Lesson 3

Converting Units

Goals

- Choose a strategy to solve problems involving unit conversions. Create a double number line diagram, a table, or another representation as needed.
- Explain (orally) how to use a "rate per 1" to solve problems involving unit conversion.
- Recognize that when we measure things in two different units, the pairs of measurements are equivalent ratios.

Learning Targets

- I can convert measurements from one unit to another, using double number lines, tables, or by thinking about "how much for 1."
- I know that when we measure things in two different units, the pairs of measurements are equivalent ratios.

Access for Students with Diverse Abilities

- Action and Expression (Warm-up)
- Engagement (Activity 2)
- Representation (Activity 3)

Access for Multilingual Learners

- MLR2: Collect and Display (Activity 2)
- MLR7: Compare and Connect (Activity 1)
- MLR8: Discussion Supports (Warm-up)

Instructional Routines

- Math Talk
- MLR7: Compare and Connect

Required Materials

Materials to Gather

- Four-function calculators: Activity 3

Lesson Narrative

In this lesson, students convert units of measurement by reasoning about ratios. The goal is to see that when a quantity is measured in two different units, the pairs of measurements form equivalent ratios. Students also begin to think about "rates per 1" in this context and consider how these can help with unit conversion. The reasoning here serves as a transition for understanding unit rates more broadly in future lessons.

In earlier grades, conversion work was limited to units in the same system of measurement. Here, students convert units that may be in different systems. In one activity, the context of comparing speeds (in miles per hour and kilometers per hour) motivates the conversion between miles and kilometers. In another activity, students convert between kilograms and pounds.

The last activity is optional. It offers a chance to convert between units of volume—cups and tablespoons—in a cooking context.

Lesson Timeline

Warm-up	Activity 1	Activity 2	Activity 3	Lesson Synthesis	Assessment: Cool-down
10 min	15 min	10 min	15 min	10 min	5 min

Lesson 3

Converting Units

Lesson Narrative (continued)

In solving problems, students may use double number line diagrams, tables, or no particular representations. They may relate the units in terms of multiplication and division, for instance. Although students can opt for any strategy that makes sense to them, they should have opportunities to see pairs of measurements represented in different ways and to make connections. This would reinforce the idea of equivalent ratios and prompt students to look for and make use of structure.

Student Learning Goal

Let's convert measurements to different units.

Warm-up
Number Talk: Fractions of a Number

10 min

Activity Narrative

This *Math Talk* focuses on finding a fraction of a whole number. It encourages students to rely on what they know about fractions and the relationship between multiplication and division to mentally solve problems. The understanding elicited here will be helpful later in the lesson when students solve rate problems involving fractional values.

Launch

Tell students to close their books or devices (or to keep them closed). Reveal one problem at a time. For each problem:

- Give students quiet think time, and ask them to give a signal when they have an answer and a strategy.
- Invite students to share their strategies, and record and display their responses for all to see.
- Use the questions in the activity synthesis to involve more students in the conversation before moving to the next problem.

Keep all previous problems and work displayed throughout the talk.

Student Task Statement

Find the values mentally.

A. $\frac{1}{4}$ of 32

8

Sample reasoning:

- A fourth of 32 is the same as $32 \div 4$, which is 8.
- $\frac{1}{4}$ of 32 is $\frac{1}{4} \cdot 32$, which is $\frac{32}{4}$, or 8.

B. $\frac{3}{4}$ of 32

24

Sample reasoning:

- If a fourth of 32 is 8, then three-fourths of 32 is 3 times 8, which is 24.
- $32 \div 4 \cdot 3 = 24$
- One of the factors in $\frac{1}{4} \cdot 32$ tripled and the other remained constant, so the product triples. $8 \cdot 3 = 24$

C. $\frac{3}{8}$ of 32

12

Sample reasoning:

- $32 \div 8 \cdot 3 = 12$
- Because $\frac{3}{8}$ is half of $\frac{3}{4}$, the product is half of the product in the second problem. Half of 24 is 12.

Instructional Routines

Math Talk

ilclass.com/r/10694967

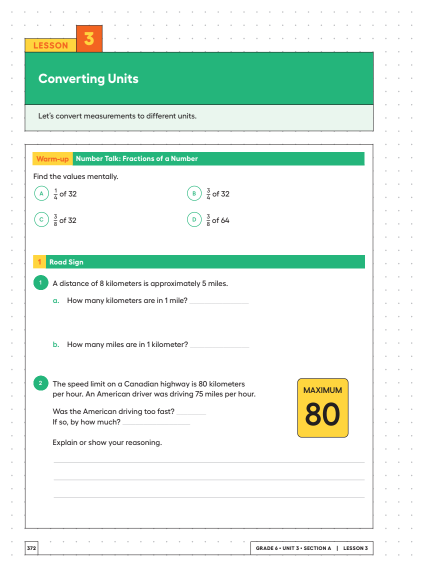
Please log in to the site before using the QR code or URL

Access for Students with Diverse Abilities (Warm-up, Student Task)

Action and Expression: Internalize Executive Functions.
To support working memory, provide students with access to sticky notes or mini whiteboards.

