

Lesson 25

Length, Liquid Volume, and Mass

Name: \_\_\_\_\_

Prerequisite: Convert Measurements

Study the example problem showing how to convert from a larger to a smaller unit of length. Then solve problems 1–7.

Example

Tammy and Jason participated in the school track meet. Tammy ran the  $\frac{1}{4}$ -mile race. Jason ran the 100-yard dash. Who ran the longer race?

First, convert miles to yards.

$1 \text{ mile} = 1,760 \text{ yards}$

One mile equals 1,760 yards. To find the number of yards in  $\frac{1}{4}$  mile, divide 1,760 by 4.

$$\begin{array}{r} 40 \\ 400 \\ 4 \overline{)1,760} \\ -1,600 \\ \hline 160 \\ -160 \\ \hline 0 \end{array}$$

$\frac{1}{4} \text{ mile} = 440 \text{ yards}$

$440 \text{ yards} > 100 \text{ yards}$

Tammy ran the longer race.

- B** 1 A concrete walkway is  $\frac{3}{4}$  mile long. How many yards long is the walkway?

Fill in the missing numbers in the table. Circle the numbers that show how many yards are equal to  $\frac{3}{4}$  mile.

Mile	$\frac{1}{4}$	$\frac{2}{4}$	$\frac{3}{4}$
Yards	440	880	1,320

The walkway is 1,320 yards long.

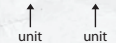
- M** 2 Explain how to use multiplication to solve problem 1.

**Possible answer:** Multiply 3 by 440. There are 440 yards in  $\frac{1}{4}$  mile, so multiply by 3 to find how many yards are in  $\frac{3}{4}$  mile.  $6 \times 440 = 1,320$ .

Vocabulary

**convert** to change from one unit to another unit.

1 foot = 12 inches



Solve.

- M** 3 The cooler at a softball game holds 5 quarts of sports drink. How many cups of sports drink does the cooler hold?

$1 \text{ quart} = 4 \text{ cups}$

Show your work.

Possible work:  $5 \times 4 = 20$

For problems 3 and 4, students might draw a picture, a table, or another model to solve the problem.

Solution: 20 cups

- B** 4 Mark ran  $\frac{1}{2}$  mile during gym class. How many feet did he run?

$1 \text{ mile} = 5,280 \text{ feet}$

Show your work.

Possible work:  $\frac{1}{2} \times 5,280 = 2,640$

Solution: 2,640 feet

- M** 5 Write an expression to convert kilograms to grams. Let  $K$  stand for kilograms.

$1 \text{ kilogram} = 1,000 \text{ grams}$

Expression:  $K \times 1,000$

- M** 6 Write an expression to convert pounds to ounces. Let  $p$  stand for pounds.

$1 \text{ pound} = 16 \text{ ounces}$

Expression:  $p \times 16$

- C** 7 Look at problems 5 and 6 to answer the questions below.

- a. How many grams are in 4 kilograms?

$4 \times 1,000 = 4,000; 4,000 \text{ grams}$

- b. How many ounces are in 7 pounds?

$7 \times 16 = 112; 112 \text{ ounces}$

Key

B Basic

M Medium

C Challenge



Lesson 25

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Solve Length Problems

Study the example problem showing how to solve a multi-step problem about length. Then solve problems 1–5.

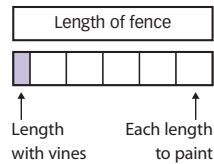
Example

Wendy has a fence that is 10 feet long. Vines cover a section of fence that is  $\frac{5}{6}$  foot long. Wendy and 4 friends will each paint an equal length of the rest of the fence. How long is the section of fence that each friend will paint?

1 foot = 12 inches

Length of fence: 10 feet = 120 inches  
 Length covered with vines:  $\frac{5}{6} \times 12$  inches = 10 inches  
 Length to paint: 120 – 10 = 110 inches  
 Length of each section:  $110 \div 5 = 22$  inches

The section of fence each friend will paint is 22 inches.



- M 1** Nestor needs 750 centimeters of rope. Rope comes in lengths of  $4\frac{1}{2}$  meters and 9 meters at the hardware store. Which length of rope should Nestor buy?

1 meter = 100 centimeters

$4\frac{1}{2}$  meters = 450 centimeters  
 9 meters = 900 centimeters

- a. Which length is greater than 750 centimeters? 900 centimeters  
 b. Nestor should buy rope with a length of 9 meters.

