Solve Word Problems Involving Conversions

Dear Family,

This week your child is learning how to solve word problems that involve converting units of measurement.

Your child might see a problem like the one below.

Laura is making punch for a party. The recipe calls for $3\frac{1}{2}$ cups of lemonade per batch. Laura wants to make 10 batches of punch. How many gallons of lemonade will she need to buy?

1 cup   1 gallon

1 gallon = 16 cups

The picture shows how cups and gallons are related.
You can see that gallons are larger units of measurement than cups.

The first step in solving the problem is to find how many cups are needed to make 10 batches of lemonade. Then you can convert cups to gallons.

- Multiply the number of cups needed for one batch by 10.

$$10 \times 3\frac{1}{2} = 10 \times \left(3 + \frac{1}{2}\right)$$
$$= 10 \times 3 + 10 \times \frac{1}{2}$$
$$= 30 + 5$$

  35 cups are needed for 10 batches. $= 35$

- Convert 35 cups to gallons.
  Divide the number of cups by 16. $35 \div 16 = 2\ R\ 3$

  35 cups is 2 gallons with 3 cups left over

The 3 cups left over means that Laura will need to buy another gallon of lemonade in addition to the 2 gallons. She will need to buy 3 gallons of lemonade in order to have enough to make 10 batches of punch.

Invite your child to share what he or she knows about solving word problems that involve converting units of measurement by doing the following activity together.

ACTIVITY USING CONVERSIONS IN WORD PROBLEMS

Do this activity with your child to solve word problems involving converting measurements.

Work with your child to make up and solve real-life problems involving converting units of measurement.

- Use the example below or use your own ideas. To convert units, you can use the equivalent units of measurement that are shown at the bottom of the page.

A sports-drink bottle holds 1 pint.

- Work together to create and solve problems about real-life situations.

  Example: Sally is bringing a sports drink to a team party. The coach asks her to bring $2\frac{1}{2}$ gallons of the sports drink. How many of the sports-drink bottles shown above will Sally need to bring?

1 gallon = 16 cups
1 gallon = 4 quarts
1 gallon = 8 pints
1 quart = 4 cups
1 pint = 2 cups
1 quart = 2 pints

1 liter = 1,000 milliliters

1 kilometer = 1,000 meters
1 meter = 100 centimeters
1 centimeter = 10 millimeters

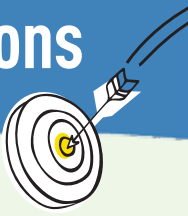| 1 mile = 1,760 yards |
| --- |
| 1 mile = 5,280 feet |
| 1 yard = 3 feet |
| 1 foot = 12 inches |

Answer to Example:

1 gallon = 8 pints; $8 \times 2\frac{1}{2} = 20$; Sally needs to bring 20 pints of the sports drink.
Since each bottle is 1 pint, she needs to bring 20 bottles.

Explore Solving Word Problems Involving Conversions

Previously, you converted among different measurement units. In this lesson, you will convert measurement units to solve multi-step, real-world problems. Use what you know to try to solve the problem below.

Learning Target
- Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.

SMP 1, 2, 3, 4, 5, 6, 7

Ray finds a log that is 90 inches long. He cuts the log into 2-foot pieces of wood to sell as firewood at his store. How many pieces of wood can Roy sell at his store using this log? (1 foot = 12 inches)

90 inches

TRY IT

Math Toolkit
- base-ten blocks
- number lines
- grid paper
- math reference sheet

DISCUSS IT

Ask your partner: Can you explain that again?

**Tell your partner:** I started by . . .

CONNECT IT

1 LOOK BACK

Explain how you found the number of 2-foot pieces of wood Roy will have to sell.

2 LOOK AHEAD

In the previous problem, you used more than one step to find a solution to a problem involving converting units of measure. You can start this type of problem in different ways. Consider this problem:

Look at the scale. How much more mass needs to be added to the left side in order to make the scale balance? (1 kilogram = 1,000 grams)
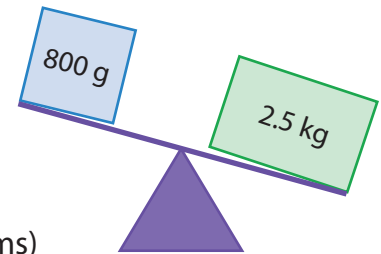
a. What should you do first to find how much more mass is needed to balance the scale?

b. Convert 2.5 kilograms to grams. What operation did you use? Convert 800 grams to kilograms. What operation did you use?

c. Choose one of the conversions from part b to solve the problem.

