

TOPIC 6

# Unit Rates and Conversions

**Lesson 6.1a/b**

Many Ways to Measure  
Using Ratio Reasoning to Convert Units

**Lesson 6.2a/b/c**

What Is the Best Buy?  
Introduction to Unit Rates

**Lesson 6.3a/b**

Seeing Things Differently  
Multiple Representations of Unit Rates



Objective Using Ratio Reasoning to Convert Units

Warm-Up



Answer each question about a common measurement conversion.

1. How many inches are in 1 foot?
  
  
  
  
  
  
  
  
  
  
2. How many feet are in 1 yard?
  
  
  
  
  
  
  
  
  
  
3. How many grams are in 1 kilogram?

## GETTING STARTED

Customary to Whom?

You've learned about the relationships between inches and feet, feet and yards, quarts and gallons, meters and millimeters—to name a few.

1. Copy and complete the table. Name a U.S. customary system unit and a metric system unit that would be an appropriate size to measure each object or quantity.

| Object/Quantity                        | U.S. Customary System | Metric System |
|--|-----------------------|---------------|
| Your height                            |                       |               |
| Length of your pencil                  |                       |               |
| Distance from your school to the beach |                       |               |
| Weight of your math book               |                       |               |
| Amount of water in a bottle            |                       |               |
| Amount of water in a swimming pool     |                       |               |



You can use more than one measurement to describe the same length, weight, or capacity. For example, you may say that a football field is 100 yards long or 300 feet long. You could also say that the football field is about 90 meters long. In each case, the lengths are the same—you just say them in different ways.

There are many situations in which you need to convert measurements to different units. To convert a measurement means to change it to an equivalent measurement in different units.

1. Name a situation in which converting one measurement to another would be necessary or useful.

Before you start converting units, it is useful to estimate the number of units to expect in a conversion. A few estimates comparing common metric and U.S. customary measures are given.

- One meter is about the same length as one yard.
- One inch is about 2.5 centimeters.
- One kilometer is a little more than half of a mile.
- One foot is about 30 centimeters.
- One liter is about the same as one quart.
- One kilogram is a little more than 2 pounds.

Use the estimates given and your knowledge of metric and U.S. customary measures to answer each question.

2. The numeric value of which measurement will be greater?

a. The length of a table in inches or in feet

b. The length of a table in meters or in centimeters

c. The length of a table in meters or in yards

d. The distance from school to your house in miles or in kilometers

e. The weight of your math book in kilograms or in pounds

3. How did you decide which value would be greater in Question 2?

4. Estimate each measurement conversion.

a. The distance to Toronto is 548 km. About how many miles is that?

b. You order 5 kilograms of food pellets for your guinea pig. About how many pounds are you ordering?

5. Describe the strategies you used to estimate each measurement conversion in Question 4.

Because most conversions compare two quantities using multiplicative strategies, the conversion estimates provided and the conversions within systems that you already know can be written using ratio language. They can also be written symbolically in terms of equality.

| Ratio Language   | Symbolically           |
|--|------------------------|
| For every inch, there are approximately 2.5 centimeters. | 1 in. $\approx$ 2.5 cm |
| For every meter, there is approximately 1 yard.          | 1 m $\approx$ 1 yd     |
| For every foot, there are approximately 30 centimeters.  | 1 ft $\approx$ 30 cm   |
| For every 12 inches, there is exactly 1 foot.            | 12 in. = 1 ft          |
| For every 1 kilometer, there are exactly 1000 meters.    | 1 km = 1000 m          |

When a conversion ratio is presented for use in converting between units of measure, it is often written as an equation: 12 in. = 1 ft.

However, it can also be written as a ratio in fractional form:  $\frac{12 \text{ in.}}{1 \text{ ft}}$ .

