14 Measurement

FOR THE SAKE OF HIS MEN

London, England **May 30, 1916**

Sir Ernest Shackleton, an English explorer, set out in the autumn of 1914 to do what most people considered impossible. He wanted to cross the continent of Antarctica on foot. Leading a team of twenty-seven men, he set sail in the wooden ship *Endurance* from Plymouth, England, for a whaling station on South Georgia, an island off the tip of the Antarctic Peninsula. On October 26 the *Endurance* left its stopping point in Argentina to head toward South Georgia. Finally, on December 5, the ship set sail for Antarctica, but the expedition never reached its destination. The ship became locked in the frozen waters for ten long months. Eventually the pressure from the ice crushed the wooden boat, causing it to sink in the Weddell Sea.

Shackleton's men found safety on an ice floe and managed to rescue three lifeboats, a twenty-two-foot whaling boat, and most of its supplies. Shackleton led his men on a dangerous journey for five months, moving from ice floe to ice floe in an effort to reach land.

Shackleton's ship, the *Endurance*, trapped in ice in Antarctica

Four hundred ninety-seven days after their initial departure, the men landed on the barren shore of Elephant Island and set up camp.

On April 24, 1916, Shackleton and five men sailed back to the whaling station to get help for his abandoned men. It was a seventeen-day, eight-hundred-mile trip through treacherous seas and weather, but they reached South Georgia Island on May 10, 1916.

But the most perilous part of their mission had only just begun. They had landed on the opposite shore from the whaling station, where they found that miles of uncharted, frozen, mountainous wasteland lay between them and their goal. Leaving three men to guard the ship, Shackleton and two others began the trek across the island. They cut their way through mountains of frozen ice, waded through freezing water, and eventually trudged into the whaling station, hungry and exhausted.

Shackleton wasted no time rescuing his other men. His navigator set sail that night on a whaling ship to rescue the three men they had left on the opposite shore. Forty-eight hours later, Shackleton himself left in the whaler *Southern Sky* to rescue the men marooned on Elephant Island. They had survived on the island for one hundred and five days.

Although Shackleton never crossed Antarctica on foot, his journey over land and sea to save the lives of his men had been far more daring. Every one of his twenty-seven men lived to tell the incredible tale.

Because of the changing ice shelves, the area of Antarctica nearly doubles as the sea around it freezes. NASA updates the image of the land and ice elevations daily on its website.

Ninety-five percent of Antarctica is covered by an ice sheet that ranges from 6,500 to nearly 16,000 feet thick.

Antarctica contains ninety percent of all the snow and ice in the world and is nearly ninety-eight percent covered by ice. It receives an average of less than one to two inches of precipitation each year.

Antarctica recorded the world's lowest temperature of $^{-}129^{o}$F in July 1983. Antarctica's warmest recorded temperature was 59^{o}F in January 1974.

Antarctica is the world's highest continent with an average height of over 8,000 feet above sea level. It has mountains, volcanoes, and the world's largest desert.

Antarctica's only industry is whaling.

Measurement

Lesson	Topic	Lesson Objectives	Chapter Materials
125	**Linear Measurement**	• Demonstrate an understanding of linear units: *inch*, *foot*, *yard*, and *mile* • Estimate measurements using benchmarks • Measure to the nearest inch, half inch, fourth inch, eighth inch, and sixteenth inch • Convert linear measurements to smaller or larger units • Find a fraction of a measurement unit • Add and subtract linear measurements	**Teaching Visuals (Teacher's Toolkit CD):** • Chart 10: *Customary Measurement* • Chart 11: *Metric Measurement* • Chart 12: *Metric Measurement: Length & Distance* • Chart 13: *Metric Measurement: Capacity* • Chart 14: *Metric Measurement: Mass* • Chart 15: *Customary & Metric Conversions* • Chart 16: *Time Measurement* **Teacher Manipulatives Packet:** • Measurement Flashcards • Rulers: Measuring Tape (meter) • Rulers: Inch Ruler (sixteenths), Centimeter Ruler, and Measuring Tape (yard) (optional) • Thermometer • Red Strip • Boiling Point steam cloud • Clock (optional) **Student Manipulatives Packet:** • Place Value Kit • Measurement Flashcards • Rulers: Measuring Tapes (yard and meter) • Rulers: Inch Ruler (sixteenths), and Centimeter Ruler (optional) • Thermometer • Red Strip • Clock **Instructional Aids (Teacher's Toolkit CD):** • Cumulative Review Answer Sheet (page IA9) for each student • Customary Measurement Craze (page IA71) • Metric Measure Mania (page IA72) for each group of students • Customary Measurement Word Problems (page IA73) • Metric Measurement Word Problems (page IA74) (optional) • Temperature Hunt (page IA75) for each group of students • Double-Scale Thermometer (page IA76) • Double-Scale Thermometer (page IA76) for each student • Time Zones of the World (page IA77) • Time Zones of the World (page IA77) for each student • Time Zones (page IA78) • Map Key (page IA79) **Christian Worldview Shaping (Teacher's Toolkit CD):** • Pages 33–34 **Other Teaching Aids:** • A ruler for each student and the teacher • A transparent ruler • A yardstick
126	**Weight & Capacity**	• Demonstrate an understanding of units of weight: *pound*, *ounce*, and *ton* • Read a spring scale • Demonstrate an understanding of units of capacity: *fluid ounce*, *cup*, *pint*, *quart*, and *gallon* • Convert weight and capacity measurements to smaller or larger units • Find a fraction of a measurement unit • Add and subtract weight and capacity measurements	
127	**Metric Linear Measurement**	• Develop an understanding of the metric system • Develop an understanding of metric linear units: *kilometer*, *meter*, *centimeter*, and *millimeter* • Estimate and measure to the nearest meter, centimeter, and millimeter • Determine the appropriate linear unit • Convert metric linear measurements to smaller or larger units • Find a fraction of a measurement unit • Compare metric linear measurements using $>$ or $<$ • Add and subtract metric linear measurements	
128	**Metric Capacity & Mass**	• Develop an understanding of metric units of capacity: *liter* and *milliliter* • Develop an understanding of metric units of mass: *gram*, *kilogram*, and *milligram* • Convert metric capacity and mass measurements to smaller or larger units • Add and subtract metric capacity and mass measurements	
129	**Customary & Metric**	• Add, subtract, multiply, and divide measurements • Solve measurement word problems • Find a fraction of a measurement	
130	**Fahrenheit & Celsius**	• Recognize *degree* as a measuring unit for temperature • Recognize that °*C* represents *degrees Celsius* and °*F* represents *degrees Fahrenheit* • Identify standard Celsius and Fahrenheit temperatures • Determine the more reasonable temperature • Read and set a Celsius and a Fahrenheit thermometer • Determine the amount of increase or decrease between two temperatures • Measure temperature using a thermometer • Convert temperatures: Celsius to Fahrenheit and Fahrenheit to Celsius	
131	**Relate Customary & Metric Units**	• Recognize approximate equivalencies between customary and metric units of measurement • Compare customary and metric measurements • Estimate conversions between customary and metric measurements	

Measurement

Lesson	Topic	Lesson Objectives
132	**Telling & Renaming Time**	• Identify equivalent units of time • Tell and write time to the minute • Differentiate between AM and PM • Develop an understanding of a 24-hour clock • Convert units of time to smaller or larger units • Find a fraction of a unit of time • Add and subtract time
133	**Elapsed Time & Time Zones**	• Demonstrate an understanding of world time zones • Determine the elapsed time • Add and subtract time
134	**Rename Units of Measure**	• Estimate customary and metric measurements of objects • Convert measurements to smaller or larger units • Compare customary and metric units of measurement • Add, subtract, multiply, and divide measurements • Solve measurement word problems • Determine mileage using a map scale • Convert temperatures: Celsius to Fahrenheit and Fahrenheit to Celsius • Identify standard temperatures • Determine the time in various time zones
135	**Unit Multipliers**	• Write an equivalency as a unit multiplier • Determine the missing term in a unit multiplier • Convert measurements using a unit multiplier
136	**Chapter 14 Review**	• Review
137	**Chapter 14 Test Cumulative Review**	• Read and interpret a line graph • Round numbers to a given place • Estimate a quotient or a sum • Simplify an expression using substitution • Determine the value of a variable in an expression or an equation • Identify common factors and common multiples of two numbers • Demonstrate an understanding of a circle: diameter, radius, and chord

Chapter Materials

- A tape measure
- A spring scale
- A 1-lb loaf of bread with 16 1-oz slices or 1 lb of cheese with 16 1-oz slices
- Objects to be weighed
- Containers: four 1-cup, four 1-pint, four 1-quart, two 1-gallon
- 2 gallons of water
- A meter stick
- Clearview Liter Cube Set
- A 1-liter beaker or metric measuring container
- A balance or a metric scale
- A 1-liter bottle of water for each student and the teacher
- Objects that fit in your hand
- 6 thermometers of various types
- Judy Clock
- A toy that changes shape for each group of students

Math 6 Tests and Answer Key

Optional (Teacher's Toolkit CD):

- Fact Review pages
- Application pages
- Calculator Activities

The ruler called for in this chapter and in the following chapters (Chapters 15–17) is a customary/metric ruler that can be used to measure inches to the nearest sixteenth, centimeters, and millimeters.

Some of the items included in the Chapter Materials were requested in the parent letter that was sent home at the beginning of Chapter 13.

A Little Extra Help

Use the following to provide "a little extra help" for the student that is experiencing difficulty with the concepts taught in Chapter 14.

Convert customary and metric units—Knowing whether to multiply or divide when converting units may be difficult for some students. Write *3 lb = __ oz* for display and write *__ lb = __ oz* below it. Ask the student to identify the equivalent relationship between pounds and ounces. ***1 lb = 16 oz*** Write 1 and 16 in the appropriate blanks. Ask the student whether multiplication or division is needed to convert 1 pound to more of the smaller unit (ounces). ***multiplication*** Ask him what he should multiply 3 pounds by to find the equivalent number of ounces and to explain his answer. ***3 lbs × 16 oz; elicit that since there are 16 ounces in 1 pound, you multiply 3 × 16 oz to find the number of ounces in 3 pounds.*** Direct him to find the number of ounces and to complete the original problem. ***3 × 16 oz = 48 oz*** Repeat the procedure for 3.98 cm = __ m, using division. ***100 cm = 1 m; 3.98 cm ÷ 100 = 0.0398 m***

Math Facts

Throughout this chapter, review fractions using Fact Review pages on the Teacher's Toolkit CD. Also, review multiplication and division facts using Fact Review pages or a Fact Fun activity on the Teacher's Toolkit CD, or you may use flashcards.

Lesson 125

Student Text pp. 302–5
Daily Review p. 451a

Objectives
- Demonstrate an understanding of linear units: *inch, foot, yard,* and *mile*
- Estimate measurements using benchmarks
- Measure to the nearest inch, half inch, fourth inch, eighth inch, and sixteenth inch
- Convert linear measurements to smaller or larger units
- Find a fraction of a measurement unit
- Add and subtract linear measurements

Teacher Materials
- Chart 10: *Customary Measurement*
- A ruler
- A yardstick
- A tape measure

Student Materials
- Place Value Kit: 1 small one and 1 ten
- Rulers: Measuring Tape (yard)
- A ruler

Preparation
Determine a familiar location 1 mile from your school.

Notes
Preview the Fact Review pages, the Application pages, and the Calculator Activities located on the Teacher's Toolkit CD.

For this chapter, you may choose to use the Rulers from the Student and the Teacher Manipulative Packets rather than generic rulers.

Throughout this chapter, use the Measurement Flashcards to daily review the equivalencies and the abbreviations in preparation for the Chapter 14 Test. Allow the students to refer to the equivalencies on pages 499–500 of the Student Text Handbook until mastery is achieved.

Introduce the Lesson

Guide the students in reading aloud the story and facts on pages 302–3 of the Student Text (pages 300–301 of this Teacher's Edition).

Teach for Understanding

Demonstrate an understanding of linear units

1. Distribute the rulers and the Measuring Tapes. Display your ruler, yardstick, and tape measure.
➤ **How many inches long is the ruler? *12 inches* the yardstick? *36 inches***
➤ **What fraction of a yard is 1 foot? $\frac{12}{36}$ *or* $\frac{1}{3}$ 2 feet? $\frac{24}{36}$ *or* $\frac{2}{3}$ 3 feet? $\frac{36}{36}$ *or* $\frac{3}{3}$**
2. Choose three students to place their rulers, one at a time, on top of the yardstick to show the following fractional comparisons: $\frac{1}{3}$ ($\frac{12}{36}$), $\frac{2}{3}$ ($\frac{24}{36}$), and $\frac{3}{3}$ ($\frac{36}{36}$) of the whole.
➤ **How far is a mile? *Answers will vary, but elicit that a mile is a long unit of measurement that is used for measuring distance.***
➤ **What is used to measure a mile? *possible answers: a car's odometer; a personal pedometer***
3. Direct attention to *1 mile = 5,280 feet* and *1 mile = 1,760 yard* on the *Customary Measurement* chart. Explain that the average person can walk 1 mile in 20 minutes. Point out that (*a predetermined location*) is 1 mile from your school.
4. Explain that when an exact measurement is not needed, you can estimate.
➤ **What part of your hand could you use to estimate 1 inch? *possible answer: the midsection of your index finger***
➤ **What could you use to estimate 1 foot? *possible answers: length of your shoe, the distance from your elbow to your wrist***
1 yard? *possible answer: the distance from your nose to the end of your out-stretched arm*
5. Choose students to use a benchmark to estimate the length of the room in yards and then to place their Measuring Tapes end-to-end along the base of the wall to measure its length.
➤ **Does the wall measure to an exact yard? *Answer may vary.*** Point out that unless the wall measures to an exact yard, the measurement is not precise.
➤ **How could you get a more precise measurement? *Elicit that you can measure using smaller units (feet or inches).***
6. Repeat the procedure using 1-foot rulers to measure the wall in feet.
➤ **Is this a precise measurement? *Elicit that it is more precise than yards, but unless the wall measures to an exact foot, it is still not precise.***
7. Follow a similar procedure to measure the wall in inches using the tape measure.
➤ **What customary unit of measurement is more precise than an inch? *Elicit that since the inch is the smallest linear customary unit, you could measure to the nearest fractional part of an inch.***
8. Ask students to choose the most precise unit of measure for the following:

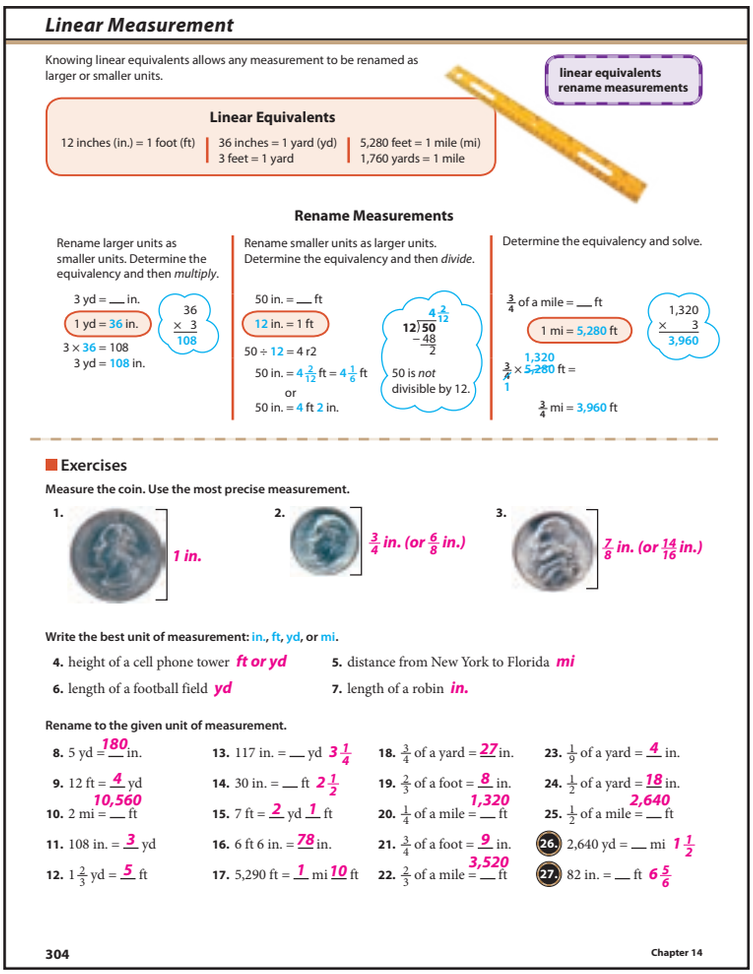
length of a pencil ***in.***	height of a student ***in. or ft***
length of carpet ***ft or yd***	distance between cities ***mi***

Estimate and measure to the nearest inch, half inch, fourth inch, eighth inch, and sixteenth inch

1. Distribute 1 one and 1 ten to each student. Point out the sixteenth marks on your ruler.
➤ **What does each sixteenth mark on your ruler measure? How do you know? $\frac{1}{16}$ *of an inch; the marks divide each inch into 16 equal parts.***
2. Guide the students in using their rulers to measure one side of the one to the nearest $\frac{1}{2}$ inch, $\frac{1}{4}$ inch, and $\frac{1}{8}$ inch.
➤ **What did the side of the one measure? *possible answers:* $\frac{1}{2}$ *in.,* $\frac{2}{4}$ *in.,* $\frac{4}{8}$ *in.,* $\frac{5}{8}$ *in.*** Point out that the actual length is between eighth marks on the ruler.
3. Repeat the procedure for students to measure the one to the nearest $\frac{1}{16}$ inch. $\frac{9}{16}$ ***in.***
➤ **Which measurement is the most precise? Why? $\frac{9}{16}$*; elicit that* $\frac{1}{16}$ *in. is a smaller unit of measurement than* $\frac{1}{2}$ *in.,* $\frac{1}{4}$ *in., or* $\frac{1}{8}$ *in.; therefore, sixteenths can be used to more precisely measure shorter lengths to get a closer estimate.***
4. Direct the students to estimate to the nearest inch the length of a long side of the ten. ***about 6 in.*** Then instruct them to measure the length as precisely as possible. ***5*** $\frac{12}{16}$ ***in. or 5*** $\frac{3}{4}$ ***in.***

Convert linear measurements

1. Write *7 ft = __ in.*
➤ **When you rename a larger unit to a smaller unit, will you have more or fewer units? Why? *More; it takes more smaller units to measure the same length as 1 larger unit.***
➤ **When applied to whole numbers, does multiplication or division give you more units? *multiplication***
➤ **What ratio or equivalency do you know for feet to inches? *1 ft: 12 in. or 1 ft = 12 in.*** Write *1 ft = 12 in.*



Linear Measurement

Knowing linear equivalents allows any measurement to be renamed as larger or smaller units.

linear equivalents rename measurements

Linear Equivalents

12 inches (in.) = 1 foot (ft) | 36 inches = 1 yard (yd); 3 feet = 1 yard | 5,280 feet = 1 mile (mi); 1,760 yards = 1 mile

Rename Measurements

Rename larger units as smaller units. Determine the equivalency and then *multiply*.

3 yd = ___ in.

1 yd = 36 in.

3 × 36 = 108

3 yd = 108 in.

36 × 3 = 108

Rename smaller units as larger units. Determine the equivalency and then *divide*.

50 in. = ___ ft

12 in. = 1 ft

50 ÷ 12 = 4 r2

50 in. = $4\frac{2}{12}$ ft = $4\frac{1}{6}$ ft

or

50 in. = 4 ft 2 in.

$12\overline{)50}$ $4\ 2/12$, -48, 2

50 is *not* divisible by 12.

Determine the equivalency and solve.

$\frac{3}{4}$ of a mile = ___ ft

1 mi = 5,280 ft

$\frac{3}{4} \times \frac{5{,}280}{1}$ ft = 1,320 ft

1,320 × 3 = 3,960

$\frac{3}{4}$ mi = 3,960 ft

Exercises

Measure the coin. Use the most precise measurement.

1. 1 in.
2. $\frac{3}{4}$ in. (or $\frac{6}{8}$ in.)
3. $\frac{7}{8}$ in. (or $\frac{14}{16}$ in.)