Supports accessibility for: Memory, Organization

Student Workbook


LESSON 3

Converting Units

Let's convert measurements to different units.

Warm-up Number Talk: Fractions of a Number

Find the values mentally.

A $\frac{1}{4}$ of 32
B $\frac{3}{4}$ of 32
C $\frac{3}{8}$ of 32
D $\frac{3}{8}$ of 64

1 Road Sign

1 A distance of 8 kilometers is approximately 5 miles.

a. How many kilometers are in 1 mile? ____

b. How many miles are in 1 kilometer? ____

2 The speed limit on a Canadian highway is 80 kilometers per hour. An American driver was driving 75 miles per hour.

Was the American driving too fast? ____
If so, by how much? ____

Explain or show your reasoning.

MAXIMUM 80

372 GRADE 6 • UNIT 3 • SECTION A | LESSON 3

Access for Multilingual Learners (Warm-up, Synthesis)

MLR8: Discussion Supports. Display sentence frames to support students when they explain their strategy. For example, "First, I ___ because ..." or "I noticed ___ so I ..." Some students may benefit from the opportunity to rehearse what they will say with a partner before they share with the whole class.

Advances: Speaking, Representing

Access for Multilingual Learners (Activity 1)

This activity uses the *Compare and Connect* math language routine to advance representing and conversing as students use mathematically precise language in discussion.

D. $\frac{3}{8}$ of 64

24

Sample reasoning:

- $64 \div 8 \cdot 3 = 24$
- One factor doubled from the previous problem and the other stayed the same, so the product doubles. $12 \cdot 2 = 24$

Activity Synthesis

To involve more students in the conversation, consider asking:

"Who can restate ___'s reasoning in a different way?"

"Did anyone use the same strategy but would explain it differently?"

"Did anyone solve the problem in a different way?"

"Does anyone want to add on to ___'s strategy?"

"Do you agree or disagree? Why?"

"What connections to previous problems do you see?"

Make sure students see that finding a fraction of a number involves multiplication and that it can be done by multiplying, dividing, or both.

Activity 1

Road Sign

15 min

Activity Narrative

The purpose of this activity is to help students understand that when a quantity is measured in two different units, the two measurements form a ratio. We can convert from one unit to the other by using what we know about equivalent ratios, including the strategies and representations for reasoning about them.

Though the term "unit rate" is not yet used in this lesson, students interact with the idea that any ratio $a:b$ has two associated unit rates: $\frac{a}{b}$ and $\frac{b}{a}$, each with a particular meaning in the context. Here, students reason that since there are 8 kilometers in approximately 5 miles, there are $\frac{8}{5}$ kilometers in 1 mile, and there are $\frac{5}{8}$ of a mile in one kilometer.

Students can then choose to use familiar reasoning strategies or either of the unit rates to solve a problem about constant speed. Monitor for students who use the following strategies to determine whether 75 miles per hour is faster than 80 kilometers per hour:

- Finding a ratio that is equivalent to 5 miles to 8 kilometers and has 75 for the distance in miles, and then comparing the corresponding distance in kilometers (120) to 80 kilometers.
- Finding a ratio that is equivalent to 5 miles to 8 kilometers and has 80 for the distance in kilometers, and then comparing the corresponding distance in miles (50) to 75 miles.

- Converting 80 kilometers to miles by multiplying 80 by $\frac{5}{8}$, the amount of miles in 1 kilometer, and comparing the result (50) to 75 miles.
- Converting 75 miles to kilometers by multiplying 75 by $\frac{8}{5}$, the amount of kilometers in 1 mile, and comparing the result (120) to 80 kilometers.

Students may use a double number line diagram, a table, or equations with any of these strategies.

Launch

Display the image from the task statement for all to see. Tell students that it is a traffic sign, and ask students to explain what it means. They will likely guess that it is a speed limit sign and assume it means 80 miles per hour. If no students mention that the limit could be in a different unit, ask students about it. Then, explain that in countries that use mainly the metric system, such as Canada and Mexico, speed limits are posted in kilometers per hour.

Give students 2 minutes of quiet work time, and ask them to pause after the first question. Ensure that everyone has correct answers for the first question before proceeding with the second question.

Select work from students with different strategies, such as those described in the *Activity Narrative*, to share later.

Student Task Statement

1. A distance of 8 kilometers is approximately 5 miles.

   a. How many kilometers are in 1 mile?

   About $\frac{8}{5}$ or 1.6 kilometers

   b. How many miles are in 1 kilometer?

   About $\frac{5}{8}$ or 0.625 miles

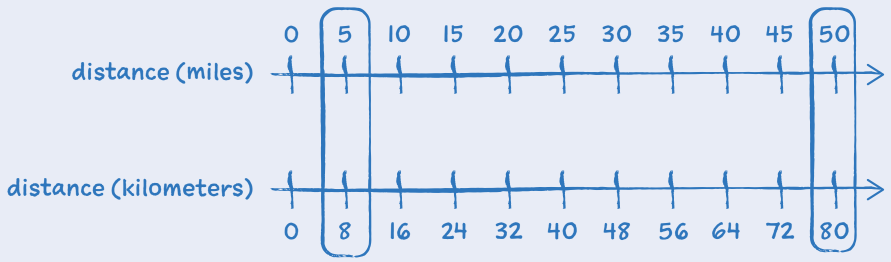
2. The speed limit on a Canadian highway is 80 kilometers per hour. An American driver was driving 75 miles per hour.