3 REFLECT

When you convert from grams to kilograms, do you end up with more units or fewer units? When you convert from kilograms to grams, do you end up with more units or fewer units? Why?

Prepare for Solving Word Problems Involving Conversions

1 Think about what you know about converting measurements. Fill in each box. Use words, numbers, and pictures. Show as many ideas as you can.

What Is It?	What I Know About It

convert

Examples	Examples	Examples

2 The statements **1 yard = 3 feet** and **1 foot = 12 inches** describe relationships among three units of length. How can you convert 5 yards to inches?

3 Solve the problem. Show your work.

Adela has a string that is 80 inches long. She cuts 3-foot pieces of the string to make necklaces. Each necklace will use one 3-foot piece. How many necklaces can Adela make using this string? (1 foot = 12 inches)

Solution ....

4 Check your answer. Show your work.

Develop Solving Multi-Step Word Problems with Conversions

Read and try to solve the problem below.

> Casey is making an exercise plan. She plans to walk a trail near her home 20 times each month. It takes 40 minutes to walk the trail. If Casey keeps the same pace, how many hours will she spend walking the trail each month? (1 hour = 60 minutes)

TRY IT

🧰 Math Toolkit
- base-ten blocks
- number lines
- grid paper
- clocks
- math reference sheet

DISCUSS IT

Ask your partner: How did you get started?

Tell your partner: I started by . . .

Explore different ways to understand converting a unit of time in order to solve a multi-step word problem.

Casey is making an exercise plan. She plans to walk a trail near her home 20 times each month. It takes 40 minutes to walk the trail. If Casey keeps the same pace, how many hours will she spend walking the trail each month? (1 hour = 60 minutes)

PICTURE IT

You can use a picture to understand the relationship between hours and minutes.
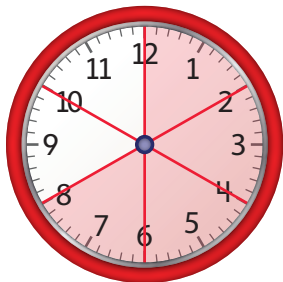
1 hour = 60 minutes

$$\frac{40 \text{ minutes}}{60 \text{ minutes}} = \frac{4}{6} = \frac{2}{3}$$

40 minutes is $\frac{2}{3}$ of an hour, or $\frac{2}{3}$ hour.

MODEL IT

You can write an equation to find the number of minutes Casey will walk the trail in one month.

Casey walks the trail in 40 minutes. To find the total number of minutes walked, *m,* multiply the number of minutes by the number of times Casey will walk the trail.

$$m = 40 \times 20$$
$$= 800$$

Casey will spend 800 minutes walking the trail each month.

CONNECT IT

Now you will use the problem from the previous page to help you understand how to convert minutes to hours to solve a multi-step word problem.

1 Why do you need to convert units of time in order to solve the problem?

2 Look at **Picture It**. You can convert minutes to hours before you multiply. What part of an hour is 40 minutes? How do you know?

3 Show how to find the number of hours Casey will walk the trail using your answer to problem 2. Explain why this method works.

4 Look at **Model It**. What operation do you use to convert 800 minutes to hours? Explain why and solve the problem.

5 How are the solution methods from **Picture It** and **Model It** alike and different?

6 REFLECT

Look back at your **Try It**, strategies by classmates, and **Picture It** and **Model It**. Which models or strategies do you like best for solving word problems involving converting units of time? Explain.

....

....

....

APPLY IT

Use what you just learned to solve these problems.

7 Elijah's dog needs 8 ounces of food per day. Elijah buys dog food by the pound. How many pounds of food does Elijah need to buy to feed his dog for 2 weeks? Show your work. (16 ounces = 1 pound and 1 week = 7 days)

Solution ....

8 Mr. Rubens has $4\frac{1}{2}$ quarts of watercolor paint. His class is making a mural. Each of the 20 students in his class will get 1 cup of paint. Does he have enough paint for all of his students? Show your work. (1 quart = 4 cups)

Solution ....

9 A lemur at a zoo has a mass of 3 kilograms, 630 grams. The zookeeper records the lemur's mass in grams. What will the zookeeper write for the mass of the lemur? Show your work. (1 kilogram = 1,000 grams)

Solution ....

Practice Solving Multi-Step Word Problems with Conversions

Study the Example showing how to solve a word problem by converting units. Then solve problems 1–5.

EXAMPLE

Michael is planning a party for 30 people. He plans for each guest to drink 1 cup of juice. He has $2\frac{1}{2}$ gallons of juice. Does he have enough juice for the party?

