Chapter 12

# Relative Sizes of Measurement Units

## Show What You Know

Check your understanding of important skills.

Name _____

### ▶ Time to the Half Hour Read the clock. Write the time.

1. 
_____

2. 
_____

3. 
_____

### ▶ Multiply by 1-Digit Numbers Find the product.

4. $\begin{array}{r} 84 \\ \times\ 7 \\ \hline \end{array}$

5. $\begin{array}{r} 536 \\ \times\ 8 \\ \hline \end{array}$

6. $\begin{array}{r} 748 \\ \times\ 5 \\ \hline \end{array}$

7. $\begin{array}{r} 2{,}524 \\ \times\ 2 \\ \hline \end{array}$

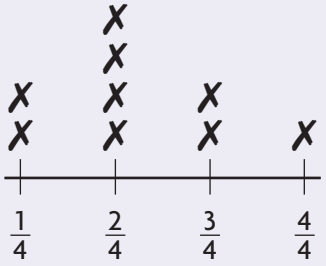
8. $\begin{array}{r} 360 \\ \times\ 9 \\ \hline \end{array}$

9. $\begin{array}{r} 296 \\ \times\ 3 \\ \hline \end{array}$

10. $\begin{array}{r} \$1{,}428 \\ \times\ 4 \\ \hline \end{array}$

11. $\begin{array}{r} 64 \\ \times\ 5 \\ \hline \end{array}$


A team was given a bucket of water and a sponge. The team had 1 minute to fill an empty half-gallon bucket with water using only the sponge. The line plot shows the amount of water squeezed into the bucket. Be a Math Detective. Did the team squeeze enough water to fill the half-gallon bucket?

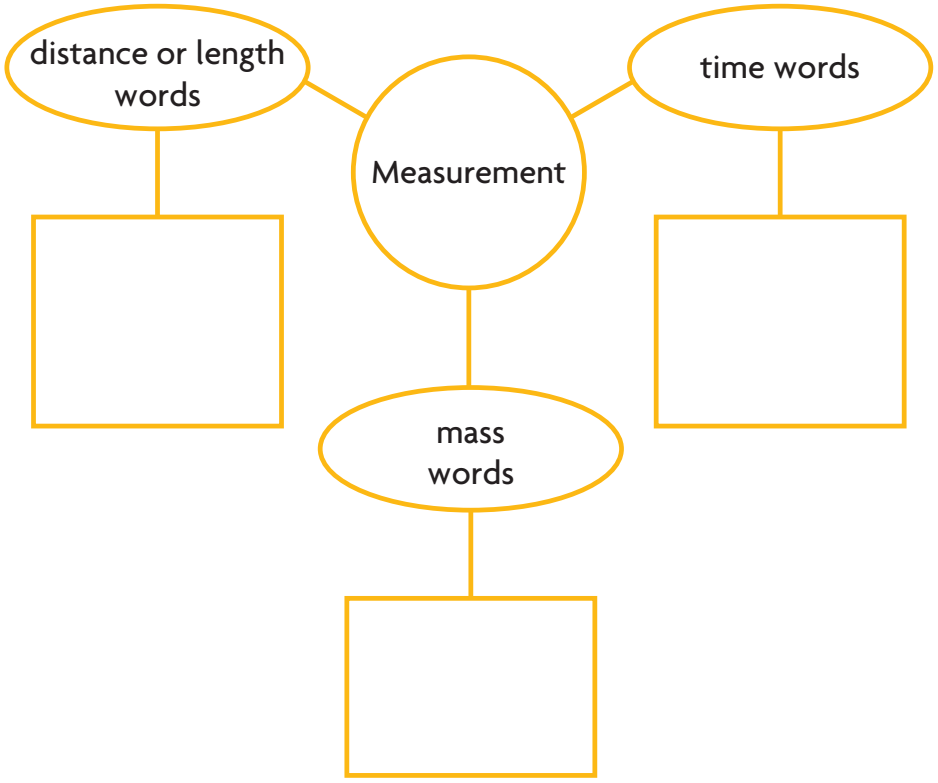



**Amount of Water Squeezed into the Bucket (in cups)**

# Vocabulary Builder

## Visualize It

**Complete the Brain Storming diagram by using words with a ✓.**




## Understand Vocabulary

**Draw a line to match each word with its definition.**

1. decimeter
2. second
3. fluid ounce
4. ton
5. line plot

- A customary unit for measuring liquid volume
- A graph that shows the frequency of data along a number line
- A customary unit used to measure weight
- A small unit of time
- A metric unit for measuring length or distance

**Review Words**

- ✓ A.M.
- ✓ centimeter
- ✓ elapsed time
- ✓ foot
- ✓ gram
- ✓ hour
- ✓ inch
- ✓ kilogram
- ✓ meter
- ✓ minute
- ✓ P.M.
- ✓ yard

**Preview Words**

- cup
- decimeter
- fluid ounce
- gallon
- half gallon
- line plot
- milliliter
- millimeter
- ounce
- pint
- pound
- quart
- second
- ton





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Name _____

# Measurement Benchmarks

**Essential Question** How can you use benchmarks to understand the relative sizes of measurement units?

## UNLOCK the Problem REAL WORLD

Jake says the length of his bike is about four yards. Use the benchmark units below to determine if Jake's statement is reasonable.

| Customary Units of Length | | | |
|---|---|---|---|
|  1 in. about 1 inch |  1 ft about 1 foot |  1 yd about 1 yard |  1 mile in about 20 minutes |

A baseball bat is about one yard long. Since Jake's bike is shorter than four times the length of a baseball bat, his bike is shorter than four yards long.

So, Jake's statement _____ reasonable.

Jake's bike is about _____ baseball bats long.

A **mile** is a customary unit for measuring length or distance. The benchmark shows the distance you can walk in about 20 minutes.

## Example 1 Use the benchmark customary units.

| Customary Units of Liquid Volume | | | | |
|---|---|---|---|---|
|  1 cup = 8 fluid ounces |  1 pint |  1 quart |  1 half gallon |  1 gallon |

- About how much liquid is in a mug of hot chocolate? _____

| Customary Units of Weight | | |
|---|---|---|
|  about 1 ounce |  about 1 pound |  about 1 ton |

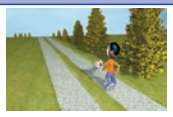
- About how much does a grapefruit weigh? _____

MATHEMATICAL PRACTICES

**Math Talk** Order the units of weight from heaviest to lightest. Use benchmarks to **explain** your answer.

**Benchmarks for Metric Units** The metric system is based on place value. Each unit is 10 times as large as the next smaller unit. Below are some common metric benchmarks.

## Example 2 Use the benchmark metric units.

| Metric Units of Length | | | | |
|---|---|---|---|---|
|  about 1 millimeter |  about 1 centimeter |  about 1 decimeter |  about 1 meter |  1 kilometer in about 10 minutes |

A **kilometer** is a metric unit for measuring length or distance. The benchmark shows the distance you can walk in about 10 minutes.

- Is the length of your classroom greater than or less than one kilometer?

_____

| Metric Units of Liquid Volume | |
|---|---|
|  1 milliliter |  1 liter |

- About how much medicine is usually in a medicine bottle?

about 120 _____

| Metric Units of Mass | |
|---|---|
|  about 1 gram |  about 1 kilogram |

- About how much is the mass of a paper clip?

_____

MATHEMATICAL PRACTICES

**Math Talk** **Explain** how benchmark measurements can help you decide which unit to use when measuring.

Name _____

## Share and Show

**Use benchmarks to choose the metric unit you would use to measure each.**

| Metric Units |
|---|
| centimeter |
| meter |
| kilometer |
| gram |
| kilogram |
| milliliter |
| liter |

1. mass of a strawberry

2. length of a cell phone

**Circle the better estimate.**

3. width of a teacher's desk

   10 meters or 1 meter

4. the amount of liquid a punch bowl holds

   2 liters or 20 liters

5. distance between Seattle and San Francisco

   6 miles or 680 miles

MATHEMATICAL PRACTICES

**Math Talk** **Explain** why you would use kilometers instead of meters to measure the distance across the United States.

## On Your Own

**Use benchmarks to choose the customary unit you would use to measure each.**

| Customary Units |
|---|
| inch |
| foot |
| yard |
| ounce |
| pound |
| cup |
| gallon |

6. length of a football field

7. weight of a pumpkin

**Circle the better estimate.**

8. weight of a watermelon

   4 pounds or 4 ounces

9. the amount of liquid a fish tank holds

   10 cups or 10 gallons

**Complete the sentence. Write *more* or *less*.**

10. Matthew's large dog weighs _____ than one ton.

11. There can be _____ than one cup of water in a kitchen sink.

12. A paper clip has a mass of _____ than one kilogram.

# Problem Solving REAL WORLD

**Solve. For 13–15, use benchmarks to explain your answer.**

SHOW YOUR WORK

**13.** Cristina is making macaroni and cheese for her family. Would Cristina use 1 pound of macaroni or 1 ounce of macaroni?