   Was the American driving too fast? If so, by how much? Explain or show your reasoning.

   Yes, the American was driving too fast, by 25 miles per hour or 40 kilometers per hour.

   Sample reasoning:

   - 80 kilometers is $10 \cdot 8$, so the speed limit in miles is $10 \cdot 5$ or 50 miles per hour. If the driver was traveling 75 miles per hour, that is 25 miles per hour faster than the speed limit.



Instructional Routines

MLR7: Compare and Connect

ilclass.com/r/10695592

Please log in to the site before using the QR code or URL

Building on Student Thinking

If students are unsure about finding the value of 5 ÷ 8 or 8 ÷ 5 in decimal form, encourage them to express the quotient in fraction form.

Instructional Routines

MLR2: Collect and Display

ilclass.com/r/10690754

Please log in to the site before using the QR code or URL

- 75 miles is 120 kilometers so the driver was driving 120 kilometers per hour, which is 40 kilometers per hour more than the speed limit of 80 kilometers per hour.

distance (miles)	distance (kilometers)
5	8
25	40
75	120

Activity Synthesis

Focus discussion on different approaches to the second question. The goal is to highlight that the same distance measured in miles and in kilometers form a ratio, and that we can use equivalent ratios to convert from one unit to the other. This includes using associated rates per 1 mile and per 1 kilometer. Display 2–3 approaches from previously selected students for all to see. If time allows, invite students to briefly describe their approaches.

Then use *Compare and Connect* to help students compare, contrast, and connect the different approaches. Here are some questions for discussion:

"What do the approaches have in common? How are they different?"

"How does the ratio of miles to kilometers show up in each method?"

During discussions, encourage students to explain the meaning of any numbers used and the reason for using particular operations. For example, if students multiplied 80 by $\frac{5}{8}$, ask them to explain what $\frac{5}{8}$ means in this situation and why they decided to multiply 80 by it. Consider displaying and using representations such as double number line diagrams or tables to facilitate these explanations.

Activity 2

Veterinary Weights

10 min

Activity Narrative

In this activity, students convert between pounds and kilograms. It gives students another opportunity to see that the strategies for reasoning with equivalent ratios can be used to convert from one measurement unit to another.

Some students may apply insights from the activity about distance in miles or kilometers and use unit rates ($\frac{10}{22}$ kilogram per 1 pound and $\frac{22}{10}$ pounds per 1 kilogram) to perform the conversions. This is also fine, but note that unit rates are not the focus here and will be studied more closely in upcoming lessons.

Monitor for students who use different representations and strategies, and select them to share later.

Launch

Ask students to recall which is heavier: 1 pound or 1 kilogram? (1 kilogram) Tell them that in this activity, they will be given weights in pounds and asked to express those weights in kilograms, and also the other way around.

Give students 3–4 minutes of quiet think time and then time to share their responses with a partner. Follow with a whole-class discussion.

Student Task Statement

A veterinarian uses weights in kilograms to figure out what dosages of medicines to prescribe for animals. For every 10 kilograms, there are 22 pounds.

1. Calculate each animal's weight in kilograms. Explain or show your reasoning. If you get stuck, consider drawing a double number line diagram or table.

   Sample reasoning for each part:

   There are $\frac{10}{22}$ kilograms per pound, so I can multiply by $\frac{10}{22}$ to convert from pounds to kilograms.

   a. Fido the Labrador weighs 88 pounds.

   40 kilograms

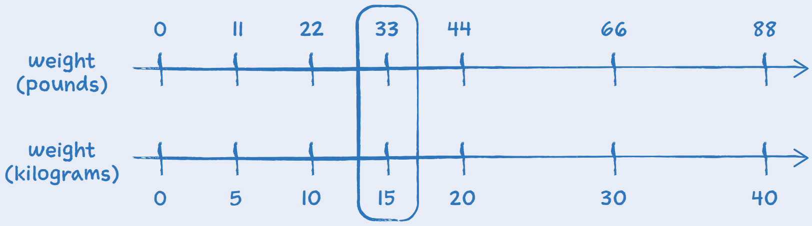
   Sample reasoning:

   88 is 4 times 22, so the weight in kilograms is 4 times 10, which is 40.

   b. Spot the Beagle weighs 33 pounds.

   15 kilograms

   Sample reasoning:



   c. Bella the Chihuahua weighs $5\frac{1}{2}$ pounds.

