

## WORDS TO KNOW

measurement system

conversion

proportion

percentage

## Lesson 1

USE PROPORTIONS AND PERCENTAGES  
TO SOLVE MEASUREMENT CONVERSION  
PROBLEMS 7.AR.3.3

## INTRODUCTION

## Real-World Connection

Selena competes in bicycling races. In her last race, she rode at a constant rate of  $\frac{1}{3}$  of a kilometer every minute. How many miles did Selena cycle per hour? She can use ratios and the unit conversion methods to find out. Let's practice the skills in the **Guided Instruction** and **Independent Practice** and, at the end of the lesson, see how many miles Selena cycled!

## What I Am Going to Learn

- How to use conversion ratios to create equivalent values
- How to use proportions and percentages to solve measurement conversion problems

## What I May Already Know 6.AR.3.5

- I know how to solve mathematical and real-world problems involving ratios, rates, and unit rates, including comparisons, mixtures, ratios of lengths, and conversions within the same measurement system.

## Vocabulary in Action

There are many different **measurement systems** that are used to measure different objects.

- Length, volume, temperature, and weight all use different measurement systems.



There are also several measurement systems to measure the same quantity.

- For example, length can be measured using inches, feet, centimeters, or meters.

You can use **conversions** to go from one measurement system to another.

- Conversions can involve **proportions**, which represent the relationship in a fractional way.
- Conversions can also involve **percentages**, which represent the relationship as one unit being a percentage of the other unit.

### EXAMPLE

Ray goes for a walk every day and keeps track of the distance he covers every day. Ray walks 700 meters on the first day, 550 meters on the second day, and 800 meters on the third day. What is the total distance covered by Ray in kilometers?

**Step One** Add the total distance covered in 3 days.

$$700 \text{ meters} + 550 \text{ meters} + 800 \text{ meters} = 2,050 \text{ meters}$$

**Step Two** Convert from meters to kilometers.

$$1 \text{ kilometer} = 1,000 \text{ meters}$$

$$1 \text{ meter} = \frac{1}{1,000} \text{ kilometer} = 0.001 \text{ kilometer}$$

$$\text{If } 1 \text{ meter} = 0.001 \text{ kilometer,}$$

$$2,050 \text{ meters} = 2,050 \times 0.001 \text{ kilometers} = 2.05 \text{ kilometers.}$$

The total distance covered by Ray is 2.05 kilometers.

### TIPS AND HINTS

$$1 \text{ kilometer} = 1,000 \text{ meters}$$

### EXAMPLE

Jane bought a cloth with a length of 3,890 centimeters. What is the length of the cloth in meters?

Convert 1 centimeter to meters.

$$1 \text{ meter} = 100 \text{ centimeters}$$

$$1 \text{ centimeter} = \frac{1}{100} \text{ meters} = 0.01 \text{ meters}$$

$$\text{If } 1 \text{ centimeter} = 0.01 \text{ meters,}$$

$$\text{then } 3,890 \text{ centimeters} = 3,890 \text{ centimeters} \times 0.01 \text{ meters} = 38.9 \text{ meters.}$$

The length of the cloth is 38.9 meters.

### TIPS AND HINTS

$$1 \text{ meter} = 100 \text{ centimeters}$$

## EXAMPLE

A garden has an area of 150 feet<sup>2</sup>. What is the area of the garden in inches<sup>2</sup>?

Feet<sup>2</sup> = feet × feet. So, when you are converting areas, you will have to multiply by the conversion proportion twice.

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

$$150 \text{ feet}^2 = 150 \text{ feet} \times \text{feet} \times 12 \text{ inches per foot} \times 12 \text{ inches per foot} = 21,600 \text{ inches} = 21,600 \text{ inches}^2$$

Writing the feet<sup>2</sup> as feet × feet can make it easier to see how the conversion works and make sure you do not forget one.

Alternatively, you can convert from feet to inches<sup>2</sup> in the beginning.

