Using Ratios to Convert Measuring Units

		If we think of it as an equation an , and a RATIO on the right side:	nd divide both
1 inch = 2.54 cm	This is the conversion factor, but we will think of it as an equation now.		
$\frac{1 \text{ inch}}{1 \text{ inch}} = \frac{2.54 \text{ cm}}{1 \text{ inch}}$	Divide both sides by "1 inch." Yes, we do include the unit <i>inch</i> in this.		
$1 = \frac{2.54 \text{ cm}}{1 \text{ inch}}$	We get a plain 1 on the left side (something divided by itself equals 1).		
What we get on the right s	ide is the ratio 2.54 cm pe	e <u>r 1 inch</u> (or 2.54 cm to 1 inch), an	nd that ratio equals 1.
We can also do this the oth	ner way around:		
1 inch = 2.54 cm	This is the conversion factor, but we will think of it as an equation now.		
$\frac{1 \text{ inch}}{2.54 \text{ cm}} = \frac{2.54 \text{ cm}}{2.54 \text{ cm}}$	Divide both sides by "2.54 cm". Yes, we do include the unit <i>cm</i> in this.		
$\frac{1 \text{ inch}}{2.54 \text{ cm}} = 1$	We get a plain 1 on the right side (something divided by itself equals 1).		
What we get on the left side is the ratio <u>1 inch per 2.54 cm</u> (or 1 inch to 2.54 cm), and that ratio equals 1.			
In fact, we can transform <i>any</i> conversion factor between measuring units into a ratio that is equal to 1.			
$1 \text{ qt} = 0.946 \text{ L}$ \downarrow $\frac{1 \text{ qt}}{0.946 \text{ L}} = 1$	$0.946 L = 1 qt$ \downarrow $\frac{0.946 L}{1 qt} = 1$	1 mi = 1.6093 km \downarrow $\frac{1 \text{ mi}}{1.6093 \text{ km}} = 1$	$1 \text{ lb} = 0.454 \text{ kg}$ \downarrow $\frac{1 \text{ lb}}{0.454 \text{ kg}} = 1$
. Think of the conversion factors as equations, and transform each one into a new equation of the form $(1 - 1)^{(1)} = 1^{(2)}$			

"1 = a ratio" or "a ratio = 1."

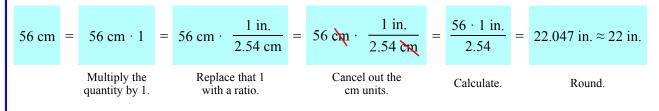
1 ft = 0.3048 m	1 ounce = 28.35 g	1 mi = 1,760 yd	1 m = 1.0936 yd
↓	↓	↓	↓

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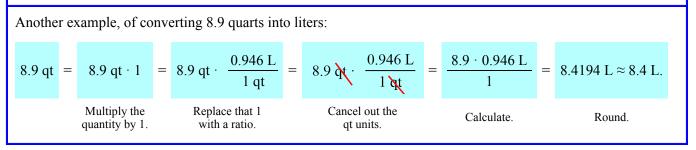
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We can use these ratios that equal one in **converting measuring units**.

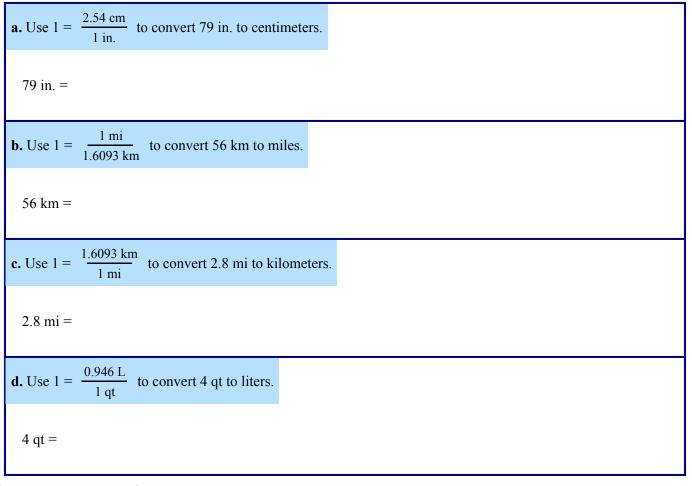
How does that happen? Study the following example carefully. Mathematically speaking, we multiply the quantity we want to convert by 1. Multiplying it by 1 does not change its value. Then, we replace that 1 with one of the ratios of measuring units that equal 1. Next, we cross out the measuring units that cancel out. Lastly, we multiply/divide the numbers involved.