   $2\frac{1}{2}$ kilograms

   Sample reasoning:

weight (pounds)	weight (kilograms)
22	10
11	5
$5\frac{1}{2}$	$2\frac{1}{2}$

Access for Multilingual Learners (Activity 2, Student Task)

MLR2: Collect and Display.
Circulate, listen for, and collect the language that students use as they convert from pounds to kilograms, and vice versa. On a visible display, record words and phrases such as "The ratio 22 to 10 is equivalent to 88 to 40," "22 pounds for every 10 kilograms," "$\frac{22}{10}$ (or $\frac{11}{5}$) pounds in 1 kilogram," "2.2 pounds per kilogram," and "$\frac{10}{22}$ (or $\frac{5}{11}$) kilogram per pound." Invite students to borrow language from the display as needed, and update it throughout the lesson.

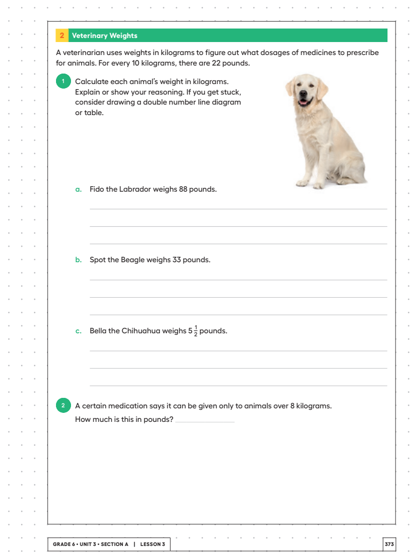
Advances: Conversing, Reading

Access for Students with Diverse Abilities (Activity 2, Student Task)

Engagement: Develop Effort and Persistence.
Chunk this task into more manageable parts. For example, ask students to first create a table or double number line diagram to represent the ratio in the situation. Then ask them how the representation could help them convert each dog's weight from pounds to kilograms. After that, ask students to complete the last question. Check in with students to provide feedback and encouragement after each chunk.

Supports accessibility for: Attention, Social-Emotional Functioning

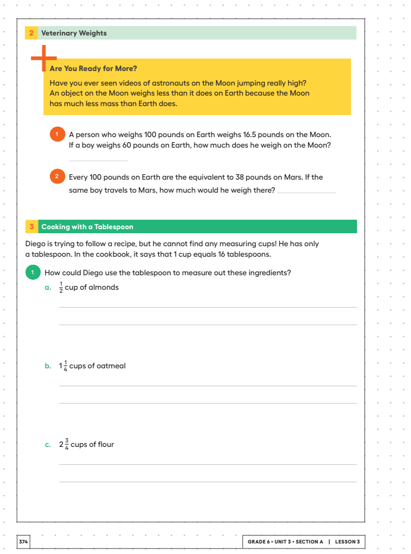
Student Workbook



Building on Student Thinking

Students working with the unit rate $\frac{10}{22}$ may want to convert it to a decimal and might get bogged down. Encourage them to work with the fraction, reviewing strategies for multiplying by a fraction as necessary.

Student Workbook


2 Veterinary Weights

Are You Ready for More?

Have you ever seen videos of astronauts on the Moon jumping really high? An object on the Moon weighs less than it does on Earth because the Moon has much less mass than Earth does.

1. A person who weighs 100 pounds on Earth weighs 16.5 pounds on the Moon. If a boy weighs 60 pounds on Earth, how much does he weigh on the Moon? ______

2. Every 100 pounds on Earth are the equivalent to 38 pounds on Mars. If the same boy travels to Mars, how much would he weigh there? ______

3 Cooking with a Tablespoon

Diego is trying to follow a recipe, but he cannot find any measuring cups! He has only a tablespoon. In the cookbook, it says that 1 cup equals 16 tablespoons.

1. How could Diego use the tablespoon to measure out these ingredients?

a. $\frac{1}{2}$ cup of almonds

b. $1\frac{1}{4}$ cups of oatmeal

c. $2\frac{3}{4}$ cups of flour

374 GRADE 6 • UNIT 3 • SECTION A | LESSON 3

2. A certain medication says it can be given only to animals over 8 kilograms. How much is this in pounds?

17.6 pounds (or equivalent)

Sample reasoning: Since 10 kilograms is 22 pounds, 1 kilogram is $\frac{22}{10}$ pounds and 8 kilograms is $8 \cdot \frac{22}{10}$, which is $\frac{176}{10}$ or 17.6 pounds.

Students may also reason about all questions using a table, with or without identifying unit rates:

weight (pounds)	weight (kilograms)
22	10
88	40
11	5
33	15
$\frac{11}{2}$	$\frac{5}{2}$
$\frac{22}{10}$	1
$\frac{88}{5}$ or 17.6	8

Are You Ready for More?

Have you ever seen videos of astronauts on the Moon jumping really high? An object on the Moon weighs less than it does on Earth because the Moon has much less mass than Earth does.

1. A person who weighs 100 pounds on Earth weighs 16.5 pounds on the Moon. If a boy weighs 60 pounds on Earth, how much does he weigh on the Moon?

   The boy weighs 9.9 pounds on the Moon.

2. Every 100 pounds on Earth are the equivalent to 38 pounds on Mars. If the same boy travels to Mars, how much would he weigh there?

