

Dimensional Analysis

Rate Conversion:

We are told that **distance = rate * time**

$$d = r \cdot t$$

Let's say an object moves at a rate of 5 meters per second:

$$r = 5 \frac{\text{m}}{\text{s}}$$

... how far will it travel after 10 seconds?

$$t = 10 \text{ s}$$

Our formula is now:

$$d = 5 \frac{\text{m}}{\text{s}} \cdot 10 \text{ s}$$

The seconds will cancel out:

$$= 5 \cdot 10 \cdot \frac{\text{m}}{\cancel{\text{s}}} \cdot \cancel{\text{s}}$$

...leaving us with the answer of 50 meters:

$$= 50 \text{ m}$$

Rate Problem:

A squirrel is running across the road at 12 feet per second. It needs to run 9 feet to get across the road. How long will it take the squirrel to run 9 feet? Round to the nearest hundredth of a second.

A car is 50 feet away from the squirrel, driving toward it at a speed of 100 feet per second. How long will it take the car to drive 50 feet? Round to the nearest hundredth of a second.

Will the squirrel make it 9 feet across the road before the car gets there?

The rate for the squirrel:

$$\text{Squirrel: } 9 \text{ ft} \cdot \frac{1 \text{ seconds}}{12 \text{ ft}}$$

$$= \frac{9}{12} \text{ seconds}$$

... so it takes the squirrel .75 seconds to cross the distance of 9 feet across the street:

$$= 0.75 \text{ seconds}$$

The rate for the car:

$$\text{Car: } 50 \text{ ft} \cdot \frac{1 \text{ seconds}}{100 \text{ ft}}$$

... so it takes the car .5 seconds to reach the spot where the squirrel is situated:

$$= 0.50 \text{ seconds}$$

... and thus, unfortunately, the squirrel will not make it 9 feet across the road before the car gets there.

Word Problem with Multiple Units:

Your car gets 25 miles per gallon and you want to go on a 400 mile road trip. Right now, gas costs \$3.00 per gallon. How much will the gas for your road trip cost?

$$400 \text{ miles} \cdot \frac{1}{25} \frac{\text{gallons}}{\text{mile}}$$

$$\cancel{400 \text{ miles}} \cdot \frac{1}{25} \frac{\text{gallons}}{\cancel{\text{mile}}} = \frac{400}{25} \text{ gallons}$$

$$= 16 \text{ gallons}$$

$$16 \text{ gallons} \cdot 3 \frac{\text{dollars}}{\text{gallons}}$$

$$16 \cancel{\text{ gallons}} \cdot 3 \frac{\text{dollars}}{\cancel{\text{gallons}}}$$

$$= \$48$$

Measurement Word Problem:

Jamir is training for a race and is running laps around a field. If the distance around the field is 300 yards, how many complete laps would he need to do to run at least 2 miles?

How many yards in 2 miles?

$$2 \text{ miles} \cdot 5280 \frac{\text{ft}}{\text{miles}}$$

$$\underline{2} \text{ miles} \cdot \underline{5280} \frac{\text{ft}}{\text{miles}} = 10560 \text{ ft}$$

$$10560 \text{ ft} \cdot \frac{1}{3} \frac{\text{yards}}{\text{ft}}$$

$$\underline{10560} \cancel{\text{ft}} \cdot \frac{1}{\underline{3}} \frac{\text{yards}}{\cancel{\text{ft}}} = \frac{10560}{3} \text{ yards}$$

$$3520 \text{ yds.} \cdot \frac{1}{300} \frac{\text{Laps.}}{\text{yds.}}$$

... so there are 3520 yards in 2 miles.

We know there are 300 yards in 1 lap.

Now how many laps can we fit in 3520 yards?

$$\underline{3520} \cancel{\text{yds.}} \cdot \frac{1}{300} \frac{\text{Laps.}}{\cancel{\text{yds.}}} = \frac{3520}{300} \text{ Laps}$$

We see that 11 laps contains 3300 yards:

$$\begin{aligned} 11 \times 300 &= 3300 \\ 12 \times 300 &= 3600 \end{aligned}$$

...the 11 laps would stop just short of the 3520 yards. Thus, he would need to run 12 laps to run at least 2 miles.