



LESSON 6.1b  
**Many Ways to Measure**

6.RP.3d

Objective **Using Ratio Reasoning to Convert Units**

**Warm-Up**



Answer each question about a common measurement conversion.

4. How many milliliters are in 1 liter?
  
  
  
  
  
  
  
  
  
  
5. How many centimeters are in 1 meter?
  
  
  
  
  
  
  
  
  
  
6. How many fluid ounces are in 1 cup?
  
  
  
  
  
  
  
  
  
  
7. How many quarts are in 1 gallon?



You can use ratio tables, as you did when determining equivalent ratios, as another strategy for converting units.

1. Copy and complete the ratio table by converting between pounds and ounces.

Pounds	1	2		$1\frac{1}{4}$	$\frac{1}{2}$		
Ounces	16		4			6	40

2. What strategies did you use to determine the missing values?

3. Copy and complete the ratio table by converting between milliliters and liters.

Milliliters	1000	100		50	1		575
Liters	1		0.5			0.01	

4. What strategies did you use to determine the unknown values?

Ratio tables are nice tools for converting within a given system of measurement. Scaling up or down is a similar strategy for determining equivalent ratios that can be more easily used to convert from one unit of measurement to another.

You will use the common conversions shown in the table to convert between customary and metric systems.

Length	Mass	Capacity
1 in. = 2.54 cm	1 oz = 28.35 g	1 pt = 0.47 L
1 cm = 0.39 in.	1 g = 0.035 oz	1 L = 2.11 pt
1 ft = 30.48 cm	1 lb = 0.45 kg	1 qt = 0.95 L
1 m = 3.28 ft	1 kg = 2.2 lb	1 L = 1.06 qt
1 mi = 1.61 km		1 gal = 3.79 L
1 km = 0.62 mi		1 L = 0.26 gal
1 m = 39.37 in.		
1 in. = 0.0254 m		
1 m = 1.09 yd		

Scaling up or down is another strategy that you already know that can be used to convert between units.

### WORKED EXAMPLE

You can use scaling up to determine how many kilograms are in 2.5 pounds. Because you want to determine the number of kilograms for a specific number of pounds, use the conversion rate  $1 \text{ lb} = 0.45 \text{ kg}$  or  $\frac{1 \text{ lb}}{0.45 \text{ kg}}$ .

$$\frac{1 \text{ lb}}{0.45 \text{ kg}} = \frac{2.5 \text{ lb}}{? \text{ kg}} \quad \longrightarrow \quad \begin{array}{c} \times 2.5 \\ \curvearrowright \\ \frac{1 \text{ lb}}{0.45 \text{ kg}} = \frac{2.5 \text{ lb}}{1.125 \text{ kg}} \\ \curvearrowleft \\ \times 2.5 \end{array}$$

5. Why was the conversion rate  $\frac{1 \text{ lb}}{0.45 \text{ kg}}$  used rather than the rate  $\frac{2.2 \text{ lb}}{1 \text{ kg}}$ ?

Use scaling up or down to answer each question.

6. The school cafeteria has eight very large cans of tomato sauce for making pizza. Each can contains 2 gallons of sauce. Is there more or less than 50 L of sauce in these 8 cans?

7. Tyrone, the quarterback for the Tigers Football team, can throw a football 40 meters. Jason, the quarterback for the Spartans, can throw a football 45 yards. Who can throw farther? How do you know?

8. Molly says that she is 1.5 meters tall. Shawna is 5 feet tall. Molly says that she is taller, but Shawna disagrees. Who is correct? Explain your reasoning.

9. Larry weighs 110 pounds, Casey weighs 98 pounds, Shaun weighs 42 kg, and Jamal weighs 52 kg. Place the boys in order from the least weight to the greatest weight using pounds and kilograms.

10. Karen has a gold bracelet that weighs 24 grams. She wants to sell the bracelet, but she needs a minimum of one ounce of gold to sell it. Can Karen sell her bracelet? Why or why not?