   The boy would weigh 22.8 pounds on Mars.

Activity Synthesis

Invite previously selected students to share. Highlight approaches that involve reasoning about equivalent ratios. Consider displaying a double number line diagram or a table of equivalent ratios to help students attend to the meaning of the numbers and the operations used.

For example, when discussing the last question, consider using a table to show that multiplying both 22 pounds and 10 kilograms by $\frac{1}{10}$ (or dividing both values by 10) gives the number of pounds in 1 kilogram. Multiplying that number by 8 gives the number of pounds in 8 kilograms.

weight (pounds)	weight (kilograms)
22	10
$\frac{22}{10}$ or 2.2	1
$\frac{176}{10}$ or 17.6	8

If any student used the unit rate $\frac{10}{22}$ kilogram per pound, consider pointing out that this value is a common approximation of the conversion factor from pounds to kilograms and not the true conversion factor.

Access for Students with Diverse Abilities (Activity 3, Launch)

Representation: Internalize Comprehension.
Activate or supply background knowledge. For students who are unfamiliar with standard baking units, have measuring cups and tablespoons available to see.

Supports accessibility for: Conceptual Processing, Language

Activity 3: Optional
Cooking with a Tablespoon

15 min

Activity Narrative

In this activity, students practice converting between two units in a cooking context. The conversion factor between cups and tablespoons is given in the form of a unit rate, 16 tablespoons for 1 cup. Students will need to decide whether to multiply or divide by the unit rate, and might choose to create a double number line diagram or a table to support their reasoning. Several of the measurements include fractions, giving students an opportunity to practice grade 5 operations with fractions, such as multiplying mixed numbers by whole numbers and dividing whole numbers that result in fractions.

Launch

Tell students that they will now convert between tablespoons and cups. Just as with pairs of weights in pounds and kilograms, these pairs of tablespoons and cups can also be thought of as equivalent ratios. Welcome any strategies for reasoning about equivalent ratios, but encourage students to find efficient methods using multiplication and division.

Give students quiet think time to complete the activity and then time to share their explanation with a partner. Follow with a whole-class discussion.

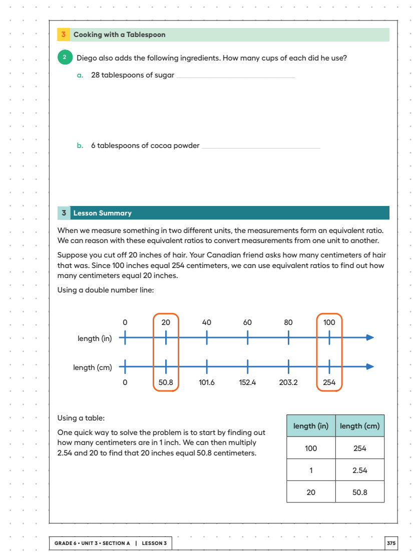
Building on Student Thinking

Students may answer "zero cups" for the last question, because it is less than one. Ask them to consider what fraction of a cup would be equivalent to 6 tablespoons.

Students may know that they can multiply the measurements given in cups by 16 to find the equivalents in tablespoons but not recall how to multiply a whole number and a mixed number. Remind students that they could reason separately about the whole number and the fraction in a mixed number. Consider asking, for instance:

> *"How would you find the number of tablespoons in 1 cup?"*
>
> $1 \cdot 16$ or 16
>
> *"What about in $\frac{1}{4}$ cup?"*
>
> $\frac{1}{4} \cdot 16$ or 4
>
> *"How might these help you find the number of tablespoons in $1\frac{1}{4}$ cups?"*
>
> Add them: $16 + 4 = 20$

Student Workbook



3 Cooking with a Tablespoon

2 Diego also adds the following ingredients. How many cups of each did he use?

a. 28 tablespoons of sugar ______

b. 6 tablespoons of cocoa powder ______

3 Lesson Summary

When we measure something in two different units, the measurements form an equivalent ratio. We can reason with these equivalent ratios to convert measurements from one unit to another.

Suppose you cut off 20 inches of hair. Your Canadian friend asks how many centimeters of hair that was. Since 100 inches equal 254 centimeters, we can use equivalent ratios to find out how many centimeters equal 20 inches.

Using a double number line:

Using a table:

One quick way to solve the problem is to start by finding out how many centimeters are in 1 inch. We can then multiply 2.54 and 20 to find that 20 inches equal 50.8 centimeters.

length (in)	length (cm)
100	254
1	2.54
20	50.8

GRADE 6 • UNIT 3 • SECTION A | LESSON 3 375

Student Task Statement

Diego is trying to follow a recipe, but he cannot find any measuring cups! He has only a tablespoon. In the cookbook, it says that 1 cup equals 16 tablespoons.

