Lesson 5
CONVERT MEASUREMENT UNITS

NY-6.RP.3, NY-6.RP.3d

INTRODUCTION

Real-World Connection

Jazmin wants to put wallpaper on a wall in her room. Her wall is 6 yards long and 3 yards high. The wallpaper she likes comes in rolls that are 24 inches wide and 30 feet long. She will hang the rolls vertically so that the stripes go up and down. She will not have any horizontal seams. How many rolls of wallpaper does she need? Let's practice the skills in the **Guided Instruction** and **Independent Practice** and, at the end of the lesson, figure out how many rolls of wallpaper Jazmin needs!

What I Am Going to Learn

- How to convert measurements to different units using conversion factors

- How to solve measurement problems involving measurement conversions

What I May Already Know

- I know how to convert among different measurement units in one system.

- I know how to use these conversions to solve measurement problems.

Vocabulary in Action

- **Conversion factors** are written as fractions equal to 1.

- The units in the numerator and denominator are equivalent.

- Example: There are 12 inches in 1 foot: $\frac{12 \text{ inches}}{1 \text{ foot}}$ and $\frac{1 \text{ foot}}{12 \text{ inches}}$

▶ TIPS AND HINTS

If the conversion is done correctly, the units that you are converting from should cancel out. The only remaining units should be the units you are converting to.

EXAMPLE

How many feet are in 15 yards?

We are converting yards to feet, and there are 3 feet in 1 yard, so use 3 feet per yard as the conversion factor.

$$5 \text{ yd} \times \frac{3 \text{ ft}}{1 \text{ yd}} = 15 \text{ ft}$$

Sometimes, you need to convert between more than one unit. You can multiply by several conversion factors because they are each equal to 1.

EXAMPLE

Sienna ran 1 mile in 8 minutes. What is her speed in yards per hour?

1 mile = 1,760 yards   60 minutes = 1 hour

$$\frac{1 \text{ mi}}{8 \text{ min}} \times \frac{1,760 \text{ yd}}{1 \text{ mi}} \times \frac{60 \text{ min}}{1 \text{ hr}} = 13,200 \text{ yards per hour}$$

Usain Bolt

Usain Bolt set a world record when he ran 100 meters in 9.58 seconds. That works out to 23.35 miles per hour.

If the units in the problem are different from the units required in the answer, then you will need to convert units.

EXAMPLE

Erin is making punch for a family party. Each batch calls for 3 cups of orange juice, 4 cups of guava nectar, and 8 cups of lemon-lime soda. If Erin makes 3 batches, how many quarts of punch will she have for the party?

3(3 cups + 4 cups + 8 cups) =

3 × 15 cups = 45 cups

There are 4 cups per quart:

$45 \text{ cups} \times \dfrac{1 \text{ qt}}{4 \text{ cups}} = 11\dfrac{1}{4} \text{ quarts}$

So, Erin will have $11\dfrac{1}{4}$ quarts of punch for the party.

◀ **TIPS AND HINTS**

When you are trying to decide which unit goes on top and which goes on the bottom for the conversion factor, think about the units that need to cancel.

Sometimes there will be a measurement in two units. You may need to do a conversion to simplify the answer.

EXAMPLE

Felix has a board that is 13 feet 6 inches long. He wants to cut the board in half to make 2 shelves. How long will each piece be?

Since 6 inches equals $\dfrac{1}{2}$ foot, or 0.5 foot, the board is 13.5 feet long.
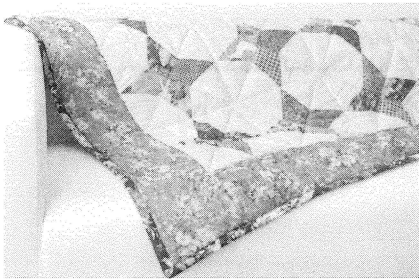
13.5 ÷ 2 = 6.75 ft

$0.75 \text{ ft} \times \dfrac{12 \text{ in.}}{1 \text{ ft}} = 9 \text{ inches}$. So, 6.75 feet = 6 feet 9 inches.

◀ **TIPS AND HINTS**

When converting 0.75 foot to inches, choose $\dfrac{12 \text{ in.}}{1 \text{ ft}}$ instead of $\dfrac{1 \text{ ft}}{12 \text{ in.}}$ because feet need to be in the denominator so they will cancel out with the feet in 0.75.

GUIDED INSTRUCTION

1. Fiona is buying fabric for a quilt and found 5 pieces that are each 1 foot 6 inches long. What is the total length of the fabric in feet and inches?

   Step One Find the total length of the 5 pieces together.

   1 ft 6 in. × 5 = 5 ft 30 in.

   Step Two Convert 30 inches to feet.

   $30 \text{ in.} \left(\frac{1 \text{ ft}}{12 \text{ in.}} \right) = 2.5 \text{ ft}$

   $2\frac{1}{2}$ ft = 2 ft 6 in.

   Step Three Add 2 feet 6 inches to 5 feet.

   5 ft + 2 ft 6 in. = 7 ft 6 in.

