


12-1

Length in the Customary System (pages 465–468)

Sometimes you need to measure objects using fractions of customary units. The most commonly used customary units of length are the **inch**, **foot**, **yard**, and **mile**.

Customary Units of Length	1 foot (ft) = 12 inches (in.) 1 yard (yd) = 3 feet or 36 inches 1 mile (mi) = 1,760 yards or 5,280 feet
Using a Ruler	$\frac{1}{8}$ inch  inches (in.) Most rulers are separated into eighths.

EXAMPLES

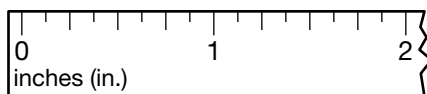
A $36 \text{ in.} = \underline{\quad} \text{ ft}$

Since $1 \text{ ft} = 12 \text{ in.}$, it follows that 36 in. , or $3 \times 12 \text{ in.}$, equals 3 ft .

B Draw a line segment measuring $1\frac{3}{8}$ inches.

Find $1\frac{3}{8}$ on the ruler.

Draw a line segment from 0 to $1\frac{3}{8}$.



Try These Together

1. $2 \text{ mi} = \underline{\quad} \text{ yd}$

HINT: Start with $1 \text{ mi} = 1,760 \text{ yd}$. Multiply.

2. Draw a line segment measuring $2\frac{1}{4}$ in.

HINT: How many eighths are in $\frac{1}{4}$?

PRACTICE

Complete.

3. $6 \text{ ft} = \underline{\quad} \text{ yd}$

4. $96 \text{ in.} = \underline{\quad} \text{ ft}$

5. $36 \text{ ft} = \underline{\quad} \text{ yd}$

Draw a line segment of each length.

6. $\frac{3}{4}$ inch

7. $1\frac{1}{8}$ inches

8. $2\frac{3}{8}$ inches

9. **Architecture** A room is 12 feet wide. How many inches wide is the room?



10. **Standardized Test Practice** Complete $9 \text{ yd} = \underline{\quad} \text{ in.}$

A 324

B 27

C 108

D 3

Answers: 1. 3,520 2. See Answer Key. 3. 2 4. 8 5. 12 6–8. See Answer Key. 9. 144 in. 10. A

12-2**Capacity and Weight in the Customary System** (pages 470–473)

The table below lists the most commonly used customary units, and the information you need in order to change them from one unit to another.

Customary Units of Capacity	1 cup (c) = 8 fluid ounces (fl oz) 1 pint (pt) = 2 cups 1 quart (qt) = 2 pints 1 gallon (gal) = 4 quarts
Customary Units of Weight	1 pound (lb) = 16 ounces (oz) 1 ton (T) = 2,000 pounds
Changing Customary Units of Capacity and Weight	<ul style="list-style-type: none"> Determine whether you are changing from smaller to larger units or from larger to smaller units. To change from smaller to larger units, divide. To change from larger to smaller units, multiply.

EXAMPLES

A $3 \text{ qt} = \underline{\quad} \text{ pt}$

Think: Each quart equals 2 pints.

$3 \times 2 = 6$ *Multiply to change from a larger unit (qt) to a smaller unit (pt).*

$3 \text{ qt} = 6 \text{ pt}$

B $8 \text{ c} = \underline{\quad} \text{ qt}$

Think: Each quart equals 2 pints and each pint equals 2 cups. You need to divide twice.

$8 \div 2 = 4$ *Divide to change from cups to pints.*

$4 \div 2 = 2$ *Divide to change from pints to quarts.*

$8 \text{ c} = 2 \text{ qt}$

Try These Together

1. $6 \text{ T} = \underline{\quad} \text{ lb}$

HINT: You are changing from larger to smaller units.

2. $48 \text{ fl oz} = \underline{\quad} \text{ pt}$

*HINT: You are changing from smaller to larger units.***PRACTICE****Complete.**

3. $4 \text{ qt} = \underline{\quad} \text{ pt}$

4. $18 \text{ fl oz} = \underline{\quad} \text{ c}$

5. $4 \text{ gal} = \underline{\quad} \text{ qt}$

6. $8 \text{ qt} = \underline{\quad} \text{ c}$

7. $36 \text{ oz} = \underline{\quad} \text{ lb}$

8. $5 \text{ lb} = \underline{\quad} \text{ oz}$

9. $10 \text{ T} = \underline{\quad} \text{ lb}$

10. $17 \text{ pt} = \underline{\quad} \text{ gal}$

11. $16 \text{ qt} = \underline{\quad} \text{ pt}$



- 12. Standardized Test Practice** An ice cream sundae has 1 cup of ice cream. How many gallons of ice cream would you need to make 64 ice cream sundaes?

