

## Formulas Using Variables

There may be times when you need to solve an equation, such as

$$d = r \cdot t \quad \text{distance} = \text{rate} \cdot \text{time}$$

for one of its variables. When you know both rate and time, it is easy to calculate the distance using the **formula** above.

If you drive 60 mph for 5 hours, how far will you go? Use the following *formula*.

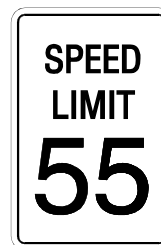
$$d = r \cdot t$$

Substitute 60 for the rate and 5 for the time to get the following.

$$d = 60 \cdot 5$$

$$d = 300 \text{ miles}$$

But what if you know your destination is 385 miles away and that the speed limit is 55 mph? It would be helpful to have a formula that gives you the amount of time you will need to get there. Rather than trying to remember a new formula for each situation, you could transform the one you already have using the rules you know.



Use the same algebraic rules that we used before, and solve the following.



**Remember:**  $t$  is for time.

$$d = r \cdot t$$

We want to get  $t$  alone on one side of the equation.

$$d = r \cdot t$$

$$\frac{d}{r} = \frac{r \cdot t}{r}$$

$$\frac{d}{r} = t \quad \leftarrow \text{divide both sides by } r$$

Now see below how dividing distance (385) by rate (55), you get time, 7 hours.

$$\begin{aligned} d &= r \cdot t \\ 385 &= 55 \cdot t \\ \frac{385}{55} &= \frac{55 \cdot t}{55} \\ 7 &= t \\ 7 \text{ hours} \end{aligned}$$

Let's try the examples below.

### Example 1

**Solve**

$$\begin{aligned} A &= \frac{1}{2}bh \text{ for } b. \\ A &= \frac{1}{2}bh \\ 2A &= bh && \longleftarrow \text{multiply both sides by 2} \\ 2\frac{A}{h} &= b && \longleftarrow \text{divide both sides by } h \end{aligned}$$

Now let's try a more challenging example.

### Example 2

**Solve**

$$\begin{aligned} A &= \frac{1}{2}(b_1 + b_2)h \text{ for } h \\ A &= \frac{1}{2}(b_1 + b_2)h \\ 2A &= (b_1 + b_2)h && \longleftarrow \text{multiply both sides by 2} \\ \frac{2A}{(b_1 + b_2)} &= h && \longleftarrow \text{divide both sides by } (b_1 + b_2) \end{aligned}$$

Your turn.