1. How could Diego use the tablespoon to measure out these ingredients?

   a. $\frac{1}{2}$ cup of almonds

   8 tablespoons of almonds, because $\frac{1}{2} \cdot 16 = 8$.

   b. $1\frac{1}{4}$ cups of oatmeal

   20 tablespoons of oatmeal, because $\frac{1}{4} \cdot 16 = 4$ and $16 + 4 = 20$.

   c. $2\frac{3}{4}$ cups of flour

   44 tablespoons of flour, because $2\frac{3}{4} \cdot 16 = 44$.

2. Diego also adds the following ingredients. How many cups of each did he use?

   a. 28 tablespoons of sugar

   Tablespoon to cup conversions:

   $1\frac{3}{4}$ cups of sugar

   Sample reasoning:

   - From earlier, 20 tablespoons is $1\frac{1}{4}$ cups. For 28 tablespoons, an additional 8 tablespoons, or an additional $\frac{1}{2}$ cup, are needed. $1\frac{1}{4} + \frac{1}{2} = 1\frac{3}{4}$
   - One tablespoon is $\frac{1}{16}$ of a cup. $\frac{1}{16} \cdot 28 = \frac{28}{16}$, which is equivalent to $1\frac{12}{16}$ and $1\frac{3}{4}$.

   b. 6 tablespoons of cocoa powder

   $\frac{3}{8}$ cup of cocoa powder

   Sample reasoning:

   - Converting from tablespoons to cups always involves dividing by 16 and $6 \div 16 = \frac{6}{16} = \frac{3}{8}$.
   - One tablespoon is $\frac{1}{16}$ of a cup, so $\frac{1}{16} \cdot 6 = \frac{6}{16} = \frac{3}{8}$.

Activity Synthesis

Select students to share based on their strategies, sequencing from less efficient to more efficient. Highlight approaches using multiplication by 16 when converting from cups to tablespoons and division by 16 (or multiplication by $\frac{1}{16}$) when converting from tablespoons to cups. Record the representations or strategies that students shared, and display them for all to see.

After the strategies have been shared, ask students how they would know whether to multiply or to divide. Emphasize that we multiply or divide depending on the information we have. Since 1 cup equals 16 tablespoons, if we know a quantity in cups, we can multiply it by 16 to find the number of tablespoons. On the other hand, if we know a quantity in tablespoons, we can divide it by 16 (or multiply by $\frac{1}{16}$) to find the number of cups.

Lesson Synthesis

The important points to highlight are:

- Two measurements of the same quantity in different units form equivalent ratios. We can convert from one unit to the other by using the same tools and strategies that we used to reason about equivalent ratios.
- If we know a "rate per 1" that relates the two measurement units, we can multiply or divide by that rate to convert one unit to the other.

Display a couple of tables of equivalent ratios from the lesson, each table showing two different measurement units (such as miles and kilometers, or cups and tablespoons).

distance (miles)	distance (kilometers)
5	8
25	40
75	120

volume (cups)	volume (tablespoons)
1	16
$\frac{1}{2}$	8
$\frac{1}{16}$	1
$\frac{6}{16}$ or $\frac{3}{8}$	6

Ask questions such as:

"In each table, where do you see equivalent ratios?"

The pair in each row is equivalent to the pairs in other rows.

"How do you know they are equivalent?"

Multiplying the values in one row by the same number gives the values in another row.

"There are approximately 5 miles in 8 kilometers. How can you use that ratio to find the number of miles in 40 kilometers?"

40 is 5 times 8, so the distance in miles is 5 times 5, or 25.

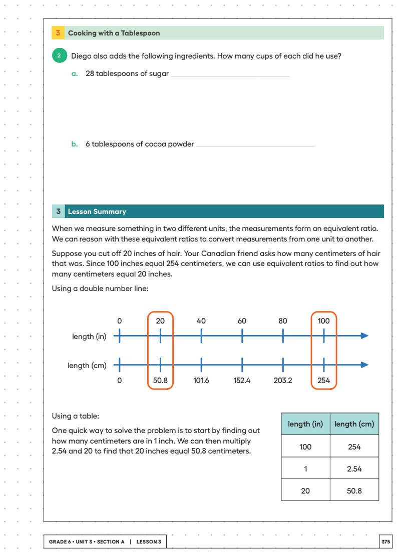
"How can you use that ratio to find the number of kilometers in 2.5 miles?"

2.5 is $\frac{1}{2}$ of 5, so the distance in kilometers is $\frac{1}{2}$ of 8, which is 4.

"When might it be helpful to find a 'rate per 1' or an equivalent ratio with 1 as the value for one quantity?"

When the measurement to be converted is not a multiple or a familiar fraction of the corresponding quantity in the given ratio. For example, we know 5 miles is about 8 kilometers. To find how many kilometers are in 6 miles, it helps to know the number of kilometers per 1 mile and multiply that by 6.

Student Workbook


3 Cooking with a Tablespoon

2 Diego also adds the following ingredients. How many cups of each did he use?

a. 28 tablespoons of sugar ______

b. 6 tablespoons of cocoa powder ______

3 Lesson Summary

When we measure something in two different units, the measurements form an equivalent ratio. We can reason with these equivalent ratios to convert measurements from one unit to another.