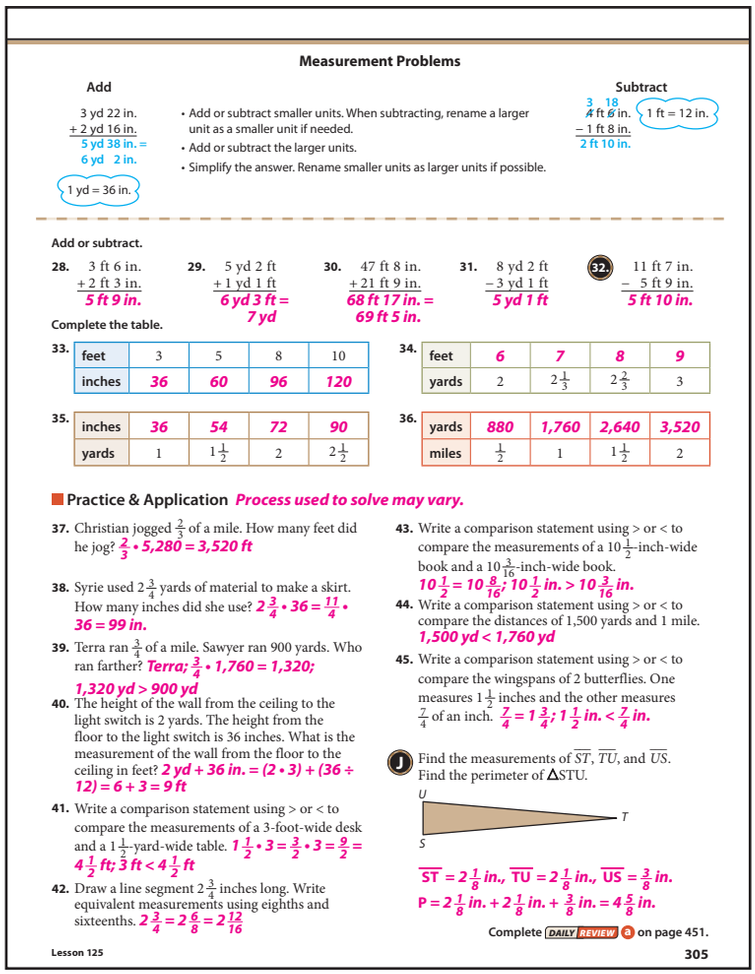
Write the best unit of measurement: in., ft, yd, or mi.

4. height of a cell phone tower ft or yd
5. distance from New York to Florida mi
6. length of a football field yd
7. length of a robin in.

Rename to the given unit of measurement.

8. 5 yd = 180 in.
9. 12 ft = 4 yd
10. 2 mi = 10,560 ft
11. 108 in. = 3 yd
12. $1\frac{2}{3}$ yd = 5 ft
13. 117 in. = ___ yd $3\frac{1}{4}$
14. 30 in. = ___ ft $2\frac{1}{2}$
15. 7 ft = 2 yd 1 ft
16. 6 ft 6 in. = 78 in.
17. 5,290 ft = 1 mi 10 ft
18. $\frac{3}{4}$ of a yard = 27 in.
19. $\frac{2}{3}$ of a foot = 8 in.
20. $\frac{1}{4}$ of a mile = 1,320 ft
21. $\frac{3}{4}$ of a foot = 9 in.
22. $\frac{2}{3}$ of a mile = 3,520 ft
23. $\frac{1}{9}$ of a yard = 4 in.
24. $\frac{1}{2}$ of a yard = 18 in.
25. $\frac{1}{2}$ of a mile = 2,640 ft
26. 2,640 yd = ___ mi $1\frac{1}{2}$
27. 82 in. = ___ ft $6\frac{5}{6}$

304 Chapter 14



Measurement Problems

Add

3 yd 22 in.
+ 2 yd 16 in.
5 yd 38 in. =
6 yd 2 in.

1 yd = 36 in.

- Add or subtract smaller units. When subtracting, rename a larger unit as a smaller unit if needed.
- Add or subtract the larger units.
- Simplify the answer. Rename smaller units as larger units if possible.

Subtract

3 18
4 ft 6 in.
− 1 ft 8 in.
2 ft 10 in.

1 ft = 12 in.

Add or subtract.

28. 3 ft 6 in. + 2 ft 3 in. = 5 ft 9 in.
29. 5 yd 2 ft + 1 yd 1 ft = 6 yd 3 ft = 7 yd
30. 47 ft 8 in. + 21 ft 9 in. = 68 ft 17 in. = 69 ft 5 in.
31. 8 yd 2 ft − 3 yd 1 ft = 5 yd 1 ft
32. 11 ft 7 in. − 5 ft 9 in. = 5 ft 10 in.

Complete the table.

33.

feet	3	5	8	10
inches	36	60	96	120

34.

feet	6	7	8	9
yards	2	$2\frac{1}{3}$	$2\frac{2}{3}$	3

35.

inches	36	54	72	90
yards	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$

36.

yards	880	1,760	2,640	3,520
miles	$\frac{1}{2}$	1	$1\frac{1}{2}$	2

Practice & Application *Process used to solve may vary.*

37. Christian jogged $\frac{2}{3}$ of a mile. How many feet did he jog? $\frac{2}{3} \cdot 5{,}280 = 3{,}520$ ft
38. Syrie used $2\frac{3}{4}$ yards of material to make a skirt. How many inches did she use? $2\frac{3}{4} \cdot 36 = \frac{11}{4} \cdot 36 = 99$ in.
39. Terra ran $\frac{3}{4}$ of a mile. Sawyer ran 900 yards. Who ran farther? Terra; $\frac{3}{4} \cdot 1{,}760 = 1{,}320$; 1,320 yd > 900 yd
40. The height of the wall from the ceiling to the light switch is 2 yards. The height from the floor to the light switch is 36 inches. What is the measurement of the wall from the floor to the ceiling in feet? 2 yd + 36 in. = (2 • 3) + (36 ÷ 12) = 6 + 3 = 9 ft
41. Write a comparison statement using > or < to compare the measurements of a 3-foot-wide desk and a $1\frac{1}{2}$-yard-wide table. $1\frac{1}{2} \cdot 3 = \frac{3}{2} \cdot 3 = \frac{9}{2} = 4\frac{1}{2}$ ft; 3 ft < $4\frac{1}{2}$ ft
42. Draw a line segment $2\frac{3}{4}$ inches long. Write equivalent measurements using eighths and sixteenths. $2\frac{3}{4} = 2\frac{6}{8} = 2\frac{12}{16}$
43. Write a comparison statement using > or < to compare the measurements of a $10\frac{1}{2}$-inch-wide book and a $10\frac{3}{16}$-inch-wide book. $10\frac{1}{2} = 10\frac{8}{16}$; $10\frac{1}{2}$ in. > $10\frac{3}{16}$ in.
44. Write a comparison statement using > or < to compare the distances of 1,500 yards and 1 mile. 1,500 yd < 1,760 yd
45. Write a comparison statement using > or < to compare the wingspans of 2 butterflies. One measures $1\frac{1}{2}$ inches and the other measures $\frac{7}{4}$ of an inch. $\frac{7}{4} = 1\frac{3}{4}$; $1\frac{1}{2}$ in. < $\frac{7}{4}$ in.

J Find the measurements of $\overline{ST}$, $\overline{TU}$, and $\overline{US}$. Find the perimeter of $\triangle STU$.

$\overline{ST} = 2\frac{1}{8}$ in., $\overline{TU} = 2\frac{1}{8}$ in., $\overline{US} = \frac{3}{8}$ in.

P = $2\frac{1}{8}$ in. + $2\frac{1}{8}$ in. + $\frac{3}{8}$ in. = $4\frac{5}{8}$ in.

Complete DAILY REVIEW 3 on page 451.

Lesson 125 305

Point out that writing the units of the standard equivalency in the same order that they appear in the problem can help you in determining whether to multiply or divide.

➤ **How many inches are in 7 feet? How do you know?** *84 inches; elicit that 7 ft is 7 sets of 12 in.; 7 × 12 in. = 84 in.*

Write *7 × 12 in. = 84 in.* for display. Elicit that to rename larger units (feet) to smaller units (inches), you determine the equivalency and multiply. Complete the statement.

2. Write *5 yd 2 ft = ___ ft* for display.

➤ **How can you determine the number of feet in 5 yards 2 feet?** *Elicit that you can identify the equivalency (1 yd = 3 ft), multiply to find the number of feet in 5 yards (5 × 3 ft = 15 ft), and then add 2 feet to the product.*

➤ **What multi-step equation can you write to find the number of feet in 5 yards 2 feet?** *(5 × 3 ft) + 2 ft = ___ ft* Choose a student to write the equation for display and solve it. *17 ft* Complete the equivalent statement.

3. Repeat the procedure for *5 yd 2 ft = ___ in.* *1 yd = 36 in. and 1 ft = 12 in.; (5 × 36 in.) + (2 × 12 in.) = 204 in.*
4. Follow a similar procedure for *3′ 11″ =___ ″* *47*, *4 yd 5 in. = ___ in.* *149*, and *2 mi 350 ft = ___ ft* *10,910*. Explain that the symbol (′) represents *foot* or *feet* and the symbol (″) represents *inch* or *inches*.

Kalee needs $\frac{1}{3}$ of a yard of ribbon for a picture frame. How many inches of ribbon does she need? *12 in.*

5. Elicit that *a yard* implies 1 yard; $\frac{1}{3}$ *of a yard* or $\frac{1}{3} \times 1$ yard. To solve the word problem, you rename the unit (yard) as an equivalent number of the desired unit (inches) and then multiply by the fraction; $\frac{1}{3}$ yd = ___ in.; 1 yd = 36 in.; $\frac{1}{3} \times 36$ in. = ___ in.

Instruct the students to write and solve an equation to find the number of inches in $\frac{1}{3}$ of a yard. $\frac{1}{3} \times 36$ in. $= \frac{36 \text{ in.}}{3} = 12$ in. Write $\frac{1}{3}$ *of a yard = 12 in.*

6. Follow a similar procedure for $2\frac{1}{3}$ yd of material. $2\frac{1}{3}$ *yd = ___ in.;* $\frac{7}{3}$ *yd = ___ in.; 1 yd = 36 in.;* $\frac{7}{3} \times 36$ *in. = 84 in.;* $2\frac{1}{3}$ *yd = 84 in.*

➤ **What generalization can be made when converting larger units to smaller units?** *Answers may vary but should include that you find the equivalency and then multiply.*

7. Follow a similar procedure (steps 1–4) to rename smaller units to larger units using division. Elicit that the remainders represent a part of the next set of the larger unit.

80 in. = ___ yd *36 in. = 1 yd; 80 in. ÷ 36 in. = $2\frac{8}{36}$ yd or $2\frac{2}{9}$ yd*

42 in. = ___ yd *36 in. = 1 yd; 42 in. ÷ 36 in. = $1\frac{6}{36}$ yd or $1\frac{1}{6}$ yd*

58″ = ___′ *12 in. = 1 ft; 58″ ÷ 12″ = $4\frac{10}{12}$′ or $4\frac{5}{6}$′*

Add and subtract linear measurements

1. Write the following problems for display and guide the students in adding and subtracting like units, beginning with the smaller units. Rename the sum to larger units when possible. Rename in the minuend as needed.

6 ft 3 in.	7 yd 2 ft	7 yd 5 in.	12 ft 5 in.
+ 4 ft 9 in.	+ 9 yd 2 ft	− 2 yd 8 in.	− 7 ft 8 in.
10 ft 12 in.	*16 yd 4 ft*	*4 yd 9 in.*	*4 ft 9 in.*
11 ft	*17 yd 1 ft*		

2. Guide the students in renaming the answers as only the larger unit and then as only the smaller unit. 11 ft *132 in.*; 17 yd 1 ft *$17\frac{1}{3}$ yd or 52 ft*; 4 yd 9 in. *$4\frac{1}{4}$ yd or 153 in.*; 4 ft 8 in. *$4\frac{8}{12}$ ft or 56 in.*

Student Text pp. 304–5

Lesson 126

Student Text pp. 306–7
Daily Review p. 451b

Objectives

- Demonstrate an understanding of units of weight: *pound*, *ounce*, and *ton*
- Read a spring scale
- Demonstrate an understanding of units of capacity: *fluid ounce*, *cup*, *pint*, *quart*, and *gallon*
- Convert weight and capacity measurements to smaller or larger units
- Find a fraction of a measurement unit
- Add and subtract weight and capacity measurements

Teacher Materials

- Chart 10: *Customary Measurement*
- Customary Measurement Craze, page IA71 (CD)
- A spring scale (pounds and ounces)
- A 1-lb loaf of bread with 16 1-oz slices (or 1 lb of cheese with 16 1-oz slices)
- Objects to be weighed (less than, equal to, and more than 1 pound)
- Containers: four 1-cup, four 1-pint, four 1-quart, two 1-gallon
- 2 gallons of water

Notes

The objects to be weighed and the containers used in this lesson are items that have been brought to class by the students in response to the parent letter that was sent home at the beginning of Chapter 13.

You may choose to add color to the water for demonstration purposes.

Introduce the Lesson

Display the *Customary Measurement* chart. Write the following equivalencies for display and choose students to complete them.

1 pt = __ c *2* 1 qt = __ pt *2* 1 gal = __ qt *4*
1 lb = __ oz *16* 1 tn = __ lb *2,000*

Teach for Understanding

Demonstrate an understanding of units of weight

1. Display the spring scale. Explain that a spring scale is used to find the weight of an object in pounds and/or ounces. Weight is used to determine the price for mailing a package, the better unit price, or a dose of medicine.
   - ➤ **Where have you seen a scale?** *possible answers: doctor's office, grocery store, recycling plant*
   - ➤ **How can you determine the weight of a loaf of bread?** *Weigh the loaf on a scale or check the packaging label.*
2. Guide students in weighing a loaf of bread and a slice of the bread. Then allow a student to count the slices in the loaf. *16* Write *1 lb of bread = 16 1-ounce slices*. Elicit that each slice weighs $\frac{1}{16}$ of a pound. Elicit that *ounce* and *pound* are standard customary units for measuring weight.
3. Display the Customary Measurement Craze page and the objects to be weighed. Elicit an estimate of each item's weight, using the slice of bread (1 ounce) and the loaf (1 pound) as benchmarks. List the item and its estimated weight as each estimate is given. Choose students to weigh each item and to record the weight.
   - ➤ **Which objects weigh less than a pound? more than a pound? exactly a pound?** *Answers will vary.*
4. Point out *ton* on the *Customary Measurement* chart. Elicit that a *ton* is a standard customary unit that is used to weigh very heavy objects.
   - ➤ **What objects can be weighed in tons?** *possible answers: cars, ships, trains, whales*
   - ➤ **What is the ratio or equivalency of tons to pounds?** *1:2,000 or 1 tn = 2,000 lb*

Convert weight measurements

1. Guide the students in identifying the equivalency and multiplying to convert the following units of weight to smaller units. Follow a procedure similar to the one used to convert units of linear measurement in Lesson 125. Elicit that it takes more smaller units to measure the same weight as larger units.

   5 lb = __ oz 3 tn 1,500 lb = __ lb
   1 lb = 16 oz *1 tn = 2,000 lb*
   5 × 16 oz = 80 oz *(3 × 2,000 lb) + 1,500 lb = 7,500 lb*

2. Follow a similar procedure for converting these weights to larger units. Elicit that the remainders represent a part of the next set of the larger unit.

   4,350 lb = __ tn __ lb
   4,350 lb ÷ 2,000 lb = $2\frac{350}{2,000}$ tn = 2 tn 350 lb
   95 oz = __ lb __ oz
   95 oz ÷ 16 oz = $5\frac{15}{16}$ lb = 5 lb 15 oz

> Faith's cookie recipe calls for 12 ounces of chocolate chips. She buys chocolate chips in 1-pound bags. If Faith makes 4 batches of cookies, how many bags of chocolate chips does she need?

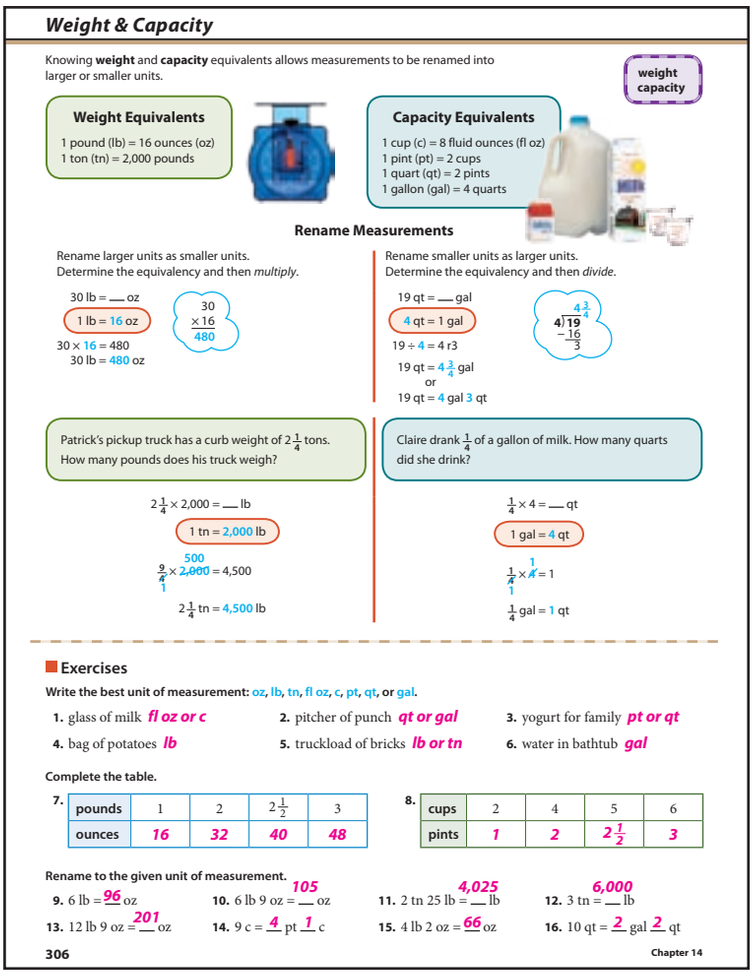
- ➤ **How can you solve this problem?** *Elicit that you can find the number of ounces of chocolate chips needed for the 4 batches and then find the number of bags needed.*
- ➤ **How many ounces of chocolate chips does Faith need? How do you know?** *48 oz; 4 batches of 12 oz is 48 oz (4 × 12 = 48)*
- ➤ **Will Faith need more than 4 bags of chocolate chips? Why?** *No; 12 oz < 16 oz (1 bag), so 4 bags would be more than enough for 4 batches.*
- ➤ **How could you find the exact number of bags Faith needs?** *Elicit that you can divide the total number of oz needed by the 16 oz in each bag; 48 oz = __ 1 lb bags; 16 oz = 1 lb; 48 oz ÷16 oz = 3 (1 lb) bags of chocolate chips.*

3. Following a similar procedure for the following word problem. Remind the students that to find a fractional part of a unit, they must first rename the unit to the desired smaller units and then multiply by the fraction.

> Dad ordered $\frac{3}{4}$ of a ton of gravel for a landscape project. How many pounds of gravel did he order? *$\frac{3}{4}$ tn = __ lb; 1 tn = 2,000 lb; $\frac{3}{4} \times 2{,}000$ lb = 1,500 lb*

Demonstrate an understanding of capacity
Convert capacity measurements

1. Direct attention to the word *Capacity* on the *Customary Measurement* chart. Explain that *capacity* is the amount a container can hold. Point out that *fluid ounce*, *cup*, *pint*, *quart*, and *gallon* are standard customary units for measuring capacity.
2. Display the various containers. Remind the students that containers that have the same capacity may vary in shape. (See Lesson 111.) Guide students in measuring the units of water to fill the containers and to determine their capacity.



Weight & Capacity

Knowing **weight** and **capacity** equivalents allows measurements to be renamed into larger or smaller units.

weight capacity

Weight Equivalents
1 pound (lb) = 16 ounces (oz)
1 ton (tn) = 2,000 pounds

Capacity Equivalents
1 cup (c) = 8 fluid ounces (fl oz)
1 pint (pt) = 2 cups
1 quart (qt) = 2 pints
1 gallon (gal) = 4 quarts

Rename Measurements

Rename larger units as smaller units.
Determine the equivalency and then *multiply*.

30 lb = ___ oz
1 lb = 16 oz
30 × 16 = 480
30 lb = 480 oz

30 × 16 = 480

Rename smaller units as larger units.
Determine the equivalency and then *divide*.

19 qt = ___ gal
4 qt = 1 gal
19 ÷ 4 = 4 r3
19 qt = $4\frac{3}{4}$ gal
or
19 qt = 4 gal 3 qt

$4\overline{)19}\ 4\frac{3}{4}$, -16, 3

Patrick's pickup truck has a curb weight of $2\frac{1}{4}$ tons. How many pounds does his truck weigh?

$2\frac{1}{4} \times 2{,}000 =$ ___ lb
1 tn = 2,000 lb
$\frac{9}{4} \times \frac{500}{2{,}000} = 4{,}500$
$2\frac{1}{4}$ tn = 4,500 lb

Claire drank $\frac{1}{4}$ of a gallon of milk. How many quarts did she drink?

$\frac{1}{4} \times 4 =$ ___ qt
1 gal = 4 qt
$\frac{1}{4} \times \frac{1}{4} = 1$
$\frac{1}{4}$ gal = 1 qt

Exercises

Write the best unit of measurement: oz, lb, tn, fl oz, c, pt, qt, or gal.

1. glass of milk *fl oz or c*
2. pitcher of punch *qt or gal*
3. yogurt for family *pt or qt*
4. bag of potatoes *lb*
5. truckload of bricks *lb or tn*
6. water in bathtub *gal*

Complete the table.

