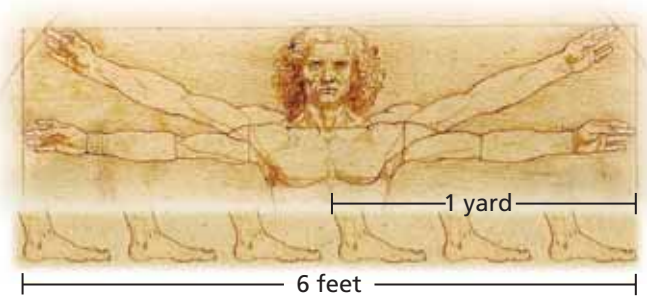
English Spanish

3.6 Converting Measures Between Systems

Essential Question How can you compare lengths between the customary and metric systems?



1 ACTIVITY: Customary Measure History

Work with a partner.

a. Match the measure of length with its historical beginning.

Length	*Historical Beginning*
Inch	The length of a human foot.
Foot	The width of a human thumb.
Yard	The distance a human can walk in 1000 paces (two steps).
Mile	The distance from a human nose to the end of an outstretched human arm.

b. Use a ruler to measure your thumb, arm, and foot. How do your measurements compare to your answers from part (a)? Are they close to the historical measures?

You know how to convert measures within the customary and metric systems.

Equivalent Customary Lengths

1 ft = 12 in. 1 yd = 3 ft 1 mi = 5280 ft

Equivalent Metric Lengths

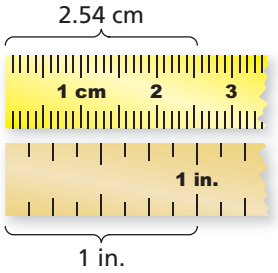
1 m = 1000 mm 1 m = 100 cm 1 km = 1000 m

You will learn how to convert between the two systems.

Converting Between Systems

1 in. ≈ 2.54 cm

1 mi ≈ 1.6 km



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2 ACTIVITY: Comparing Measures

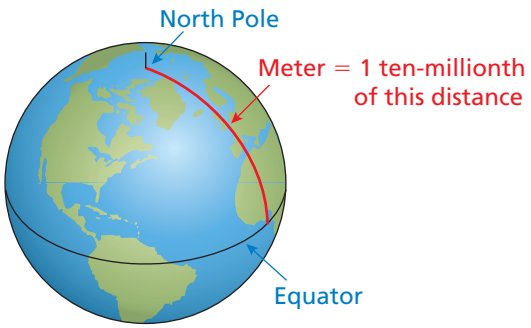
Work with a partner. Answer each question. Explain your answer. Use a diagram in your explanation.

		Metric	*Customary*
a.	**Car Speed:** Which is faster?	80 km/h	60 mi/h
b.	**Trip Distance:** Which is farther?	200 km	200 mi
c.	**Human Height:** Who is taller?	180 cm	5 ft 8 in.
d.	**Wrench Width:** Which is wider?	8 mm	5/16 in.
e.	**Swimming Pool Depth:** Which is deeper?	1.4 m	4 ft
f.	**Mountain Elevation:** Which is higher?	2000 m	7000 ft
g.	**Room Width:** Which is wider?	3.5 m	12 ft

What Is Your Answer?

3. **IN YOUR OWN WORDS** How can you compare lengths between the customary and metric systems? Give examples with your description.

4. **HISTORY** The meter and the metric system originated in France. In 1791, the French Academy of Sciences was instructed to create a new system of measurement. This new system would be based on powers of 10.



The fundamental units of this system would be based on natural values that were unchanging. The French Academy of Sciences decided to find the length of an imaginary arc that began at the North Pole and ended at the equator.

They would then divide this arc into exactly ten million identical pieces. The length of one of these pieces would be the base unit of length for the new system of measurement.

a. Find the distance around Earth in meters.

b. Find the distance around Earth in kilometers.

5. Find the distance around Earth in miles.

Practice Use what you learned about converting measures between systems to complete Exercises 4–9 on page 134.

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3.6 Lesson

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Key Vocabulary
U.S. customary system, *p. 132*
metric system, *p. 132*

The **U.S. customary system** is a system of measurement that contains units for length, capacity, and weight. The **metric system** is a decimal system of measurement, based on powers of 10, that contains units for length, capacity, and mass.

Use the relationships below to convert units *between* systems.

Length	Capacity	Weight and Mass
1 in. ≈ 2.54 cm 1 mi ≈ 1.6 km	1 qt ≈ 0.95 L	1 lb ≈ 0.45 kg

EXAMPLE 1 Converting Units

Convert 5 liters to quarts.