A 4 gal**B** 2 gal**C** 6 gal**D** 8 gal

Answers 1. 12,000 2. 3 3. 8 4. $2\frac{1}{2}$ 5. 16 6. 32 7. $2\frac{1}{2}$ 8. 80 9. 20,000 10. $2\frac{1}{2}$ 11. 32 12. A

12-3**Length in the Metric System** (pages 476–479)

The basic unit of length in the **metric system** is the **meter**. A centimeter is one-hundredth of a meter. A millimeter is one-thousandth of a meter. A kilometer is a thousand meters.

Choosing a Unit of Length

A millimeter is about the width of the lead in a pencil.
A centimeter is about the width of a little fingernail.
A meter is about the length of the handle of a broom.
A kilometer is about the length of TEN football fields.

EXAMPLES

- A** How many meters are in 5 kilometers?

One kilometer is 1,000 meters. Two kilometers is $2 \times 1,000$ or 2,000 meters. There are 5,000 meters in 5 kilometers.

- B** Use a centimeter ruler to measure the width of a piece of notebook paper.

The width is about 21.5 centimeters.

Try These Together

1. What unit of length in the metric system would you use to measure the distance across your city or town?

HINT: What unit is large enough to use for long distances?

2. What metric unit of length would you use to measure the thickness of a piece of cardboard?

HINT: Choose a unit that is very small.

PRACTICE

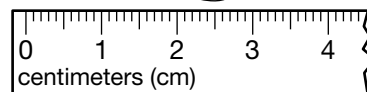
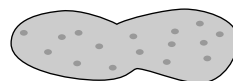
Write the metric unit of length that you would use to measure each of the following.

3. height of a refrigerator
4. length of a banana
5. thickness of a quarter
6. distance from New York to Los Angeles
7. length of a car
8. height of a two-story house
9. How many centimeters are in 2 meters?
10. How many meters are in 8 kilometers?
11. **School** For a science experiment, students need a piece of string about as long as their science textbook. What metric unit should they use to measure the string?



12. **Standardized Test Practice** How long is the peanut in centimeters?

- A** 2 centimeters **B** 3 centimeters
C 4 centimeters **D** 5 centimeters



Answers: 1. kilometer 2. millimeter 3. meter 4. centimeter 5. millimeter 6. kilometer 7. meter 8. meter 9. 200 10. 8,000 11. centimeter 12. B

12-4

Mass and Capacity in the Metric System

(pages 484–487)

In the metric system, all units are defined in terms of a basic unit. The basic unit of mass is the **kilogram** (kg). The basic unit of capacity is the **liter** (L).

Metric Units of Mass	gram (g)	1,000 g = 1 kg	A small paperclip has a mass of about 1 gram.
	kilogram (kg)		A textbook has a mass of about 1 kilogram.
	milligram (mg)	1 mg = 0.001 g	A grain of salt has a mass of about 1 milligram.
Metric Units of Capacity	liter (L)		A small pitcher has a capacity of about 1 liter.
	milliliter (mL)	1 mL = 0.001 L	An eyedropper holds about 1 milliliter of liquid.

EXAMPLES

What unit would you use to measure each of the following?

A the mass of a compact car
Even a compact car has quite a bit of mass. The kilogram is the appropriate unit to measure the mass of a compact car. The average compact car has a mass of about 1,200 kilograms.

B the capacity of a soda can
Since a liter is about the same capacity as a quart, you know that a soda can has less than one liter of capacity. The milliliter is the appropriate unit to measure the capacity of a soda can, which holds about 355 mL.

Try These Together

What unit would you use to measure each of the following? Estimate the mass or capacity.

1. a coffee cup
2. a candy bar

PRACTICE

Write the metric unit of mass or capacity that you would use to measure each of the following. Then estimate the mass or capacity.

3. a wading pool
4. a hammer
5. the wings of a housefly
6. the ink in a fountain pen
7. a nickel
8. a bird bath

Name an item that you think has the given measure.

9. about 20 g
10. about 500 mL
11. about 2 L
12. about 5 kg

13. Food A bottle of grape juice has a capacity of 1890 mL. If the bottle has eight servings, how many mL is one serving?



14. Standardized Test Practice What is the mass of a large can of tomatoes?

- A** 1 mL **B** 1 L **C** 1 g **D** 1 kg

Answers: 1. milliliter, about 200 mL 2. gram, about 50 g 3. liter, about 1,000 L 4. kilogram, about 1 kg 5. milligram, about 2 mg 6. milliliter, about 1 mL 7. gram, about 5 g 8. liter, about 8 L 9–12. Answers will vary. 13. 236.25 mL 14. D

12-5

Changing Metric Units (pages 490–493)

To change from one metric unit to another, you either multiply or divide by powers of 10. The chart below shows the relationship between the metric units and the powers of 10.