7.

pounds	1	2	$2\frac{1}{2}$	3
ounces	*16*	*32*	*40*	*48*

8.

cups	2	4	5	6
pints	*1*	*2*	*$2\frac{1}{2}$*	*3*

Rename to the given unit of measurement.

9. 6 lb = *96* oz
10. 6 lb 9 oz = *105* oz
11. 2 tn 25 lb = *4,025* lb
12. 3 tn = *6,000* lb
13. 12 lb 9 oz = *201* oz
14. 9 c = *4* pt *1* c
15. 4 lb 2 oz = *66* oz
16. 10 qt = *2* gal *2* qt

Rename to the given unit of measurement.

17. $\frac{1}{2}$ of a ton = *1,000* lb
18. $\frac{5}{8}$ of a pound = *10* oz
19. $\frac{3}{4}$ of a gallon = *3* qt
20. $\frac{3}{8}$ of a cup = *3* oz
21. $\frac{1}{2}$ of a pound = *8* oz
22. $\frac{1}{4}$ of a ton = *500* lb
23. $\frac{3}{4}$ of a cup = *6* oz
24. $\frac{1}{2}$ of a gallon = *2* qt
25. $3\frac{1}{2}$ qt = *7* pt
26. $1\frac{1}{2}$ lb = *24* oz
27. $10\frac{1}{4}$ tn = *20,500* lb
28. $3\frac{1}{2}$ gal = *14* qt

Add or subtract. Simplify the answer.

29. 2 tn 345 lb + 4 tn 536 lb = *6 tn 881 lb*
30. 3 gal 2 qt + 4 gal 3 qt = *7 gal 5 qt = 8 gal 1 qt*
31. 2 qt 1 pt + 1 qt 1 pt = *3 qt 2 pt = 4 qt = 1 gal*
32. 2 lb 2 oz − 1 lb 4 oz = *14 oz*
33. 3 qt 2 pt − 1 qt 1 pt = *2 qt 1 pt*

Practice & Application

34. What fraction of a gallon is a quart? *$\frac{1}{4}$*
35. Which has the greater capacity: 6 ounces or $\frac{1}{2}$ cup? *6 oz*
36. Which hamburger weighs more: $\frac{1}{4}$ of a pound or 8 ounces? *8 oz*
37. What fraction of a quart is a pint? *$\frac{1}{2}$*
38. Which is larger: 2 pints or 3 cups? *2 pt*
39. Ben measured the game area by walking heel-to-toe 9 steps. Did he measure 9 inches, 9 feet, or 9 yards? *9 ft*
40. Anna measured the ribbon from her nose to her fingertips twice. Did Anna measure 2 inches, 2 feet, or 2 yards? *2 yd*
41. Coach Willis had the team walk around the track for 20 minutes. Did the team walk 1 mile, 2 miles, or 3 miles? *1 mi*
42. Kaylee needs a bowl for two 12-ounce cans of corn. Did she use a bowl that held 1 cup, 1 pint, or 1 quart? *1 qt*
43. Jamile knows that 1 pound equals sixteen ounces. Which ratio shows the relationship of pounds to ounces: 16:16, 1:16, or 16:1? *1:16*
44. Mother needed $\frac{3}{4}$ of a pound of hamburger for her meat pie. Did she use 4 ounces, 8 ounces, or 12 ounces? *12 oz*
45. Mr. Pennington had a board $2\frac{1}{4}$ feet long. He used 21 inches. How much of the board did he have left: $\frac{1}{4}$ foot, $\frac{1}{2}$ foot, or $\frac{3}{4}$ foot? *6 in. = $\frac{1}{2}$ ft*

DID YOU KNOW

Weight is a measure of the pull of gravity on an object. *Gravity* is the force of one object pulling on another object. Lunar gravity is $\frac{1}{6}$ of the earth's gravity, so the average astronaut in a lunar suit weighs only 60 pounds on the moon.

Mass is the measurement of the amount of matter an object has. Although the astronaut's weight is different on the moon from what it is on the earth, his mass—the amount of matter making up his body—does not change.

Even though some people use the terms *weight* and *mass* interchangeably, scientists are careful to make a distinction between the words. A scientist uses the terms *gram* and *kilogram* as units of mass, but for weight he uses the term *newton*.

Complete DAILY REVIEW b on page 451.

3. Elicit the following ratios and/or equivalencies. Choose students to show each equivalency by pouring water from a full larger container into smaller containers.
   gallons to quarts *1 gal:4 qt or 1 gal = 4 qt*
   quarts to pints *1 qt:2 pt or 1 qt = 2 pt*
   pints to cups *1 pt:2 c or 1 pt = 2 c*
   cups to fluid ounces *1 c:8 fl oz or 1 c = 8 fl oz*

➤ **What is the difference between a fluid ounce and an ounce?** *Elicit that a fluid ounce is used to measure capacity, and an ounce is used to measure weight.*

➤ **How could you find the number of fluid ounces in 1 quart?** *Elicit that you can count (or add) the number of fluid ounces as you pour measured fluid ounces of water into a quart container or you can solve the equivalency statement 1 qt = ___ fl oz; possible solution: 1 c = 8 fl oz; 1 pt = 2 c or 16 fl oz (2 × 8 fl oz = 16 fl oz); 1 qt = 2 pt or 32 fl oz (2 × 16 fl oz = 32 fl oz).*

➤ **How could you find the number of fluid ounces in 1 gallon?** *Elicit that you can solve the equivalency statement 1 gal = ___ fl oz; possible solution: since 1 qt = 32 fl oz and 4 qt = 1 gal, you can multiply 4 qt × 32 fl oz; 128 fl oz.*

4. Guide the students in solving these equivalencies. Elicit whether multiplication or division should be used.
   8 qt = *16* pt 10 pt = *5* qt 62 fl oz = *7* c *6* fl oz
   6 gal = *24* qt 21 c = *5* qt *1* c 3 gal 2 qt = *14* qt

Jorgen is to provide 20 fluid ounces of sports drink for each of the 12 players on his team. The powdered drink mix gives instructions for mixing 1 gallon. Will 1 gallon be enough for the team? How much drink is needed? Does Jorgen need to fill the 3-gallon drink cooler? *No; he needs 240 fl oz or 1 $\frac{7}{8}$ gal; no.*

➤ **How many fluid ounces are in 1 gallon?** *1 gal = 128 fl oz*

➤ **How many ounces of sports drink are needed?** *12 × 20 fl oz = 240 oz* **Will 1 gallon be enough?** *No; 128 fl oz < 240 fl oz.*

➤ **How can you find out if Jorgen needs to fill the 3-gallon drink cooler?** *Possible answers: 240 fl oz needed − 128 fl oz (1 gal) = ___ fl oz more than 1 gal needed; 240 fl oz ÷ 128 fl oz = ___ gal; 2 gal × 128 fl oz per gal = ___ fl oz per 2 gallons; make an equivalency (ratio) table for gal/ fl oz ($\frac{1}{128} = \frac{2}{\_\_} = \frac{3}{\_\_}$).*

5. Direct the students to find out if Jorgen needs to fill the 3-gallon drink cooler. Choose students to explain their answer. *No; explanations will vary, but elicit that the 240 fluid ounces needed is equivalent to 1 $\frac{7}{8}$ gallons, which is less than 2 gallons (256 fluid ounces).*

Add and subtract weight and capacity measurements

Follow procedures similar to those used in Lesson 125 to first guide the students in solving the following problems and then in renaming the answers as only the larger unit and only the smaller unit.

3 gal 2 qt	7 tn 200 lb	6 tn 250 lb
+ 7 gal 4 qt	+ 12 tn 300 lb	− 1 tn 750 lb
10 gal 6 qt	*19 tn 500 lb*	*4 tn 1,500 lb*
11 gal 2 qt	*19 $\frac{1}{4}$ tn*	*4 $\frac{3}{4}$ tn*
11 $\frac{1}{2}$ gal	*38,500 lb*	*9,500 lb*
46 qt		

Student Text pp. 306–7

Lesson 127

Student Text pp. 308–9
Daily Review p. 452c

Objectives
- Develop an understanding of the metric system
- Develop an understanding of metric linear units: *kilometer*, *meter*, *centimeter*, and *millimeter*
- Estimate and measure to the nearest meter, centimeter, and millimeter
- Determine the appropriate linear unit
- Convert metric linear measurements to smaller or larger units
- Find a fraction of a measurement unit
- Compare metric linear measurements using > or <
- Add and subtract metric linear measurements

Teacher Materials
- Chart 11: *Metric Measurement*
- Chart 12: *Metric Measurement: Length & Distance*
- Rulers: Measuring Tape (meter)
- A ruler
- A meter stick
- A yardstick

Student Materials
- Rulers: Measuring Tape (meter)
- Metric Measure Mania, page IA72 (CD) for each group of students
- A ruler

Note
Commas have purposely been omitted from metric measurements with whole numbers having more than 3 digits.

Teach for Understanding

Develop an understanding of the metric system

1. Display the *Metric Measurement* chart. Explain that the metric measurement system, like our decimal system, is a base ten system. However, it is not like our customary measurement system. The metric system of measurement is used in the United States and in most other countries. It includes linear, capacity, and mass units. Point out that the *meter*, *liter*, and *gram* are metric units that are used to measure linear distance (length), capacity, and mass.
2. Explain that since the metric system of measurement is based on the number 10, the larger unit immediately to the left of any metric unit on the chart is 10 times greater than the unit and the smaller unit to the right is $\frac{1}{10}$ of the unit.
3. Point out that each prefix is combined with a metric unit to identify larger and smaller measuring units and to tell the value of each unit. Guide the students in reading each prefix at the top of the chart. Choose students to give the meaning of each prefix (the number written below it).

Demonstrate an understanding of *kilometer*, *meter*, *centimeter*, and *millimeter*

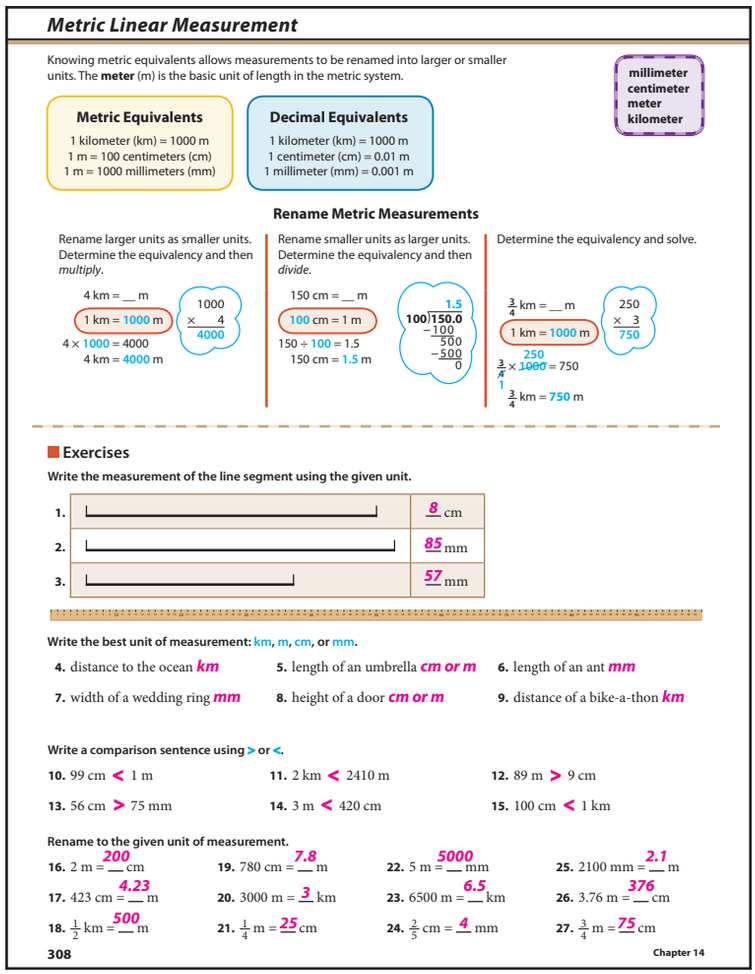
1. Display the meter stick. Explain that the *meter* is the basic unit for metric linear measurement (length or distance).
2. Write the following metric units and their meter equivalents for display. Explain that these are the most commonly used metric units of length. Point out that the prefix before the unit *meter* indicates that the unit is either a multiple or a fraction of 1 meter.

*kilo*meter = 1000 m	meter = 1 m
*centi*meter= $\frac{1}{100}$ m	*milli*meter = $\frac{1}{1000}$ m

3. Display the yardstick beside the meter stick.
➤ **How does 1 meter compare to 1 yard?** ***Elicit that 1 meter is slightly longer than 1 yard.*** Elicit that 1 meter is about $39\frac{1}{4}$ inches.
4. Distribute the Measuring Tapes. Direct the students to use them to find a personal benchmark for 1 meter, similar to the customary benchmarks. Discuss the pictured benchmarks on the *Metric Measurement: Length & Distance* chart.
5. Arrange the students in groups and distribute a Metric Measure Mania page to each group. Direct each group to choose a record keeper. Throughout this activity, instruct each record keeper to record his group's answers as they are given.
Direct each group to estimate the height of a door to the nearest meter and then to select a student to use his meter tape to measure the height of the door to the nearest meter.
➤ **Is your measured length of the door a precise or exact measurement? Why?** ***Answers will vary; elicit that the measurement is precise if it is to an exact meter, but if it is longer or shorter than an exact meter it is not precise.***
➤ **What smaller units on the meter tape could you use to measure more precisely than a meter?** ***centimeter or millimeter***
➤ **What benchmark can you use to estimate a centimeter?** ***width of a finger***
➤ **What is the ratio or equivalency of centimeters to meters?** ***100 cm:1 m or 100 cm = 1 m***
6. Call attention to the shortest marks on the meter tape.
➤ **What unit is $\frac{1}{10}$ of a centimeter?** ***a millimeter*** **What is the ratio or equivalency of millimeters to centimeters?** ***10 mm:1 cm or 10 mm = 1 cm*** **millimeters to meters?** ***1000 mm:1 m or 1000 mm = 1 m***
7. Instruct each group to estimate the height of the same door to the nearest centimeter and the nearest millimeter and then to select a student to use his meter tape to measure the height to the nearest centimeter and the nearest millimeter.
8. Follow a similar procedure, allowing each group to estimate and measure other objects in the room. Guide the students in comparing the estimate and measurement of each object.
9. Direct attention to the *kilometer* on the *Metric Measurement: Length & Distance* chart. Elicit that a *kilometer* is used for measuring long distances.
➤ **What is the ratio or equivalency of kilometers to meters?** ***1 km:1000 m or 1 km = 1000 m***
➤ **How could you measure a kilometer using meter sticks?** ***Elicit that you could place 1000 meter sticks end to end.***
➤ **What are some distances that could be measured in kilometers?** ***possible answers: the distance from home to school, the length of a bridge, the distance of a marathon***
10. Write the abbreviations *km*, *m*, *cm*, and *mm* for display. Choose students to tell the unit that would likely be used to measure the following items. Discuss why you might choose one unit instead of another.

height of a ceiling ***m or cm***	length of a race ***m or km***
width of a button ***mm or cm***	width of a door ***m or cm***
distance between cities ***km***	thickness of a dime ***mm***

11. Guide the students in determining the better estimate.



Metric Linear Measurement

Knowing metric equivalents allows measurements to be renamed into larger or smaller units. The **meter** (m) is the basic unit of length in the metric system.

millimeter
centimeter
meter
kilometer

Metric Equivalents
1 kilometer (km) = 1000 m
1 m = 100 centimeters (cm)
1 m = 1000 millimeters (mm)

Decimal Equivalents
1 kilometer (km) = 1000 m
1 centimeter (cm) = 0.01 m
1 millimeter (mm) = 0.001 m

Rename Metric Measurements

Rename larger units as smaller units. Determine the equivalency and then *multiply*.

4 km = __ m
1 km = 1000 m
4 × 1000 = 4000
4 km = 4000 m

1000 × 4 = 4000

Rename smaller units as larger units. Determine the equivalency and then *divide*.

150 cm = __ m
100 cm = 1 m
150 ÷ 100 = 1.5
150 cm = 1.5 m

1.5
100|150.0
−100
500
−500
0

Determine the equivalency and solve.

$\frac{3}{4}$ km = __ m
1 km = 1000 m
$\frac{3}{4} \times \cancel{1000} = 750$
$\frac{3}{4}$ km = 750 m

250 × 3 = 750

Exercises

Write the measurement of the line segment using the given unit.

1. 8 cm
2. 85 mm
3. 57 mm

Write the best unit of measurement: km, m, cm, or mm.

4. distance to the ocean *km*
5. length of an umbrella *cm or m*
6. length of an ant *mm*
7. width of a wedding ring *mm*
8. height of a door *cm or m*
9. distance of a bike-a-thon *km*

Write a comparison sentence using > or <.

10. 99 cm < 1 m
11. 2 km < 2410 m
12. 89 m > 9 cm
13. 56 cm > 75 mm
14. 3 m < 420 cm
15. 100 cm < 1 km

Rename to the given unit of measurement.

16. 2 m = 200 cm
17. 423 cm = 4.23 m
18. $\frac{1}{2}$ km = 500 m
19. 780 cm = 7.8 m
20. 3000 m = 3 km
21. $\frac{1}{4}$ m = 25 cm
22. 5 m = 5000 mm
23. 6500 m = 6.5 km
24. $\frac{2}{5}$ cm = 4 mm
25. 2100 mm = 2.1 m
26. 3.76 m = 376 cm
27. $\frac{3}{4}$ m = 75 cm

Add or subtract.

28. 25 m + 8 m = *33 m*
29. 4.7 m − 3.2 m = *1.5 m*
30. 10.5 km + 2.1 km = *12.6 km*
31. 981 mm − 245 mm = *736 mm*
32. 795 m + 349 m = *1144 m*

Complete the table.

33.

m	1000	1500	2000
km	*1*	*1.5*	*2*

34.

cm	300	350	400
m	*3*	*3.5*	*4*

35.

m	1	1.5	2
mm	*1000*	*1500*	*2000*

Place a decimal point in the answer to make a reasonable measurement.

36. height of a doghouse = 082 m *0.82 m*
37. width of a bracelet = 12 cm *1.2 cm*

Find the length in millimeters and centimeters.

38. *80* mm or *8* cm
39. *53* mm or *5.3* cm

Practice & Application

40. Is the length of a cell phone closer to 10 mm or 10 cm? *10 cm*
41. Which trail is shorter: River Trail at 1.2 km or Mountain Trail at 958 m? *Mountain Trail*
42. Would the length of a minivan be closer to 2 m or 5 m? *5 m*
43. Is the wingspan of a butterfly about 55 mm or 55 cm? *55 mm*
44. Mrs. Poole planted a square flower bed 100 cm long. Is each side of the flower bed *greater than*, *less than*, or *equal to* a meter? *equal to a meter*
45. Preston scribbled the number 25 when he measured the length of his computer. What metric unit of measurement did he use to measure the computer? *cm*
46. The Haas family visited Canada on vacation. What metric unit would complete the speed limit sign that reads 60 __? *km/h or kilometers per hour*
47. Jade went to the eye doctor to get contacts. The doctor measured her pupil at 4. What metric unit of measure did he use to measure her pupil? *mm*
48. Megan trained for a 5K race. How many meters are in 5 kilometers? *5000 m*

Complete DAILY REVIEW on page 452.

distance across a state—500 m or 500 km? *500 km*
length of a book cover—25 cm, 25 mm, or 25 m? *25 cm*
face of a quarter—25 m, 25 cm, or 25 mm? *25 mm*
width of a garage door—5 cm, 5 m, or 5 km? *5 m*

Convert metric linear measurements

Marco and his dad ran a 5K race. Since 5K stands for 5 kilometers, how many meters did Marco run? *5000 m*

- What problem can you write to find the answer? *5 km = __ m*
- What equivalency can you use to solve the problem? *1 km = 1000 m*
- What operation is used to rename larger units (km) to smaller units (m)? Why? *Multiplication; elicit that it takes more smaller units to measure the same distance as 1 larger unit.*
- What equation can you write to find the answer? Why? *5 × 1000 m = 5000 m; elicit that 5 km is equal to 5 sets of 1000 m.*

Complete the equivalency.

1. Follow a similar procedure for the following word problem. Elicit that to find a fraction of a unit, you must first rename the unit as the desired smaller unit.

Marco's younger sister ran half of a kilometer. How many meters did she run? *500 m; $\frac{1}{2}$ km = __ m; 1 km = 1000 m; $\frac{1}{2} \times$ 1000 m = 500 m*

2. Guide the students in solving this word problem using the following questions.

Marco's brother ran 7500 meters. How many kilometers did he run? *7.5 km*

- What problem can you write to find the answer? *7500 m = __ km*
- What equivalency can you use to solve the problem? *1000 m = 1 km*
- What operation is used to rename smaller units (m) to larger units (km)? Why? *Division; elicit that 1 larger unit can measure the same distance as a number of smaller units.*
- What equation can you write to find the answer? *Elicit that 7500 m ÷ 1000 m = 7.5 km.*

3. Guide the students in identifying the needed equivalency and in using multiplication or division to find the number of renamed units. (***Note:*** Using mental math to multiply or divide by a power of 10 when converting metric units of measurement will be taught in the next lesson.)