Notice that we **keep the the units of measure** in the calculation! The "cm" units cancel out, and we end up with only the unit "in" (which is what we wanted: to convert the given quantity into *inches*).



2. Use the given ratios to convert the measuring units.



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How do you know whether into centimeters?	er to use the ratio $\frac{1}{2}$	$\frac{1 \text{ in.}}{.54 \text{ cm}}$ or the r	ratio $\frac{2.54 \text{ cm}}{1 \text{ in.}}$	when converting 7 inches	
If the quantity you start with has inches, then you will need to cancel out the unit "inches" in the conversion. Therefore, choose the ratio that has inches in the denominator.					sion.
Here is an example of usi	ng the wrong ratio:				
$7 \text{ in.} = 7 \text{ in.} \cdot 1 = 7 \text{ in.}$	$\frac{1 \text{ in.}}{2.54 \text{ cm}} = 7 \text{ in.}$	$\cdot \frac{1 \text{ in.}}{2.54 \text{ cm}} =$	$\frac{7 \text{ in.} \cdot 1 \text{ in.}}{2.54 \text{ cm}} =$	2.7559 in. ² / cm	
	Replace 1 Notl ith a ratio.	ning cancels.	Calculate.	The answer is not reasonable. Sinc inches are the longer units, 7 inche should convert to a bigger number cm. The units didn't work out, eith	es of
Here are some conversion factors you will need in the following problems.					
1 inch = 2.54 cm	1 yard = 0.9144 m		1 quart = 0.94	1 lb = 0.454 l	٢g
1 foot = 0.3048 m	8 m 1 mile = 1.6093 km		1 ounce $= 28$.	1 kg = 2.2 lb	

3. Use ratios to convert the measuring units.

a. 89 cm into inches	
b. 15 kg into pounds	
c. 78 miles into km	
d. 89 feet into meters	
u. 89 feet into meters	
e. 365 g into ounces	
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Chaining (optional). We can use TWO (or more) ratios in the conversion, and "chain" them together. Example. Convert 0.9 liters into liquid ounces. We have TWO conversion factors: 1 quart = 0.946 L and 1 quart = 32 oz. From these, we can write *four* ratios: $\frac{1 \text{ qt}}{0.946 \text{ L}}$, $\frac{0.946 \text{ L}}{1 \text{ qt}}$, $\frac{32 \text{ oz}}{1 \text{ qt}}$, and $\frac{32 \text{ oz}}{1 \text{ qt}}$, all equaling 1. We can use TWO of those four, "chaining" them together, to go from 0.9 liters to however many ounces: $0.9 \text{ L} = 0.9 \text{ L} \cdot \frac{1 \text{ qt}}{0.946 \text{ L}} \cdot \frac{32 \text{ oz}}{1 \text{ qt}} = 0.9 \text{ L} \cdot \frac{1 \text{ qt}}{0.946 \text{ L}} \cdot \frac{32 \text{ oz}}{1 \text{ qt}} = \frac{0.9 \text{ L} \cdot \frac{32 \text{ oz}}{1 \text{ qt}}}{0.946 \text{ L}} = \frac{0.9 \text{ L} \cdot \frac{32 \text{ oz}}{0.946 \text{ L}}}{0.946 \text{ L}} = \frac{230.4 \text{ oz}}{0.946 \text{ L}}$ Write the two ratios that equal 1. How do you choose which two of the possible four ratios to use? Since you start out with LITERS, you want a

How do you choose which two of the possible four ratios to use? Since you start out with LITERS, you want a ratio where LITERS are in the denominator. And since you want to end up with OUNCES, you want a ratio where OUNCES are NOT in the denominator. The quarts and liters cancel out in the process, leaving the ounces.

4. Convert the measuring units as indicated.

. Use the ratios (2.54 cm / 1 in.) and (12 in. /1 ft) to convert 5 ft into centime	eters.
5 ft =	
b. Use the ratios (1 qt / 32 oz) and (0.946 L / 1 qt) to convert 24 oz into liters	
c. Convert 700 yards into meters.	
I. Convert 8 kg into ounces (weight).	
Convert 371 ounces into grams.	
Convert 15 pints into liters.	

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