- M 2** Which length is greater,  $\frac{1}{2}$  meter or 240 centimeters? Explain.

**Possible explanation:** 1 meter = 100 centimeters, so  $\frac{1}{2}$  meter = 50 centimeters.

240 centimeters > 50 centimeters, so 240 centimeters is the greater length.

Solve.

- M 3** Jorge is playing football. He carries the ball forward  $5\frac{2}{3}$  yards and then moves backward 1 foot. How far forward is the ball, in feet, from where Jorge started carrying the ball?

1 yard = 3 feet

Show your work.

**Possible work:**  
 $5 \times 3 = 15$  and  $\frac{2}{3} \times 3 = 2$   
 $5\frac{2}{3}$  yards = 15 + 2 = 17 feet  
 17 feet – 1 foot = 16 feet

Solution: 16 feet

- M 4** Last summer, Marion was  $3\frac{1}{2}$  feet tall. She was 4 inches taller than her brother Elijah. She was  $1\frac{1}{4}$  feet shorter than her sister Lorie. How tall were Elijah and Lorie last summer?

1 foot = 12 inches

Show your work.

**Possible work:**  
 Marion:  $3\frac{1}{2}$  feet:  $3 \times 12 = 36$ ;  $\frac{1}{2} \times 12 = 6$ ;  $36 + 6 = 42$  inches  
 Elijah:  $42 - 4 = 38$  inches  
 Lorie:  $\frac{1}{4} \times 12 = 3$ ;  $12 + 3 = 15$ ;  $42 + 15 = 57$  inches

Solution: Elijah: 38 inches Lorie: 57 inches

- C 5** Paula has  $4\frac{2}{3}$  yards of ribbon. She cuts 4 inches off each end of the ribbon to remove the frayed ends. She divides the remaining ribbon into 16 equal pieces to make bows. What is the length of ribbon, in inches, used to make each bow?

Show your work. Possible work:

Convert  $4\frac{2}{3}$  yards to feet:  $4 \times 3$  feet = 12 feet and  $\frac{2}{3} \times 3$  feet = 2 feet  
 $4\frac{2}{3}$  yards = 12 feet + 2 feet = 14 feet  
 Convert 14 feet to inches:  $14 \times 12 = 168$  inches  
 Subtract 8 inches cut off:  $168 - 8 = 160$  inches;  $160 \div 16 = 10$  inches

Solution: 10 inches



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Solve Liquid Volume Problems

Study the example showing how to solve a liquid volume problem. Then solve problems 1–5.

Example

Naomi has a container of water. She uses 4 liters of water her vegetable garden. She uses  $3\frac{1}{2}$  liters to water flowers. She uses the remaining 500 milliliters in the container to fill up a bird bath. How many milliliters of water did Naomi have in the container?

1 liter (L) = 1,000 milliliters (mL)

Write an equation to find the total amount of water.  $W = 4\text{ L} + 3\frac{1}{2}\text{ L} + 500\text{ mL}$

Convert liters to milliliters.  $4 \times 1,000\text{ mL} = 4,000\text{ mL}$   
 $3 \times 1,000\text{ mL} = 3,000\text{ mL}$  and  $\frac{1}{2} \times 1,000\text{ mL} = 500\text{ mL}$

Write the equation using milliliters and solve.  $W = 4,000\text{ mL} + 3,500\text{ mL} + 500\text{ mL}$   
 $W = 8,000\text{ mL}$

Naomi had 8,000 milliliters of water in the container.

Benny has two small fish tanks with one fish in each tank. One tank has  $3\frac{1}{2}$  quarts of water. The other tank has 6 pints of water. Benny combines the water into one large fish tank with both fish in the large tank.

1 quart (qt) = 2 pints (pt)

- B** 1 How many pints of water are in the large tank?

$3\frac{1}{2}$  quarts:  $3 \times 2$  pints = 6 pints and  $\frac{1}{2} \times 2$  pints = 1 pint

$3\frac{1}{2}$  quarts = 7 pints; Total water: 7 pints + 6 pints = 13 pints

There are 13 pints of water in the large tank.

- M** 2 At least 5 cups of water are needed for each fish in a tank. How many more fish would Benny be able to put in the large tank? Explain.