To use scaling up or down to convert one unit to another, you set up a proportion and use the conversion rate based on the given measurement that you are converting. In another strategy, unit analysis, you are multiplying by a form of 1 to rewrite the given measurement in a different unit.

## WORKED EXAMPLE

Determine the quantity in pounds that is equivalent to 4.5 kilograms.

Scaling Up

$$\frac{1 \text{ kg}}{2.2 \text{ lb}} = \frac{4.5 \text{ kg}}{? \text{ lb}}$$

$\times 4.5$

A circular diagram with two arrows. The top arrow points from the left side of the proportion to the right side and is labeled 'x 4.5'. The bottom arrow points from the right side back to the left side and is labeled 'x 4.5'.

Unit Analysis


$$4.5 \text{ kg} \left( \frac{2.2 \text{ lb}}{1 \text{ kg}} \right)$$
$$\frac{4.5 \text{ kg}}{1} \left( \frac{2.2 \text{ lb}}{1 \text{ kg}} \right) = 9.9 \text{ lb}$$
$$\frac{1 \text{ kg}}{2.2 \text{ lb}} = \frac{4.5 \text{ kg}}{9.9 \text{ lb}}$$
$$4.5 \text{ kg} = 9.9 \text{ lb}$$

1. Analyze the worked examples.


a. Both strategies used a form of 1 to determine the equivalent number of pounds in 4.5 kilograms. How is the form of 1 used in scaling up different from the form of 1 used in unit analysis?

b. Why are the labels for kilograms crossed out in the unit analysis strategy?

Christopher and Max want to determine the number of miles in 31,680 feet using unit analysis.

Christopher 

$$31,680 \text{ ft} \left( \frac{5280 \text{ ft}}{1 \text{ mi}} \right) = 167,270,400 \text{ mi}$$

Max 

$$31,680 \text{ ft} \frac{1 \text{ mi}}{5280 \text{ ft}} = 6 \text{ mi}$$

2. Explain why Christopher's answer is not reasonable.

3. Explain what is different in how Christopher and Max set up their multiplication problem. What is important about how the units are arranged in the conversion rates?

Use unit analysis to convert each unit of measurement. Check to make sure your answer is reasonable.

4. A giraffe is 18 feet tall. How tall is the giraffe in inches?

5. A giraffe is 174 inches tall. How tall is the giraffe in feet?

6. The length of the school playground is 32 yards. How many feet long is the playground?

A marathon is a long-distance foot race with an official distance of 42.195 kilometers (26 miles and 385 yards) that is usually run as a road race. Larger marathons can have tens of thousands of runners. Most of these marathon runners are not professional marathoners but run to raise funds for various charities.

7. Although a marathon is a popular distance for a race, there are many other distances in which runners can train to race. Copy and complete the table shown by writing the unknown measurements.

Race	Kilometers	Miles
Short Distance	5	
Medium Distance	10	
Medium Distance	20	
Half Marathon		13.1
Ultramarathon	100	
Ironman Triathlon Swim		2.4
Ironman Triathlon Bike		112



Conversion rates are also common in other contexts, like currency. During the 2016 Summer Olympics, the currency exchange rate between the U.S. dollar and the Brazilian real (pronounced "ray-all") was \$1 US for every 3.17 BRL.

8. Alejandra's family went to the Rio de Janeiro Olympics and she budgeted \$500 to spend while she was gone.

a. Write the conversion rate: \_\_\_\_\_ US = \_\_\_\_\_ BRL.

b. Did Alejandra budget more or less than 500 BRL? Explain.

c. How many BRL could she spend in Rio de Janeiro?

d. After Rio de Janeiro, Alejandra's family traveled to Mexico, where 1 BRL was equal to 5.92 pesos. If Alejandra had 295 BRL remaining, how many pesos did she have?