**14.** Which is the better estimate for the length of a kitchen table, 200 centimeters or 200 meters?

**15.** Amy thinks her dog weighs about 15 tons. Is this a reasonable estimate?

**16.** H.O.T. Write Math Dalton used benchmarks to estimate that there are more cups than quarts in one gallon. Is Dalton's estimate reasonable? **Explain.**

**17.** **Test Prep** Which is the best estimate for a dose of medicine?

Ⓐ 2 milliliters Ⓒ 2 millimeters

Ⓑ 2 liters Ⓓ 2 meters



FOR MORE PRACTICE:
Standards Practice Book, pp. P221–P222

Name _____

# Customary Units of Length

**Essential Question** How can you use models to compare customary units of length?

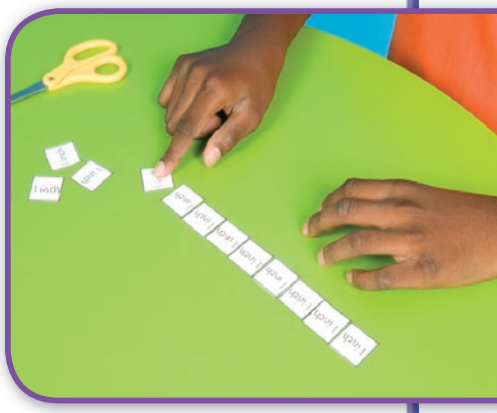
## UNLOCK the Problem REAL WORLD

You can use a ruler to measure length. A ruler that is 1 foot long shows 12 inches in 1 foot. A ruler that is 3 feet long is called a yardstick. There are 3 feet in 1 yard.

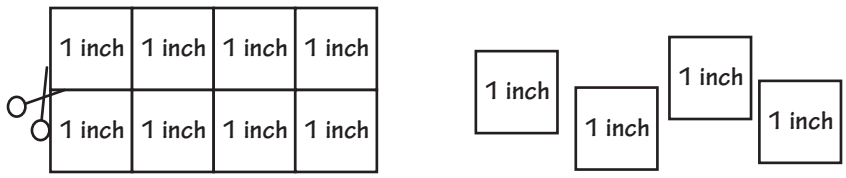
How does the size of a foot compare to the size of an inch?

## Activity

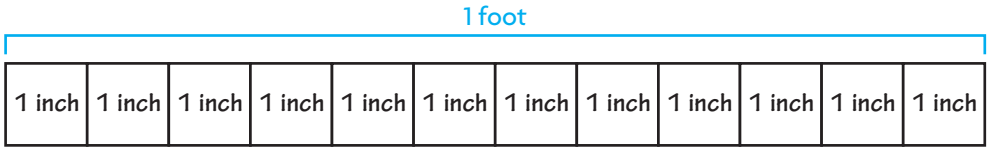
**Materials** ■ 1-inch grid paper ■ scissors ■ tape



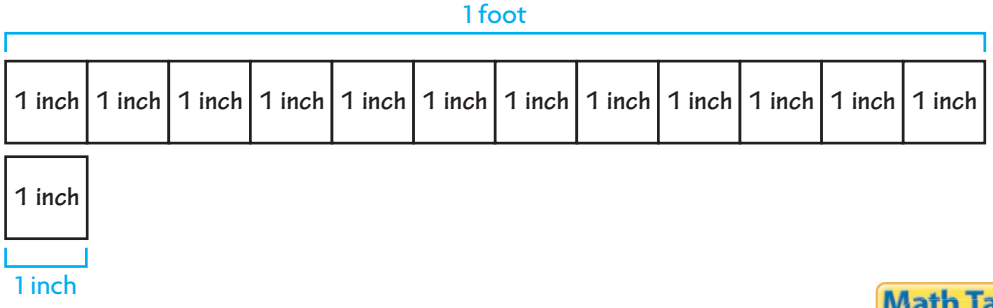
**STEP 1** Cut out the paper inch tiles. Label each tile 1 inch.




**STEP 2** Place 12 tiles end-to-end to build 1 foot. Tape the tiles together.




**STEP 3** Compare the size of 1 foot to the size of 1 inch.




**Think:** You need 12 inches to make 1 foot.

So, 1 foot is _____ times as long as 1 inch.

**Math Talk** MATHEMATICAL PRACTICES

How many inches would you need to make a yard? **Explain.**

## Example Compare measures.

Emma has 4 feet of thread. She needs 50 inches of thread to make some bracelets. How can she determine if she has enough thread to make the bracelets?

Since 1 foot is 12 times as long as 1 inch, you can write feet as inches by multiplying the number of feet by 12.

**STEP 1** Make a table that relates feet and inches.

| Feet | Inches |
|---|---|
| 1 | 12 |
| 2 | |
| 3 | |
| 4 | |
| 5 | |

**Think:**

1 foot × 12 = 12 inches

2 feet × 12 = _____

3 feet × _____ = _____

4 feet × _____ = _____

5 feet × _____ = _____

**STEP 2** Compare 4 feet and 50 inches.

4 feet ↓ 50 inches ↓

**Think:** Write each measure in inches and compare using <, >, or =.

_____ ◯ _____

Emma has 4 feet of thread. She needs 50 inches of thread.

4 feet is _____ than 50 inches.

So, Emma _____ enough thread to make the bracelets.

MATHEMATICAL PRACTICES

**Math Talk** **Explain** how making a table helped you solve the problem.

- **What if** Emma had 5 feet of thread? Would she have enough thread to make the bracelets? **Explain.**

_____

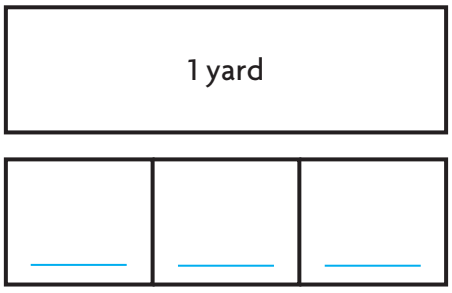
_____

_____

Name _____

## Share and Show

1. Compare the size of a yard to the size of a foot. Use a model to help.




| Customary Units of Length |
|---|
| 1 foot (ft) = 12 inches (in.) |
| 1 yard (yd) = 3 feet |
| 1 yard (yd) = 36 inches |

1 yard is _____ times as long as _____ foot.

**Complete.**

**2.** 2 feet = _____ inches

**3.** 3 yards = _____ feet

**4.** 7 yards = _____ feet

MATHEMATICAL PRACTICES

**Math Talk** If you measured the length of your classroom in yards and then in feet, which unit would have a greater number of units? **Explain.**

## On Your Own

**Complete.**

**5.** 4 yards = _____ feet

**6.** 10 yards = _____ feet

**7.** 7 feet = _____ inches

**Algebra** **Compare using <, >, or =.**

**8.** 1 foot ◯ 13 inches

**9.** 2 yards ◯ 6 feet

**10.** 6 feet ◯ 60 inches

## Problem Solving

**11.** **Write Math** Joanna has 3 yards of fabric. She needs 100 inches of fabric to make curtains. Does she have enough fabric to make curtains? **Explain.** Make a table to help.

_____

_____

| Yards | Inches |
|---|---|
| 1 | |
| 2 | |
| 3 | |

**12.** **Test Prep** Jim has 12 yards of carpet to cover his basement floor. He knows the length of his basement in feet. How many feet of carpet does he have?

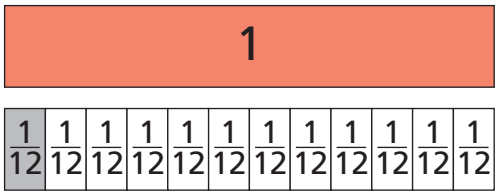
Ⓐ 4 feet Ⓒ 36 feet

Ⓑ 15 feet Ⓓ 432 feet

## H.O.T. Sense or Nonsense?

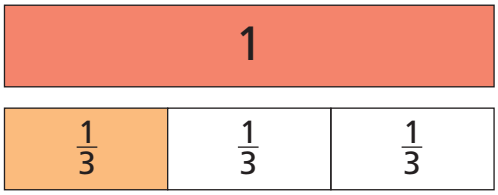
**13.** Jasmine and Luke used fraction strips to compare the size of a foot to the size of an inch using fractions. They drew models to show their answers. Whose answer makes sense? Whose answer is nonsense? **Explain** your reasoning.

**Jasmine's Work**




1 inch is $\frac{1}{12}$ of a foot.

**Luke's Work**




1 inch is $\frac{1}{3}$ of a foot.

**a.** For the answer that is nonsense, write an answer that makes sense.

**b.** Look back at Luke's model. Which two units could you compare using his model? **Explain.**





FOR MORE PRACTICE:
Standards Practice Book, pp. P223–P224

Name _____

# Customary Units of Weight

**Essential Question** How can you use models to compare customary units of weight?

## UNLOCK the Problem REAL WORLD

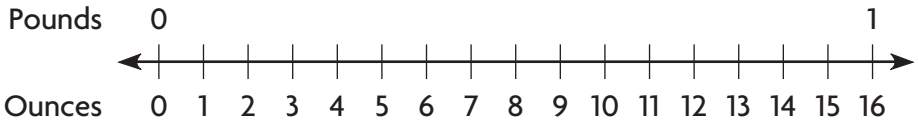
Ounces and pounds are customary units of weight. How does the size of a pound compare to the size of an ounce?

▲ You can use a spring scale to measure weight.

## Activity

**Materials** ■ color pencils

The number line below shows the relationship between pounds and ounces.