1 gallon = 16 cups, so cups are a smaller measurement unit than gallons.

Michael multiplies $2\frac{1}{2}$ by 16 to find the number of cups of juice he has.

$$2\frac{1}{2} \times 16 = \left(2 + \frac{1}{2}\right) \times 16$$
$$= 2 \times 16 + \frac{1}{2} \times 16$$
$$= 32 + 8$$
$$= 40$$

There are 40 cups of juice.

40 > 30, so Michael has enough juice for the party.

1 Juanita has $3\frac{1}{4}$ pounds of sugar. How many ounces of sugar does she have? Explain how you know. (1 pound = 16 ounces)

2 Benjamin rode the train for 45 minutes. Then it took him another 30 minutes to walk to his friend's house. How many hours did he spend riding and walking to his friend's house? Explain how you know. (1 hour = 60 minutes)

3 Ms. Monet, the art teacher at Giverny School, has $3\frac{1}{2}$ quarts of liquid glue and 24 empty glue bottles that each hold 1 cup. Does she have enough glue to fill all of the bottles? Explain. (1 quart = 4 cups)

4 Ms. Monet gave $2\frac{1}{2}$ cups of red paint to each of her 20 students. How many quarts of red paint did she give out? Show your work. (1 quart = 4 cups)

Solution ....

5 Ms. Monet is combining 15 cups of green paint with 15 cups of white paint. She is pouring the paint mixture into empty quart bottles. How many quart bottles does she need? Explain. Show your work. (1 quart = 4 cups)

Solution ....

....

....

....

Develop Choosing a Unit to Solve a Word Problem

Read and try to solve the problem below.

> **Heather and Diego measure worms from their class compost bin. Heather measures a 3.5-centimeter worm and Diego measures a 28-millimeter worm. Which worm is longer? How much longer is the longer worm? (10 millimeters = 1 centimeter)**

TRY IT

Math Toolkit
- base-ten blocks
- base-ten grid paper
- number lines
- centimeter rulers
- math reference sheet

DISCUSS IT

**Ask your partner:** Do you agree with me? Why or why not?

Tell your partner: I agree with you about . . . because . . .

Explore different ways to understand solving a word problem by choosing a unit to convert.

> **Heather and Diego measure worms from their class compost bin. Heather measures a 3.5-centimeter worm and Diego measures a 28-millimeter worm. Which worm is longer? How much longer is the longer worm? (10 millimeters = 1 centimeter)**

PICTURE IT

You can use a picture to help understand the relationship between centimeters and millimeters.

centimeters

| 0 | 1 | 2 | 3 | 4 | 5 |

| 0 | 10 | 20 | 30 | 40 | 50 |
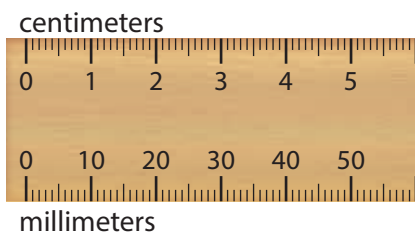
millimeters

There are 10 millimeters in each centimeter.

MODEL IT

You can write equations to convert centimeters to millimeters or millimeters to centimeters.

To compare the lengths, the measurements need to be in the same unit.

Convert centimeters to millimeters:

There are 10 millimeters in each centimeter.

$$3.5 \times 10 = 35$$

3.5 centimeters is 35 millimeters.

Convert millimeters to centimeters:

There are 10 millimeters in each centimeter.

$$28 \div 10 = 2.8$$

28 millimeters is 2.8 centimeters.

CONNECT IT

Now you will use the problem from the previous page to help you understand how to solve the problem by choosing a unit to convert.

1 Why do you need to convert one of the units of measure to solve the problem?

2 Why do you multiply to convert centimeters to millimeters?

Why do you divide to convert millimeters to centimeters?

3 Who measured the longer worm? How much longer was it? Explain how you know.

4 Look at the problem wording again. Why can you give the answer in millimeters or centimeters?

5 REFLECT

Look back at your **Try It**, strategies by classmates, and **Picture It** and **Model It**. Which models or strategies do you like best for choosing a unit to convert? Explain.
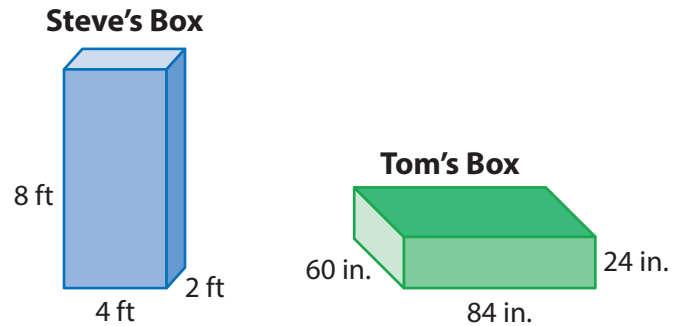
....