9. Emma is preparing to re-carpet her room. She measured the room to be 6 yards long and 8 yards wide. When she got to the carpet store, all of the measurements were in square feet.

a. Determine how many square yards of carpet Emma needs to buy to re-carpet her room.

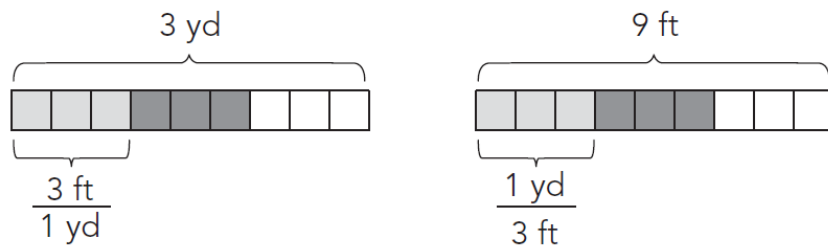
b. Determine how many square feet of carpet Emma needs to buy to re-carpet her room. How can you check your answer?

## Show You Know

Larger or Smaller?

1. Compare the two conversions. How are they similar?

How are they different?



2. When you convert a measurement with smaller units to a measurement with larger units, does the number of units increase or decrease?

3. When you convert a measurement with larger units to a measurement with smaller units, does the number of units increase or decrease?

4. What information is always needed to convert between measurement units?

For each conversion, explain which strategy you prefer to use and then convert the units.

5. 12 gal = \_\_\_\_\_ L

6. 240 oz = \_\_\_\_\_ lb

7. 0.380 km = \_\_\_\_\_ m

8. 324 in = \_\_\_\_\_ yd



## LESSON 6.1b

# Many Ways to Measure



Objective Using Ratio Reasoning to Convert Units

### Practice

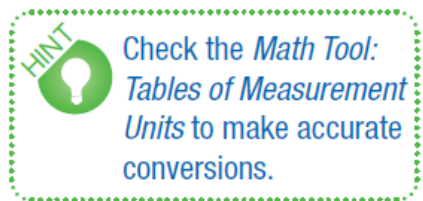
*Use Math Tool: Tables of Measurement Units.*

Use ratios to convert each measurement.

1. 24 ft = \_\_\_\_\_ yd

2. 96 oz = \_\_\_\_\_ lb

3. 4 h = \_\_\_\_\_ min



4. 20 mm = \_\_\_\_\_ cm

5. 16 L = \_\_\_\_\_ mL

6. 9,000 g = \_\_\_\_\_ kg

7. 36 gal = \_\_\_\_\_ qt

8. 2 ft = \_\_\_\_\_ in.

9. 5 km = \_\_\_\_\_ cm

10. 1.4 kg = \_\_\_\_\_ g

11. 6 pt = \_\_\_\_\_ c

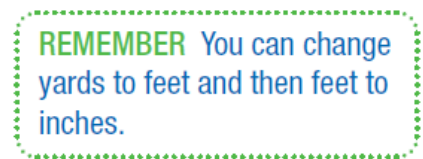
12. 120 h = \_\_\_\_\_ d

Compare. Write  $>$ ,  $<$ , or  $=$ .

13. 320 s \_\_\_\_\_ 4 min

14. 5 yd \_\_\_\_\_ 175 in.

15. 800 mm \_\_\_\_\_ 80 cm



16. 2 lb \_\_\_\_\_ 42 oz

17. 6 km \_\_\_\_\_ 6,100 cm

18. 3 g \_\_\_\_\_ 450 mg

19. 3 qt \_\_\_\_\_ 6 pt

20. 35 L \_\_\_\_\_ 2 kL

21. 20 ft \_\_\_\_\_ 6 yd

22. 70 cm \_\_\_\_\_ 7 m

23. 2 gal \_\_\_\_\_ 15 pt

24. 1 d \_\_\_\_\_ 38 h