2. A 1-gallon container of limeade costs \$3.69. A 2-quart container costs \$2.59. Which is the better price per ounce?

   1 gal = 4 qt, 1 qt = 32 oz

   Step One Find the number of ounces in 1 gallon.

   $1 \text{ gal} \times \frac{4 \text{ qt}}{1 \text{ gal}} \times \frac{32 \text{ oz}}{1 \text{ qt}} = 128 \text{ oz}$

   Step Two Find the price per ounce.

   $\frac{\$3.69}{128 \text{ oz}} \approx \$0.03 \text{ per oz}$

   Step Three Find the number of ounces in the 2-quart container.

   $2 \text{ qt} \times \frac{32 \text{ oz}}{1 \text{ qt}} = 64 \text{ oz}$

   Step Four Find the price per ounce.

   $\frac{\$2.59}{64} \text{ oz} \approx \$0.04 \text{ per oz}$
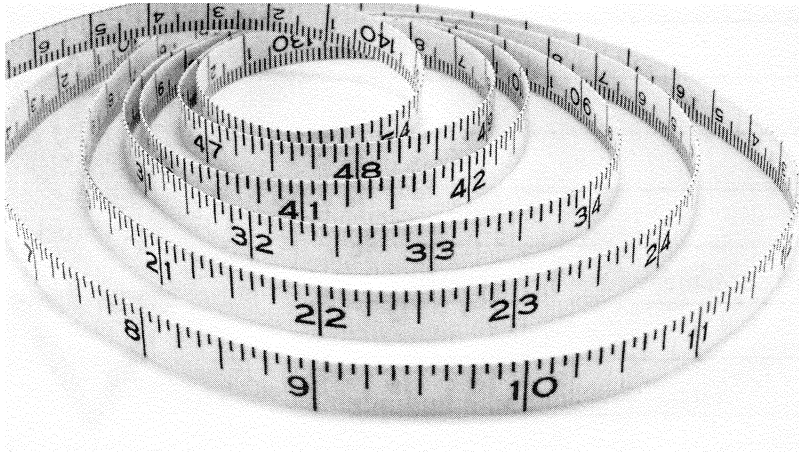
   Step Five Decide which container is sold at a better price.

   The 1-gallon container is a better choice because the limeade costs about \$0.03 per ounce. The limeade in the 2-quart container costs about \$0.04 per ounce.

3. Which measurement is less than 1 yard?

$$1 \text{ yard} = 3 \text{ feet}$$

Ⓐ 28 inches

Ⓑ 52 inches

Ⓒ 2 feet 18 inches

Ⓓ 4 feet

Learning Together

Working with a partner, design and create unit rate conversion bookmarks for each of you. Include length, capacity, and weight measurements for both customary and metric units. If possible, make your bookmark with a computer so you can easily fit a lot of information in a small space.
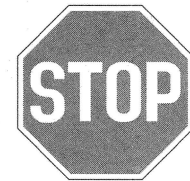
Length
12 in. = 1 ft
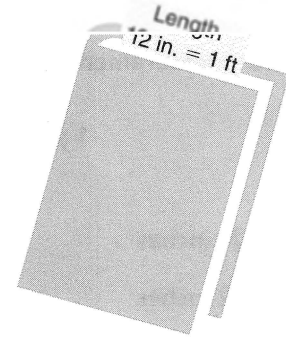
How Am I Doing?

What questions do you have?

How do you convert between units to solve measurement problems?

What is an example of when you needed to convert units? Have you ever needed to compare measurements that were in different units?

Circle the sign that shows how you are doing with the skill.

STOP

I am stuck.

YIELD

I almost have it.

I understand the skill.

INDEPENDENT PRACTICE 1

1 Doctors recommend drinking eight 8-ounce glasses of water each day. Which measurement matches that recommendation?

   A   2 quarts

   B   3 pints

   C   1 gallon

   D   10 cups

2 An 18-ton truck weighs 48 tons when hauling 15 cars in its trailer. What is the weight of each car?

   A   450 lb

   B   2,000 lb

   C   4,000 lb

   D   6,400 lb

3 One pipe is 18 inches long. Which expression can be used to find the length in feet of three pipes, arranged end-to-end without overlapping?

   A $18 \text{ in.} \times \dfrac{1 \text{ ft}}{12 \text{ in.}} \times 3$

   B $18 \text{ in.} \times \dfrac{1 \text{ ft}}{36 \text{ in.}} \times 3$

   C $18 \text{ in.} \times \dfrac{1 \text{ ft}}{12 \text{ in.}}$

   D $18 \text{ in.} \times \dfrac{12 \text{ in.}}{1 \text{ ft}} \times 3$

4 Chad and Ramos picked strawberries all morning. At the end of the morning, they combined their strawberries. Chad had 22.5 pounds of strawberries, and Ramos had 400 ounces. What is the total weight of their strawberries in pounds?

Show your work.

◀ **TIPS AND HINTS**

Both Chad and Ramos picked strawberries all morning. Would you estimate that they have similar amounts of strawberries or that one would have 20 times as many as the other?

Answer _____ pounds

Explain your answer.