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

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

$$1 \text{ foot}^2 = 144 \text{ inches}^2$$

$$\text{So, } 150 \text{ feet}^2 \times \frac{144 \text{ inches}^2}{\text{foot}^2} = 21,600 \text{ inches}^2.$$

The garden has an area of 21,600 inches<sup>2</sup>.

## GUIDED INSTRUCTION

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**TURN AND TALK**

Can Riya use 0.3 of a piece? How should you round in this problem?

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- Riya finds a metal rod that is 120 inches long. She cuts the rod into 3-foot pieces to work on a project. How many pieces of the metal rod can Riya use for her project?

**Step One** Find the number of inches in 3 feet.

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

$$3 \text{ feet} = 3 \times 12 \text{ inches} = \boxed{\phantom{000}} \text{ inches}$$

**Step Two** Determine how many pieces can be cut.

$$120 \text{ inches of rod will be cut into } \boxed{\phantom{000}} \text{ -inch pieces.}$$

$$\frac{120 \text{ inches}}{36 \text{ inches}} \text{ per piece} = 3.3 \text{ pieces}$$

Riya can cut  $\boxed{\phantom{000}}$  pieces of metal rod to use for the project.

2. If a printer can print 8 pages per minute, how many pages can it print per day?

**Step One** Convert hours to minutes.

1 day =  hours

1 hour =  minutes

**Step Three** Multiply by the conversions.

8 pages are printed in a minute

So, 8 pages per minute  $\times$  60 minutes per hour =  pages per hour.

So, 480 pages per hour  $\times$  24 hours per day =  pages per day.

The printer can print  pages per day.

3. A cup is 25% of a quart. Amy's mom bought 32 quarts of juice for a party. How many cups of juice did Amy's mom buy?

**Step One** Convert percentage to a decimal.

25% =

**Step Two** Convert quarts to cups.

1 cup = 0.25 quarts.

1 quart =  cups

**Step Three** Multiply by the conversion.

There are 4 cups in a quart.

So,  cups  $\times$  32 quarts =  cups.

Amy's mom bought  cups of juice.

4. A mid-size car weighs about 1,520 kilograms. What is the weight of the car in tons?

- (A) 3,344.0 tons  
 (B) 690.9 tons  
 (C) 1.7 tons  
 (D) 0.3 tons

◀ TIPS AND HINTS

1 kilogram = 2.2 pounds

2,000 pounds = 1 ton

5. A gram is 1% of a kilogram. If a book weighs 4 kilograms, how much does the book weigh in grams?

Write your answer in the box.

**TURN AND TALK**

Work with a partner to solve the problem. A car is traveling at a speed of 35 miles per hour. What is the speed of the car in meters per second?

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**How Am I Doing?**

What questions do you have?

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What is the distance you walk every day in miles? If there are 5,280 feet in a mile, what is that distance you walk measured in feet?

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When might you have to convert from one system of measurement to a different system of measurement in the real world?

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Color in the traffic signal that shows how you are doing with the skill.



# INDEPENDENT PRACTICE

## Answer the questions.

1. Jade has a piece of string 2,500 centimeters long. What is the length of the string in meters?

(A) 250,000 meters  
(B) 25 meters  
(C) 25,000 meters  
(D) 250 meters

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### ◀ TIPS AND HINTS

A meter is longer than a centimeter. So, your answer should be smaller than the number in the problem.

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2. Convert 5 meters<sup>2</sup> to centimeters<sup>2</sup>.

(A) 500 centimeters  
(B) 5,000 centimeters  
(C) 50 centimeters  
(D) 50,000 centimeters

3. Max purchased 2 kilograms of sugar. He used 1,500 grams to make a dessert. How many grams of sugar does he have left?

(A) 1,00 grams  
(B) 750 grams  
(C) 500 grams  
(D) 250 grams

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### ◀ TIPS AND HINTS

Convert kilograms to grams and then subtract.

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4. Brielle walks 2 miles every day. How many yards does she walk each day?

Write your answer in the box to complete the statement.

Brielle walks  yards each day.

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### ◀ TIPS AND HINTS

1 mile = 1,760 yards.