Suppose you cut off 20 inches of hair. Your Canadian friend asks how many centimeters of hair that was. Since 100 inches equal 254 centimeters, we can use equivalent ratios to find out how many centimeters equal 20 inches.

Using a double number line:

Using a table:

One quick way to solve the problem is to start by finding out how many centimeters are in 1 inch. We can then multiply 2.54 and 20 to find that 20 inches equal 50.8 centimeters.

length (in)	length (cm)
100	254
1	2.54
20	50.8

GRADE 6 • UNIT 3 • SECTION A | LESSON 3 375

Responding To Student Thinking

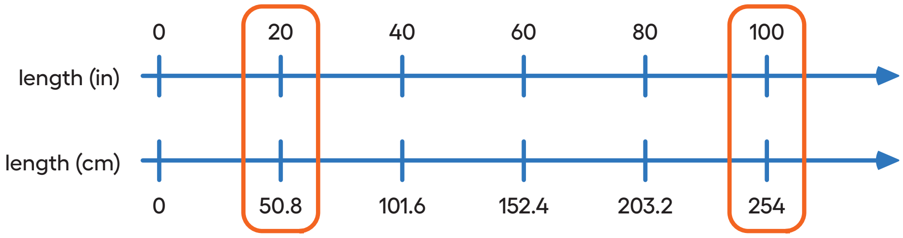
Points to Emphasize
If students struggle with finding equivalent ratios, revisit equivalent ratios when opportunities arise over the next several lessons. For example, in this activity, make sure to invite multiple students to share their thinking about finding equivalent ratios in context: Unit 3, Lesson 4, Activity 2 The Best Deal on Beans.

Lesson Summary

When we measure something in two different units, the measurements form an equivalent ratio. We can reason with these equivalent ratios to convert measurements from one unit to another.

Suppose you cut off 20 inches of hair. Your Canadian friend asks how many centimeters of hair that was. Since 100 inches equal 254 centimeters, we can use equivalent ratios to find out how many centimeters equal 20 inches.

Using a double number line:



Using a table:

length (in)	length (cm)
100	254
1	2.54
20	50.8

One quick way to solve the problem is to start by finding out how many centimeters are in 1 inch. We can then multiply 2.54 and 20 to find that 20 inches equal 50.8 centimeters.

Cool-down

Buckets

5 min

Student Task Statement

A large bucket holds 5 gallons of water, which is about the same as 19 liters of water.

A small bucket holds 2 gallons of water. About how many liters does it hold?

$\frac{38}{5}$ (or 7.6 or equivalent)

Sample reasoning:

gallons	liters
5	19
1	$\frac{19}{5}$
2	$\frac{38}{5}$

Practice Problems

7 Problems

Problem 1

Priya's family exchanged 250 dollars for 4,250 pesos. Priya bought a sweater for 510 pesos. How many dollars did the sweater cost?

pesos	dollars
4,250	250
	25
	1
	3
510	30

Problem 2

There are 3,785 milliliters in 1 gallon, and there are 4 quarts in 1 gallon. For each question, explain or show your reasoning.

a. How many milliliters are in 3 gallons?

11,355 milliliters

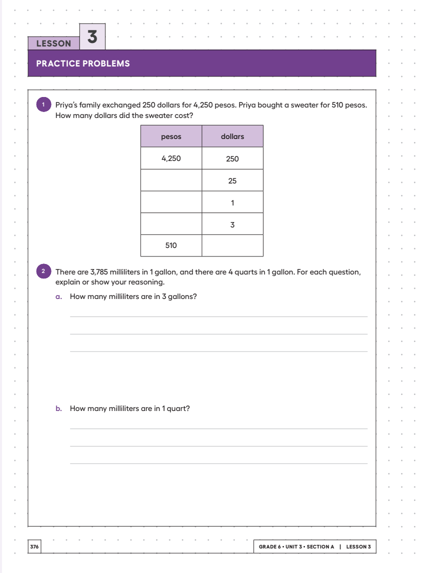
Sample reasoning: $3{,}785 \cdot 3 = 11{,}355$

b. How many milliliters are in 1 quart?

946.25 milliliters

Sample reasoning: $3{,}785 \div 4 = 946.25$

Student Workbook


LESSON 3

PRACTICE PROBLEMS

1 Priya's family exchanged 250 dollars for 4,250 pesos. Priya bought a sweater for 510 pesos. How many dollars did the sweater cost?

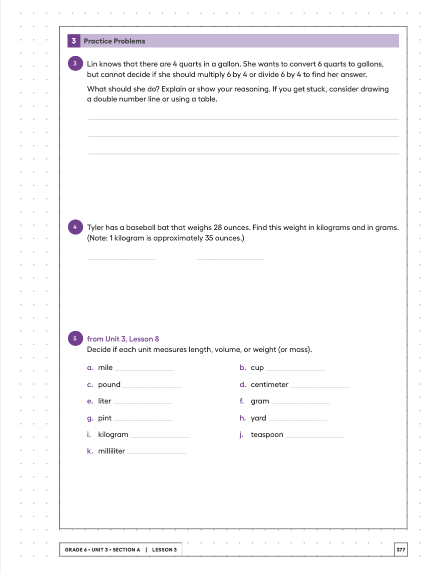
pesos	dollars
4,250	250
	25
	1
	3
510	

2 There are 3,785 milliliters in 1 gallon, and there are 4 quarts in 1 gallon. For each question, explain or show your reasoning.

a. How many milliliters are in 3 gallons?

b. How many milliliters are in 1 quart?