**STEP 1** Use a color pencil to shade 1 pound on the number line.

**STEP 2** Use a different color pencil to shade 1 ounce on the number line.

**STEP 3** Compare the size of 1 pound to the size of 1 ounce.

You need _____ ounces to make _____ pound.

So, 1 pound is _____ times as heavy as 1 ounce.

MATHEMATICAL PRACTICES

**Math Talk** Which is greater, 9 pounds or 9 ounces? **Explain.**

- **Explain** how the number line helped you to compare the sizes of the units.

_____

_____

_____

_____

## Example Compare measures.

Nancy needs 5 pounds of flour to bake pies for a festival. She has 90 ounces of flour. How can she determine if she has enough flour to bake the pies?

**STEP 1** Make a table that relates pounds and ounces.

| Pounds | Ounces |
|---|---|
| 1 | 16 |
| 2 | |
| 3 | |
| 4 | |
| 5 | |

**Think:**

1 pound × 16 = 16 ounces

2 pounds × 16 = _____

3 pounds × _____ = _____

4 pounds × _____ = _____

5 pounds × _____ = _____

**STEP 2** Compare 90 ounces and 5 pounds.

90 ounces ↓ _____ ◯ _____ ↓ 5 pounds

**Think:** Write each measure in ounces and compare using <, >, or =.

Nancy has 90 ounces of flour. She needs 5 pounds of flour.

90 ounces is _____ than 5 pounds.

So, Nancy _____ enough flour to make the pies.

**Try This!** There are 2,000 pounds in 1 **ton**.
Make a table that relates tons and pounds.

| Tons | Pounds |
|---|---|
| 1 | 2,000 |
| 2 | |
| 3 | |

1 ton is _____ times as heavy as 1 pound.

Name _____

## Share and Show

1. 4 tons = _____ pounds

Think: 4 tons × _____ = _____

| Customary Units of Weight |
| --- |
| 1 pound (lb) = 16 ounces (oz) |
| 1 ton (T) = 2,000 pounds |

**Complete.**

2. 5 tons = _____ pounds

3. 6 pounds = _____ ounces

## On Your Own

MATHEMATICAL PRACTICES

**Math Talk** What equation can you use to solve Exercise 4? **Explain.**

**Complete.**

4. 7 pounds = _____ ounces

5. 6 tons = _____ pounds

**Algebra** **Compare using >, <, or =.**

6. 1 pound ◯ 15 ounces

7. 2 tons ◯ 2 pounds

## Problem Solving

8. A landscaping company ordered 8 tons of gravel. They sell the gravel in 50 pound bags. How many pounds of gravel did the company order?

_____

9. **H.O.T.** **Write Math** If you could draw a number line that shows the relationship between tons and pounds, what would it look like? **Explain.**

_____

_____

_____

10. **Test Prep** Kwadir is recording his baby sister's weight in pounds and in ounces each week. This week she weighs 10 pounds. How many ounces does she weigh?

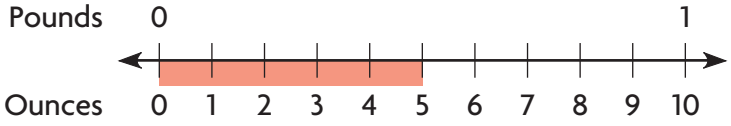
Ⓐ 10 ounces Ⓒ 20 ounces

Ⓑ 16 ounces Ⓓ 160 ounces

## H.O.T. What's the Error?

**11.** Alexis bought $\frac{1}{2}$ pound of grapes. How many ounces of grapes did she buy?

Dan drew the number line below to solve the problem. He says his model shows that there are 5 ounces in $\frac{1}{2}$ pound. What is his error?




**Look at the way Dan solved the problem. Find and describe his error.**

**Draw a correct number line and solve the problem.**

So, Alexis bought _____ ounces of grapes.

- Look back at the number line you drew. How many ounces are in $\frac{1}{4}$ pound? **Explain.**

Name _____

# Customary Units of Liquid Volume

**Essential Question** How can you use models to compare customary units of liquid volume?

## UNLOCK the Problem REAL WORLD

**Liquid volume** is the measure of the space a liquid occupies. Some basic units for measuring liquid volume are **gallons**, **half gallons**, **quarts**, **pints**, and **cups**.

The bars below model the relationships among some units of liquid volume. The largest units are gallons. The smallest units are **fluid ounces**.

1 cup = 8 fluid ounces
1 pint = 2 cups
1 quart = 4 cups

1 gallon

| 1 gallon | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 half gallon | | | | | | | | 1 half gallon | | | | | | | |
| 1 quart | | | | 1 quart | | | | 1 quart | | | | 1 quart | | | |
| 1 pint | | 1 pint | | 1 pint | | 1 pint | | 1 pint | | 1 pint | | 1 pint | | 1 pint | |
| 1 cup | 1 cup | 1 cup | 1 cup | 1 cup | 1 cup | 1 cup | 1 cup | 1 cup | 1 cup | 1 cup | 1 cup | 1 cup | 1 cup | 1 cup | 1 cup |
| 8 fluid ounces | 8 fluid ounces | 8 fluid ounces | 8 fluid ounces | 8 fluid ounces | 8 fluid ounces | 8 fluid ounces | 8 fluid ounces | 8 fluid ounces | 8 fluid ounces | 8 fluid ounces | 8 fluid ounces | 8 fluid ounces | 8 fluid ounces | 8 fluid ounces | 8 fluid ounces |

## Example How does the size of a gallon compare to the size of a quart?

MATHEMATICAL PRACTICES

**Math Talk** **Describe** the pattern in the units of liquid volume.

**STEP 1** Draw two bars that represent this relationship. One bar should show gallons and the other bar should show quarts.

**STEP 2** Shade 1 gallon on one bar and shade 1 quart on the other bar.

**STEP 3** Compare the size of 1 gallon to the size of 1 quart.

So, 1 gallon is _____ times as much as 1 quart.

## Example Compare measures.


Serena needs to make 3 gallons of lemonade for the lemonade sale. She has a powder mix that makes 350 fluid ounces of lemonade. How can she decide if she has enough powder mix?

**STEP 1** Use the model on page 457. Find the relationship between gallons and fluid ounces.

1 gallon = _____ cups

1 cup = _____ fluid ounces

1 gallon = _____ cups × _____ fluid ounces

1 gallon = _____ fluid ounces

**STEP 2** Make a table that relates gallons and fluid ounces.

| Gallons | Fluid Ounces |
|---|---|
| 1 | 128 |
| 2 | |
| 3 | |

**Think:**

1 gallon = 128 fluid ounces

2 gallons × 128 = _____ fluid ounces

3 gallons × 128 = _____ fluid ounces

**STEP 3** Compare 350 fluid ounces and 3 gallons.

350 fluid ounces ↓ _____ ◯ _____ ↓ 3 gallons

**Think:** Write each measure in fluid ounces and compare using <, >, or =.

Serena has enough mix to make 350 fluid ounces.
She needs to make 3 gallons of lemonade.

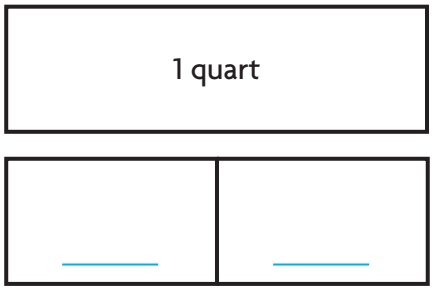
350 fluid ounces is _____ than 3 gallons.

So, Serena _____ enough mix to make 3 gallons of lemonade.

Name _____

## Share and Show

1. Compare the size of a quart to the size of a pint. Use a model to help.




| Customary Units of Liquid Volume |
|---|
| 1 cup (c) = 8 fluid ounces (fl oz) |
| 1 pint (pt) = 2 cups |
| 1 quart (qt) = 2 pints |
| 1 quart (qt) = 4 cups |
| 1 gallon (gal) = 4 quarts |
| 1 gallon (gal) = 8 pints |
| 1 gallon (gal) = 16 cups |

1 quart is _____ times as much as _____ pint.

**Complete.**

**2.** 2 pints = _____ cups **3.** 3 gallons = _____ quarts **4.** 6 quarts = _____ cups

## On Your Own

MATHEMATICAL PRACTICES

**Math Talk** **Explain** how the conversion chart above relates to the bar model in Exercise 1.

**Complete.**

**5.** 4 gallons = _____ pints **6.** 5 cups = _____ fluid ounces

**Algebra** **Compare using >, <, or =.**

**7.** 2 gallons ◯ 32 cups **8.** 4 pints ◯ 6 cups **9.** 5 quarts ◯ 11 pints

## Problem Solving

**10.** H.O.T. A soccer team has 25 players. The team's thermos holds 4 gallons of water. If the thermos is full, is there enough water for each player to have 2 cups? **Explain.** Make a table to help.

| Gallons | Cups |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |

**11.** **Test Prep** A pitcher contains 5 quarts of water. How many cups of water does the pitcher contain?

Ⓐ 4 cups Ⓒ 20 cups

Ⓑ 10 cups Ⓓ 40 cups

# Problem Solving REAL WORLD

## H.O.T. Sense or Nonsense?

**12.** Whose statement makes sense? Whose statement is nonsense? **Explain** your reasoning.

1 pint is $\frac{1}{4}$ of a gallon.

**Zach's Statement**

1 pint is $\frac{1}{8}$ of a gallon.