265 cm = __ m *2.65* 3.4 m = __ cm *340*
2471 mm = __ m *2.471* 3000 mm = __ m *3*

4. Guide the students in using equivalencies to complete the following comparison statements. Elicit that either unit can be converted so that like units are being compared if needed.

952 m < 8 km 1 m > 100 mm 675 cm > 6 m
5 cm < 54 mm 4 km > 49.82 cm 25.3 mm < 3 cm

Add and subtract metric linear measurements

Guide the students in solving these problems.

5.2 km	763 m	465 mm	21.7 cm
+ 3.0 km	+ 819 m	− 243 mm	− 4.9 cm
8.2 km	*1582 m*	*222 mm*	*16.8 cm*

Student Text pp. 308–9

Lesson 128

Student Text pp. 310–11
Daily Review p. 452d

Objectives
- Develop an understanding of metric units of capacity: *liter* and *milliliter*
- Develop an understanding of metric units of mass: *gram*, *kilogram*, and *milligram*
- Convert metric capacity and mass measurements to smaller or larger units
- Add and subtract metric capacity and mass measurements

Teacher Materials
- Chart 11: *Metric Measurement*
- Chart 13: *Metric Measurement: Capacity*
- Chart 14: *Metric Measurement: Mass*
- A 1-liter bottle of water
- Clearview Liter Cube Set
- A 1-liter beaker or metric measuring container filled with water
- Containers (from Lesson 126) (optional containers: utility bucket, nail polish bottle, soup can, pitcher, drink cooler, teacup) and water to fill the containers
- A balance or metric scale

Student Materials
- A 1-liter bottle of water
- Objects that fit in your hand

Notes
The bottles of water, the containers, and the objects used in this lesson are items that have been brought to class by the students.

You may choose to add color to the water for demonstration purposes.

Introduce the Lesson

Display the *Metric Measurement* chart and choose students to solve the problems. Point out that the meaning of the prefix can help them to rename. (e.g., 2 *km* = 2 *thousand* meters or 2000 m; 500 *cm* = 500 *hundredths* of a meter, $\frac{500}{100}$ m or 5 m; 30 *mm* = 30 *thousandths* of a meter, 0.030 m or 0.03 m)

2 km = __ m ***2000*** 500 cm = __ m ***5*** 30 mm = __ cm ***3***

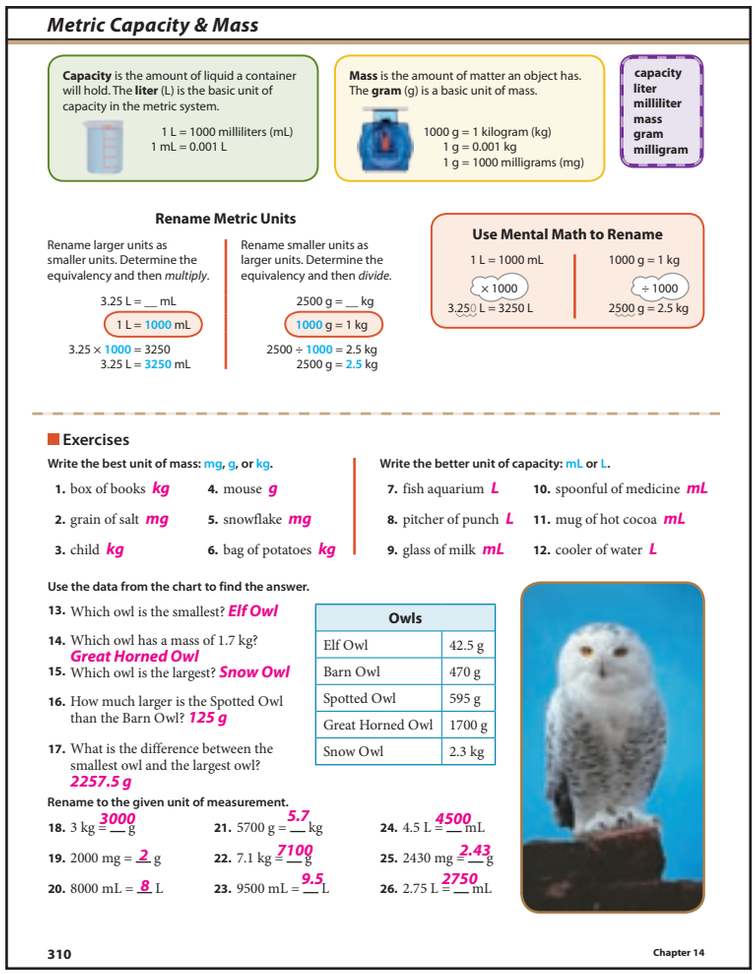
Teach for Understanding

Develop an understanding of *liter* and *milliliter*

1. Display the *Metric Measurement*: *Capacity* chart. Point out the abbreviations and the equivalency for *liter* and *milliliter*. Distribute the 1-liter bottles of water.
   - ➤ **What is *capacity*? *the amount a container can hold***
   - ➤ **What is the standard metric unit of capacity? *liter***
   - ➤ **What abbreviation is used for *liter*? *L* for *milliliter*? *mL***
   - ➤ **What items are measured in liters? *possible answers: water, soft drinks* in milliliters? *possible answers: medicine, lotion, food items***
   - ➤ **Can you drink 1 liter of water? *Answers will vary.***
2. Display the Clearview liter cube, 1 Clearview milliliter cube, and the 1-liter beaker of water. Point out the markings on the liter cube: 100 mL, 200 mL, . . . 1000 mL or 1 L. Explain that the small cube has a capacity of 1 mL.
   - ➤ **How many 1-milliliter cubes of water are needed to fill the 1-liter cube? Why? *1000; 1000 milliliters equal 1 liter.***
   - ➤ **What is the ratio or equivalency of liters to milliliters? *1 L: 1000 mL or 1 L = 1000 mL***
3. Pour the water from the 1-liter beaker into the 1-liter cube. Allow the students to use the beaker, the cubes, and the 1-liter bottles of water to measure the capacity of different containers in liters and milliliters. Provide additional water if needed.
   - ➤ **What item can you use as a benchmark for 1 liter? *possible answer: a 1-liter water bottle or beaker***
4. Display containers such as the examples listed below. Direct the students to choose the better unit (milliliters or liters) for measuring the contents of each container and to write an estimate of each container's capacity to the nearest 100 mL or the nearest 1 L: utility bucket ***L***, nail polish bottle ***mL***, soup can ***mL***, pitcher ***L***, drink cooler ***L***, and teacup ***mL***.
   Demonstrate filling each container to find its capacity. Guide in determining which estimates are the closest to the actual capacities. Continue to display the filled containers.

Convert metric capacity measurements

1. Write *3.254 L* = __ *mL* for display.
   - ➤ **Should you rename larger units as smaller units or smaller units as larger units to solve this problem? *larger units as smaller units (liters as milliliters)* Should you multiply or divide? Why? *Multiply; it takes more small units to measure the same capacity as 1 large unit.***
   - ➤ **What equivalency can you use to rename liters as milliliters? *1 L = 1000 mL*** Remind the students that writing the equivalency in the same order that the units appear in the problem will help them to determine which operation to use when renaming units of measurement.
   - ➤ **How can you estimate the number of milliliters in 3.254 L? *Since 1 L = 1000 mL, 3 L = 3 × 1000 mL or 3000 mL.***
   - ➤ **What should you multiply 3.254 L by to rename it as mL? Why? *1000; elicit that each L is equal to 1000 times as many mL.***
2. Write 1000 × 3.254 vertically. Demonstrate solving the problem by annexing 3 zeros in the product and writing the decimal point in the product. ***3254.000 mL or 3254 mL***
   - ➤ **What do you notice about the decimal point in a number when it is multiplied by a power of 10? *Elicit that the decimal point moves one place to the right for each power of 10.***
   - ➤ **How many places did the decimal move when multiplying by 1000? Why? *3 places; 1000 = 10^3***
   - ➤ **Is 3254 a reasonable answer? Why? *Yes; answers will vary but elicit that 3.254 L = 3 L (or 3000 mL) + $\frac{254}{1000}$ L (or 254 mL).*** Choose a student to complete the problem.
3. Write *8417 mL* = __ *L* for display.
   - ➤ **Should you rename larger units as smaller units or smaller units as larger units to solve this problem? *smaller units as larger units (milliliters as liters)* Should you multiply or divide? Why? *Divide; it takes 1 larger unit to measure the same capacity as a number of smaller units.***
   - ➤ **What equivalency can you use to rename milliliters as liters? *1000 mL = 1 L***
   - ➤ **How many liters do you estimate 8417 milliliters to be? Why? *8 L; answers will vary, but elicit that the amount is a little more than 8000 mL and, since 1000 mL = 1 L, 8000 mL ÷ 1000 mL= 8 L.*** (***Note:*** Some students may find it easier to estimate by writing a proportion: $\frac{1000\text{ mL}}{1\text{ L}} = \frac{8000\text{ mL}}{8\text{ L}}$.)
   - ➤ **What could you divide 8417 milliliters by to rename them as liters? Why? *1000; each milliliter is equal to $\frac{1}{1000}$ of 1 liter.***
   - ➤ **How could you use mental math to solve the problem? *Elicit that since the decimal moves one place to the left for each power of 10 in the divisor, you can divide 8417 mL by 1000 mL by moving***



Metric Capacity & Mass

Capacity is the amount of liquid a container will hold. The **liter** (L) is the basic unit of capacity in the metric system.

1 L = 1000 milliliters (mL)
1 mL = 0.001 L

Mass is the amount of matter an object has. The **gram** (g) is a basic unit of mass.

1000 g = 1 kilogram (kg)
1 g = 0.001 kg
1 g = 1000 milligrams (mg)

capacity
liter
milliliter
mass
gram
milligram

Rename Metric Units

Rename larger units as smaller units. Determine the equivalency and then *multiply*.

3.25 L = __ mL
1 L = 1000 mL
3.25 × 1000 = 3250
3.25 L = 3250 mL

Rename smaller units as larger units. Determine the equivalency and then *divide*.

2500 g = __ kg
1000 g = 1 kg
2500 ÷ 1000 = 2.5 kg
2500 g = 2.5 kg

Use Mental Math to Rename

1 L = 1000 mL
× 1000
3.250 L = 3250 L

1000 g = 1 kg
÷ 1000
2500 g = 2.5 kg

Exercises

Write the best unit of mass: mg, g, or kg.

1. box of books *kg*
2. grain of salt *mg*
3. child *kg*
4. mouse *g*
5. snowflake *mg*
6. bag of potatoes *kg*

Write the better unit of capacity: mL or L.

7. fish aquarium *L*
8. pitcher of punch *L*
9. glass of milk *mL*
10. spoonful of medicine *mL*
11. mug of hot cocoa *mL*
12. cooler of water *L*

Use the data from the chart to find the answer.

Owls	
Elf Owl	42.5 g
Barn Owl	470 g
Spotted Owl	595 g
Great Horned Owl	1700 g
Snow Owl	2.3 kg

13. Which owl is the smallest? *Elf Owl*
14. Which owl has a mass of 1.7 kg? *Great Horned Owl*
15. Which owl is the largest? *Snow Owl*
16. How much larger is the Spotted Owl than the Barn Owl? *125 g*
17. What is the difference between the smallest owl and the largest owl? *2257.5 g*

Rename to the given unit of measurement.

18. 3 kg = *3000* g
19. 2000 mg = *2* g
20. 8000 mL = *8* L
21. 5700 g = *5.7* kg
22. 7.1 kg = *7100* g
23. 9500 mL = *9.5* L
24. 4.5 L = *4500* mL
25. 2430 mg = *2.43* g
26. 2.75 L = *2750* mL

Add or subtract.

27. 2.5 kg + 1.4 kg *3.9 kg*
28. 4271 g − 1 kg *3271 g or 3.271 kg*
29. 3 L − 2500 mL *500 mL or 0.5 L*

Use the data from the chart to find the answer.

Weight of Plymouth Rock Chickens	
Pullet	2700 g
Hen	3.4 kg
Cockerel	3.65 kg
Cock	4.1 kg

30. Which has the greater mass: a cock or a hen? *cock*
31. What is the difference between the weight of a cock and the weight of a cockerel? *0.45 kg*
32. What is the pullet's weight in kilograms? *2.7 kg*
33. A Cornish cockerel weighs 3.86 kg. Which is larger: the Plymouth Rock cockerel or the Cornish cockerel? *Cornish cockerel*
34. A farmer ordered 15 pullets. Give the mass of the shipment in kilograms. *15 × 2700 = 40500 g = 40.5 kg*

Complete the table.

35.

m	cm
9	*900*
10	1000
11	*1100*

36.

mL	L
2000	2
3500	*3.5*
4200	4.2

37.

g	kg
7000	*7*
9500	*9.5*
1500	1.5

38.

m	km
4000	*4*
6500	6.5
1500	*1.5*

Practice & Application

39. Would a math book have a mass of 15 kg or 1.5 kg? *1.5 kg*
40. Would Alexander drink 1 L or 100 mL during a hike? *1 L*
41. Would a man walk 25 m or 1 km in 20 minutes? *1 km*
42. Would a basketball player be 150 cm tall or 2 m tall? *2 m*
43. Would the most precise measurement of the width of a penny be in centimeters or millimeters? *millimeters*
44. Would an aquarium hold 20 mL or 20 L of water? *20 L*
45. Would a bag of 1,000 small candies have a mass of 1 g or 1 kg? *1 kg*
46. Would the average sixth-grader weigh 40 g or 40 kg? *40 kg*

DID YOU KNOW

Capacity is the amount of liquid that a container can hold. The capacity of this container is 1 liter.

Mass is measurement of the amount of matter an object has. The mass of this container filled with water is 1 kilogram.

Volume is the number of cubic units within a three-dimensional figure. The volume of this container is 1000 cm³.

Capacity = 1 L
Mass = 1 kg
Volume = 1000 cm³
Length = 10 cm
Width = 10 cm
Height = 10 cm

Complete DAILY REVIEW on page 452.

the decimal point 3 places to the left; 8417 mL ÷ 1000 mL = 8.417 L. The quotient will be a smaller number of liters (larger units).
Choose a student to demonstrate the moving of the decimal from the right of the Ones place in 8417 to 8.417.

➤ **Is 8.417 a reasonable answer? Why?** *Yes; answers will vary, but elicit that 8417 mL = 8000 mL (or 8 L) + 417 mL (or $\frac{417}{1000}$ L).*

4. Guide the students in solving problems similar to the ones below. Elicit that the unlike units must be renamed as either unit so that like units are being added or subtracted.

3 L = 3 L	3 L = 3000 mL
+ 26 mL = 0.026 L	+ 26 mL = 26 mL
3.026 L	*3026 mL*

Develop an understanding of *gram*, *kilogram*, and *milligram*

1. Display the *Metric Measurement: Mass* chart, the balance, and the Clearview 1-liter cube filled with water. Point out the metric measurement units of mass and their abbreviations. Explain that the balance (or metric scale) is a tool for measuring *mass*, the amount of matter an object has.
2. Measure the mass of water in a Clearview 1-milliliter cube (1 gram) and in the Clearview 1-liter cube (1 kilogram). Point out that a 1-liter bottle of water can also be used as a bench-mark for 1 kilogram.

➤ **What are some other items that would have a mass of about 1 gram?** *possible answers: raisin, paper clip* **1 kilogram?** *possible answers: 1-liter bottle of water, a book*

3. Direct attention to each of the filled containers used earlier in the lesson. Follow a procedure similar to the one used in the capacity activity to guide the students in determining the better unit of measure (kg or g), the estimated mass to the nearest 100 g or the nearest 1 kg, and the actual mass of each filled container: utility bucket *kg*, nail polish bottle *g*, soup can *g*, pitcher *kg*, drink cooler *kg*, and teacup *g*.

➤ **What metric unit for mass is smaller than a gram and a kilogram?** *milligram*

4. Explain that milligrams are used to measure the mass of very light objects. The mass of one crystal of salt is about 1 milligram.

➤ **How many milligrams are equal to 1 gram?** *1000*
➤ **What unit is 1 thousandth (0.001) of a gram?** *milligram*
➤ **What are some other items that would be measured in milligrams?** *possible answers: medicine; tiny insect*

Convert metric mass measurements

1. Write *2.476 kg* = __ *g* for display. Follow a procedure similar to the one used to convert liters to milliliters to guide the student in converting kilograms to grams.

➤ **How can you use mental math to solve the problem?** *Elicit that since you need to find more of a smaller unit, you can think of the equivalency 1 kg = 1000 g and multiply 2.476 times 1000 g, moving the decimal point 3 places to the right; 2.476 × 1000 g = 2476 g.*
➤ **Is 2476 g a reasonable answer? Why?** *Yes; answers will vary, but elicit that 2476 g = 2000 g + 476 g = 2 kg + $\frac{476}{1000}$ kg = 2.476 kg.*

2. Follow a similar procedure for 265 g = __ kg. Elicit that you can mentally divide by 1000 g to find the number of larger units. *1000 g = 1 kg; 265 g ÷ 1000 g = 0.265 kg*

Student Text pp. 310–11

(***Note***: *Assessment* available on Teacher's Toolkit CD.)

Lesson 129

Student Text pp. 312–13
Daily Review p. 453e

Objectives
- Add, subtract, multiply and divide measurements
- Solve measurement word problems
- Find a fraction of a measurement

Teacher Materials
- Customary Measurement Word Problems, page IA73 (CD)
- Metric Measurement Word Problems, page IA74 (CD) (optional)

Student Materials
- Measurement Flashcards: customary (1 set of flashcards for every 2 students)

Introduce the Lesson

1. Allow pairs of students to quiz one another using their Measurement Flashcards.
2. Write the following problems for display. Guide the students in renaming the measurements.

3 L = __ mL *3000*	12 ft = __ yd *4*
3 gal = __ qt *12*	200 cm = __ m *2*
3 c = __ fl oz *24*	32 oz = __ lb *2*
4 tn = __ lb *8,000*	6000 mg = __ g *6*

Teach for Understanding

Add, subtract, multiply, and divide measurements

(***Note:*** If you choose to guide your students in solving the problems on the Metric Measurement Word Problems page rather than the problems on the Customary Measurement Word Problems page, follow procedures similar to the ones provided for solving the customary word problems and refer to the metric solutions at the end of this lesson.)

1. Display the Customary Measurement Word Problems page and direct the students to silently read the first word problem.

> The Poole family raises broiler chickens. They feed the baby chicks starter feed. How much starter feed is needed for 1 chick for the first 3 weeks? *1 lb 14 oz*
>
Week 1	4 oz of starter feed per chick
Week 2	9 oz of starter feed per chick
Week 3	1 lb 1 oz of starter feed per chick

➤ **How could you solve the word problem?** ***Add the amounts of starter feed needed for each of the first 3 weeks.***

2. Write the problem vertically for display and choose a student to solve it. *4 oz + 9 oz + 1 lb 1 oz = 1 lb 14 oz*

➤ **What fraction of a pound does 14 ounces represent? How do you know?** *$\frac{14}{16}$ lb; elicit that since 16 ounces equal 1 pound, 14 ounces represent 14 of the 16 equal parts of a pound and can be written $\frac{14}{16}$ lb or $\frac{7}{8}$ lb.*

➤ **How can you find the decimal equivalent for 14 ounces?** ***Elicit that since 14 ounces is $\frac{7}{8}$ of a pound, you can divide the numerator 7 by the denominator 8.***

Direct the students to find the decimal equivalent for $\frac{7}{8}$ of a pound. *0.875 lb*

➤ **How many pounds is 1 pound 14 ounces?** *$1\frac{7}{8}$ lb or 1.875 lb*

➤ **How many ounces is 1 pound 14 ounces? How do you know?** *30 oz; 1 lb = 16 oz and 16 oz + 14 oz = 30 oz*

3. Repeat the procedure for the second word problem, using the following questions.

> One of the Poole's broiler chickens weighs 5 lb 4 oz after seven weeks of intense feeding. One of their laying hens that is the same age weighs 4 lb 8 oz. What is the difference in the weights of the two chickens? *5 lb 4 oz − 4 lb 8 oz = 12 oz; $\frac{3}{4}$ lb or 0.75 lb*

➤ **How could you solve this word problem?** ***Elicit that you can compare the weights of the chickens by subtracting the weight of the laying hen from the weight of the broiler chicken.***

➤ **How can you subtract 8 oz from 4 oz?** ***Elicit that you must rename 1 of the pounds in 5 lb 4 oz as 16 oz and add it to the 4 oz.***

➤ **What is the difference in weight of the two chickens?** *12 oz*

4. Follow a similar procedure for the third word problem, using the information from problem number 1. Elicit that since you already know that 30 ounces of starter feed is needed to feed 1 chick for the first three weeks, you can multiply the 30 ounces by 12 to find the amount of starter feed that is needed for the 12 chicks.