1 pint (pt) = 2 cups (c)

**3 more fish; Possible explanation: Each pint is 2 cups so there are  $2 \times 13$ , or 26 cups of water.  $26 \div 5 = 5\text{ R }1$ , so there is enough water for 5 fish. There are already 2 fish, so Benny can put in 3 more.**

Solve.

- M** 3 Tamara prepared fruit punch for a party. She used  $\frac{3}{4}$  gallon of pineapple juice, 2 quarts of lemonade, and  $1\frac{1}{4}$  gallons of orange juice. How many quarts of punch did Tamara prepare?

1 gallon = 4 quarts

Show your work.

Possible work: Pineapple juice:  $\frac{3}{4} \times 4$  quarts = 3 quarts

Lemonade: 2 quarts

Orange juice:  $1 \times 4$  quarts = 4 quarts;  $\frac{1}{4} \times 4$  quarts = 1 quart;  
4 quarts + 1 quart = 5 quarts

Total number of quarts =  $3 + 2 + 5 = 10$

Solution: 10 quarts

- M** 4 Sharon and her cousin are making milkshakes at a family reunion. Sharon brought  $2\frac{1}{2}$  gallons of milk. Her cousin brought 2 quarts of milk. The girls used 8 quarts of milk for the milkshakes. How much milk is left? There may be more than one correct answer. Circle the letter for all that apply.

- A** 4 quarts      **D** 1 gallon  
**B** 6 quarts      **E**  $1\frac{1}{2}$  gallons  
**C**  $\frac{1}{2}$  gallon

- C** 5 Rob has 6 quarts of apple cider for the fall fair. He pours the cider into glasses to set on picnic tables. He pours 6 ounces of cider into each glass. How many glasses of cider does Rob set on the tables?

1 quart = 4 cups  
1 cup = 8 ounces

Show your work.

Possible work:

6 quarts =  $6 \times 4$  cups = 24 cups

24 cups =  $24 \times 8$  ounces = 192 ounces

$192 \div 6 = 32$

Solution: 32 glasses



Lesson 25

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Solve Mass and Weight Problems

Study the example problem showing how to solve a mass and weight problem. Then solve problems 1–5.

Example

The softball coach has a box filled with softballs. The weight of the empty box is 3 pounds. When it is filled with softballs, the box weighs 12 pounds. Each softball has a weight of 6 ounces. How many softballs are in the box?

$$1 \text{ pound} = 16 \text{ ounces}$$

Find the weight of the softballs in ounces.

$$S = 12 \text{ pounds} - 3 \text{ pounds} = 9 \text{ pounds}$$

$$S = 9 \times 16 \text{ ounces} = 144 \text{ ounces}$$

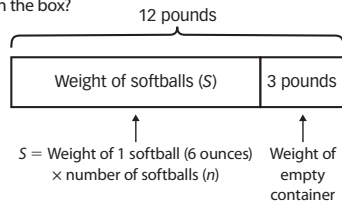
Find the number of softballs.

$$S = 6 \times n$$

$$144 = 6 \times n$$

$$24 = n$$

There are 24 softballs in the box.



- B 1** Look at the example above. Explain why you need to find the weight of the softballs in the box in ounces.

**Possible explanation:** Because the weight of one softball is given in ounces, you need to know the total weight of all the softballs in ounces. Then you can find the number of softballs by dividing the total weight in ounces by the weight of one softball in ounces.

- M 2** Tyson's baby brother weighed 7 pounds, 3 ounces when he was born. The baby lost 9 ounces after a few days, and then gained 1 pound, 6 ounces by the end of the week. How much did the baby weigh at the end of the week?

**Show your work.**

**Possible work:** 7 pounds, 3 ounces =  $(7 \times 16) + 3 = 115$  ounces  
 115 ounces – 9 ounces = 106 ounces; 1 pound, 6 ounces =  $16 + 6 = 22$  ounces  
 106 ounces + 22 ounces = 128 ounces

**Solution:** 128 ounces or 8 pounds

Solve.

- M 3** A large truck that moves cars can carry a maximum load of 15,720 pounds. The table below shows the weight of each kind of car that could be loaded onto the truck.

$$1 \text{ ton} = 2,000 \text{ pounds}$$

Kind of Car	Compact	Mid-size	Full-size
Weight (in tons)	$1\frac{1}{2}$	$2\frac{1}{4}$	3

Choose Yes or No to tell whether the truck is able to carry each load of cars below.