	<p>To change from a larger unit to a smaller unit, you need to multiply. To change from a smaller unit to a larger unit, you need to divide.</p> <div style="text-align: center;"> <p><i>MULTIPLY</i></p> <table style="margin: auto;"> <tr> <td></td> <td>1,000</td> <td>100</td> <td>10</td> <td></td> </tr> <tr> <td>km</td> <td>↔</td> <td>m</td> <td>↔</td> <td>cm</td> </tr> <tr> <td></td> <td>↔</td> <td></td> <td>↔</td> <td>mm</td> </tr> <tr> <td></td> <td>1,000</td> <td>100</td> <td>10</td> <td></td> </tr> </table> <p><i>DIVIDE</i></p> </div>		1,000	100	10		km	↔	m	↔	cm		↔		↔	mm		1,000	100	10	
	1,000	100	10																		
km	↔	m	↔	cm																	
	↔		↔	mm																	
	1,000	100	10																		

EXAMPLES

A $1.5 \text{ L} = \underline{\quad} \text{ mL}$

To change from liters to milliliters, multiply by 1,000 since $1 \text{ mL} = 0.001 \text{ L}$.

$$1.5 \times 1,000 = 1,500$$

$$1.5 \text{ L} = 1,500 \text{ mL}$$

B $12 \text{ cm} = \underline{\quad} \text{ m}$

To change from centimeters to meters, divide by 100 since $1 \text{ m} = 100 \text{ cm}$.

$$12 \div 100 = 0.12$$

$$12 \text{ cm} = 0.12 \text{ m}$$

Try These Together

Complete.

1. $3 \text{ kg} = \underline{\quad} \text{ g}$

HINT: Kilograms are larger units than grams; multiply.

2. $9 \text{ mm} = \underline{\quad} \text{ cm}$

HINT: Millimeters are smaller units than centimeters; divide.

PRACTICE

Complete.

- | | | |
|---|---|---|
| 3. $4,860 \text{ mm} = \underline{\quad} \text{ km}$ | 4. $\underline{\quad} \text{ L} = 397 \text{ mL}$ | 5. $669 \text{ mm} = \underline{\quad} \text{ cm}$ |
| 6. $\underline{\quad} \text{ mg} = 0.0079 \text{ g}$ | 7. $8,170 \text{ mm} = \underline{\quad} \text{ m}$ | 8. $\underline{\quad} \text{ mL} = 7.6 \text{ L}$ |
| 9. $0.0034 \text{ kg} = \underline{\quad} \text{ mg}$ | 10. $\underline{\quad} \text{ mg} = 0.4 \text{ g}$ | 11. $460 \text{ mL} = \underline{\quad} \text{ L}$ |
| 12. $\underline{\quad} \text{ g} = 557 \text{ mg}$ | 13. $748 \text{ cm} = \underline{\quad} \text{ m}$ | 14. $\underline{\quad} \text{ mL} = 0.06 \text{ L}$ |
| 15. $1.68 \text{ km} = \underline{\quad} \text{ cm}$ | 16. $\underline{\quad} \text{ g} = 8.05 \text{ kg}$ | 17. $336 \text{ m} = \underline{\quad} \text{ km}$ |

18. **Food** A baby drinks 85 milliliters of juice a day. How many liters of juice does the baby drink in a week?



19. **Standardized Test Practice** How many centimeters are in 0.082 kilometers?

- A** 8.2 **B** 82 **C** 8,200 **D** 82,000

Answers: 1. 3,000 2. 0.9 3. 0.00486 4. 0.397 5. 66.9 6. 7.9 7. 8.17 8. 7,600 9. 3,400 10. 400 11. 0.46 12. 0.557 13. 7.48 14. 60 15. 168,000 16. 8,050 17. 0.336 18. 0.595 L 19. C

12-6

Measures of Time (pages 494–497)

You add and subtract measures of time in the same way you add and subtract mixed numbers.

<p>Adding and Subtracting Measures of Time</p>	<ul style="list-style-type: none"> • Add or subtract the seconds. • Add or subtract the minutes. • Finally, add or subtract the hours. <p>Rename, if necessary, in each step.</p>
---	--

EXAMPLES

A Find $3\text{ h } 15\text{ min} + 2\text{ h } 20\text{ min}$.

<i>First add the minutes.</i>	$3\text{ h } 15\text{ min}$	$+ 2\text{ h } 20\text{ min}$	\rightarrow	<i>Then add the hours.</i>	$3\text{ h } 15\text{ min}$	$+ 2\text{ h } 20\text{ min}$	\rightarrow	$5\text{ h } 35\text{ min}$
	<u>35 min</u>					<u>5 h 35 min</u>		

B Find $8\text{ h } 12\text{ min} - 6\text{ h } 48\text{ min}$.