Method 1: Convert using a ratio.

1 qt ≈ 0.95 L

$$5\,\text{L} \times \frac{1\text{ qt}}{0.95\,\text{L}} \approx 5.26\text{ qt}$$

So, 5 liters is about 5.26 quarts.

Method 2: Convert using a proportion.

Let x be the number of quarts equivalent to 5 liters.

quarts, liters

$$\frac{1}{0.95} = \frac{x}{5}$$

quarts, liters

Write a proportion.

$$5 = 0.95x$$ Use the Cross Products Property.

$$5.26 \approx x$$ Divide each side by 0.95.

So, 5 liters is about 5.26 quarts.

On Your Own

Now You're Ready
Exercises 10–22

Copy and complete the statement. Round to the nearest hundredth, if necessary.

1. 7 mi ≈ ____ km
2. 12 qt ≈ ____ L
3. 25 kg ≈ ____ lb
4. 8 cm ≈ ____ in.

Multi-Language Glossary at BigIdeasMath.com

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EXAMPLE 2 Comparing Units

Copy and complete the statement using < or >: 25 oz ☐ 2 kg.

Convert 25 ounces to kilograms.

1 lb = 16 oz 1 lb ≈ 0.45 kg

$$25 \text{ oz} \times \frac{1 \text{ lb}}{16 \text{ oz}} \times \frac{0.45 \text{ kg}}{1 \text{ lb}} = \frac{25 \cdot 1 \cdot 0.45 \text{ kg}}{16 \cdot 1} \approx 0.70 \text{ kg}$$

∴ Because 0.70 kilogram is less than 2 kilograms, 25 oz < 2 kg.

On Your Own

Now You're Ready
Exercises 25–30

Copy and complete the statement using < or >.

5. 7 cm ☐ 3 in. **6.** 8 c ☐ 2 L **7.** 3 oz ☐ 70 g

EXAMPLE 3 Converting a Rate

Which of the two remote controlled planes is faster?

Biplane
70 kilometers per hour

Monoplane
50 miles per hour

Convert 50 miles per hour to kilometers per hour.

$$\frac{50 \text{ mi}}{1 \text{ h}} \times \frac{1.6 \text{ km}}{1 \text{ mi}} = \frac{80 \text{ km}}{1 \text{ h}}$$

The speed of the monoplane is 80 kilometers per hour. The speed of the biplane is 70 kilometers per hour.

∴ So, the monoplane is faster.

Check Convert 70 kilometers per hour to miles per hour.

$$\frac{70 \text{ km}}{1 \text{ h}} \times \frac{1 \text{ mi}}{1.6 \text{ km}} = \frac{44 \text{ mi}}{1 \text{ h}}$$

Monoplane ***Biplane***

$$\frac{50 \text{ mi}}{1 \text{ h}} > \frac{44 \text{ mi}}{1 \text{ h}} \quad ✓$$

On Your Own

Now You're Ready
Exercises 31–34

8. The speed of a remote controlled car is 0.2 kilometer per minute. Order the speeds of the car and the two planes in Example 3 from least to greatest.

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3.6 Exercises

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Help with Homework
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Vocabulary and Concept Check

1. **WRITING** Describe two methods you can use to convert measurements.
2. **OPEN-ENDED** Which method would you use to convert 10 miles to kilometers? Explain your reasoning.
3. **DIFFERENT WORDS, SAME QUESTION** Which is different? Find "both" answers.

Convert 5 inches to centimeters.	Find the number of inches in 5 centimeters.
How many centimeters are in 5 inches?	Five inches equals how many centimeters?

Practice and Problem Solving

Copy and complete the statement using < or >.

4. 1 ft ____ 1 cm
5. 450 yd ____ 450 cm
6. 30 in. ____ 30 mm
7. 125 in. ____ 125 cm
8. 100 ft/h ____ 100 km/h
9. 10 L ____ 10 gal

Copy and complete the statement using a ratio. Round to the nearest hundredth, if necessary.

10. 3 mi ≈ ____ km
11. 10 qt ≈ ____ L
12. 68 kg ≈ ____ lb
13. 8.3 in. ≈ ____ cm
14. 25.5 lb ≈ ____ kg
15. 5 km ≈ ____ mi

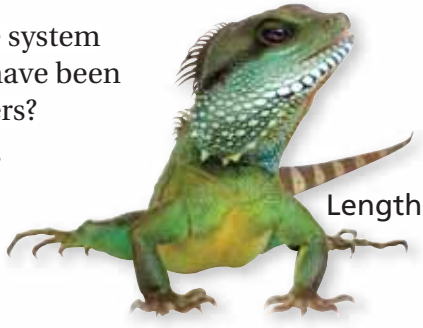
16. **ERROR ANALYSIS** Describe and correct the error in using a ratio to convert 12 kilometers to miles.

$$12 \text{ km} \times \frac{1.6 \text{ mi}}{1 \text{ km}} \approx 19.2 \text{ mi}$$

Copy and complete the statement using a proportion. Round to the nearest hundredth, if necessary.