- a. 2 full-size cars, 1 compact car  Yes  No  
 b. 2 compact cars, 2 full-size cars  Yes  No  
 c. 2 mid-size cars, 2 compact cars  Yes  No  
 d. 4 mid-size cars  Yes  No

- M 4** Melinda donated fudge for the school bake sale. She wrapped 80 pieces of fudge. Each piece of fudge weighed 1 ounce. How many pounds of fudge did Melinda wrap?

$$1 \text{ pound} = 16 \text{ ounces}$$

**Show your work.**

**Possible work:**  $80 \times 1 \text{ ounce} = 80 \text{ ounces}$   
 $n \times 16 = 80$   
 $n = 5$

**Solution:** 5 pounds

- C 5** A paper clip has a mass of 1 gram. A box of paper clips has 100 paper clips. Which equation below can be used to find the number of boxes of paper clips that will have a mass of 1 kilogram? Let  $n$  be the number of boxes. Circle the letter for all that apply.

$$1 \text{ kilogram} = 1,000 \text{ grams}$$

- A  $100 = 1,000 \div n$   
 B  $n = 1,000 \times 100$   
 C  $n = 1,000 \div 100$   
 D  $1,000 = n \times 100$



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Length, Liquid Volume, and Mass

Solve the problems.

**B**

- 1** Miguel and his brother put two 8-foot tables end to end for a graduation party. The tablecloth they plan to use is 5 yards in length. Is the tablecloth long enough to cover both tables?

- A** Yes, because 8 feet < 10 yards.  
**B** Yes, because the tables are 8 feet long and the tablecloth is 15 feet long.  
**C** No, because the tables are 16 feet long and the tablecloth is 15 feet long.  
**D** No, because 8 feet > 5 yards.

1 yard = 3 feet.  
What units should you use to compare the length of the tables and the length of the tablecloth?



**M**

- 2** Patel bought a 2-pound bag of trail mix. He poured  $\frac{1}{2}$  pound of the mix into a bowl and divided the remaining amount into bags. Each bag had 2 ounces of trail mix. How many bags did Patel use?

- A** 20 bags  
**B** 16 bags  
**C** 12 bags  
**D** 8 bags

Jen chose **A** as the correct answer. How did she get that answer?

**Possible answer:** She added 2 pounds and  $\frac{1}{2}$  pound instead of subtracting  $\frac{1}{2}$  pound from 2 pounds to find the remaining amount of trail mix that Patel divided into bags.

1 pound = 16 ounces.  
How many ounces of trail mix is he dividing into bags?



Solve.

**M**

- 3** Marcus poured an equal amount of milk into 4 bottles. He started with 1 quart of milk. After pouring, he had  $\frac{1}{4}$  of a quart of milk left. How many ounces of milk did Marcus pour into each bottle?

**Show your work.**

**Possible work:**

$$1 \text{ quart} - \frac{1}{4} \text{ quart} = \frac{3}{4} \text{ quart}$$

$$\frac{3}{4} \text{ quart} = \frac{3}{4} \times 4 \text{ cups} = 3 \text{ cups}$$

$$3 \text{ cups} = 3 \times 8 \text{ ounces} = 24 \text{ ounces}$$

$$24 \text{ ounces} \div 4 = 6 \text{ ounces}$$

**Solution:** 6 ounces

1 quart = 4 cups.  
1 cup = 8 ounces.  
There are two steps in this problem.



**C**

- 4** Maya cut a length of wood into strips to make 5 small picture frames. She used 14 inches of wood for each frame. For another project, she cut another length of wood into 3 strips of 1 foot each and 4 strips of  $\frac{1}{6}$  foot each. How much wood, in inches, did Maya use in all?

**Show your work.**

**Possible work:**

**Frame:**

$$5 \times 14 \text{ inches} = 70 \text{ inches}$$

**Strips:**

$$3 \times 1 \text{ foot} = 3 \text{ feet}$$

$$3 \text{ feet} = 3 \times 12 \text{ inches} = 36 \text{ inches}$$

$$4 \times \frac{1}{6} \text{ foot} = \frac{4}{6} \text{ foot}$$

$$\frac{4}{6} \text{ foot: } \frac{4}{6} \times 12 = 8 \text{ inches}$$

$$70 + 36 + 8 = 114$$

**Solution:** 114 inches

1 foot = 12 inches.  
You can use multiplication and addition to solve this problem.