**Angela's Statement**

**a.** For the statement that is nonsense, write a statement that makes sense.

**b.** Describe the size of a pint as it relates to a quart using fractions.





FOR MORE PRACTICE:
Standards Practice Book, pp. P227–P228

Name _____

# Line Plots

**Essential Question** How can you make and interpret line plots with fractional data?

## UNLOCK the Problem REAL WORLD

The data show the lengths of the buttons in Jen's collection. For an art project, she wants to know how many buttons are longer than $\frac{1}{4}$ inch.

You can use a line plot to solve the problem. A **line plot** is a graph that shows the frequency of data along a number line.

| Length of Buttons in Jen's Collection (in inches) |
|---|
| $\frac{1}{4}, \frac{3}{4}, \frac{1}{4}, \frac{4}{4}, \frac{1}{4}, \frac{4}{4}$ |

Make a line plot to show the data.

## Example 1

**STEP 1** Order the data from least to greatest length and complete the tally table.

_____

| Buttons in Jen's Collection | |
|---|---|
| Length (in inches) | Tally |
| $\frac{1}{4}$ | |
| $\frac{3}{4}$ | |
| $\frac{4}{4}$ | |

**STEP 2** Label the fraction lengths on the number line below from the least value of the data to the greatest.

**STEP 3** Plot an *X* above the number line for each data point. Write a title for the line plot.

_____ _____ _____ _____

_____

So, _____ buttons are longer than $\frac{1}{4}$ inch.

MATHEMATICAL PRACTICES

**Math Talk** **Explain** how you labeled the numbers on the number line in Step 2.

1. How many buttons are in Jen's collection? _____

2. What is the difference in length between the longest button and the shortest button in Jen's collection? _____

**Think:** To find the difference, subtract the numerators. The denominators stay the same.

## Example 2

Some of the students in Ms. Lee's class walk to school. The data show the distances these students walk. What distance do most students walk?

| Distance Students Walk to School (in miles) |
|---|
| $\frac{1}{2}, \frac{1}{2}, \frac{1}{4}, \frac{3}{4}, \frac{1}{4}, \frac{1}{2}, \frac{1}{2}$ |

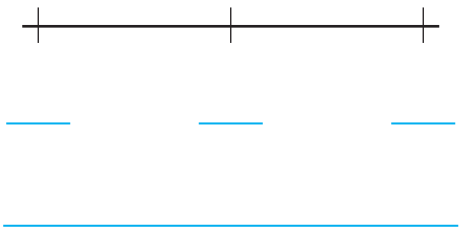
Make a line plot to show the data.

**STEP 1** Order the data from least to greatest distance and complete the tally table.

| Distance Students Walk to School | |
|---|---|
| Distance (in miles) | Tally |
| | |
| | |
| | |

**STEP 2** Label the fraction lengths on the number line below from the least value of the data to the greatest.

**STEP 3** Plot an *X* above the number line for each data point. Write a title for the line plot.



So, most students walk _____.

**3.** How many more students walk $\frac{1}{2}$ mile than $\frac{1}{4}$ mile to school?

**4.** What is the difference between the longest distance and the shortest distance that students walk?

**5.** **What if** a new student joins Ms. Lee's class who walks $\frac{3}{4}$ mile to school? How would the line plot change? **Explain.**

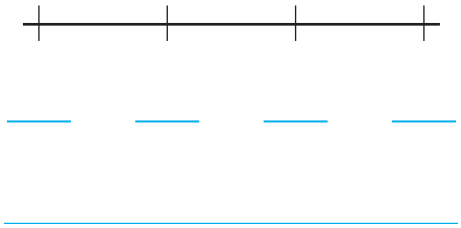
Name _____

## Share and Show MATH BOARD

1. A food critic collected data on the lengths of time customers waited for their food. Order the data from least to greatest time. Make a tally table and a line plot to show the data.

| Time Customers Waited for Food (in hours) |
|---|
| $\frac{1}{2}, \frac{1}{4}, \frac{3}{4}, \frac{1}{4}, \frac{1}{4}, \frac{1}{2}, 1$ |

| Time Customers Waited for Food | |
|---|---|
| Time (in hours) | Tally |
| | |
| | |
| | |
| | |



MATHEMATICAL PRACTICES

**Math Talk** **Explain** how the line plot helped you answer the question for Exercise 2.

**Use your line plot for 2 and 3.**

2. On how many customers did the food critic collect data? _____

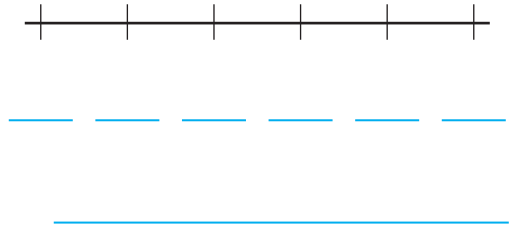
3. What is the difference between the longest time and the shortest time that customers waited? _____

## On Your Own

4. The data show the lengths of the ribbons Mia used to wrap packages. Make a tally table and a line plot to show the data.

| Ribbon Length Used to Wrap Packages (in yards) |
|---|
| $\frac{1}{6}, \frac{2}{6}, \frac{5}{6}, \frac{3}{6}, \frac{2}{6}, \frac{6}{6}, \frac{3}{6}, \frac{2}{6}$ |

| Ribbon Used to Wrap Packages | |
|---|---|
| Length (in yards) | Tally |
| | |
| | |
| | |
| | |
| | |

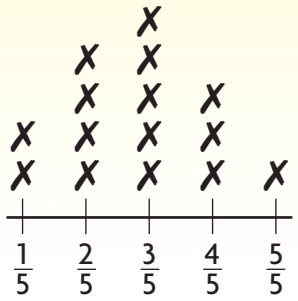


**Use your line plot for 5.**

5. What is the difference in length between the longest ribbon and the shortest ribbon Mia used? _____

## UNLOCK the Problem REAL WORLD

**6.** The line plot shows the distances the students in Mr. Boren's class ran at the track in miles. Altogether, did the students run more or less than 5 miles?




**a.** What are you asked to find? _____

_____

**b.** What information do you need to use? _____

_____

**c.** How will the line plot help you solve the problem? _____

_____

**d.** What operation will you use to solve the problem? _____

**e.** Show the steps to solve the problem.

_____

_____

**f.** Complete the sentences.

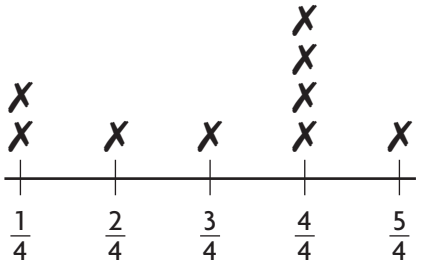
The students ran a total of _____ miles.

_____ miles _____ 5 miles; so, altogether the students ran _____ than 5 miles.

**7.** H.O.T. Write Math Lena collects antique spoons. The line plot shows the lengths of the spoons in her collection. If she lines up all of her spoons in order of size, what is the size of the middle spoon? **Explain.**

_____

_____




**Length of Spoons (in feet)**

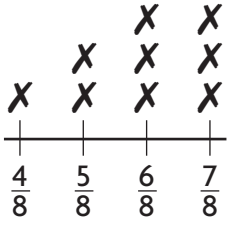
**8.** **Test Prep** The line plot shows the distances some students hiked. What is the difference between the longest distance and the shortest distance the students hiked?

Ⓐ $\frac{1}{8}$ mile

Ⓑ $\frac{3}{8}$ mile

Ⓒ $\frac{7}{8}$ mile

Ⓓ $\frac{11}{8}$ mile




**Distance Students Hiked (in miles)**

Name _____

# Mid-Chapter Checkpoint

## Vocabulary

**Choose the best term from the box to complete the sentence.**

| Vocabulary |
|---|
| pint |
| pound |
| yard |

1. A _____ is a customary unit used to measure weight. (p. 453)

2. The cup and the _____ are both customary units for measuring liquid volume. (p. 457)

## Concepts and Skills

**Complete the sentence. Write *more* or *less*.**

3. A cat weighs _____ than one ounce.

4. Serena's shoe is _____ than one yard long.

**Complete.**

5. 5 feet = _____ inches

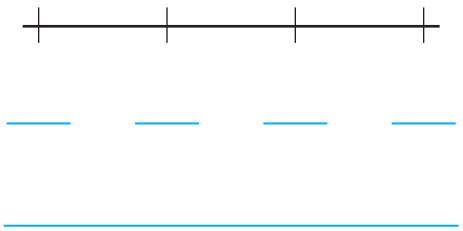
6. 4 tons = _____ pounds

7. 4 cups = _____ pints

8. Mrs. Byrne's class went raspberry picking. The data show the weights of the cartons of raspberries the students picked. Make a tally table and a line plot to show the data.

| Weight of Cartons of Raspberries Picked (in pounds) |
|---|
| $\frac{3}{4}, \frac{1}{4}, \frac{2}{4}, \frac{4}{4}, \frac{1}{4}, \frac{1}{4}, \frac{2}{4}, \frac{3}{4}, \frac{3}{4}$ |

| Cartons of Raspberries Picked | |
|---|---|
| Weight (in pounds) | Tally |
| | |
| | |
| | |
| | |



**Use your line plot for 9 and 10.**

9. What is the difference in weight between the heaviest carton and lightest carton of raspberries? _____

10. How many pounds of raspberries did Mrs. Byrne's class pick in all? _____

**Fill in the bubble completely to show your answer.**

**11.** A jug contains 2 gallons of water. How many quarts of water does the jug contain?

Ⓐ 4 quarts

Ⓑ 8 quarts

Ⓒ 16 quarts

Ⓓ 32 quarts

**12.** Serena bought 4 pounds of dough to make pizzas. The recipe gives the amount of dough needed for a pizza in ounces. How many ounces of dough did she buy?