6. Rewrite each common conversion using ratio language and as a ratio in fractional form.

a. 3 ft = 1 yd

b. 5280 ft = 1 mi

c. 1 lb  $\approx$  0.45 kg

d. 4 qt = 1 gal

e. 1 m = 100 cm

f.  $\frac{1}{1000}$  m = 1 mm

Because these measurement conversion are ratios, you can use ratio reasoning to convert between units. For example, you can determine the number of miles in a 10-kilometer race or the number of fluid ounces in 500 milliliters of a solution.



When you learned about ratios, you learned how to use double number lines to determine equivalent ratios. You can also use double number lines to convert from one unit to another.

Although you may not have realized it before, many rulers are set up as double number lines and can be used to convert between inches and centimeters.



1. Determine which scale represents inches and which represents centimeters. How did you decide? Label the scales on the ruler.

2. Use the ruler as a double number line to determine each approximate conversion.

a. 1 cm  $\approx$  \_\_\_\_\_ in.

b. 1 in.  $\approx$  \_\_\_\_\_ cm

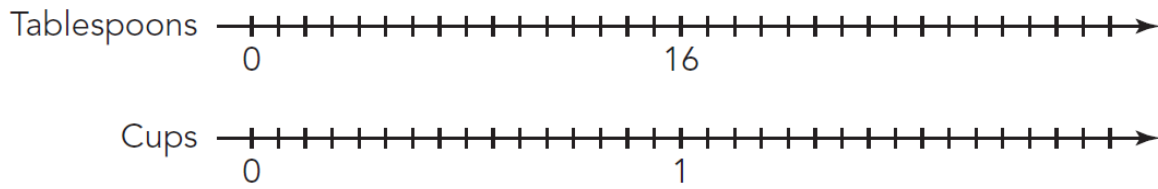
c. 5 cm  $\approx$  \_\_\_\_\_ in.

d. 3 in.  $\approx$  \_\_\_\_\_ cm



You are baking cookies at your friend's house. After searching the cupboards and drawers, you cannot find the measuring cups, but you can find the tablespoon.

3. Use the double number line to determine how many tablespoons you need of each ingredient in the recipe.



a. 2 cups of sugar

b.  $1\frac{3}{4}$  cups of flour

c.  $\frac{1}{2}$  cup of raisins

4. Suppose you had found the cup but not the tablespoon. Use the double number line to determine how many cups you need if the recipe calls for 2 tablespoons of vanilla extract.

You want to redecorate your bedroom and need to measure the room for new carpeting, paint, and a border on the walls. You realize that you have only a meter stick. You measure the room, but you need to know the dimensions in feet to purchase the materials. You record these measurements:

- The length of the room is 5 meters.
- The width of the room is 4 meters.
- The height of the room is 2.5 meters.

5. Use a double number line to determine the measurement of each dimension in feet.

a. length

b. width

c. height

**LESSON 6.1a**  
**Many Ways to Measure**

Objective

**Using Ratio Reasoning to Convert Units****Review**

1. At Union Middle School, 99 girls, or 33% of the girls, play basketball. How many girls attend Union Middle School?
2. Kasey gets a 35% employee discount on anything she buys at The Foot Parade. If Kasey got a \$5.25 discount on her new flip-flops, how much did they cost originally?
3. Mr. Hawkins manages a small store called Action Sporting Goods. He wants to make sure that his store is stocked with enough equipment for all of the community sports. He surveys 240 of his customers and asks them to choose the one sport that they're most likely to buy sports equipment for this season.

| Sport      | Percent of Responses |
|------------|----------------------|
| Basketball | 30%                  |
| Baseball   | 20%                  |
| Football   | 35%                  |
| Wrestling  | 15%                  |

- a. How many of the surveyed customers will need baseball equipment?
- b. How many of the surveyed customers will need wrestling equipment?

4. Estimate each quotient to the nearest whole number. Then calculate the quotient.
  - a.  $0.796 \div 9.95$
  - b.  $23.84 \div 6.4$