_____

_____

_____

_____

_____

INDEPENDENT PRACTICE 2

1 Which price is less than $2.00 per inch?

1 yard = 3 feet

A   2.4 ft for $56.16

B   1.5 yd for $121.50

C   0.75 yd for $85.25

D   7 ft for $251.16

2 The weight limit for a shelf is 5 kilograms. How many 450-gram pots can sit on the shelf?

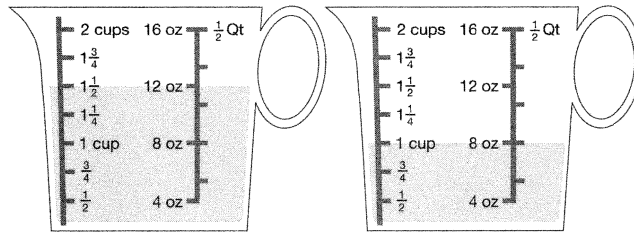1,000 grams = 1 kilogram

A   10

B   11

C   12

D   13

3 A recipe calls for $4\frac{1}{2}$ cups flour and 2.5 cups oats. Which proportion shows how to convert this total amount of ingredients to pints?

2 cups = 1 pint

A $\dfrac{4.5 \text{ cups}}{x} = \dfrac{2.5 \text{ cups}}{1 \text{ pint}}$

B $\dfrac{2 \text{ cups}}{1 \text{ pint}} = \dfrac{x}{7 \text{ pints}}$

C $\dfrac{7 \text{ cups}}{x} = \dfrac{1 \text{ pint}}{2 \text{ cups}}$

D $\dfrac{7 \text{ cups}}{x} = \dfrac{2 \text{ cups}}{1 \text{ pint}}$

4 A recipe calls for the liquid measurements shown below.

How many quarts of liquid are needed in the recipe?

$$4 \text{ cups} = 1 \text{ quart}$$

A $\dfrac{1}{2}$ **C** $\dfrac{3}{8}$

B $\dfrac{3}{5}$ **D** $\dfrac{5}{8}$

5 A student determined that there are 8,000 milliliters in 80 liters. Is the student correct? Why or why not?

$$1,000 \text{ milliliters} = 1 \text{ liter}$$

A Yes, that is correct, because $\dfrac{x \text{ mL}}{80 \text{ L}} = \dfrac{1,000 \text{ mL}}{1 \text{ L}}$

B Yes, that is correct, because $\dfrac{x \text{ mL}}{80 \text{ L}} = \dfrac{100 \text{ mL}}{1 \text{ L}}$

C No, that is incorrect, because $\dfrac{x \text{ mL}}{80 \text{ L}} = \dfrac{1,000 \text{ mL}}{1 \text{ L}}$

D No, that is incorrect, because $\dfrac{x \text{ mL}}{80 \text{ L}} = \dfrac{100 \text{ mL}}{1 \text{ L}}$

6 An industrial woodcutting machine is cutting a long piece of wood into 5-inch sections. The cut sections are then shaped to make shims. How long is the original piece of wood, in feet, if exactly 18 shims can be made from this piece?

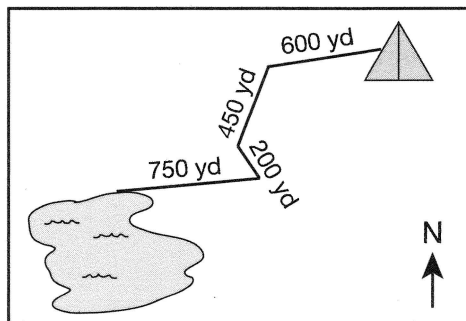$$12 \text{ inches} = 1 \text{ foot}$$

A 5

B $7\dfrac{1}{2}$

C 18

D 90

7 The map below shows the trail from the campsite to the lake.

What is the distance in miles from the campsite to the lake?

1,760 yards = 1 mile

A 0.5

B 0.88

C 1

D 1.14

8 Sarah is 145 centimeters tall. She writes the expression $145 \text{ cm} \times \frac{1 \text{ m}}{100 \text{ cm}}$ to find her height in meters. Joe writes the proportion $\frac{1 \text{ m}}{100 \text{ cm}} = \frac{x \text{ m}}{145 \text{ cm}}$ to find Sarah's height in meters. If Sarah and Joe perform the calculations correctly, who will find Sarah's correct height in meters?
100 centimeters = 1 meter

Explain your answer.

_____

_____

_____

_____

How tall is Sarah in meters?

Answer _____ meters

9 To escape the moon's gravity, a rocket must achieve a speed of about 1.5 miles per second. Determine how many miles per hour this is.

60 seconds = 1 minute; 60 minutes = 1 hour; 3,600 seconds = 1 hour

Show your work.

Answer _____ miles per hour

EXIT TICKET

Now that you have mastered measurement conversions, let's solve the problem in the
Real-World Connection. Jazmin wants to paper a wall that is 6 yards long and 3 yards high.
The wallpaper rolls are 24 inches wide and 30 feet long and should be hung vertically with
no horizontal seams. How many rolls of wallpaper does she need?

12 inches = 1 foot; 3 feet = 1 yard; 36 inches = 1 yard