Ⓐ 8 ounces

Ⓑ 16 ounces

Ⓒ 64 ounces

Ⓓ 96 ounces

**13.** Vaughn threw the shot put 9 yards at a track meet. The official used a tape measure to measure the distance in feet. How many feet did he throw the shot put?

Ⓐ 27 feet

Ⓑ 30 feet

Ⓒ 108 feet

Ⓓ 324 feet

**14.** What is the best estimate for the amount of liquid a watering can holds?

Ⓐ 5 ounces

Ⓑ 5 cups

Ⓒ 5 quarts

Ⓓ 5 gallons

Name _____

# Metric Units of Length

**Essential Question** How can you use models to compare metric units of length?

## Investigate

**Materials** ■ ruler (meter) ■ scissors ■ tape

Meters (m), **decimeters** (dm), centimeters (cm), and **millimeters** (mm) are all metric units of length.

Build a meterstick to show how these units are related.

**A.** Cut out the meterstick strips.

**B.** Place the strips end-to-end to build 1 meter. Tape the strips together.

**C.** Look at your meter strip. What patterns do you notice about the sizes of the units?

1 meter is _____ times as long as 1 decimeter.

1 decimeter is _____ times as long as 1 centimeter.

1 centimeter is _____ times as long as 1 millimeter.

**Describe** the pattern you see.

_____

_____

**Math Idea**

If you lined up 1,000 metersticks end-to-end, the length of the metersticks would be 1 kilometer.

## Draw Conclusions

1. **Compare** the size of 1 meter to the size of 1 centimeter. Use your meterstick to help.

_____

2. **Compare** the size of 1 meter to the size of 1 millimeter. Use your meterstick to help.

3. H.O.T. **Apply** What operation could you use to find how many centimeters are in 3 meters? **Explain.**

## Make Connections

You can use different metric units to describe the same metric length. For example, you can measure the length of a book as 3 decimeters or as 30 centimeters. Since the metric system is based on the number 10, decimals or fractions can be used to describe metric lengths as equivalent units.

Think of 1 meter as one whole. Use your meterstick to write equivalent units as fractions and decimals.

| 1 meter = 10 decimeters | 1 meter = 100 centimeters |
|---|---|
| Each decimeter is | Each centimeter is |
| _____ or _____ of a meter. | _____ or _____ of a meter. |

**Complete the sentence.**

- A length of 51 centimeters is _____ or _____ of a meter.
- A length of 8 decimeters is _____ or _____ of a meter.
- A length of 82 centimeters is _____ or _____ of a meter.

MATHEMATICAL PRACTICES

**Math Talk** **Explain** how you are able to locate and write decimeters and centimeters as parts of a meter on the meterstick.

Name _____

## Share and Show MATH BOARD

**Complete.**

| Metric Units of Length |
|---|
| 1 centimeter (cm) = 10 millimeters (mm) |
| 1 decimeter (dm) = 10 centimeters |
| 1 meter (m) = 10 decimeters |
| 1 meter (m) = 100 centimeters |
| 1 meter (m) = 1,000 millimeters |

**1.** 2 meters = _____ centimeters

**2.** 3 centimeters = _____ millimeters

**3.** 5 decimeters = _____ centimeters

**Algebra** **Compare using <, >, or =.**

**4.** 4 meters ◯ 40 decimeters

**5.** 5 centimeters ◯ 5 millimeters

**6.** 6 decimeters ◯ 65 centimeters

**7.** 7 meters ◯ 700 millimeters

**Describe the length in meters. Write your answer as a fraction and as a decimal.**

**8.** 65 centimeters = _____ or _____ meter

**9.** 47 centimeters = _____ or _____ meter

**10.** 9 decimeters = _____ or _____ meter

**11.** 2 decimeters = _____ or _____ meter

## Problem Solving REAL WORLD

**12.** Lucille runs the 50-meter dash in her track meet. How many decimeters long is the race?

_____

**13.** H.O.T. Alexis is knitting a blanket 2 meters long. Every 2 decimeters, she changes the color of the yarn to make stripes. How many stripes will the blanket have? **Explain.**

_____

_____

_____

14. Write Math **Explain** how you know that a line that is 8 centimeters long is longer than a line that is 75 millimeters long.

15. H.O.T. **What's the Error?** Julianne's desk is 75 centimeters long. She says her desk is 7.5 meters long. **Describe** her error.

## H.O.T. Pose a Problem

16. Aruna was writing a report on pecan trees. She made the table of information to the right.

Write a problem that can be solved by using the data.

| Pecan Tree | |
|---|---|
| **Average Measurements** | |
| Length of nuts | 3 cm to 5 cm |
| Height | 21 m to 30 m |
| Width of trunk | 18 dm |
| Width of leaf | 10 cm to 20 cm |

**Pose a problem.**

**Solve your problem.**

- **Describe** how you could change the problem by changing a unit in the problem. Then solve the problem.





FOR MORE PRACTICE:
Standards Practice Book, pp. P231–P232

Name _____

# Metric Units of Mass and Liquid Volume

**Essential Question** How can you use models to compare metric units of mass and liquid volume?

## UNLOCK the Problem REAL WORLD

Mass is the amount of matter in an object. Metric units of mass include kilograms (kg) and grams (g). Liters (L) and **milliliters** (mL) are metric units of liquid volume.

The charts show the relationship between these units.

| Metric Units of Mass | Metric Units of Liquid Volume |
|---|---|
| 1 kilogram (kg) = 1,000 grams (g) | 1 liter (L) = 1,000 milliliters (mL) |

## Example 1 Compare kilograms and grams.

Becky planted a flower garden full of bluebonnets. She used 9 kilograms of soil. How many grams of soil is that?

| number of kilograms | | grams in 1 kilogram | | total grams |
|---|---|---|---|---|
| 9 | × | 1,000 | = | _____ |

So, Becky used _____ grams of soil to plant her bluebonnets.

- Are kilograms larger or smaller than grams?

_____

- Will the number of grams be greater than or less than the number of kilograms?

_____

- What operation will you use to solve the problem?

_____

## Example 2 Compare liters and milliliters.

Becky used 5 liters of water to water her bluebonnet garden. How many milliliters of water is that?

| number of liters | | milliliters in 1 liter | | total milliliters |
|---|---|---|---|---|
| 5 | × | 1,000 | = | _____ |

So, Becky used _____ milliliters of water.

MATHEMATICAL PRACTICES

**Math Talk** **Compare** the size of a kilogram to the size of a gram. Then compare the size of a liter to the size of a milliliter.

## Share and Show

MATH BOARD

1. There are 3 liters of water in a pitcher. How many milliliters of water are in the pitcher?

There are _____ milliliters in 1 liter. Since I am changing from a larger unit to a smaller unit, I can _____ 3 by 1,000 to find the number of milliliters in 3 liters.

So, there are _____ milliliters of water in the pitcher.

**Complete.**

2. 4 liters = _____ milliliters

3. 6 kilograms = _____ grams

MATHEMATICAL PRACTICES

**Math Talk** Explain how you found the number of grams in 6 kilograms in Exercise 3.

## On Your Own

**Complete.**

4. 8 kilograms = _____ grams

5. 7 liters = _____ milliliters

**Algebra** **Compare using <, >, or =.**

6. 1 kilogram ◯ 900 grams

7. 2 liters ◯ 2,000 milliliters

**Algebra** **Complete.**

8.

| Liters | Milliliters |
|---|---|
| 1 | 1,000 |
| 2 | |
| 3 | |
| | 4,000 |
| 5 | |
| 6 | |
| | 7,000 |
| 8 | |
| 9 | |
| 10 | |

9.

| Kilograms | Grams |
|---|---|
| 1 | 1,000 |
| 2 | |
| | 3,000 |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| | 8,000 |
| 9 | |
| 10 | |

Name _____

## Problem Solving REAL WORLD

**10.** Frank wants to fill a fish tank with 8 liters of water. How many milliliters is that?

**11.** Kim has 3 water bottles. She fills each bottle with 1 liter of water. How many milliliters of water does she have?

**12.** Jared's empty backpack has a mass of 3 kilograms. He doesn't want to carry more than 7 kilograms on a trip. How many grams of equipment can Jared pack?

**13.** A large cooler contains 20 liters of iced tea and a small cooler contains 5 liters of iced tea. How many more milliliters of iced tea does the large cooler contain than the small cooler?

**14.** H.O.T. A 500-gram bag of granola costs $4, and a 2-kilogram bag of granola costs $15. What is the cheapest way to buy 2,000 grams of granola? **Explain.**

**15.** **Sense or Nonsense?** The world's largest apple had a mass of 1,849 grams. Sue said the mass was greater than 2 kilograms. Does Sue's statement make sense? **Explain.**

SHOW YOUR WORK

## UNLOCK the Problem REAL WORLD

**16.** Lori bought 600 grams of cayenne pepper and 2 kilograms of black pepper. How many grams of pepper did she buy?

black pepper

cayenne pepper

**a.** What are you asked to find?

_____

**b.** What information will you use?

_____

**c.** Tell how you might solve the problem.

_____

_____

_____

**d.** Show how you solved the problem.

_____

_____

_____

_____

**e.** Complete the sentences.

Lori bought _____ grams of cayenne pepper.