> The Poole's had 12 baby chicks to raise. How many pounds of starter feed were needed to feed the 12 chicks for the first 3 weeks? *12 × 30 oz = 360 oz; 360 oz ÷ 16 oz = $22\frac{1}{2}$ lb or 22.5 lb*

5. Read aloud word problem number 4.

> The baby chicks were kept in a small square area that is easy to keep warm. The length of the area is 5 ft 8 in. What is its perimeter? *20 ft 32 in.; 22 ft 8 in.; or $22\frac{2}{3}$ ft*

➤ **How can you find the perimeter of the square area?** ***Since a square has 4 congruent sides, you can add the length 4 times or multiply the length by 4.***

6. Write *4 × 5 ft 8 in.* vertically for display. Explain that when multiplying a measurement, you multiply each unit by the multiplier.
7. Choose a student to demonstrate the multiplication. *20 ft 32 in.* Point out that the Distributive Property of Multiplication was used to solve the problem: 4(5 ft + 8 in.) = (4 × 5 ft) + (4 × 8 in.) = 20 ft + 32 in.

➤ **What do you notice about the product?** ***Elicit that the number of inches in the product can be renamed as feet.***

➤ **How can you find the number of feet that is equal to 32 inches?** ***Elicit that since the equivalency of feet to inches is 1 ft = 12 in. (a ratio of 1:12), you can divide the 32 in. by 12 in.; 32 in. ÷ 12 in. = $2\frac{8}{12}$ ft = $2\frac{2}{3}$ ft or 2 ft 8 in.***

➤ **What is the perimeter of the chick's area? How do you know?** ***$22\frac{2}{3}$ ft 8 in. or $22\frac{2}{3}$ ft; elicit that 2 ft 8 in. (the renamed 32 inches) added to the 20 feet equals 22 ft 8 in. or $22\frac{2}{3}$ ft.***

8. Follow a similar procedure for word problem number 5. Elicit that the average weight is found by dividing the total weight by the number of chickens. When dividing a measurement, you divide each unit by the divisor and rename the quotient if needed.

> At the end of seven weeks, the twelve broiler chickens had a total weight of 60 lb 12 oz. What was the average weight of one broiler chicken? *60 lb 12 oz ÷ 12 = 5 lb 1 oz*

Customary & Metric

	Addition	Subtraction	Multiplication	Division
Customary	11 in. + 1 ft 7 in. 1 ft 18 in. = 2 ft 6 in. Simplify the answer when 2 units of measure are used.	1 lb = 16 oz 16 + 8 = 24 34 24 ~~35~~ lb ~~8~~ oz − 1 lb 13 oz 33 lb 11 oz	1 lb 4 oz × 7 7 lb 28 oz = 8 lb 12 oz	12 ft 4 in. ÷ 4 = ___ 3 ft 1 in. 4)12 ft 4 in. −12 0 ft 4 in. − 4 0 3 ft 1 in.
Metric	1.8 kg + 1500 g = ___ 1.8 kg or 1800 g + 1.5 kg + 1500 g 3.3 kg 3300 g	7000 mg − 3 g = ___ 7 g or 7000 mg − 3 g − 3000 mg 4 g 4000 mg	3.61 L × 7 25.27 L	72.48 m ÷ 8 = ___ 9.06 m 8)72.48 m −72 048 −48 0

Exercises

Solve. Simplify the answer.

1. 10 ft 4 in. + 5 ft 6 in. — *15 ft 10 in.*
2. 3 gal 2 qt + 7 gal 3 qt — *10 gal 5 qt = 11 gal 1 qt*
3. 6 yd 2 ft + 8 yd 2 ft — *14 yd 4 ft = 15 yd 1 ft*
4. 9 ft 9 in. + 8 ft 7 in. — *17 ft 16 in. = 18 ft 4 in.*
5. 12 lb 4 oz − 7 lb 9 oz — *4 lb 11 oz*
6. 23 ft 7 in. − 8 ft 10 in. — *14 ft 9 in.*
7. 6000 mL − 1500 mL — *4500 mL*
8. 3906 L − 2879 L — *1027 L*
9. 8 L + 14 L + 72 mL — *22,072 mL or 22.072 L*
10. 703 g + 4 kg + 65 g — *4768 g or 4.768 kg*
11. 6 qt − 5 pt — *3 qt 1 pt*
12. 4 yd − 5 ft — *2 yd 1 ft*
13. 1.47 g × 6 — *8.82 g*
14. 4 pt 3 c × 3 — *12 pt 9 c = 16 pt 1 c*
15. 6 ft 6 in. × 4 — *24 ft 24 in. = 26 ft*
16. 16 gal 2 qt × 8 — *128 gal 16 qt = 132 gal*
17. 48.6 m ÷ 3 — *16.2 m*
18. 4)16 ft 8 in. — *4 ft 2 in.*
19. 2)6 tn 210 lb — *3 tn 105 lb*
20. 3)18 gal 9 pt — *6 gal 3 pt*
21. Mrs. DeYoung used a long roll of paper to cover 9 tables for the neighborhood picnic. Each table cover was 5 ft 3 in. long. What was the total length of paper she used? *9 • 5 ft 3 in. = 45 ft 27 in. = 47 ft 3 in.*
22. The church shipped a garden tiller and a garden seeder to a missionary in South America. The tiller weighed 75 lb, and the seeder weighed 7 lb 11 oz. How much more did the tiller weigh than the seeder? *75 lb − 7 lb 11 oz = 67 lb 5 oz*

Practice & Application *Steps to solve may vary.*

23. The average dairy cow produces 7 gallons of milk per day. How many 8-ounce glasses are in 7 gallons of milk?
24. Dairy cows need to drink 200 L of water to produce 30 L of milk. How many liters of water would a cow need to drink to produce 300 L of milk? *$\frac{200\ L}{30\ L} = \frac{x}{300\ L}$; 2000 L of water*
25. The average Holstein cow needs 22 kg of feed to produce 30 L of milk. If a cow received 10 kg of hay, how many kilograms of corn would she need to produce 30 L of milk? *22 kg − 10 kg = 12 kg of corn*
26. The average Holstein cow produces 7 gallons of milk per day. How many cows would it take to fill a 1,000-gallon milk tank in one day? *1,000 ÷ 7 ≈ 143 cows*
27. Mr. Well's prized Holstein weighs 1,598 pounds. Mr. Bradstreet's top Jersey weighs 987 pounds. What is the difference in the weight of the two cows? *1,598 lb − 987 lb = 611 lb*
28. The Hayner Dairy Farm houses 1,500 cows in a barn that is 200 ft wide and 750 ft long. What is the perimeter and the area of the barn?
29. If a sixth-grader drank 8 ounces of milk at each meal, how many ounces would he consume in a day? *3 • 8 oz = 24 oz*
30. Everett drinks 3 quarts of milk each week. Wesley drinks 13 cups of milk each week. Who drinks more milk? *4 c = 1 qt; 3 qt • 4 c = 12 c; Wesley; 13 c > 12 c*
31. Adriana bought 36 ounces of cheese. Did she purchase 4 eight-ounce bags or 3 twelve-ounce bags? *3 • 12 oz = 36 oz; 3 twelve-ounce bags*
32. The menu offered 1 L of chocolate milk and 750 mL of chocolate milk. Which choice offered more milk? *1 L; 1L = 1000 mL*
33. The total amount of milk produced in one day on the Belmont Farm is 2250 L. There are 75 cows on the farm. What is the average amount of milk each cow produces per day? *2250 ÷ 75 = 30 L of milk*
34. A cow needs 0.92 meters of space while eating. How many meters of space are needed for 50 cows? *50 • 0.92 = 46 m*

J The Carson family drinks 2 gallons of milk each week. How many quarts of milk do they drink? Use the number of quarts to find an equivalent number of pints and cups. *2 gal • 4 qt = 8 qt; 8 qt • 2 pt = 16 pt; 16 pt • 2 c = 32 c*

23. *8 oz = 1 c*
2 c = 1 pt
2 pt = 1 qt
4 qt = 1 gal
16 c = 1 gal
7 • 16 = 112 eight-ounce glasses

28. *P = (2 • 200 ft) + (2 • 750 ft) = 400 + 1,500 = 1,900 ft*
A = 200 ft • 750 ft = 150,000 ft²

Complete DAILY REVIEW e on page 453.

9. Direct the students to solve the last word problem. Choose students to write their solutions for display. Discuss the solutions as needed.

> The chicks ate half of a 5-pound bag of starter feed. How many pounds of starter feed were eaten? *$2\frac{1}{2}$ lb* How many ounces of starter feed were eaten? *40 oz; possible solutions: $\frac{1}{2} \times 5$ lb = $2\frac{1}{2}$ lb, $2\frac{1}{2}$ lb × 16 oz = 40 oz*

10. You may choose to guide the students in solving the word problems on the Metric Measurement Word Problems page.
    1. *12 × 5.74 kg = 68.88 kg*
    2. *24 × 0.5 L = 12 L*
    3. *2.4 kg − 1.9 kg = 0.5 kg or 500 g*
    4. *31.57 kg ÷ 12 = 2.63 kg (rounded to the nearest hundredth)*
    5. *$1 - \frac{2}{3} = \frac{1}{3}$; $\frac{1}{3} \times 3.27$ kg = 1.09 kg; 1090 g*

    (***Note:*** If you taught the Metric Measurement Word Problems page during the lesson, you may choose to guide the students in solving the word problems on the Customary Measurement Word Problems page now.)

Student Text pp. 312–13

Lesson 130

Student Text pp. 314–15
Daily Review p. 453f

Objectives
- Recognize *degree* as a measuring unit for temperature
- Recognize that *°C* represents *degrees Celsius* and *°F* represents *degrees Fahrenheit*
- Identify standard Celsius and Fahrenheit temperatures
- Determine the more reasonable temperature
- Read and set a Celsius and a Fahrenheit thermometer
- Determine the amount of increase or decrease between two temperatures
- Measure temperature using a thermometer
- Convert temperatures: Celsius to Fahrenheit and Fahrenheit to Celsius

Teacher Materials
- Thermometer
- Red Strip
- Boiling Point steam cloud
- Double-Scale Thermometer, page IA76 (CD)
- 6 thermometers of various types (e.g., medical, candy, weather, digital, Celsius, Fahrenheit)

Student Materials
- Thermometer
- Red Strip
- Temperature Hunt, page IA75 (CD), for each group of students
- Double-Scale Thermometer, page IA76 (CD)

Preparation
During the lesson you will fill 3 containers with water having the following approximate temperatures: 145°F (hot); 85°F (lukewarm); and 33°F (ice water). Place a thermometer in each container. Also place a thermometer at each of 3 different locations in the room so that the temperatures will vary. (***Note:*** An adult may volunteer to be a "location" and have his temperature taken by the students.)

Teach for Understanding

Recognize *degree* as a measuring unit for temperature

➤ **What unit is used to measure temperature?** ***a degree***

1. Display the Thermometer with the Red Strip and the Boiling Point steam cloud. Direct attention to the Celsius scale and the Fahrenheit scale. Explain that in the metric system temperature is measured in *degrees Celsius*, and in the customary system it is measured in *degrees Fahrenheit*.
2. Write a degree sign (°) followed by a *C* and a degree sign (°) followed by an *F*. Elicit that *°C* represents *degrees Celsius* and *°F* represents *degrees Fahrenheit*.

➤ **What does each line on both sides of the thermometer represent?** ***1 degree***
➤ **What is the freezing point of water in degrees Celsius?** ***0°C*** **Fahrenheit?** ***32°F***
➤ **What is the boiling point of water in degrees Celsius?** ***100°C*** **Fahrenheit?** ***212°F***
➤ **What is the normal body temperature in degrees Celsius?** ***37°C*** **Fahrenheit?** ***98.6°F***

3. Explain that these standard temperatures can be used as a reference when considering other Celsius and Fahrenheit temperatures.
4. Select students to choose the more reasonable Celsius and Fahrenheit temperatures for each of the following items, using the standard temperatures as reference.

   Frozen yogurt: 4°C or ⁻4°C ***⁻4°C***; 25°F or 35°F ***25°F***
   Room temperature: 23°C or 3°C ***23°C***; 70°F or 100°F ***70°F***
   A child with a fever: 38.7°C or 50°C ***38.7°C***; 96°F or 101.7°F ***101.7°F***
   A fall day: 15°C or 80°C ***15°C***; 10°F or 60°F ***60°F***
   Lava: 95°C or 700°C ***700°C***; 199°F or 1,300°F ***1,300°F***

Read and set a Celsius and a Fahrenheit thermometer

1. Distribute the Thermometers and Red Strips. Instruct the students to set their Thermometers at 10°F.

➤ **What is the corresponding Celsius temperature of 10° F?** ***⁻13°C–⁻14°C***

2. Repeat the procedure for 32°F ***0°C***, 79°F ***26°C–27° C***, ⁻5°F ***⁻22°C–⁻23°C***.

➤ **As the Red Strip moves down the Thermometer, does it show colder or hotter temperatures?** ***colder temperatures***
➤ **How much colder is –1°C than 0°C?** ***1 degree colder*** **–2°C than 0°C?** ***2 degrees colder***

3. Direct the students to show the following temperatures on their Thermometers and to tell how many degrees warmer or colder than zero each temperature is.

   ⁻7°C ***7°C colder than zero***
   8°F ***8°F warmer than zero***
   13°C ***13°C warmer than zero***
   ⁻5°F ***5°F colder than zero***

Determine the increase or decrease between two temperatures

1. Set your Thermometer at 18° Celsius and direct the students to set their Thermometers at 6° Celsius.

➤ **If the temperature at noon was 18°C and later that same day it was 6°C, how much did the temperature change? How do you know?** ***12°; elicit that you can count the number of degrees between the two temperatures, or you can subtract to find the difference between the two temperatures.***

2. Explain that thermometers can use intervals other than 1 degree between the lines (marks) on their scales, so it is important to determine the scale used before attempting to read a thermometer.
3. Arrange the students in groups and distribute the Temperature Hunt page to each group. Instruct each group of students to read the temperatures of the prepared liquids and of the predetermined locations and to record the data on the page. Following the activity, allow each group to share and compare its data with the class. Elicit the changes in temperature that occurred at each station throughout the activity.

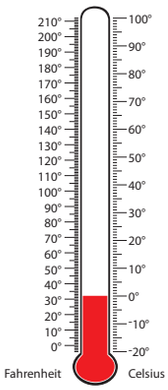
Convert temperatures

1. Display and distribute the Double-Scale Thermometer page. Explain that the double-scale thermometer compares Celsius to Fahrenheit degrees. Point out that although water freezes at the same temperature and boils at the same temperature, the temperatures are expressed differently on each scale (32°F = 0°C and 212°F = 100°C). On the Fahrenheit scale, the degree difference between freezing and boiling (180°F) is divided into 20 equal parts of 9°F. On the Celsius scale the difference between freezing and boiling (100°C) is divided into 20 equal parts of 5°C.

Fahrenheit & Celsius

Use the facts for temperature to convert between **Fahrenheit** and **Celsius**.

Fahrenheit
Celsius



Temperature Equivalents

Boiling point of water	212°F	100°C
Normal body temperature	98.6°F	37°C
Freezing point of water	32°F	0°C

Convert Temperature

Celsius to Fahrenheit

$F = (\frac{9}{5} \times C) + 32$

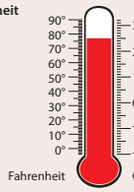
__°F = 25°C

$F = (\frac{9}{5} \times 25) + 32$

$F = (\frac{9}{5} \times \frac{25}{1}) + 32$

$F = 45 + 32$

$F = 77°$



77°F = 25°C

Fahrenheit to Celsius

$C = \frac{5}{9} \times (F - 32)$

__°C = 77°F

$C = \frac{5}{9} \times (77 - 32)$

$C = \frac{5}{9} \times 45$

$C = \frac{5}{9} \times \frac{45}{1}$

$C = 25°$

Exercises

Choose the more reasonable temperature.

1.	bowl of ice cream	(32°F)	32°C
2.	day at the beach	50°F	(38°C)
3.	room temperature	20°F	(20°C)
4.	water for boiling eggs	(212°F)	50°C
5.	sick child	98.6°F	(103°F)
6.	snowy day	(-3°C)	30°C
7.	fall day	(65°F)	25°F
8.	normal body temperature	30°C	(37°C)
9.	mowing the yard	(25°C)	80°C
10.	ice skating	40°F	(30°F)
11.	boiling water	(100°C)	200°C

Determine the scale of the thermometer. Write the temperature.

12. 

-2 °F

13. 

26 °C

14. 

3 °C

Answers based on cancellation.

Use the formula to convert the temperature.

15. 59°F = __°C *15*
16. 41°F = __°C *5*
17. 95°F = __°C *35*
18. 10°C = __°F *50*
19. 20°C = __°F *68*
20. 50°C = __°F *122*

Aaron's journal while climbing Mount McKinley in Alaska

Day 1: Today, June 11, I packed about 8 kg of food on my sled for the climb up Mount McKinley. Tomorrow we will hike from the Base Camp to Camp 1. The elevation at **Camp 1** is **7,999 ft** (**2438 m**) above sea level. The temperature is a warm 15°C.

Day 6: It has taken 3 days to hike from **Camp 2** (elev. **7,770 ft**) to **Camp 3** (elev. **11,500 ft**). The temperature is a warm 14°C in the sun. I dragged a 30 kg sled and carried a 25 kg backpack while hiking up the 4-mile slope. At camp I melted 2.5 L of snow for drinking water.

Day 9: Praise the Lord! Today our team safely climbed to **Camp 4** (elev. **14,400 ft**). The temperature is -10°C with a cold wind blowing off the mountain. Inside the tent it is above freezing. We are safe and will rest here tonight.

Day 12: Today the guide said, "The snowstorm is over. We will climb to **Camp 5** (elev. **17,200 ft**)." Leaving Camp 4 at 9:20 AM, we began the long hike (14,400 ft to 17,200 ft). My backpack weighed over 30 kg. A 700 m long ice slope slowed our climb. About 5:00 PM we trudged into camp and set up tents. It started to snow, and the temperature dropped to -20°C. We were only 3,120 feet below the summit!

Day 16: The Summit! The temperature was -18°C as we began our climb. When we reached a place only 330 feet below the summit, I looked up and saw clearly that the route was on a steep ridge. I kept moving slowly upward to the summit (elev. **20,320 ft**, **6194 m**). On June 27, I was at the top of the world, and the view was breathtaking! The cliffs around me dropped thousands of feet. I was overcome with the power and the greatness of my Creator. "Be thou exalted, O God, above the heavens: let thy glory be above all the earth" (Psalm 57:11).

28. 

Exercises

Use the journal entries above to find the answer. *Steps to solve may vary.*

21. What was the temperature in Fahrenheit on Day 1? *15°C = 59°F*
22. How many grams of food did Aaron take on his hike? *8 × 1000 = 8000; 8 kg = 8000 g*
23. How many kilometers is Camp 1 above sea level? *2438 ÷ 1000 = 2.438; 2438 m = 2.438 km*
24. What is a mild temperature for this part of Alaska? *14°C or 15°C*
25. What is the total mass of the sled and the backpack that Aaron took from Camp 2 to Camp 3? *30 kg + 25 kg = 55 kg*
26. What is the difference in elevation from Camp 2 to Camp 3? *11,500 – 7,770 = 3,730 ft*
27. If the ratio of melted snow to water is 10 : 1, how many milliliters of water did Aaron prepare for drinking on Day 6? *$\frac{10}{1} = \frac{2.5\ L}{0.25\ L}$; n = 0.25 L or 250 mL*
28. How many degrees warmer was it on Day 6 than it was on Day 9? *10 + 14 = 24 degrees*
29. On Day 9 what was the temperature inside the tent? *Answers may vary, but should be above 0°C.*
30. How much elevation did they gain on the hike on Day 12? *17,200 – 14,400 = 2,800 ft*
31. On Day 12 the team encountered a long ice slope. Was the ice slope a kilometer long? Explain. *no; 700 m = 0.7 km*
32. On Day 16 Aaron looked up from the trail and saw the summit. About how many meters was the summit above him at that point? *330 ft ÷ 3 ≈ 100 yd; approximately 100 m*
33. How many meters higher is the summit than Camp 1? *6194 – 2438 = 3756 m*

Complete DAILY REVIEW on page 453.