<i>First rename.</i>	$7\text{ h } 72\text{ min}$	$- 6\text{ h } 48\text{ min}$	\rightarrow	<i>Subtract the minutes.</i>	$7\text{ h } 72\text{ min}$	$- 6\text{ h } 48\text{ min}$	\rightarrow	<i>Subtract the seconds.</i>	$7\text{ h } 72\text{ min}$	$- 6\text{ h } 48\text{ min}$	\rightarrow	$1\text{ h } 24\text{ min}$
		<u>24 min</u>				<u>1 h 24 min</u>						

Try These Together

Add or subtract.

<p>1. $4\text{ min } 32\text{ s} + 8\text{ min } 41\text{ s}$ <i>HINT: Add the seconds, and then add the minutes.</i></p>	<p>2. $11\text{ min } 4\text{ s} - 5\text{ min } 12\text{ s}$ <i>HINT: Rename, subtract the seconds, and then subtract the minutes.</i></p>
--	--

PRACTICE

Complete.

- | | |
|--|--|
| 3. $3\text{ h } 14\text{ min} = 2\text{ h } \underline{\quad} \text{ min}$ | 4. $17\text{ h } 18\text{ min} = 16\text{ hr } \underline{\quad} \text{ min}$ |
| 5. $12\text{ h } 6\text{ min} = 11\text{ hr } \underline{\quad} \text{ min}$ | 6. $2\text{ h } 9\text{ min } 62\text{ s} = 2\text{ h } \underline{\quad} \text{ min } 2\text{ s}$ |

Add or subtract.

- | | | |
|--|---|--|
| 7. $8\text{ h } 46\text{ min}$
$- 1\text{ h } 52\text{ min}$ | 8. $4\text{ h } 36\text{ min}$
$- 3\text{ h } 5\text{ min}$ | 9. $6\text{ h } 24\text{ min}$
$+ 4\text{ h } 18\text{ min}$ |
| 10. $5\text{ h } 43\text{ min } 21\text{ s}$
$- 2\text{ h } 18\text{ min } 14\text{ s}$ | 11. $1\text{ h } 12\text{ min } 36\text{ s}$
$+ 8\text{ h } 54\text{ min } 4\text{ s}$ | 12. $7\text{ h } 42\text{ min } 16\text{ s}$
$+ 1\text{ h } 58\text{ min } 12\text{ s}$ |



13. Standardized Test Practice Margarita is flying from Chicago to Denver. Her $2\text{ h } 35\text{ min}$ flight leaves Chicago at 5:55 P.M. What time does the flight arrive in Denver? Hint: The local Chicago time is one hour ahead of the local time in Denver.

- A** 6:30 P.M. **B** 5:30 P.M. **C** 7:30 P.M. **D** 8:30 P.M.

<p>Answers: 1. 13 min 13 s 2. 5 min 52 s 3. 74 4. 78 5. 66 6. 10 7. 6 h 54 min 8. 1 h 31 min 9. 10 h 42 min 10. 3 h 25 min 7 s 11. 10 h 6 min 40 s 12. 9 h 40 min 28 s 13. C</p>

12

Chapter 12 Review

Classroom Math

You will need a tape measure for this activity. Round all answers to the nearest hundredth.

EXAMPLE

Find the length of your classroom in yards. How many feet are in 1 yard?
Find the length of your classroom in feet.

Yards: 12 yards
Conversion: 3 feet in 1 yard, $3 \cdot 12 = 36$
Feet: 36 feet

1. Find the height of the door to your classroom in inches. How many inches are in 1 foot? Find the height of the door in feet.

Inches: _____
 _____ inches in 1 foot
 Feet: _____

2. Find the length of your textbook in centimeters. How many centimeters are in 1 meter? Find the length of your textbook in meters.

Centimeters: _____
 _____ centimeters in 1 meter
 Meters: _____

3. Estimate the number of miles you live from school. How many feet are in 1 mile? Find the number of feet you live from school.

Miles: _____
 _____ feet in 1 mile
 Feet: _____

4. Find an object in the classroom that is approximately $1\frac{1}{2}$ inches long. Name this object. How long is this object in feet?

Object: _____
 Feet: _____

5. Find an object in the classroom that is approximately 3.5 centimeters long. How many millimeters are in 1 centimeter? How long is this object in millimeters?

Object: _____
 _____ millimeters in 1 centimeter
 Millimeters: _____

6. Find an object in the classroom that is approximately 4 grams. How many ounces are in 1 gram? How much does this object weigh in ounces?

Object: _____
 _____ ounces in 1 gram
 Ounces: _____

Answers are located on p. 107.