She bought _____ grams of black pepper.

_____ + _____ = _____ grams

So, Lori bought _____ grams of pepper in all.

**17.** Write Math Jill has two rocks. One has a mass of 20 grams and the other has a mass of 20 kilograms. Which rock has the greater mass? **Explain.**

_____

_____

_____

**18.** **Test Prep** Caroline bought a bag of onions that was labeled 5 kilograms. She needs to know how many grams that is for her recipe. How many grams is 5 kilograms?

Ⓐ 50 grams

Ⓑ 500 grams

Ⓒ 5,000 grams

Ⓓ 50,000 grams

Name _____

# Units of Time

**Essential Question** How can you use models to compare units of time?

## UNLOCK the Problem REAL WORLD

The analog clock below has an hour hand, a minute hand, and a **second** hand to measure time. The time is 4:30:12.

**Read Math**

Read 4:30:12 as 4:30 and 12 seconds, or 30 minutes and 12 seconds after 4.

- Are there more minutes or seconds in one hour?

_____

There are 60 seconds in a minute and 60 minutes in an hour. The clocks below show the length of a second, a minute, and an hour.

**Start Time: 3:00:00**

**1 second elapses.**

**The time is now 3:00:01.**

**1 minute, or 60 seconds, elapses. The second hand has made a full turn clockwise.**

**The time is now 3:01:00.**

**1 hour, or 60 minutes, elapses. The minute hand has made a full turn clockwise.**

**The time is now 4:00:00.**

## Example 1 How does the size of an hour compare to the size of a second?

There are _____ minutes in an hour.

There are _____ seconds in a minute.

60 minutes × _____ = _____ seconds

**Think:** Multiply the number of minutes in a hour by the number of seconds in a minute.

There are _____ seconds in a hour.

So, 1 hour is _____ times as long as 1 second.

**MATHEMATICAL PRACTICES**

**Math Talk** How many full turns clockwise does a minute hand make in 3 hours? **Explain.**

## Example 2 Compare measures.

Larissa spent 2 hours on her science project.
Cliff spent 200 minutes on his science project.
Who spent more time?

**STEP 1** Make a table that relates hours and minutes.

| Hours | Minutes |
|---|---|
| 1 | 60 |
| 2 | |
| 3 | |

**STEP 2** Compare 2 hours and 200 minutes.

2 hours ____ 200 minutes

**Think:** Write each measure in minutes and compare using <, >, or =.

2 hours is _____ than 200 minutes.

So, _____ spent more time than _____ on the science project.

## Activity Compare the length of a week to the length of a day.

**Materials** ■ color pencils

The number line below shows the relationship between days and weeks.

**STEP 1** Use a color pencil to shade 1 week on the number line.


**STEP 2** Use a different color pencil to shade 1 day on the number line.

**STEP 3** Compare the size of 1 week to the size of 1 day.

There are _____ days in _____ week.

So, 1 week is _____ times as long as 1 day.

Name _____

## Share and Show

| Units of Time |
|---|
| 1 minute (min) = 60 seconds (s) |
| 1 hour (hr) = 60 minutes |
| 1 day (d) = 24 hours |
| 1 week (wk) = 7 days |
| 1 year (yr) = 12 months (mo) |
| 1 year (yr) = 52 weeks |

**1.** Compare the length of a year to the length of a month. Use a model to help.


1 year is _____ times as long as _____ month.

MATHEMATICAL PRACTICES

**Math Talk** **Explain** how the number line helped you compare the length of a year and the length of a month.

**Complete.**

**2.** 2 minutes = _____ seconds

**3.** 4 years = _____ months

## On Your Own

**Complete.**

**4.** 3 minutes = _____ seconds

**5.** 4 hours = _____ minutes

**Algebra** **Compare using >, <, or =.**

**6.** 3 years ◯ 35 months

**7.** 2 days ◯ 40 hours

## Problem Solving

**8.** Damien has lived in the apartment building for 5 years. Ken has lived there for 250 weeks. Who has lived in the building longer? **Explain.** Make a table to help.

| Years | Weeks |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |

**9.** H.O.T. How many hours are in a week? **Explain.**

**10.** Write Math **Explain** how you know that 9 minutes is less than 600 seconds.

**11.** H.O.T. Football practice lasts 3 hours. The coach wants to spend an equal number of minutes on each of 4 different plays. How many minutes will the team spend on each play?

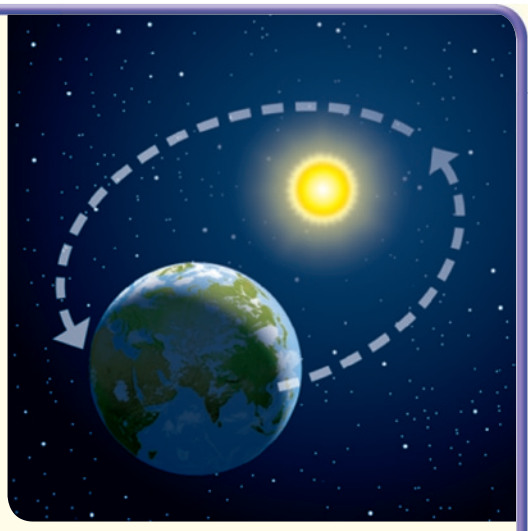
**12.** **Test Prep** Martin's brother just turned 2 years old. What is his brother's age in months?

Ⓐ 2 months Ⓒ 24 months

Ⓑ 14 months Ⓓ 104 months

## Connect to Science

One day is the length of time it takes Earth to make one complete rotation. One year is the time it takes Earth to revolve around the sun. To make the calendar match Earth's orbit time, there are leap years. Leap years add one extra day to the year. A leap day, February 29, is added to the calendar every four years.



| |
|---|
| 1 year = 365 days |
| 1 leap year = 366 days |

**13.** How many days are there in 4 years, if the fourth year is a leap year? **Explain.** Make a table to help.

| Years | Days |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |

**14.** Parker was born on February 29, 2008. The second time he is able to celebrate on his actual birthday is in 2016. How many days old will Parker be on February 29, 2016? **Explain.**

Name _____

# Problem Solving • Elapsed Time

**Essential Question** How can you use the strategy *draw a diagram* to solve elapsed time problems?

## UNLOCK the Problem REAL WORLD

Dora and her brother Kyle spent 1 hour and 35 minutes doing yard work. Then they stopped for lunch at 1:20 P.M. At what time did they start doing yard work?

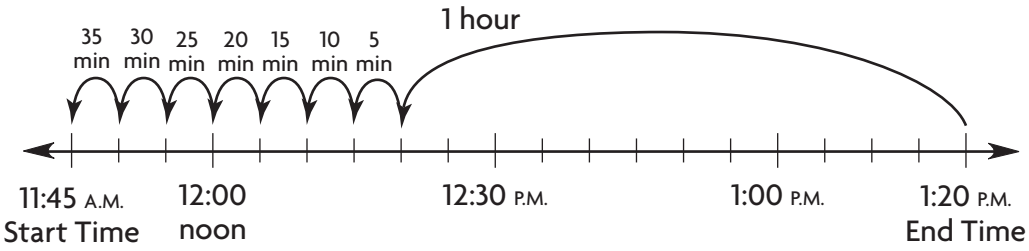
Use the graphic organizer to help you solve the problem.

### Read the Problem

| What do I need to find? | What information do I need to use? | How will I use the information? |
|---|---|---|
| I need to find the time that Dora and Kyle _____. | I need to use the _____ and the time that they _____. | I can draw a time line to help me count backward and find the _____. |

### Solve the Problem

I draw a time line that shows the end time 1:20 P.M. Next, I count backward 1 hour and then 5 minutes at a time until I have 35 minutes.




So, Dora and her brother Kyle started doing yard work at _____.

1. **What if** Dora and Kyle spent 50 minutes doing yard work and they stopped for lunch at 12:30 P.M.? What time would they have started doing yard work?

_____

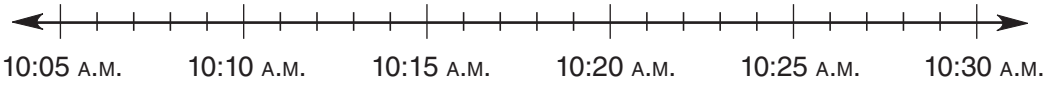
## Try Another Problem

Ben started riding his bike at 10:05 A.M. He stopped 23 minutes later when his friend Robbie asked him to play kickball. At what time did Ben stop riding his bike?

### Read the Problem

| What do I need to find? | What information do I need to use? | How will I use the information? |
|---|---|---|
| | | |

### Solve the Problem




**2.** How did your diagram help you solve the problem?

_____

_____

_____

MATHEMATICAL PRACTICES

**Math Talk** **Describe** another way you could find the time an activity started or ended given the elapsed time and either the start or end time.

Name _____

## Share and Show

**UNLOCK the Problem** Tips

- Use the Problem Solving MathBoard.
- Choose a strategy you know.
- Underline important facts.

