Distance, rate, and time

This lesson looks at how to find distance, rate, and time, given the values of two out of three of these quantities. Distance, rate, and time are related by the equation

$$\text{Distance} = \text{Rate} \cdot \text{Time}$$

$$D = RT$$

Let's talk about the units of each of these values.

Distance has units of inches, feet, miles, etc.; or of centimeters, meters, kilometers, etc.

Time has units of seconds, minutes, hours, etc.

Rate has units of distance/time, for example inches/second, miles/hour, or kilometers/hour.

Before you can use the formula $D = RT$ you need to make sure that your units for the distance and time are the same as the units in your rate. If they aren't, you'll need to change them so you're working with the same units.

Let's do an example of a standard distance, rate, and time problem.

Example

Heather ran 56 km in 5 hours. What was Heather's rate in km/hr?

We'll use the formula for distance.

$$\text{Distance} = \text{Rate} \cdot \text{Time}$$

$$D = RT$$

Let's write down what we know.

$$D = 56 \text{ km}$$

$$T = 5 \text{ hr}$$

If we plug these into the distance formula, we get

$$56 \text{ km} = R \cdot 5 \text{ hr}$$

Now solve for the Rate.

$$\frac{56 \text{ km}}{5 \text{ hr}} = \frac{R \cdot 5 \text{ hr}}{5 \text{ hr}}$$

$$R = 11.2 \frac{\text{km}}{\text{hr}}$$

Let's try one with two people.

Example

Susan and Benjamin were 60 miles apart on a straight trail. Susan started walking toward Benjamin at a rate of 5 mph at 7:30 a.m. Benjamin left

three hours later, and they met on the trail at 3:30 p.m. How fast did Benjamin walk?

We've been given information about distance, rate and time, so we'll use the formula

$$\text{Distance} = \text{Rate} \cdot \text{Time}$$

$$D = RT$$

where D is the distance traveled, R is the rate, and T is the time. We can use subscripts to create unique equations for Susan and Benjamin; we'll use S for Susan, and B for Benjamin.

$$\text{Susan: } D_S = R_S T_S$$

$$\text{Benjamin: } D_B = R_B T_B$$

We know that in order to meet each other, they must have covered a distance of 60 miles between them. Therefore,

$$D_S + D_B = 60$$

Since we know that $D_S = R_S T_S$ and $D_B = R_B T_B$, we can substitute the known quantities (Susan's speed and time, and Benjamin's time) into the following equation.

$$R_S T_S + R_B T_B = 60$$

The problem tells us that Susan walked at a speed of 5 mph, and that she walked for 8 hours, since she walked from 7:30 a.m. until 3:30 p.m. So

$$(5)(8) + R_B T_B = 60$$

$$40 + R_B T_B = 60$$

$$R_B T_B = 20$$

Benjamin left three hours after Susan, which means he started walking at 10:30 a.m., and he kept walking until they met at 3:30 p.m., which means he walked for 5 hours. So

$$R_B(5) = 20$$

$$R_B = 4$$

Which means that Benjamin walks at a speed of 4 mph.