Student Workbook


3 Practice Problems

3 Lin knows that there are 4 quarts in a gallon. She wants to convert 6 quarts to gallons, but cannot decide if she should multiply 6 by 4 or divide 6 by 4 to find her answer.

What should she do? Explain or show your reasoning. If you get stuck, consider drawing a double number line or using a table.

4 Tyler has a baseball bat that weighs 28 ounces. Find this weight in kilograms and in grams. (Note: 1 kilogram is approximately 35 ounces.)

5 from Unit 3, Lesson 8
Decide if each unit measures length, volume, or weight (or mass).

a. mile
b. cup
c. pound
d. centimeter
e. liter
f. gram
g. pint
h. yard
i. kilogram
j. teaspoon
k. milliliter

GRADE 6 • UNIT 3 • SECTION A | LESSON 3

377

Problem 3

Lin knows that there are 4 quarts in a gallon. She wants to convert 6 quarts to gallons, but cannot decide if she should multiply 6 by 4 or divide 6 by 4 to find her answer.

What should she do? Explain or show your reasoning. If you get stuck, consider drawing a double number line or using a table.

Lin should divide 6 by 4

Sample reasoning:

- She's looking for a number to multiply by 4 to get 6, or $4 \cdot ? = 6$, so she would need to divide 6 by 4.
- We can put 6 for the number of quarts in a table. To convert it to gallons, we need to find a number that when multiplied by 4 gives 6, which means finding $6 \div 4$.

quarts	gallons
4	1
6	

Problem 4

Tyler has a baseball bat that weighs 28 ounces. Find this weight in kilograms and in grams. (Note: 1 kilogram is approximately 35 ounces.)

0.8 kilograms ($28 \div 35 = 0.8$) and 800 grams ($0.8 \cdot 1{,}000 = 800$)

Problem 5

from Unit 3, Lesson 8

Decide if each unit measures length, volume, or weight (or mass).

a mile length

b. cup volume

c. pound weight (or mass)

d. centimeter length

e. liter volume

f. gram weight (or mass)

g. pint volume

h. yard length

i. kilogram weight (or mass)

j. teaspoon volume

k. milliliter volume

Problem 6

from Unit 2, Lesson 11

A recipe for trail mix uses 7 ounces of almonds with 5 ounces of raisins. (Almonds and raisins are the only ingredients.) How many ounces of almonds would be in a one-pound bag of this trail mix? Explain or show your reasoning.

$9\frac{1}{3}$ ounces of almonds

Sample reasoning: The original mix has 12 ounces, so a 16-ounce mix has $\frac{16}{12}$ or $\frac{4}{3}$ times as many ounces of each ingredient. $\frac{4}{3} \cdot 7 = \frac{28}{3}$, which is $9\frac{1}{3}$.

Problem 7

from Unit 2, Lesson 9

An ant can travel at a constant speed of 980 inches every 5 minutes.

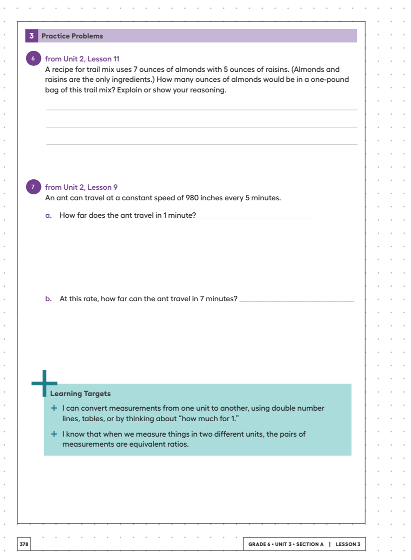
a. How far does the ant travel in 1 minute?

196 inches per minute ($980 \div 5 = 196$)

b. At this rate, how far can the ant travel in 7 minutes?

1,372 inches ($7 \cdot 196 = 1,372$)

Student Workbook



3 Practice Problems

6 from Unit 2, Lesson 11

A recipe for trail mix uses 7 ounces of almonds with 5 ounces of raisins. (Almonds and raisins are the only ingredients.) How many ounces of almonds would be in a one-pound bag of this trail mix? Explain or show your reasoning.

7 from Unit 2, Lesson 9

An ant can travel at a constant speed of 980 inches every 5 minutes.

a. How far does the ant travel in 1 minute?

b. At this rate, how far can the ant travel in 7 minutes?

Learning Targets

+ I can convert measurements from one unit to another, using double number lines, tables, or by thinking about "how much for 1."
+ I know that when we measure things in two different units, the pairs of measurements are equivalent ratios.

378 GRADE 6 • UNIT 3 • SECTION A | LESSON 3