**1.** Evelyn has dance class every Saturday. It lasts 1 hour and 15 minutes and is over at 12:45 P.M. At what time does Evelyn's dance class begin?

**First**, write the problem you need to solve.

_____

**Next**, draw a time line to show the end time and the elapsed time.


**Finally**, find the start time.

Evelyn's dance class begins at _____ .

**2.** H.O.T. **What if** Evelyn's dance class started at 11:00 A.M. and lasted 1 hour and 25 minutes? At what time would her class end? **Describe** how this problem is different from Problem 1.

_____

_____

**3.** Beth got on the bus at 8:06 A.M. Thirty-five minutes later, she arrived at school. At what time did Beth arrive at school?

_____

_____

**4.** Lyle went fishing for 1 hour and 30 minutes until he ran out of bait at 6:40 P.M. At what time did Lyle start fishing?

_____

_____

## On Your Own

**Choose a STRATEGY**

- Act It Out
- Draw a Diagram
- Find a Pattern
- Make a Table or List
- Solve a Simpler Problem

SHOW YOUR WORK

5. Mike and Jed went skiing at 10:30 A.M. They skied for 1 hour and 55 minutes before stopping for lunch. At what time did Mike and Jed stop for lunch?

6. H.O.T. **What's the Question?** One hour and 10 minutes later, it was 6:20 P.M.

7. Write Math **Explain** how you can use a diagram to determine the start time when the end time is 9:00 A.M. and the elapsed time is 26 minutes. What is the start time?

8. H.O.T. Bethany finished her math homework at 4:20 P.M. She did 25 multiplication problems in all. If each problem took her 3 minutes to do, at what time did Bethany start her math homework?

9. **Test Prep** Vincent began his weekly chores on Saturday morning at 11:20. He finished 1 hour and 15 minutes later. At what time did Vincent finish his chores?

Ⓐ 12:35 A.M.  Ⓒ 12:35 P.M.

Ⓑ 10:05 A.M.  Ⓓ 1:05 P.M.





FOR MORE PRACTICE:
Standards Practice Book, pp. P237–P238

Name _____

# Mixed Measures

**Essential Question** How can you solve problems involving mixed measures?

## UNLOCK the Problem REAL WORLD

Herman is building a picnic table for a new campground. The picnic table is 5 feet 10 inches long. How long is the picnic table in inches?

- Is the mixed measure greater than or less than 6 feet?

- How many inches are in 1 foot?

**Change a mixed measure.**

Think of 5 feet 10 inches as 5 feet + 10 inches.

Write feet as inches.

5 feet
+ 10 inches

**Think:** 5 feet × 12 = 60 inches → ☐ inches

☐ inches + ☐ inches = ☐ inches

So, the picnic table is _____ inches long.

## Example 1 Add mixed measures.

Herman built the picnic table in 2 days. The first day he worked for 3 hours 45 minutes. The second day he worked for 2 hours 10 minutes. How long did it take him to build the table?

**STEP 1** Add the minutes.

3 hr 45 min
+ 2 hr 10 min
☐ min

**STEP 2** Add the hours.

3 hr 45 min
+ 2 hr 10 min
☐ hr 55 min

So, it took Herman _____ to build the table.

**MATHEMATICAL PRACTICES**

**Math Talk** How is adding mixed measures similar to adding tens and ones? How is it different? **Explain.**

- **What if** Herman worked an extra 5 minutes on the picnic table? How long would he have worked on the table then? **Explain.**

_____

_____

## Example 2 Subtract mixed measures.

Alicia is building a fence around the picnic area. She has a pole that is 6 feet 6 inches long. She cuts off 1 foot 7 inches from one end. How long is the pole now?

**STEP 1** Subtract the inches.

**Think:** 7 inches is greater than 6 inches. You need to regroup to subtract.

6 ft 6 in. = 5 ft 6 in. + 12 in.

= 5 ft _____ in.

$$\begin{array}{r} 5\ \ 18 \\ 6\text{ ft}\ \ 6\text{ in.} \\ -\ 1\text{ ft}\ \ 7\text{ in.} \\ \hline \square\text{ in.} \end{array}$$

**ERROR Alert**

Be sure to check that you are regrouping correctly. There are 12 inches in 1 foot.

**STEP 2** Subtract the feet.

$$\begin{array}{r} 5\ \ 18 \\ 6\text{ ft}\ \ 6\text{ in.} \\ -\ 1\text{ ft}\ \ 7\text{ in.} \\ \hline \square\text{ ft}\ \ 11\text{ in.} \end{array}$$

So, the pole is now _____ long.

**Try This!** Subtract.

3 pounds 5 ounces − 1 pound 2 ounces

## Share and Show MATH BOARD

1. A truck is carrying 2 tons 500 pounds of steel. How many pounds of steel is the truck carrying?

Think of 2 tons 500 pounds as 2 tons + 500 pounds.
Write tons as pounds.

2 tons
+ 500 pounds

**Think:** 2 tons × 2,000 = ⟶ _____ pounds

_____ pounds
+ _____ pounds
_____ pounds

So, the truck is carrying _____ pounds of steel.

Name _____

**Rewrite each measure in the given unit.**

**2.** 1 yard 2 feet

_____ feet

**3.** 3 pints 1 cup

_____ cups

**4.** 3 weeks 1 day

_____ days

**Add or subtract.**

**5.** 2 lb 4 oz
+ 1 lb 6 oz

**6.** 3 gal 4 qt
− 1 gal 5 qt

**7.** 5 hr 20 min
− 3 hr 15 min

MATHEMATICAL PRACTICES

**Math Talk** How do you know when you need to regroup to subtract? **Explain.**

## On Your Own

**Rewrite each measure in the given unit.**

**8.** 1 hour 15 minutes

_____ minutes

**9.** 4 quarts 2 pints

_____ pints

**10.** 10 feet 10 inches

_____ inches

**Add or subtract.**

**11.** 2 tons 300 lb
− 1 ton 300 lb

**12.** 10 gal 8 c
+ 8 gal 9 c

**13.** 7 lb 6 oz
− 2 lb 12 oz

## Problem Solving REAL WORLD

**14.** H.O.T. Jackson has a rope 1 foot 8 inches long. He cuts it into 4 equal pieces. How many inches long is each piece?

_____

**15.** H.O.T. Ahmed fills 6 pitchers with juice. Each pitcher contains 2 quarts 1 pint. How many pints of juice does he have?

_____

**16.** H.O.T. **Sense or Nonsense?** Sam and Dave each solve the problem at the right. Sam says the sum is 4 feet 18 inches. Dave says the sum is 5 feet 6 inches. Whose answer makes sense? Whose answer is nonsense? **Explain.**

2 ft 10 in.
+ 2 ft 8 in.

_____

_____

## UNLOCK the Problem REAL WORLD


**17.** Theo is practicing for a 5-kilometer race. He runs 5 kilometers every day and records his time. His normal time is 25 minutes 15 seconds. Yesterday it took him only 23 minutes 49 seconds. How much faster was his time yesterday than his normal time?

Ⓐ 1 minute 26 seconds
Ⓒ 2 minutes 26 seconds
Ⓑ 1 minute 64 seconds
Ⓓ 2 minutes 34 seconds

**a.** What are you asked to find?

_____

**b.** What information do you know?

_____

_____

**c.** How will you solve the problem?

_____

**d.** Solve the problem.

**e.** Fill in the bubble for the correct answer choice above.

**18.** H.O.T. Don has 5 pieces of pipe. Each piece is 3 feet 6 inches long. If Don joins the pieces end to end to make one long pipe, how long will the new pipe be?

Ⓐ 8 feet 11 inches
Ⓑ 15 feet 6 inches
Ⓒ 15 feet 11 inches
Ⓓ 17 feet 6 inches

**19.** Maya's cat weighed 7 pounds 2 ounces last year. The cat gained 1 pound 8 ounces this year. What is the weight of Maya's cat now?

Ⓐ 5 pounds 10 ounces
Ⓑ 8 pounds 2 ounces
Ⓒ 8 pounds 10 ounces
Ⓓ 9 pounds





FOR MORE PRACTICE:
Standards Practice Book, pp. P239–P240

Name _____

# Patterns in Measurement Units

**Essential Question** How can you use patterns to write number pairs for measurement units?

CONNECT The table at the right relates yards and feet. You can think of the numbers in the table as number pairs. 1 and 3, 2 and 6, 3 and 9, 4 and 12, and 5 and 15 are number pairs.

| Yards | Feet |
|---|---|
| 1 | 3 |
| 2 | 6 |
| 3 | 9 |
| 4 | 12 |
| 5 | 15 |

The number pairs show the relationship between yards and feet. 1 yard is equal to 3 feet, 2 yards is equal to 6 feet, 3 yards is equal to 9 feet, and so on.


## UNLOCK the Problem REAL WORLD

Lillian made the table below to relate two units of time. What units of time does the pattern in the table show?

**Activity** **Use the relationship between the number pairs to label the columns of the table.**

| _____ | _____ |
|---|---|
| 1 | 7 |
| 2 | 14 |
| 3 | 21 |
| 4 | 28 |
| 5 | 35 |

- List the number pairs.

_____

- **Describe** the relationship between the numbers in each pair.

_____

_____

- Label the columns of the table.