....

....

APPLY IT

Use what you just learned to solve these problems. Refer to the Math Reference Sheet as necessary.

Steve's Box

6 Steve and Tom each build a box. Who builds a box with a greater volume? How much greater is the volume? Show your work.

8 ft
2 ft
4 ft

Tom's Box

60 in.
24 in.
84 in.

Solution ....

7 A tree in Kenji's backyard is 6.7 meters tall. A tree in Cho's backyard is 730 centimeters tall. Which tree is taller? How much taller? Show your work.

Solution ....

8 A rectangular coffee table is $1\frac{2}{3}$ yards long and 2 feet wide. Which of the following show the perimeter of the tabletop?

   Ⓐ $3\frac{2}{3}$ yards

   Ⓑ 14 feet

   Ⓒ 7 feet

   Ⓓ $\frac{14}{3}$ yards

   Ⓔ $4\frac{2}{3}$ yards

Practice Choosing a Unit to Solve a Word Problem

**Study the Example showing how to compare measurements in different units.
Then solve problems 1–6.**

EXAMPLE

Ryan and Layla measured the length of their hermit crabs. Ryan measured his crab to be 34 millimeters. Layla measured her crab to be 2.8 centimeters. Who has the longer crab? (1 centimeter = 10 millimeters)

34 millimeters
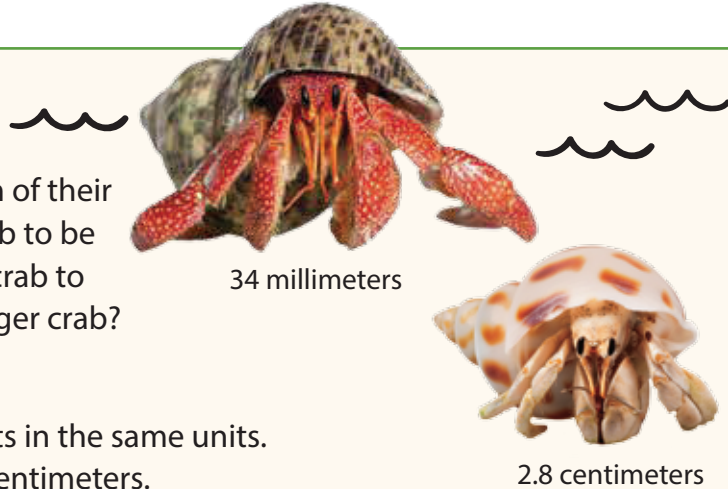
2.8 centimeters

It is easier to compare measurements in the same units. You can compare in millimeters or centimeters.

To compare the crabs in millimeters, convert the length of Layla's crab into millimeters. To convert from centimeters to millimeters, use multiplication:
2.8 centimeters × 10 = 28 millimeters
Layla's crab is 28 millimeters long.

    34 millimeters > 28 millimeters

Ryan has the longer crab.

1   Which is the smaller unit, centimeters or millimeters? ....

2   In the Example, multiplication was used to convert centimeters to millimeters. What operation would you use to convert millimeters to centimeters? ....

3   Look at the Example. Ryan and Layla's friend Jan also has a hermit crab. Jan measures her hermit crab to be 3.3 centimeters long.

   a. Who has the longer crab, Jan or Layla? ....

   b. Who has the longer crab, Jan or Ryan? ....
      Show your work.

4 Geno's hamster Zippy ran in her hamster wheel for 48 seconds, stopped to drink water, and then ran in the wheel for another $2\frac{1}{2}$ minutes. How long did Zippy run in all? Show your work. (1 minute = 60 seconds)

Solution

5 Diego has two guinea pigs, Pia and Zia. Pia weighs $1\frac{3}{4}$ pounds. Zia weighs 32 ounces. Who weighs more? How much more? Show your work. (1 pound = 16 ounces)

Solution

6 The perimeter of a rectangular table is 18 feet. The table is 42 inches wide. Which of the following show the length of the table? (1 foot = 12 inches)

Ⓐ 6 feet

Ⓑ 60 inches

Ⓒ 66 inches

Ⓓ 5 feet

Ⓔ $5\frac{1}{2}$ feet

Refine Solving Word Problems Involving Conversions

Complete the Example below. Then solve problems 1–8, using the Math Reference Sheet as necessary.