17. 48 in. ≈ ____ cm
18. 2 km ≈ ____ mi
19. 165 cm ≈ ____ in.
20. 85 lb ≈ ____ kg
21. 2.5 qt ≈ ____ L
22. 14.2 L ≈ ____ qt

23. **CAVES** Mammoth Cave is the longest cave system in the world. So far, 365 miles of the cave have been explored. What is this distance in kilometers?
24. **IGUANA** How long is the iguana in inches?



Length: 24.7 cm

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Copy and complete the statement using < or >.

25. 8 kg ____ 30 oz

26. 6 ft ____ 300 cm

27. 3 gal ____ 6 L

28. 10 in. ____ 200 mm

29. 1200 g ____ 5 lb

30. 1500 m ____ 3000 ft

Copy and complete the statement. Round to the nearest hundredth, if necessary.

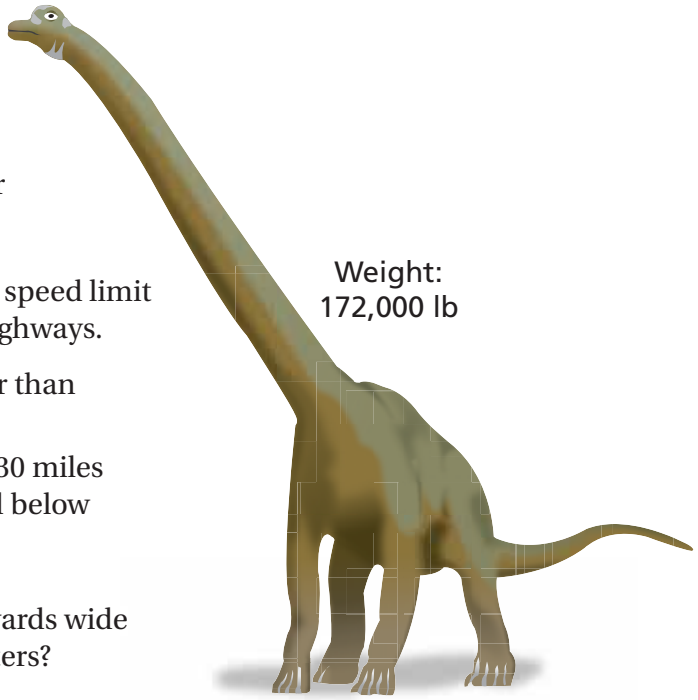
31. 45 mi/h ≈ ____ km/h

32. 5 gal/min ≈ ____ L/min

33. 120 mm/sec ≈ ____ in./sec

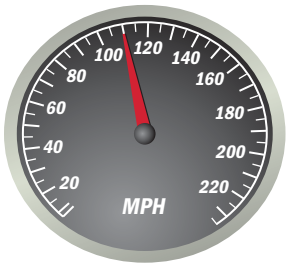
34. 900 g/day ≈ ____ lb/day

35. BRACHIOSAURUS One of the largest dinosaurs was the brachiosaurus. How much did it weigh in kilograms?



36. BOTTLE Can you pour the water from a full 2-liter bottle into a 2-quart pitcher without spilling any? Explain.

37. AUTOBAHN Germany suggests a speed limit of 130 kilometers per hour on highways.



a. Is the speed shown greater than the suggested limit?

b. Suppose the speed drops 30 miles per hour. Is the new speed below the suggested limit?

38. SOCCER The size of a soccer field is 50 yards wide by 80 yards long. What is the size in meters?

39. PAINT One liter of paint covers 100 square feet. How many gallons does it take to cover 1400 square feet?

40. Critical Thinking The speed of light is about 300,000 kilometers per second. Convert the speed to miles per hour.

Fair Game Review What you learned in previous grades & lessons

Graph the data. Then find the slope of the line through the points. SECTION 3.2

41.

Months, x	Height, y
2	3
4	6
6	9

42.

Hours, x	Units, y
4	60
8	120
12	180

43. MULTIPLE CHOICE Which equation has a solution of 4? SECTION 2.6

(A) $2x + 7 = -1$ (B) $-3 + 2x = -11$ (C) $2x - 11 = -3$ (D) $11 + 2x = 3$