2. Guide the students in completing the lower section of both scales, adding 9° to find the next warmer Fahrenheit temperatures *50°, 59°, 68°* and adding 5° degrees to find the next warmer Celsius temperatures *10°, 15°, 20°*. Compare the Fahrenheit and Celsius temperatures. Point out that the Celsius freezing point is a good reference point because it is 0°C.
   - **What do you think is the Fahrenheit equivalent of 105°C? How do you know?** *221°F; elicit that 105°C is 5° more than boiling, which is the same as 9° more than the Fahrenheit boiling temperature; 100°C + 5°C = 212°F + 9°F.* Complete both scales.
   - **What ratio represents the relationship of Fahrenheit to Celsius? Why?** *9 to 5; for every 9°F that the temperature increases, the equivalent Celsius temperature increases by 5°C.*
3. Write the formulas $F = (\frac{9}{5} \times C) + 32$ and $C = \frac{5}{9} \times (F - 32)$ for display. Explain that these are the formulas used to convert a known Celsius temperature to an equivalent Fahrenheit temperature and a known Fahrenheit temperature to an equivalent Celsius temperature.
   - **Why do you think 32° is added when converting from Celsius to Fahrenheit?** *Elicit that the difference in the freezing points of Celsius and Fahrenheit is 32°.*
   - **Is the difference between the other equivalent temperatures 32°? Why?** *No; elicit that the Fahrenheit scale increases by 9° for every 5° the Celsius scale increases.*

   Point out that the 9:5 ratio is the reason for multiplying by $\frac{9}{5}$ or $\frac{5}{9}$ when converting from Fahrenheit to Celsius or from Celsius to Fahrenheit.
4. Demonstrate using the formula to find the Fahrenheit temperature that is equivalent to 105°C. Point out that the answer is the same as when you counted on the Double-Scale Thermometer.

   $F = (\frac{9}{5} \times C) + 32°$

   $F = (\frac{9}{5} \times 105°) + 32°$

   $F = (\frac{9}{\cancel{5}} \times \frac{\overset{21}{\cancel{105°}}}{\underset{1}{\cancel{1}}}) + 32°$

   $F = (9 \times 21°) + 32°$

   $F = 189° + 32°$

   $F = 221°$
5. Guide the students in using the formulas to solve these word problems.

> On Monday morning, Reagan checked the temperature to see if she would need to wear a heavy coat to school. It was 20°C. Did she need a heavy coat? What was the Fahrenheit temperature? *No coat was needed; $F = (\frac{9}{5} \times 20°) + 32° = 68°F$.*
>
> During a science experiment, Damon read a Fahrenheit thermometer as 59°F. He needed to record the temperature in Celsius. What was the Celsius temperature? *$C = \frac{5}{9} \times (59° - 32°) = 15°C$*

Student Text pp. 314–15

Lesson 131

Student Text pp. 316–17
Daily Review p. 454g

Objectives
- Recognize approximate equivalencies between customary and metric units of measurement
- Compare customary and metric measurements
- Estimate conversions between customary and metric measurements

Teacher Materials
- Chart 15: *Customary & Metric Conversions*
- Christian Worldview Shaping, pages 33–34 (CD)
- A ruler
- Clearview Liter Cube (from Lesson 128)
- A 1-liter beaker (from Lesson 128)
- A 1-liter bottle (from Lesson 128)
- A spring scale (optional)
- A balance or metric scale (optional)
- The objects used in Lessons 126 and 128
- Water (optional)

Student Materials
- Christian Worldview Shaping, page 34 (CD)
- A ruler

Introduce the Lesson

1. Write for display standard equivalencies such as *1 lb = __ oz* and *1 kg = __ g* and direct the students to complete them.
2. Write the following equivalencies and direct the students to complete them.

3 mi = __ ft ***15,840***	2.5 L = __ mL ***2500***
$\frac{2}{3}$ yd = __ ft ***2***	$\frac{7}{10}$ m = __ cm ***70***
4 kg = __g ***4000***	30 in. = __ ft ***2$\frac{1}{2}$***

Teach for Understanding

Recognize approximate equivalencies between customary and metric units of measurement

1. Review the personal benchmarks that were established in Lessons 125 and 127 for 1 inch, 1 foot, 1 mile, and 1 meter. (***Note:*** See the example benchmarks given in parentheses in step 3 below.)
2. Display the *Customary & Metric Conversions* chart with the equivalencies covered.

   Direct each student to use his metric ruler to measure the midsection of his index finger (a benchmark for 1 inch) to find a close metric equivalent. ***Elicit 2$\frac{1}{2}$ or 2.5 centimeters.***

   Uncover the equivalency *1 in. ≈ 2.5 cm* on the chart.
3. Follow a similar procedure to elicit the other equivalencies on the chart. Allow the students to refer to the chart throughout the remainder of the lesson.

   1 ft (a student's foot with shoe on) ≈ ***30*** cm
   1 mi (the predetermined distance used in Lesson 125) ≈ ***1.6*** km
   1 m (from the nose to outstretched fingertips) ≈ ***39*** in.
   1 fl oz (2 tablespoons of liquid) ≈ ***30*** mL
   1 L (a 1-L bottle of water) ≈ ***1*** qt
   1 oz (a slice of bread) ≈ ***30*** g
   1 kg (a 1-L bottle of water) ≈ ***2.2*** lb

➤ **Which is longer, an inch or a centimeter?** ***an inch*** **a mile or a kilometer?** ***a mile*** **a yard or a meter?** ***a meter***
➤ **Which has the greater capacity, a quart or a liter?** ***Elicit that the capacity of a quart and a liter are approximately the same, but the capacity of the liter is slightly greater than the quart; 1 qt = 32 oz and 1 L ≈ 33.81 oz.***
➤ **Which has the greater mass, a pound or a kilogram?** ***a kilogram***
➤ **What do you notice about the number of customary units and the number of metric units in each approximation?** ***Answers will vary, but elicit that a greater number of smaller units are needed to measure approximately the same amount as one larger unit.***

4. Write the following comparisons for display. Choose students to write > or < to complete the comparisons. Allow them to refer to the chart.

4 in. > 4 cm	2 kg > 2 lb	5 mi > 5 km
2 ft < 100 cm	3 m < 4 yd	4 L > 2 qt
2 m > 40 in.	5 fl oz > 5 mL	1 oz < 50 g

5. Arrange the students in groups. Distribute the Clearview Liter Cube, the 1-liter beaker, the 1-liter bottle, and several of the various objects to each group. Provide a spring scale, a balance or metric scale, and water for the students to use as needed.
6. Direct the students to determine an approximate customary and metric unit of measurement for each item (length, capacity, weight or mass), and then to label the item appropriately. (***Note:*** Capacity or weight/mass provided on the labels of manufactured items may be used.)
7. Collect two or three items from each group and display the items with the measurement labels turned away from the students. Read the metric measurement information from the label of one of the items and direct the students to identify the item with the given metric measurement. Give the approximate customary equivalent as a help, if needed. (e.g., capacity of 237 mL; hint: 8 oz.; ***liquid hand sanitizer***)
8. Continue the activity until all of the items have been identified.

Estimate conversions between customary and metric measurements

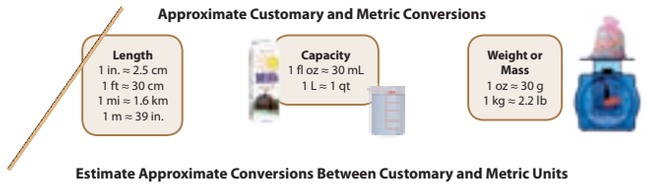
1. Follow procedures similar to the ones used in Lessons 125–128 to rename the units of measurement in the following word problems, using the approximate equivalencies on the chart. Elicit whether multiplication or division should be performed to rename the units.

> Seth ran a 5-mile race. Approximately how many kilometers did he run? ***8 km; 5 × 1.6 km ≈ 8 km***
>
> After the race, Seth drank 960 mL of sports drink. Approximately how many fluid ounces did he drink? ***32 fl oz; 960 mL ÷ 30 mL ≈ 32 fl oz***
>
> While training for the race, Seth lost 3 kg. Approximately how many pounds did he lose? ***6.6 lb; 3 × 2.2 lb ≈ 6.6 lb***
>
> Kira jumped 510 cm in the long jump competition. Approximately how many feet did she jump? ***17 ft; 510 cm ÷ 30 cm ≈ 17 ft***

2. **Christian Worldview Shaping (CD)**

Relate Customary & Metric Units

Approximate Customary and Metric Conversions



Estimate Approximate Conversions Between Customary and Metric Units

Rename larger units as smaller units.
Determine the approximate equivalency and then *multiply*.

3 ft ≈ ___ cm
1 ft ≈ 30 cm
3 × 30 = 90
3 ft ≈ 90 cm

Rename smaller units as larger units.
Determine the approximate equivalency and then *divide*.

11 lb ≈ ___ kg
1 kg ≈ 2.2 lb
11 ÷ 2.2 = 5
11 lb ≈ 5 kg

Exercises

Write the approximate measurement.

1. Vivian's umbrella is 1 yard long. About how many meters long is it? *1 m*
2. Laura drank 1 quart of water. About how many liters of water did she drink? *1 L*
3. Mom bought 2 pounds of chocolates. About how many kilograms of chocolates did she purchase? *1 kg*
4. Dan took 1 fluid ounce of antibiotic medicine. How many milliliters of medicine did he take? *30 mL*
5. Lee ran 1.6 kilometers. About how many miles did he run? *1 mi*
6. A worm was 2.5 centimeters long. How many inches long was the worm? *1 in.*

Write a comparison sentence using >, <, or ≈.

7. 4 in. > 4 cm
8. 3 kg > 3 lb
9. 1 qt ≈ 1 L
10. 2 m ≈ 2 yd
11. 2 ft > 30 cm
12. 30 mL < 5 fl oz
13. 2 lb < 4 kg
14. 3 m < 3 km

Use the conversion facts above to find an approximate equivalency.

15. 3 in. ≈ ___ cm *3 × 2.5 = 7.5*
16. 4 m ≈ ___ in. *4 × 39 = 156*
17. 78 in. ≈ ___ m *78 ÷ 39 = 2*
18. 2 fl oz ≈ ___ mL *2 × 30 = 60*
19. 7 L ≈ ___ qt *7 × 1 = 7*
20. 120 cm ≈ ___ ft *120 ÷ 30 = 4*
21. 6 ft ≈ ___ cm *6 × 30 = 180*
22. 60 mL ≈ ___ fl oz *60 ÷ 30 = 2*
23. 8.8 lb ≈ ___ kg *8.8 ÷ 2.2 = 4*

Write the answer. *Steps to solve may vary.*

24. When you convert kilograms to pounds, do you get a higher or lower number of pounds? *higher*
25. The Colemans traveled 160 kilometers. How many miles did they travel? *160 km ÷ 1.6 = 100 miles*
26. Sara's kitten weighed 3 pounds. Mira's kitten was 2 kilograms. Who had the smaller kitten? *2 • 2.2 lb = 4.4 lb; 3 lb < 4.4 lb; Sara*
27. Brady's rope measured 2 meters. Rory's rope measured 80 inches. Whose rope was longer? *2 • 39 in. = 78 in.; 78 in. < 80 in.; Rory's rope*

Rename to the given unit of measurement.

28. 1 ft = *12* in.; 1 yd = *3* ft; 1 mi = *1,760* yd
29. 1 c = *8* fl oz; 1 pt = *2* c; 1 gal = *4* qt
30. 1 lb = *16* oz; 1 tn = *2,000* lb
31. 1 L = *1000* mL; 1 m = *100* cm; 1 kg = *1000* g
32. $\frac{1}{3}$ of a yard — *12 in. or 1 ft*
33. $\frac{3}{4}$ of a foot — *9 in.*
34. $\frac{1}{2}$ of a meter — *50 cm*
35. $\frac{1}{4}$ of a kilometer — *250 m*

Complete the table.

36.

ounces	*16*	48	*80*
pounds	1	*3*	5

37.

grams	2,000	*7,000*	*10,000*
kilograms	*2*	7	10

Add or subtract. Simplify the answer.

38. 3 ft 8 in. + 1 ft 9 in. = *4 ft 17 in. = 5 ft 5 in.*
39. 6 gal 3 qt + 2 gal 2 qt = *8 gal 5 qt = 9 gal 1 qt*
40. 9 lb 8 oz − 3 lb 10 oz = *5 lb 14 oz*
41. 3 kg 760 g − 1 kg 820 g = *1 kg 940 g*

Practice & Application

42. Andre needed $\frac{2}{3}$ of a yard of rope for his project. How many feet did he use? *$\frac{2}{3}$ • 3 ft = 2 ft*
43. Marco ate $\frac{1}{4}$ of a gallon of ice cream. How many quarts did he eat? *$\frac{1}{4}$ • 4 qt = 1 qt*
44. Dad grilled 6 quarter-pound hamburgers. How many ounces of hamburger did he grill? *6 • ($\frac{1}{4}$ • 16) = 6 • 4 oz = 24 oz*
45. Kendra measured the width of her bracelet as 13. What would be a reasonable metric unit? *mm*
46. Mom needed half of a foot of ribbon for a craft project. How many inches did she need?
47. Kristen drank half of a liter of water. How many milliliters did she drink? *$\frac{1}{2}$ • 1000 mL = 500 mL*
48. Mr. Lehman biked 1$\frac{3}{4}$ kilometers. How many meters did he bike? *1$\frac{3}{4}$ • 1000 m = $\frac{7}{4}$ • 1000 m = 1750 m*
49. Miss Cherie used 6 feet 8 inches of border for a bulletin board. How many inches did she use? *(6 • 12 in.) + 8 in. = 72 in. + 8 in. = 80 in.*
50. Nathaniel measured his foot as 28. What would be a reasonable metric unit? *cm*
51. A box that weighs 1 kg holds 1,000 paper clips. What is the mass of 5 paper clips? *5 × (1000 g ÷ 1000) = 5 g*
52. The printing company ordered 2$\frac{1}{4}$ tons of paper. How many pounds did it order?
53. Devon compared his body mass to 40, the body mass of an average sixth-grader. What would be a reasonable metric unit? *kg*
54. Josie prepared a quart of punch. How many ounces did she prepare? *1 qt = 2 pt; 2 pt = 4 c; 4 c = 32 oz*

46. *$\frac{1}{2}$ • 12 in. = 6 in.*

52. *2$\frac{1}{4}$ • 2,000 lb = $\frac{9}{4}$ • 2,000 = 4,500 lb*

Complete DAILY REVIEW 5 on page 454.

Student Text pp. 316–17

(*Note*: *Assessment* available on Teacher's Toolkit CD.)

Lesson 132

Student Text pp. 318–19
Daily Review p. 454h

Objectives
- Identify equivalent units of time
- Tell and write time to the minute
- Differentiate between AM and PM
- Develop an understanding of a 24-hour clock
- Convert units of time to smaller or larger units
- Find a fraction of a unit of time
- Add and subtract time

Teacher Materials
- Chart 16: *Time Measurement*
- Judy Clock (or Clock from the Teacher Manipulatives Packet)

Student Materials
- Clock

Introduce the Lesson

1. Write these equivalencies for display and choose students to complete them. Use the *Time Measurement* chart to review the equivalencies as needed.

1 minute = __ seconds ***60***	1 hour = __ minutes ***60***
1 day = __ hours ***24***	1 week = __ days ***7***
1 month = __ days ***28–31***	1 year = __ months ***12***
1 year = __ weeks ***52***	1 year = __ days ***365***
1 leap year = __ days ***366***	1 decade = __ years ***10***
1 century = __ years ***100***	1 millennium = __ years ***1000***

(***Note:*** You may choose to allow the students to refer to the *Time Measurement* chart or the time equivalents on page 500 of the Student Text Handbook throughout the lesson.)

2. Choose students to tell whether hours, minutes, or seconds is the best unit for estimating the amount of time needed for each of these activities.

a sneeze ***seconds***	an educational film ***hours or minutes***
a trip ***hours or minutes***	repeat a math fact ***seconds***
a song ***minutes***	a lunch break ***minutes or hours***

Teach for Understanding

Tell time to the minute

1. Set the demonstration clock for 10:34.

➤ **What time is shown?** ***10:34*** **How did you count the minutes to reach 34 minutes after the hour?** ***Accept any correct answer, but elicit that you begin at 10:00, count by 5s until you reach the number 6 on the clock, and then count each additional minute by 1s.***

2. Set the clock for 2:30.

➤ **What ways can you read this time?** ***2:30; half past 2***

3. Repeat the procedure using these times.

6:20 ***6:20; 20 minutes after six***
9:45 ***9:45; 15 minutes before 10; quarter to 10***
12:15 ***12:15; 15 minutes after 12; quarter after 12***
8:55 ***8:55; 5 minutes before 9***

Differentiate between AM and PM

1. Display 12:00 on the clock. Elicit that when it is 12:00 during the day, we say it is 12 *noon*; when it is 12:00 at night, we say it is 12 *midnight*.
2. Write AM and PM for display. Explain that the abbreviation AM is for *ante meridiem*, which is Latin for *before noon*. The abbreviation PM is for *post meridiem*, which is Latin for *after noon*.
3. Guide the students in discussing that a day begins at midnight and continues until the next midnight; therefore, 12:00 at night is 12 AM because the minutes following it begin the morning hours, and 12:00 during the day is 12 PM because the minutes following it begin the afternoon hours.

   Explain that in military time, which uses a 24-hour clock, midnight is referred to as 0000 (zero) hours, 1 AM as 0100 (zero one hundred) hours, noon is 1200 (twelve hundred) hours, 1 PM is 1300 (thirteen hundred) hours, and 11 PM is 2300 (twenty-three hundred) hours.
4. Choose students to tell whether the following activities would occur during the AM hours or during the PM hours.

7:00 breakfast ***AM***	12:00 lunch ***PM***
3:00 school dismissal ***PM***	9:00 bedtime ***PM***
7:00 basketball game ***PM***	12:00 celebration of a new year ***AM***

5. Explain a 24-hour clock using the information at the bottom of Student Text page 319. Point out that midnight simultaneously ends one day (2400 hours) and begins the next day (0000 hours). Time on a 24-hour clock can also be read using the word *o'clock*; e.g., 13 o'clock (1 PM) and 23 o'clock (11 PM).

Convert units of time

1. Write *120 min* = __ *hr* for display.

➤ **How do you rename 120 minutes to hours?** ***Elicit that to rename smaller units (minutes) to larger units (hours), you determine the equivalency (60 min = 1 hr) and then divide by 60 minutes.***

2. Select a student to demonstrate renaming 120 minutes as hours and to complete the expression. ***120 min ÷ 60 min = 2 hr***
3. Repeat the procedure for 3 days = __ hr. Elicit that to rename larger units (days) to smaller units (hours), you determine the equivalency (1 d = 24 hr) and then multiply by 24 hours. ***3 × 24 hr = 72 hr***
4. Write the following equivalencies for display. Choose students to solve the equivalencies while the other students solve them on paper. Instruct the students to explain the renaming process in their displayed solutions.

420 minutes = __ hours ***7***	96 hours = __ days ***4***
5 minutes = __ seconds ***300***	36 hours = __ days ***$1\frac{1}{2}$***

Find a fraction of a unit of time

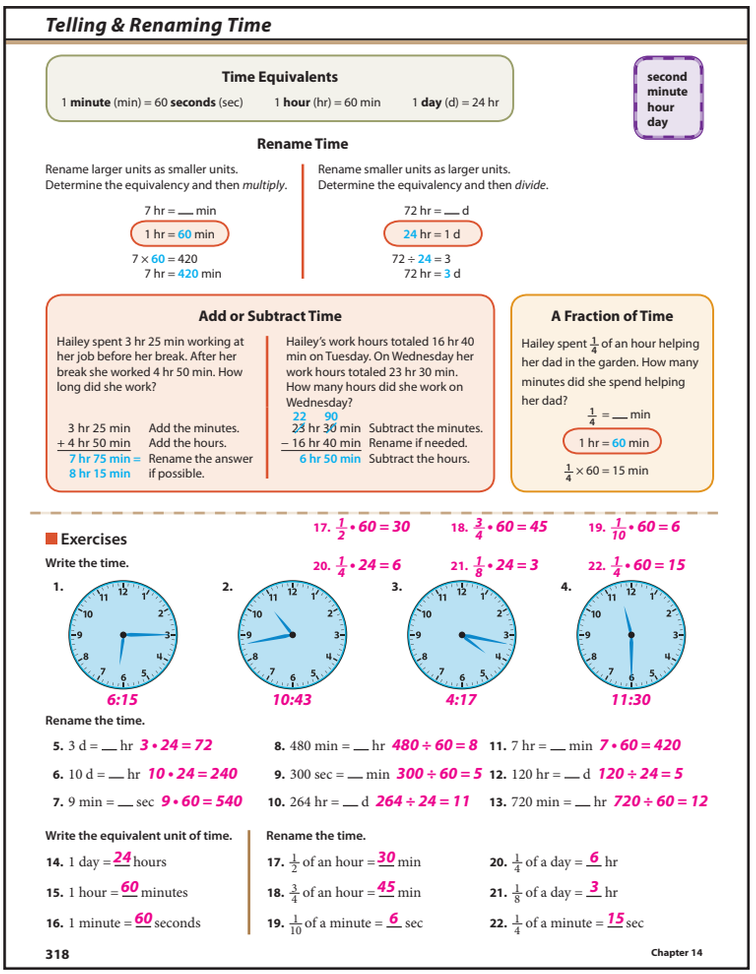
Faith spent $\frac{1}{3}$ of an hour practicing her piano lesson. How much time did she spend practicing the piano? ***20 min***

➤ **What smaller unit of time can be used to show part of an hour?** ***minute***

➤ **What ratio or equivalency do you know for hours to minutes?** ***1 hr: 60 min or 1 hr = 60 min***

➤ **How can you find $\frac{1}{3}$ of an hour?** ***Elicit that since you need to find part of an hour or minutes, and "of" means times or multiply, you can substitute 60 minutes for 1 hour and multiply $\frac{1}{3} \times 60$ min.***

1. Choose a student to write the equation and solve it.
   $\frac{1}{3} \times 60$ min = 20 min



Telling & Renaming Time

Time Equivalents

1 **minute** (min) = 60 **seconds** (sec) 1 **hour** (hr) = 60 min 1 **day** (d) = 24 hr

second
minute
hour
day

Rename Time

Rename larger units as smaller units. Determine the equivalency and then *multiply*.

