can calculate costs of multiple pounds of ham by simply knowing the cost per pound. In short, rates allow us to quickly relate two different quantities to each other because they provide a link between the two.

Not only are rates useful, but they are remarkably easy to use. Remember how I said that rates almost always were in terms of one of something? That means that you don't have to think about too much cross-multiplying when using rates, since you'll be multiplying by one. If that doesn't make sense yet, don't worry about it - we're almost there! For now, just remember that as long as

you can make sure that the units match up properly, you're good to go.

Process for Solving With Rates

Making sure that the units match up properly is where many people get tricked up when using rates. Remember, the units are there to help you. Sure, it may save you a little bit of paper space to not write down miles or miles per hour, but the units will really help you keep your thinking straight. So, how do you solve something using rates?

First, figure out what it is that you are trying to solve for. For example, if you are solving for how long it will take you to get to a destination, acknowledge that time is what you are trying to solve for. Then, write down the information you've got. If you're solving for time, for example, you should have the distance as well as the rate in terms of distance over time. Remember, miles per hour is just another way of saying distance over time. Ask yourself what you have to do to end up with only the desired unit left as time. In solving for hours, that means setting up the problem where you divide out the miles. As such, you'll have to flip the rate. From there, divide out the units for distance leaving only the unit for time, and solve the math.

Examples

That may have all sounded complicated, so let's use an example to help us understand it. Say that you were driving at a speed of 60 miles per hour, and you wanted to know how long it would take you to go 120 miles. First, what do you want to find? You want to find the time, so you're focusing on the hours. Right now, in our rate, the time is on the bottom, but you want to divide by the distance. As such, flip the equation to be 1 hour over 60 miles. Divide 120 miles by 60 miles, and you'll get the number of hours, 2.

Or, better yet, let's say that you reached your final destination where you had wanted to have a pool party and are met with an empty pool. It seems that the water had to be pumped out, so now your friend has to start all over again. Luckily, the local fire department has agreed to let you use a fire hydrant to get more water per minute. The fire hydrant provides water at a rate of 1,000 gallons per minute, and your friend has a pool that holds 30,000 gallons. How long will it take to fill the pool?

In this case, you want to solve for time, so you need to look at your formula and isolate time by itself. In this case, that means that time is equal to the capacity of the pool over the rate of the hose. That means that it is 30,000 gallons over 1,000 gallons per minute. Do the math, and you end up with 30 minutes.

Lesson Summary

In this lesson, we learned how to use **rates** to solve one-step problems. Rates are very useful since they let us figure out everything from how much meat to buy at the deli counter to how long we are from our final destination. When using rates, the easiest way to make sure that you are getting the right answer is to follow the units and let them lead you to the proper answer. That could mean flipping a rate, but it will help make sure that your math is correct.