**Think:** What unit of time is 7 times as great as another unit?

MATHEMATICAL PRACTICES

**Math Talk** Look at each number pair in the table. Could you change the order of the numbers in the number pairs? **Explain** why or why not.

**Try This!** Jasper made the table below to relate two customary units of liquid volume. What customary units of liquid volume does the pattern in the table show?

- List the number pairs.

_____

- **Describe** the relationship between the numbers in each pair.

_____

_____

_____

- Label the columns of the table.

| _____ | _____ |
|---|---|
| 1 | 4 |
| 2 | 8 |
| 3 | 12 |
| 4 | 16 |
| 5 | 20 |

**Think:** What customary unit of liquid volume is 4 times as great as another unit?

- What other units could you have used to label the columns of the table above? **Explain.**

_____

_____

_____

## Share and Show


**1.** The table shows a pattern for two units of time. Label the columns of the table with the units of time.

**Think:** What unit of time is 24 times as great as another unit?

| _____ | _____ |
|---|---|
| 1 | 24 |
| 2 | 48 |
| 3 | 72 |
| 4 | 96 |
| 5 | 120 |

MATHEMATICAL PRACTICES

**Math Talk** **Explain** how you labeled the columns of the table.

Name _____

**Each table shows a pattern for two customary units. Label the columns of the table.**

**2.**

| _____ | _____ |
|---|---|
| 1 | 2 |
| 2 | 4 |
| 3 | 6 |
| 4 | 8 |
| 5 | 10 |

**3.**

| _____ | _____ |
|---|---|
| 1 | 16 |
| 2 | 32 |
| 3 | 48 |
| 4 | 64 |
| 5 | 80 |

## On Your Own

**Each table shows a pattern for two units of time. Label the columns of the table.**

**4.**

| _____ | _____ |
|---|---|
| 1 | 60 |
| 2 | 120 |
| 3 | 180 |
| 4 | 240 |
| 5 | 300 |

**5.**

| _____ | _____ |
|---|---|
| 1 | 12 |
| 2 | 24 |
| 3 | 36 |
| 4 | 48 |
| 5 | 60 |

**Each table shows a pattern for two metric units of length. Label the columns of the table.**

**6.**

| _____ | _____ |
|---|---|
| 1 | 10 |
| 2 | 20 |
| 3 | 30 |
| 4 | 40 |
| 5 | 50 |

**7.**

| _____ | _____ |
|---|---|
| 1 | 100 |
| 2 | 200 |
| 3 | 300 |
| 4 | 400 |
| 5 | 500 |

**8.** Write Math List the number pairs for the table in Exercise 6. **Describe** the relationship between the numbers in each pair.

_____

_____

_____

## Problem Solving REAL WORLD

**9.** H.O.T. **What's the Error?** Maria wrote *Weeks* as the label for the first column of the table and *Years* as the label for the second column. **Describe** her error.

| ? | ? |
|---|---|
| 1 | 52 |
| 2 | 104 |
| 3 | 156 |
| 4 | 208 |
| 5 | 260 |

**10.** H.O.T. **Sense or Nonsense?** The table shows a pattern for two metric units. Lou labels the columns *Meters* and *Millimeters*. Zayna labels them *Liters* and *Milliliters*. Whose answer makes sense? Whose answer is nonsense? **Explain.**

| ? | ? |
|---|---|
| 1 | 1,000 |
| 2 | 2,000 |
| 3 | 3,000 |
| 4 | 4,000 |
| 5 | 5,000 |

**11.** Look back at Problem 10. What other labels for metric units could you write for the columns of the table? **Explain.**

**12.** H.O.T. Look at the following number pairs: 1 and 365, 2 and 730, 3 and 1,095. The number pairs describe the relationship between which two units of time? **Explain.**

**13.** **Test Prep** The table shows a pattern for two customary units of length. Which are the best labels?

Ⓐ Years, Months  Ⓒ Yards, Inches

Ⓑ Feet, Inches  Ⓓ Yards, Feet

| ? | ? |
|---|---|
| 1 | 12 |
| 2 | 24 |
| 3 | 36 |
| 4 | 48 |
| 5 | 60 |





FOR MORE PRACTICE:
Standards Practice Book, pp. P241–P242

Name _____

# Chapter Review/Test

## Vocabulary

**Choose the best term from the box to complete the sentence.**

| Vocabulary |
|---|
| gram |
| line plot |
| milliliter |
| millimeter |
| quart |

1. A _____ is a metric unit for measuring length or distance. (p. 467)
2. A _____ is a metric unit for measuring liquid volume. (p. 471)
3. A _____ is a graph that shows the frequency of data along a number line. (p. 461)
4. A _____ is a customary unit for measuring liquid volume. (p. 457)

## Concepts and Skills

**Complete.**

5. 9 feet = _____ inches
6. 7 tons = _____ pounds
7. 10 pints = _____ cups
8. 4 decimeters = _____ centimeters
9. 8 liters = _____ milliliters
10. 5 weeks = _____ days

**Compare using <, >, or =.**

11. 3 yards ◯ 36 inches
12. 10 cups ◯ 80 fluid ounces
13. 4 pounds ◯ 96 ounces
14. 8 meters ◯ 700 centimeters
15. 6 liters ◯ 6,500 milliliters
16. 9 kilograms ◯ 9,000 grams

**Add or subtract.**

17. 8 hr 30 min
    − 6 hr 25 min
18. 7 c 4 fl oz
    + 4 c 3 fl oz
19. 9 yd 1 ft
    − 5 yd 2 ft



GO Online Assessment Options Chapter Test

**Fill in the bubble completely to show your answer.**

**20.** Maya's band rehearsal started at 10:30 A.M. It ended 1 hour and 40 minutes later. At what time did Maya's band rehearsal end?

Ⓐ 12:10 A.M.

Ⓑ 8:50 A.M.

Ⓒ 12:10 P.M.

Ⓓ 11:10 P.M.

**21.** Darlene is making punch. She pours 4 quarts 2 cups of apple juice into a bowl. Then she pours 3 quarts 1 cup of grape juice into the bowl. How much juice is in the bowl now?

Ⓐ 1 quart 1 cup

Ⓑ 7 quarts 1 cup

Ⓒ 7 quarts 3 cups

Ⓓ 8 quarts 1 cup

**22.** Kainoa bought a brick of modeling clay that was labeled 2 kilograms. He needs to separate the clay into balls that are measured in grams. How many grams does he have?

Ⓐ 20 grams

Ⓑ 200 grams

Ⓒ 2,000 grams

Ⓓ 20,000 grams

**23.** A truck driver's truck weighs 3 tons. A weigh station measures the weight in pounds. How many pounds does the truck weigh?

Ⓐ 600 pounds

Ⓑ 2,000 pounds

Ⓒ 3,000 pounds

Ⓓ 6,000 pounds

Name _____

**Fill in the bubble completely to show your answer.**

**24.** Brody and Amanda canoed for 1 hour and 20 minutes before stopping to fish at 1:15 P.M. At what time did they start canoeing?

Ⓐ 11:55 A.M.

Ⓑ 12:05 P.M.

Ⓒ 2:35 P.M.

Ⓓ 11:55 P.M.

**25.** Lewis fills his thermos with 2 liters of water. Garret fills his thermos with 1 liter of water. How many more milliliters of water does Lewis have than Garret?

Ⓐ 1 more milliliter

Ⓑ 100 more milliliters

Ⓒ 1,000 more milliliters

Ⓓ 2,000 more milliliters

**26.** Lola won the 100-meter freestyle event at her swim meet. How many decimeters did Lola swim?

Ⓐ 1 decimeter

Ⓑ 10 decimeters

Ⓒ 100 decimeters

Ⓓ 1,000 decimeters

**27.** What is the best estimate for the length of an ant's leg?

Ⓐ 2 millimeters

Ⓑ 2 centimeters

Ⓒ 2 decimeters

Ⓓ 2 meters

## Constructed Response

**28.** Sabita made this table to relate two customary units of liquid volume. List the number pairs for the table. **Describe** the relationship between the numbers in each pair.

| _____ | _____ |
|---|---|
| 1 | 2 |
| 2 | 4 |
| 3 | 6 |
| 4 | 8 |
| 5 | 10 |

**29.** Label the columns of the table. **Explain** your answer.

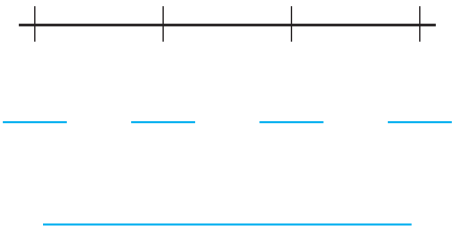
## Performance Task

**30.** Landon borrowed a book from the library. The data show the lengths of time Landon read the book each day until he finished it.

| Time Reading Book (in hours) |
|---|
| $\frac{1}{4}, \frac{1}{4}, 1, \frac{1}{4}, \frac{1}{2}, \frac{3}{4}, \frac{1}{2}, \frac{1}{4}$ |

**A** Make a tally table and a line plot to show the data.

| Time Reading Book | |
|---|---|
| **Time (in hours)** | **Tally** |
| | |
| | |
| | |
| | |



**B** **Explain** how you used the tally table to label the numbers and plot the *X*s on the line plot.

**C** What is the difference between the longest time and shortest time Landon spent reading the book? _____