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WORK SPACE

5. A water tank can hold 1,200 liters of water. A liter is about 26% of a gallon. What is the approximate volume, in gallons, in the tank if it is completely full?
- Ⓐ 4,615.4 gallons  
Ⓑ 312 gallons  
Ⓒ 260 gallons  
Ⓓ 3,846.2 gallons
6. Tina requires a 14-foot length of rope to make a swing. The store sells the rope she needs by the inch. How many inches of rope should she purchase to have exactly 14 feet of rope?
- Ⓐ 14 inches  
Ⓑ 24 inches  
Ⓒ 168 inches  
Ⓓ 84 inches
7. Ryan spends a total of 450 minutes a week reading a book. How many hours does he spend each week reading a book?

Fill in the bubble before the number that correctly completes the statement.

- Ryan spends 

Ⓐ	4.5
Ⓑ	7
Ⓒ	7.5
Ⓓ	10

 hours a week reading.

8. Fill in one bubble in each row to complete the conversion.

	24	72	96
Number of inches in 6 feet	(A)	(B)	(C)
Number of cups in 6 quarts	(D)	(E)	(F)
Number of ounces in 6 pounds	(G)	(H)	(I)

9. This question has **two** parts.

Mathew reads a book that has 180 pages in 3.5 hours.

**Part A.** How much time does it take him to read the book in minutes?

Write your answer in the box.

It takes Matthew  to read the book.

#### ◀ TIPS AND HINTS

Read the two-part question carefully. Part A wants the answer in minutes. Part B wants the answer in hours. Be sure to label your answers.



**Part B.** Assuming he reads at the same speed, how long would it take Matthew, in hours, to read a book that is 450 pages long?

Write your answer in the box.



WORK SPACE

- 10.** Georgina is spending the summer in Italy for an exchange program. She went shopping with some friends and found some keepsakes that she wants to bring home. The keepsakes cost a total of 76 euros. If Georgina budgeted \$80 for keepsakes, does she have enough money to make this purchase? Assume the dollar is worth 90% of a Euro. Explain your answer.

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## EXIT TICKET

7.AR.3.3

Now that you have practiced unit rates and conversions, let's solve the problem in the Real -World Connection.

Selena competes in a bicycling races. In her last race, she rode at a constant rate of  $\frac{1}{3}$  of a kilometer every minute. How many miles did Selena cycle per hour?



SALES

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# TEACHER NOTES

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## REAL-WORLD GOAL FOR STUDENTS

- Students will understand how to solve mathematical and real-world conversion problems across different measurement systems using proportions and percentages.

## TIPS FOR THE STRUGGLING LEARNER

- Students may have trouble determining whether to divide or multiply by the conversion factor. Have them think about what they are trying to convert to. If they are converting to a smaller unit of measurement, should the answer be bigger or smaller? Based on that, do they think they should multiply or divide. Encourage students to think about the problem before starting it.
- Students may have trouble converting areas because they do not grasp the concept of what it means for a measurement to be squared. Draw examples of rectangles on the board and have them find the area in square feet. Then, have students convert the lengths to inches and find the area in square inches. Ask them if they can go from square feet to square inches by multiplying by 12. This illustrates why you have to multiply by 144, or the square of the conversion factor.

## TIPS FOR THE ENGLISH LEARNER

- English learners may be unfamiliar with the vocabulary associated with the units of measurement. Write some measurement terms, such as *quart*, *cup*, *meter*, *kilometer*, *minute*, and *second* on the board. Have students group the different terms by what they measure. Then, have them work with a partner to compare sizes.
- English learners may get confused by the numbers of different ways to measure something. Encourage them to write down all the different measurements they know for weight and length. This grouping helps to chunk the information to make the details easier to remember.

## ACTIVITIES FOR THE ADVANCED LEARNER

- Students can work with partners to research the values of different currency and determine how much money they would have in those currencies.
- Students can discuss why there are different units of measurement. Have them make a list of 10 different things that can be measured. Then, have students swap their list with a partner and determine what unit of measurement would be appropriate and why.