EXAMPLE

Pierre is 53 inches tall. Pilar is 5 feet tall. Who is shorter? How much shorter is the shorter person?

Look at one way you could explain your work using conversions.

12 inches = 1 foot, so multiply 5 by 12.

5 × 12 = 60

60 − 53 = 7

Solution ....

> The student used the relationship between feet and inches to solve the problem.

PAIR/SHARE
How could you answer this question in feet?

APPLY IT

1 Venell put together a model train with 25 train cars. Each train car is 80 millimeters long. How many meters long is Venell's model train if there are no gaps between the cars? Show your work.

> Which is the larger unit, meters or millimeters?

Solution ....

PAIR/SHARE
There are 100 centimeters in 1 meter. How long is the train in centimeters?

2 Ed solved a puzzle $\frac{3}{4}$ minute faster than Brett. Brett solved the puzzle in 135 seconds. How long did it take Ed to solve the puzzle? Show your work.

How many seconds are in one minute?

Solution ....

PAIR/SHARE

How can you use a clock to find the number of seconds in $\frac{3}{4}$ minute?

3 Bennett exercises by lifting weights. He can lift 200 pounds 3 times without resting between lifts. Which equation shows a correct way to find the total number of ounces, *n*, he can lift without resting?

Does Bennett lift a greater number of pounds or a greater number of ounces?

Ⓐ $n = (200 \times 3) \div 16$

Ⓑ $n = (200 \div 16) \times 3$

Ⓒ $n = (200 \times 3) \times 16$

Ⓓ $n = (16 \div 3) \times 200$

Jory chose Ⓐ as the correct answer. How did he get that answer?

PAIR/SHARE

Does Jory's answer make sense?

4   A football field is marked every 5 yards. Garrett ran from the first mark to the eleventh mark. Which expression can you use to find the number of feet Garrett ran?

Ⓐ $(10 \times 5) \div 3$

Ⓑ $(10 \div 5) \div 3$

Ⓒ $(10 \times 5) \times 3$

Ⓓ 5×3

5   Mr. Wayne's class collected empty soda cans for a recycling project. Each of the 20 students had to collect 40 cans. Each can has a mass of 15 grams. How many kilograms of cans did the class collect to recycle?

Ⓐ 0.6 kilogram

Ⓑ 12 kilograms

Ⓒ 12,000 kilograms

Ⓓ 12,000,000 kilograms

6   Susan is stacking boxes on a shelf. Each box is shaped like a rectangular prism and has a length of 2 feet, a width of 15 inches, and a height of 3 inches, as shown below at the left.

Susan will stack the boxes on top of each other, as shown below at the right.

The space above the shelf is $1\frac{1}{2}$ yards high.

What is the greatest number of boxes that Susan can stack on the shelf?

3 in.   15 in.   2 ft
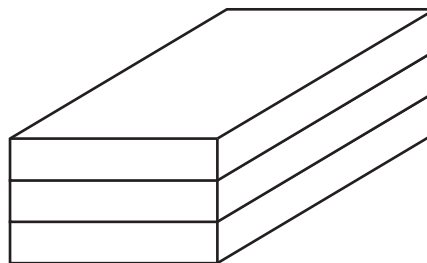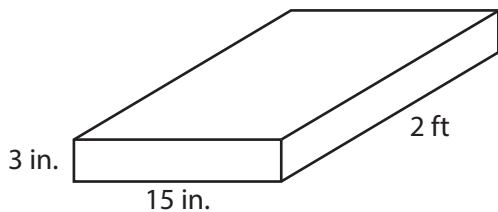
.... boxes

7 Emma keeps track of the time she spends on a report each week.

Week 1: $1\frac{1}{2}$ hours research, $\frac{3}{4}$ hour reading, and 45 minutes on outline

Week 2: $2\frac{1}{4}$ hours writing, 45 minutes editing, and $\frac{1}{2}$ hour on cover

Part A How much time did Emma spend on her report the first week?
Show your work.

Solution ....

Part B How much more time did Emma spend on the report the
second week than she spent the first week? Show your work.

Solution ....

8 MATH JOURNAL

Teresa has 800 milliliters of water. Sara has 5 liters of water. Without converting
units, tell why Sara has more water than Teresa. Then show how much more water
Sara has.

☑ SELF CHECK Go back to the Unit 4 Opener and see what you can check off.