7 hr = ___ min
1 hr = 60 min
7 × 60 = 420
7 hr = 420 min

Rename smaller units as larger units. Determine the equivalency and then *divide*.

72 hr = ___ d
24 hr = 1 d
72 ÷ 24 = 3
72 hr = 3 d

Add or Subtract Time

Hailey spent 3 hr 25 min working at her job before her break. After her break she worked 4 hr 50 min. How long did she work?

3 hr 25 min Add the minutes.
+ 4 hr 50 min Add the hours.
7 hr 75 min = 8 hr 15 min Rename the answer if possible.

Hailey's work hours totaled 16 hr 40 min on Tuesday. On Wednesday her work hours totaled 23 hr 30 min. How many hours did she work on Wednesday?

22 90
23 hr 30 min Subtract the minutes.
− 16 hr 40 min Rename if needed.
6 hr 50 min Subtract the hours.

A Fraction of Time

Hailey spent $\frac{1}{4}$ of an hour helping her dad in the garden. How many minutes did she spend helping her dad?

$\frac{1}{4}$ = ___ min
1 hr = 60 min
$\frac{1}{4}$ × 60 = 15 min

Exercises

Write the time.

1. 6:15
2. 10:43
3. 4:17
4. 11:30

Rename the time.

5. 3 d = ___ hr *3 • 24 = 72*
6. 10 d = ___ hr *10 • 24 = 240*
7. 9 min = ___ sec *9 • 60 = 540*
8. 480 min = ___ hr *480 ÷ 60 = 8*
9. 300 sec = ___ min *300 ÷ 60 = 5*
10. 264 hr = ___ d *264 ÷ 24 = 11*
11. 7 hr = ___ min *7 • 60 = 420*
12. 120 hr = ___ d *120 ÷ 24 = 5*
13. 720 min = ___ hr *720 ÷ 60 = 12*

Write the equivalent unit of time.

14. 1 day = *24* hours
15. 1 hour = *60* minutes
16. 1 minute = *60* seconds

Rename the time.

17. $\frac{1}{2}$ of an hour = *30* min
18. $\frac{3}{4}$ of an hour = *45* min
19. $\frac{1}{10}$ of a minute = *6* sec
20. $\frac{1}{4}$ of a day = *6* hr
21. $\frac{1}{8}$ of a day = *3* hr
22. $\frac{1}{4}$ of a minute = *15* sec

17. $\frac{1}{2} \cdot 60 = 30$ 18. $\frac{3}{4} \cdot 60 = 45$ 19. $\frac{1}{10} \cdot 60 = 6$
20. $\frac{1}{4} \cdot 24 = 6$ 21. $\frac{1}{8} \cdot 24 = 3$ 22. $\frac{1}{4} \cdot 60 = 15$

318 Chapter 14

Add or subtract.

23. 5 hr 15 min + 5 hr 26 min = *10 hr 41 min*
24. 7 hr 45 min 20 sec + 6 hr 39 min 15 sec = *13 hr 84 min 35 sec = 14 hr 24 min 35 sec*
25. 10 hr 35 min 15 sec + 6 hr 29 min 45 sec = *16 hr 64 min 60 sec = 17 hr 5 min*
26. 3 min 15 sec + 4 min 49 sec = *7 min 64 sec = 8 min 4 sec*
27. 15 hr 43 min − 8 hr 50 min = *6 hr 53 min*
28. 18 hr 17 min 45 sec − 9 hr 46 min 21 sec = *8 hr 31 min 24 sec*
29. 23 hr 32 min 10 sec − 20 hr 40 min 30 sec = *2 hr 51 min 40 sec*
30. 15 min 10 sec − 8 min 21 sec = *6 min 49 sec*

Write the best unit of measurement: hours, minutes, or seconds.

31. to use speed dial *seconds*
32. to bake cookies *minutes*
33. to run a mile *minutes*
34. to read a chapter book *hours*
35. to take a trip *hours*
36. to finish math homework *minutes*
37. to open a door *seconds*
38. to ride to the store *minutes*

Practice & Application

39. The temperature inside the room was 71°___. *F*
40. The pair of shoes had a mass of 1 ___. *kg*
41. The ballplayer drank 1 ___ of a sports drink. *L or qt*
42. The width of the wedding ring was 4 ___. *mm*
43. The boiling water was 212°___. *F*
44. The football game lasted about 2 ___. *hr*
45. The backpack weighed about 4 ___. *lb or kg*
46. Hayden ate 1 ___ of ice cream. *c or pt*
47. Eleanor walked 1 ___ in 20 minutes. *mi*
48. Mom worked in her garden for $\frac{1}{4}$ of an hour; she worked *15* minutes.
49. Paul needed $\frac{3}{4}$ of a foot of rope; he needed *9* inches.
50. Dad cut $\frac{2}{3}$ of a yard from a board; he cut *24* inches.

J Use the information below about the 24-hour clock to convert 6:00 PM, 10:00 PM, and 9:00 PM to 24-hour time. *18:00; 22:00; 21:00*

DID YOU KNOW

Time begins at the **Prime Meridian** (0° longitude) in Greenwich, England. There a 24-hour clock runs from midnight to midnight. The last hour of the day is 24 o'clock, or is that the first hour? It can be both times!

On a 24-hour clock, the first 12 hours of the day are numbered from 1 to 12. Then 1 in the afternoon is numbered 13, 2 is numbered 14, and so on. To convert 12-hour time to 24-hour time, add 12 to the afternoon time. If it is 3 PM, add 12. On a 24-hour clock, 3 PM is 15 o'clock in the afternoon. The 24-hour clock is used in many countries. In the United States, the military uses the 24-hour clock, and it is commonly called "military time."

Shepherd Gate Clock, Greenwich, England

Complete DAILY REVIEW on page 454.

Lesson 132 319

2. Follow a similar procedure for the following word problem. Elicit that the smaller unit hour is needed to find a part ($\frac{1}{4}$) of a day. *1 d: 24 hr or 1 d = 24 hr; substitute 24 hours for 1 day.*

Eli spends $\frac{1}{4}$ of his day at school. How much time does he spend at school? $\frac{1}{4} \times$ *24 hr = 6 hr*

Add and subtract time

Maria was training to run a half marathon. She recorded her running times for three training sessions: 1 hr 36 min 22 sec, 1 hr 35 min 14 sec, and 1 hr 30 min 41 sec. How much time did Maria run during these training sessions? *4 hr 42 min 17 sec*

➤ **How can you find the amount of time Maria spent running during the three training sessions?** *Add the recorded times and rename in the sum if needed.*

1. Write the problem for display and select a student to solve it. Elicit that first the like units are added, beginning with the smallest unit. Then the seconds and minutes in the sum are renamed to larger units because each of their totals is greater than 60; 60 sec = 1 min and 60 min = 1 hr.

1 hr 36 min 22 sec
1 hr 35 min 14 sec
+ 1 hr 30 min 41 sec
3 hr 101 min 77 sec = *4 hr 42 min 17 sec*

The Pilgar family ran a marathon. Mr. Pilgar ran it in 2 hr 34 min 53 sec. Mrs. Pilgar ran the race in 3 hr 9 min 14 sec. Who ran the race faster? How much faster? *34 min 21 sec*

➤ **Who ran the race faster? How do you know?** *Mr. Pilgar; his time is less than Mrs. Pilgar's time.*

➤ **How can you find how much faster he ran the race?** *Subtract Mr. Pilgar's time from Mrs. Pilgar's time.*

2. Write the problem for display and choose a student to solve it. Elicit that in order to subtract 53 seconds you must rename 1 minute as 60 seconds so that there are 74 seconds in the minuend. Then, in order to subtract 34 minutes, you must rename 1 hour as 60 minutes so that there are 68 minutes in the minuend.

3 hr 9 min 14 sec
− 2 hr 34 min 53 sec
34 min 21 sec

3. Write the following problems for display and direct the students to solve them. Then select students to demonstrate solving the problems, explaining each step as they solve the problem.

3 hr 25 min	55 min 28 sec	5 hr 9 min 35 sec
+ 4 hr 50 min	+ 40 min 59 sec	− 2 hr 25 min 45 sec
7 hr 75 min	*95 min 87 sec*	*2 hr 43 min 50 sec*
8 hr 15 min	*1 hr 36 min 27 sec*	

Student Text pp. 318–19

Lesson 133

Student Text pp. 320–21
Daily Review p. 455i

Objectives
- Demonstrate an understanding of world time zones
- Determine the elapsed time
- Add and subtract time

Teacher Materials
- Chart 16: *Time Measurement*
- Time Zones of the World, page IA77 (CD)
- Time Zones, page 78 (CD)
- Judy Clock (or Clock from the Teacher Manipulatives Packet)

Student Materials
- Time Zones of the World, page IA77 (CD)
- Clock

Note
The students will use the Time Zones of the World page again in Lesson 134.

Introduce the Lesson

Repeat the activity used in the Introduce the Lesson section of Lesson 132 to review the equivalent units of time. If needed, review the equivalencies using the *Time Measurement* chart.

Teach for Understanding

Demonstrate an understanding of world time zones

1. Display and distribute the Time Zones of the World page. Explain that the time zones begin at the *Prime Meridian* (0° longitude) in Greenwich, England. The time in this time zone is referred to as *Greenwich mean time*. All other time zones are ahead or behind Greenwich mean time (0° longitude) and were created so that noon is the middle of the day in each time zone.

   Point out the different time zones on the map. Explain that each time zone is approximately a 15-degree longitudinal segment. All locations in each time zone share the same time.
2. Direct attention to the number line at the bottom of the map. Point out that the number line shows each time zone and its relationship to Greenwich, England or 0° longitude. The clocks show the time relationship when it is 12 noon in Greenwich. Elicit that time increases by 1 hour for each time zone east of Greenwich (0 on the number line) and decreases by 1 hour for each time zone west of Greenwich.

   ➤ **How many time zones are there in the world?** ***24***
3. Guide the students in counting the zones. Point out that +12 and ⁻12 are the same zone and are both written as ⁻12+. The *International Date Line*, an imaginary line running through the Pacific Ocean at about 180° longitude, is located in this time zone. A person traveling west across the date line gains a day and a person traveling east across the date line loses a day.
4. Display the Time Zones page and write *12:00 noon* in the Greenwich Mean Time column. Guide the students in completing the table by determining the time in the designated locations when it is 12 noon in Greenwich, England. Allow the students to use the number line on their Time Zones of the World page to count the time zones.

Time Zones of Major Cities				
Greenwich Mean Time	City	Zone	Time	AM/PM
12:00 noon	London	*+1*	*1:00*	*PM*
	Moscow	*+3*	*3:00*	*PM*
	Hong Kong	*+8*	*8:00*	*PM*
	New York	*⁻5*	*7:00*	*AM*
	Los Angeles	*⁻8*	*4:00*	*AM*

5. Repeat the procedure to complete the table using 3:00 PM Greenwich mean time.

Time Zones of Major Cities				
Greenwich Mean Time	City	Zone	Time	AM/PM
3:00 PM	London	*+1*	*4:00*	*PM*
	Moscow	*+3*	*6:00*	*PM*
	Hong Kong	*+8*	*11:00*	*PM*
	New York	*⁻5*	*10:00*	*AM*
	Los Angeles	*⁻8*	*7:00*	*AM*

Determine the elapsed time

1. Write *1:15 PM to 5:31 PM* for display.

   ➤ **How can you determine the elapsed time or the amount of time that passed from 1:15 PM to 5:31 PM?** ***Elicit that you can first count the full hours and then count the remaining minutes that passed between the beginning time (1:15 PM) and the ending time (5:31 PM).***
2. Set the demonstration clock at 1:15. Lead the students in counting the elapsed time as you advance the time to 2:15, 3:15, 4:15, 5:15, 5:16, 5:17, . . . 5:31: *1 hour, 2 hours, 3 hours, 4 hours, 4 hours 1 minute, 4 hours 2 minutes, . . . 4 hours 16 minutes.*

   ➤ **How many hours elapsed between 1:15 PM and 5:15 PM?** ***4 hours*** **minutes between 5:15 PM and 5:31 PM?** ***16 minutes***

   ➤ **What is the total amount of elapsed time between 1:15 PM and 5:31 PM?** ***4 hours 16 minutes***
3. Write *10:45 AM to 2:14 PM*. Elicit that whenever time elapses over the 12:00 hour, the label of AM or PM changes. Repeat the previous procedure as you lead the students in counting the elapsed time.

   ➤ **How much time elapsed between 10:45 AM and 2:14 PM?** ***3 hours 29 minutes***
4. Distribute the Clocks and write the following times for display. Direct each student to use his clock to find the elapsed times.

   5:17 PM to 7:19 PM ***2 hours 2 minutes***

   12:15 AM to 4:30 AM ***4 hours 15 minutes***

   10:20 AM to 5:10 PM ***6 hours 50 minutes***

   1:40 PM to 2:15 AM ***12 hours 35 minutes***
5. Instruct the students to use their Clocks to determine the elapsed time in each of the following word problems.

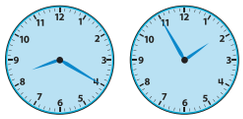
Elapsed Time & Time Zones

Elapsed time is the amount of time that passes as an event takes place.

elapsed time
time zones

How much time passes between 8:20 AM and 1:55 PM?
Count the hours first and then count the minutes.

Count the hours: 8:20 AM to 1:20 PM = **5 hr**
Count the minutes: 1:20 AM to 1:55 PM = **35 min**
Elapsed time: **5 hr 35 min**



8:20 AM 1:55 PM

Exercises

Write the elapsed time.

1. 9:15 AM to 9:45 AM — *30 min*
2. 8:20 AM to 9:00 AM — *40 min*
3. 4:17 PM to 4:59 PM — *42 min*
4. 6:25 PM to 6:51 PM — *26 min*
5. 3:20 AM to 5:20 PM — *14 hr*
6. 11:45 PM to 12:30 AM — *45 min*
7. 2:18 AM to 5:42 AM — *3 hr 24 min*
8. 10:11 AM to 1:31 PM — *3 hr 20 min*
9. 7:30 AM to 4:45 PM — *9 hr 15 min*
10. 8:10 AM to 12:35 PM — *4 hr 25 min*
11. 1:50 PM to 12:10 AM — *10 hr 20 min*
12. 5:30 PM to 7:45 PM — *2 hr 15 min*

Write the time.

13. 2 hr 15 min after 3:00 — *5:15*
14. 3 hr 20 min after 12:00 — *3:20*
15. 25 min after 2:45 — *3:10*
16. 1 hr 50 min before 5:00 — *3:10*
17. 45 min before 3:15 — *2:30*
18. 3 hr before 7:00 — *4:00*

Complete the elapsed time on the schedule.
Use the data from the chart to find the answer.

19. Which bus trip is the longest? *#1*
20. Which bus trip is the shortest? *#2*
21. Which bus trip begins in the afternoon and ends before midnight? *#4*
22. The four bus trips depart from San Diego and arrive at San Francisco. What accounts for the difference in elapsed times? *Answers may vary. Possible answers include heavy traffic times, different routes, and extra stops.*

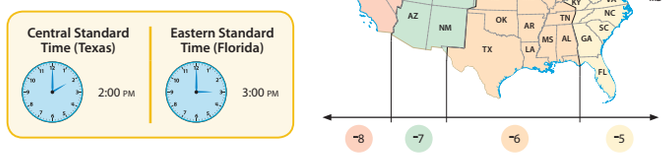
Bus Schedule

Bus	Departure San Diego	Arrival San Francisco	Elapsed Time
#1	1:30 AM	2:40 PM	*13 hr 10 min*
#2	8:15 PM	7:15 AM	*11 hr*
#3	10:15 PM	10:50 AM	*12 hr 35 min*
#4	12:15 PM	11:35 PM	*11 hr 20 min*

Add or subtract.

23. 6 hr 21 min 50 sec + 1 hr 45 min 20 sec = *7 hr 66 min 70 sec = 8 hr 7 min 10 sec*
24. 8 hr 29 min + 3 hr 50 min = *11 hr 79 min = 12 hr 19 min*
25. 4 hr − 2 hr 17 min = *1 hr 43 min*
26. 7 hr 0 min 50 sec − 2 hr 30 min 15 sec = *4 hr 30 min 35 sec*

Time zones help the world identify the same time of day. They were created so that noon is the middle of the day in each time zone. The zones make a number line starting with zero at Greenwich, England. To the east or right of Greenwich (0), the numbers *increase* by one up to 12. To the left of Greenwich (0), the numbers *decrease* by one down to −12. There are twenty-four time zones around the world; six of these are in the United States. When it is 3:00 PM in Florida, it is 2:00 PM in Texas.



Central Standard Time (Texas)	Eastern Standard Time (Florida)
2:00 PM	3:00 PM

Exercises

Use a time zone map to find the answer.

27. What time zone is represented by 0° longitude, the Prime Meridian? *0 or Greenwich mean time*
28. What is the time in the middle of the day in each time zone? *12:00 PM or noon*
29. What time zone is 1 hour earlier than eastern standard time? *central standard time*
30. The eastern standard time zone is −5 on the number line. How many time zones is the eastern standard time zone from Greenwich (0°)? *5 time zones*
31. Why is the Pacific standard time zone represented by −8? *because it is 8 time zones west of 0 or Greenwich mean time*
32. If Greenwich mean time is 12:00, what time is it in eastern standard time? Mountain standard time? *5:00; 7:00*
33. If it is 5:00 Pacific standard time, then it is 6:00 mountain standard time. What time would it be in central standard time? *7:00*
34. If it is 6:00 in eastern standard time, what time is it in the following places?

New York City, NY	*6:00*
Chicago, IL	*5:00*
Denver, CO	*4:00*
Portland, OR	*3:00*

Practice & Application

35. Mrs. Alier placed a pie in the oven at 1:45 PM. The pie needed to bake 50 minutes. What time will the pie be finished? *2:35 PM*
36. Dominic left school at 10:20 AM for a dentist appointment. The drive to the dentist took 10 minutes. The appointment lasted 1 hour 15 minutes. The drive back to school took 15 minutes. What time did Dominic return to school? *12:00 PM*
37. Hudson starts school at 8:00 AM. His first class is reading, which lasts 45 minutes. Next he has a 50-minute math class. Then he has a break. What time is Hudson's break? *9:35 AM*
38. Macy practiced her flute for 20 minutes on Monday. She practiced from 3:30 PM to 4:15 PM on Wednesday. She got in an extra hour of practice on Friday. What was Macy's total practice time? *2 hr 5 min*

Complete DAILY REVIEW 1 on page 455.

The Pattons left on a trip at 1:50 PM and arrived at their destination at 7:30 PM. How long did their trip take them? *5 hours 40 min*

Daniel played basketball from 10:10 AM until 10:42 AM. How long did he play? *32 minutes*

6. Direct attention to the Americana Airlines Flight Schedule at the bottom of the Time Zones page. Elicit the elapsed time for each flight to complete the table.
   Detroit to Atlanta *1 hour 49 minutes*
   Detroit to London *10 hours 30 minutes*
   Detroit to Houston *1 hour 28 minutes*
7. Guide the students in finding the following times. Allow them to use their Clocks to count on or to count back the hours and minutes.
   2 hours 12 minutes after 3:35 AM *5:47 AM*
   40 minutes after 11:50 AM *12:30 PM*
   3 hours 30 minutes before 7:00 PM *3:30 PM*

Add and subtract time

1. Guide the students in solving the following word problems on paper. Follow a procedure similar to the one used in Lesson 132.

Morgan raked leaves for his elderly neighbor. He raked for 2 hours and 35 minutes on Saturday and again on Monday afternoon for 1 hour and 50 minutes. How much time did he spend raking leaves? *2 hr 35 min + 1 hr 50 min = 4 hr 25 min*

Sophie's trip to the museum took 1 hour 50 minutes. The trip home took 2 hours 35 minutes because her family stopped at a restaurant. How much time did they spend at the restaurant? *2 hr 35 min − 1 hr 50 min = 45 min*

2. Write 4 hr 9 min − 1 hr 15 min vertically for display and instruct the students to solve. *2 hr 54 min*

Student Text pp. 320–21

Allow the students to use their Clocks while solving the elapsed time problems on both pages. Also, allow them to refer to the Time Zones of the World page to answer questions 27–34 on page 321.

Lesson 134

Student Text pp. 322–23
Daily Review p. 455j

Objectives
- Estimate customary and metric measurements of objects
- Convert measurements to smaller or larger units
- Compare customary and metric units of measurement
- Add, subtract, multiply, and divide measurements
- Solve measurement word problems
- Determine mileage using a map scale
- Convert temperatures: Celsius to Fahrenheit and Fahrenheit to Celsius
- Identify standard temperatures
- Determine the time in various time zones

Teacher Materials
- Time Zones of the World (from Lesson 133)
- Map Key, page IA79 (CD)
- Labeled objects from Lesson 131
- A transparent ruler

Student Materials
- Rulers: Measuring Tape (yard)
- Thermometer
- Red Strip
- Time Zones of the World (from Lesson 133)
- A ruler

Notes
This lesson reinforces concepts taught previously in this chapter and further develops the skill of using a map scale to determine mileage. Refer to Lesson 118 in Chapter 13 and Lessons 125–133 in this chapter as needed.

For the first activity in this lesson, provide the measuring tools needed to determine the length, capacity, and weight/mass of the objects that you choose to use.

Introduce the Lesson

Write the following problems for display and direct the students to solve them. Elicit from the students that thinking of the standard equivalency in the order that the units appear in the problem will help them determine whether to multiply or divide.

180 sec = __ min ***3***	5 m = __ cm ***500***
5 gal = __ qt ***20***	2 gal 3 qt = __ qt ***11***
1600 g = __ kg ***1.6***	3 lb 7 oz = __ oz ***55***
2 c = __ fl oz ***16***	3 km = __ m ***3000***
48 in. = __ ft ***4***	21 in. = __ ft __ in. ***1; 9***
16 ft = __ yd __ ft ***5; 1***	1 mi 500 ft = __ ft ***5, 780***

Teach for Understanding

Estimate customary and metric measurements of objects

1. Display the labeled objects with the labels turned away from the students. Hold up one of the objects and direct each student to write a customary or metric estimate of the length, capacity, or weight/mass for the item. Allow the students to form groups to compare their estimates and to determine the best estimate. Choose a student to measure the item or refer to its label to find the exact measurement. (e.g., mass [g] of a pudding cup ***estimates will vary, 100 g***; customary capacity [fl oz] of a pudding cup ***estimates will vary, 3.5 fl oz***; metric length [cm] of a standard index card ***estimates will vary, 12.5 cm***)
2. Repeat the procedure using the other displayed objects.
3. Elicit a reasonable estimate for measuring each of the following typical items. Select a student to explain how he determined his estimate. Encourage the students to refer to benchmarks and equivalencies when giving their explanations. ***possible estimates and explanations:***

   5 paper clips ***5 g; 1 paper clip is 1 g.***

   distance from the floor to the ceiling ***9 ft, 3 yd, or 3 m; the door is 6 feet tall, so the ceiling is 9 feet from the floor.***

   tall glass of water ***2 c, 1 pt, or 16 oz; larger amounts are not the typical capacity of a tall glass.***

   loaf of bread ***16 oz or 1 lb; most bread loaves weigh 1 lb.***

   walk around a park ***1 mi or 1 km; mile and kilometer are the best units for measuring distance.***

   large bottle of soft drink ***2 L; most soft drinks are in 2-liter bottles.***

Add, subtract, and multiply measurements

Write these problems for display and direct the students to solve them. Elicit each answer renamed as its larger unit and as its smaller unit.

5 hr 35 min + 3 hr 45 min ***9 hr 20 min*** ***$9\frac{1}{3}$ hr; 560 min***	7 km 500 m − 3 km 450 m ***4 km 50 m*** ***4.05 km; 4050 m***	5 kg − 1 kg 750 g ***3 kg 250 g*** ***3.250 kg or 3250 g***
8 lb 4 oz − 2 lb 12 oz ***5 lb 8 oz*** ***$5\frac{1}{2}$ lb; 88 oz***	2 ft 8 in. × 2 ***5 ft 4 in.*** ***$5\frac{1}{3}$ ft; 64 in.***	3 gal 2 qt × 3 ***10 gal 2 qt*** ***$10\frac{1}{2}$ gal; 42 qt***

Solve measurement word problems

Guide students in solving the following word problems. Review the standard equivalencies as needed and discuss the solutions.

John and his dad walk a quarter of a mile from their home to the golf range each Saturday. How many feet is it from their home to the golf range? $\frac{1}{4} \times$ ***5,280 ft = 1,320 ft***

How many yards have John and his dad walked upon returning home from their $\frac{1}{4}$ mile walk to the golf range? ***880 yd; possible solutions: 2($\frac{1}{4} \times$ 1,760 yd) = 2(440 yd) = 880 yd; 2(1,320 ft ÷ 3 ft) = 2(440 yd) = 880 yd***

If John and his dad left home at 8:30 AM, played a round of golf, and returned home at 12:15 PM, how long were they gone from home? ***Count on the hours and then the minutes from the beginning time to the ending time or subtract 12 hr 15 min − 8 hr 30 min; 3 hr 45 min or 3 $\frac{3}{4}$ hr.***

Dad and John ate lunch at the Biggie Burger Restaurant. They each ordered the Gigantic Burger. The hamburger in each Gigantic Burger weighed $\frac{3}{4}$ of a pound. How many ounces of meat were in each burger? $\frac{3}{4} \times$ ***16 oz = 12 oz***

Last week, Mom and Katie walked 2 kilometers in 30 minutes on Monday, 4900 meters in 1 hour 15 minutes on Wednesday, and 3850 meters in $\frac{3}{4}$ of an hour on Friday. How many meters did they walk? ***2000 m + 4900 m + 3850 m = 10750 m*** How many kilometers did they walk? ***2 km + 4.9 km + 3.85 km = 10.75 km*** How much time did they walk? ***possible solutions: 30 min + 1 hr 15 min + 45 min = 1 hr 90 min or 2$\frac{1}{2}$ hr; 30 min + 75 min + 45 min = 150 min or 2$\frac{1}{2}$ hr***

What is the average time per day that Mom and Katie walked last week? ***150 min ÷ 3 = 50 min***

Rename Units of Measure

Write the equivalent unit of measurement.

1.

Linear
1 cm = 10 mm
1 mi = 1,760 yd
1 m = 100 cm
1 yd = 3 ft

2.

Capacity
1 c = 8 oz
1 L = 1000 mL
1 gal = 4 qt
1 pt = 2 c

3.

Weight/Mass
1 lb = 16 oz
1 kg = 1000 g
1 tn = 2,000 lb
1 g = 0.001 kg

4.

Part of a Unit
$\frac{2}{3}$ of a yard = ___ ft
$\frac{1}{2}$ of a kilometer = ___ m
$\frac{1}{4}$ of a meter = ___ cm
$\frac{1}{3}$ of a foot = ___ in.

Choose the best unit of measurement.

5.	a baseball bat	1 ft	(1 yd)	1 km
6.	the mass of a paper clip	1 lb	1 kg	(1 g)
7.	a large jug of milk	(1 gal)	1 oz	1 L
8.	a twenty-minute walk	1 ft	1 m	(1 km)

4.

Part of a Unit
2 ft
500 m
25 cm
4 in.

Solve.

9. 4 hr 23 min + 2 hr 59 min = 6 hr 82 min = 7 hr 22 min

10. 6 yd 2 ft 8 in. − 1 yd 2 ft 9 in. = 4 yd 2 ft 11 in.

11. 3.7 L × 4 = 14.8 L

12. 3 gal 1 qt 1 pt + 2 gal 2 qt 1 pt = 7 gal 3 qt 2 pt = 8 gal

13. 9 m − 3 m 87 cm = 5 m 13 cm

14. 1.760 yd × 2 = 3.52 yd

15. 3 hr 25 min 40 sec + 2 hr 45 min 35 sec = 5 hr 70 min 75 sec = 6 hr 11 min 15 sec

16. 7 hr 30 min 5 sec − 2 hr 45 min 10 sec = 4 hr 44 min 55 sec

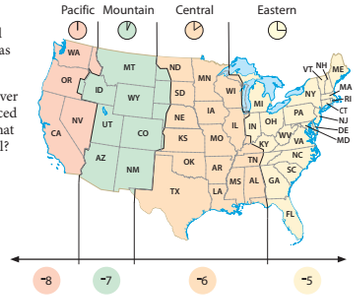
17. 3 ft 8 in. × 5 = 15 ft 40 in. = 18 ft 4 in.

Use a centimeter ruler and the map to find the answer.

18. What is the mileage from Jackson to Addison? 15 mi

19. The Brickmans live in Jackson. Last week they traveled to Addison for piano lessons and then went shopping in Pittsford. They returned home by the shortest route. How many miles did they travel? 40 mi

Use the time zone map to find the answer.



20. At noon Pacific standard time, Sebastian called his sister Tory in South Carolina. What time was it at Tory's house? 3:00 PM

21. Callie lives in Virginia. She made a video call over the Internet to her family in Colorado. She placed the call at 4:00 PM eastern standard time. At what time of day did her family receive the video call? 2:00 PM

Solve.

22. 6 yd = ___ in. 6 • 36 = 216

23. 8 ft = 2 yd 2 ft 8 ÷ 3 = 2 r2

24. 26 in. = 2 ft 2 in

25. 48 in. = ___ yd $1\frac{1}{3}$

26. 6 qt = 1 gal 2 qt 6 ÷ 4 = 1 r2

27. 2 m = ___ cm 2 • 100 = 200

28. $2\frac{1}{2}$ gal = ___ qt $\frac{5}{2} \cdot 4 = 10$

29. 3.51 m = ___ cm 351

30. 3500 mL = ___ L 3.5

31. 4.1 kg = ___ g 4100

32. 68°F = ___ °C 20
C = $\frac{5}{9} \times (F - 32)$

33. 95°C = ___ °F 203
F = $(\frac{9}{5} \times C) + 32$

34. 213 cm ÷ 3 71 cm

35. 8 gal 4 qt ÷ 4 2 gal 1 qt

36. 12 ft 6 in. ÷ 2 6 ft 3 in.

Practice & Application

37. Mrs. Lynch needs a quart of milk. She could only find milk in liter containers. Would she have enough milk if she purchased a liter? yes; 1 qt ≈ 1 L

38. The nurse took Autumn's temperature and found that she had a fever. The thermometer read 39°. What scale was the thermometer? Celsius

39. Dad bought 1 kilogram of hamburger from the store. Would that be enough meat to feed a family of 5? yes; 1 kg ≈ 2.2 lb

40. Travis had a yardstick that was 36 inches. He measured his dad's desk at $1\frac{1}{2}$ yards. Is Travis's measurement of $1\frac{1}{2}$ yards precise? What is more precise? no; 54 inches or 4 feet 6 inches

24. 26 ÷ 12 = 2 r2

25. 48 ÷ 36 = $1\frac{12}{36} = 1\frac{1}{3}$

29. 3.51 × 100 = 351

30. 3500 ÷ 1000 = 3.5

31. 4.1 × 1000 = 4100

32. $C = \frac{5}{9} \times (68° - 32°)$
$C = \frac{5}{9} \times 36°$
$C = \frac{5}{9} \cdot \frac{36°}{1}$
C = 20°

33. $F = (\frac{9}{5} \times 95°) + 32°$
$F = (\frac{9}{5} \cdot \frac{95°}{1}) + 32°$
F = 171° + 32°
F = 203°

Complete DAILY REVIEW on page 455.

Determine mileage using a map scale

1. Display the Map Key page. Elicit that the key on the page shows the scale that is needed to determine the actual distance or mileage between locations shown on the map.
2. Choose a student to measure the distance from Peaceful Valley to Stonefield using a transparent ruler. $2\frac{1}{2}$ inches or 2.5 inches
   - What is the mileage (or the number of miles) from Peaceful Valley to Stonefield? 25 miles
3. Repeat the procedure using other pairs of locations.

Identify standard temperatures; convert temperatures

1. Distribute the Thermometers and Red Strips. Elicit the standard Fahrenheit and Celsius temperatures (freezing point of water 32°F, 0°C, boiling point of water 212°F, 100°C, and normal body temperature 98.6°F and 37°C).
2. Instruct the students to show the following temperatures on their Thermometers. Choose students to read the approximate Celsius temperature for each Fahrenheit temperature and the approximate Fahrenheit temperature for each Celsius temperature.
   38°F 3°C −16°C 6°F 75°F 24°C −5°C 24°F
3. Write the formulas $F = (\frac{9}{5} \times C) + 32°$ and $C = \frac{5}{9} \times (F - 32°)$ for display. Remind the students that the ratio of Fahrenheit temperatures to Celsius temperatures is 9:5. Elicit that 32° is added or subtracted because 32° is the difference in the freezing points on the Fahrenheit and Celsius scales.
4. Guide the students in using the formulas to convert the Celsius temperatures to equivalent Fahrenheit temperatures and the Fahrenheit temperatures to equivalent Celsius temperatures.
   50°C $F = (\frac{9}{5} \times 50°) + 32°$; F = 122°
   15°C $F = (\frac{9}{5} \times 15°) + 32°$; F = 59°
   104°F $C = \frac{5}{9} \times (104° - 32°)$; C = 40°
   68°F $C = \frac{5}{9} \times (68° - 32°)$; C = 20°

Determine the time in various time zones

Display and distribute the Time Zones of the World page. Review the relationship of the number line at the bottom of the map to the time zones. Guide the students in determining the following times.

When it is 5:00 AM in New York, what time is it in California? 2:00 AM

When it is 8:00 PM in Denver, what time is it in Rio de Janeiro? 12:00 AM (midnight)

When it is 2:00 PM in Halifax, what time is it in London, England? 6:00 PM

Student text pp. 322–23

Lesson 135

Student Text pp. 324–25
Daily Review p. 456k

Objectives
- Write an equivalency as a unit multiplier
- Determine the missing term in a unit multiplier
- Convert measurements using a unit multiplier

Student Materials
- A toy that changes shape (at least one toy for each group of students)

Introduce the Lesson

1. Arrange the students in groups and distribute the toys. Allow the students in each group to discuss how their toys work. Elicit that the shape of each toy can be changed from its original form into another form that looks different without changing its makeup (adding or subtracting any parts that make up the toy).
2. Explain that in math, measurements can be *transformed* (renamed or changed) from one unit of measure to another without changing their value. (e.g., A 1.5-foot length of ribbon is the same length as an 18-inch length of ribbon.)

Teach for Understanding

Write an equivalency as a unit multiplier

1. Write $\frac{3}{3}$, $\frac{5}{5}$, $\frac{24}{24}$, and $\frac{1000}{1000}$ for display.
➤ **What do these ratios or fractions have in common?** ***Elicit that each has a value of 1.***
➤ **What does the Identity Property of Multiplication state?** ***When a number is multiplied by 1, the product is always the other factor.***
2. Elicit that a fraction can be renamed as an equivalent fraction in higher terms by multiplying the fraction by a fraction form of 1 (e.g., $\frac{2}{3} \times \frac{4}{4} = \frac{8}{12}$). The terms of a fraction change when multiplied by 1 ($\frac{2}{3} = \frac{8}{12}$), but its value does not change.
➤ **What is $\frac{8}{12}$ renamed to lowest terms?** $\frac{2}{3}$

> Mrs. Roberts distributed to her students lengths of string for them to measure. Some students said their strings measured 1 foot. Other students said their strings measured 12 inches. What do you know about the lengths of string?
> ***Elicit that the lengths of string were all the same length because the measurements are equivalent; 1 ft = 12 in., and 12 in. = 1 ft.***

3. Choose students to write the equivalencies for display.
1 ft = 12 in.; 12 in. = 1 ft
➤ **How can you write these equivalencies as ratios in fraction form?** ***Elicit*** $\frac{1 \text{ ft}}{12 \text{ in.}}$ ***and*** $\frac{12 \text{ in.}}{1 \text{ ft}}$
Write $\frac{1\ ft}{12\ in.}$ and $\frac{12\ in.}{1\ ft}$ for display. Remind the students that a ratio is a comparison of two quantities or amounts.
➤ **What do you notice about these equivalencies when written in fraction form?** ***Elicit that they have a value of 1.***
4. Point out that without the unit labels written in the ratios ($\frac{1}{12}$ and $\frac{12}{1}$), the terms would not appear to be equal. Explain that when the unit labels in the terms of a ratio have a one-to-one correspondence (e.g., 1 in. = 1 in.), it is not necessary to write the unit labels; 12 in.: 12 in. can be written $\frac{12}{12}$. However, unit labels are necessary when the units in the terms of a ratio are different and do not have a one-to-one correspondence (e.g., 1 in.: 12 ft and 12 ft: 1 in.). Equivalencies written in fraction form are called *unit multipliers*. A *unit multiplier* is a fraction in which two different units that are equal to 1.
5. Guide the students in writing two unit multipliers for each of the following equivalencies.
1 yd = 3 ft $\frac{1 \text{ yd}}{3 \text{ ft}}$; $\frac{3 \text{ ft}}{1 \text{ yd}}$
1 mi = 5,280 ft $\frac{1 \text{ mi}}{5{,}280 \text{ ft}}$; $\frac{5{,}280 \text{ ft}}{1 \text{ mi}}$
1 m = 100 cm $\frac{1 \text{ m}}{100 \text{ cm}}$; $\frac{100 \text{ cm}}{1 \text{ m}}$
1 lb = 16 oz $\frac{1 \text{ lb}}{16 \text{ oz}}$; $\frac{16 \text{ oz}}{1 \text{ lb}}$
1 hr = 60 min $\frac{1 \text{ hr}}{60 \text{ min}}$; $\frac{60 \text{ min}}{1 \text{ hr}}$
➤ **What is the value of each unit multiplier that was written? How do you know?** ***1; the terms in a unit multiplier are equivalent.***
6. Write the following problems for display. Guide the students in identifying the number of units needed to complete the unit multiplier.

$\frac{\_\_ \text{ kg}}{1000 \text{ g}}$ ***1*** $\quad \frac{2000 \text{ lb}}{\_\_ \text{ tn}}$ ***1*** $\quad \frac{1 \text{ min}}{\_\_ \text{ sec}}$ ***60***

$\frac{1 \text{ mi}}{\_\_ \text{ yd}}$ ***1,760*** $\quad \frac{2 \text{ c}}{\_\_ \text{ pt}}$ ***1*** $\quad \frac{1 \text{ gal}}{\_\_ \text{ qt}}$ ***4***

Convert measurements using a unit multiplier

1. Write *108 in. = __ yd* for display. Explain that a unit multiplier is a *transformer*; it is used to *transform* or convert one unit of measurement to another unit.
➤ **What measurement do you need to convert?** ***108 in.***
➤ **What unit do you need to convert 108 inches to?** ***yards***
➤ **What equivalency do you know for inches to yards?** ***36 in. = 1 yd***
➤ **What unit multipliers can you write?** $\frac{36 \text{ in.}}{1 \text{ yd}}$; $\frac{1 \text{ yd}}{36 \text{ in.}}$ Write $\frac{36\ in.}{1\ yd}$ and $\frac{1\ yd}{36\ in.}$ for display.
2. Write $\frac{108\ in.}{1} \times \frac{1\ yd}{36\ in.}$ for display. Remind the students that a number can be written as a fraction with 1 in the denominator without changing its value.
Explain that since unit multipliers are used to transform or change the units of a number, you must choose the unit multiplier with the same unit label in the denominator (in.) so that the two labels (in.) cancel out one another, leaving the desired label (yd) in the answer.
3. Demonstrate the multiplication, showing the cancellation. Point out that the two labels (in.) cancel out one another so that the label in the product is *yd*.

$$\frac{\overset{3}{\cancel{108\ in.}}}{1} \times \frac{1\ yd}{\underset{1}{\cancel{36\ in.}}} = \frac{3\ yd}{1} = 3\ yd$$

4. Write *12.5 gal = __ qt* for display.
➤ **What equivalency can you think of to solve this problem?** ***1 gal = 4 qt or 4 qt = 1 gal***
➤ **What unit multiplier is needed? Why?** $\frac{4 \text{ qt}}{1 \text{ gal}}$***; elicit that since the unit*** **gallons** ***needs to be transformed to*** **quarts, gallons** ***needs to be in the denominator of the unit multiplier.***
➤ **What equation can you write to convert 12.5 gallons to an equivalent number of quarts?** $\frac{12.5 \text{ gal}}{1} \times \frac{4 \text{ qt}}{1 \text{ gal}} = \_\_ \text{ qt}$
5. Direct the students to solve the problem. Then choose a student to write the equation for display and to demonstrate solving it. $\frac{12.5\ \cancel{gal}}{1} \times \frac{4\ qt}{1\ \cancel{gal}} = \frac{50\ qt}{1} =$ ***50 qt***

Unit Multipliers

Transformer means "one that transforms." In math we transform units of measure when we "convert" from one unit to another to find the equivalent value. We can convert inches to feet or grams to kilograms without changing the original value.

transformer
unit multiplier

12 inches = 1 foot and 1 foot = 12 inches
The value is the same; the units are different.

Equivalencies written in fraction form are called unit multipliers. A **unit multiplier** is a fraction with two different units that equal 1.

1 ft = 12 in.; $\frac{1\text{ ft}}{12\text{ in.}}$ or $\frac{12\text{ in.}}{1\text{ ft}}$

Twelve inches and 1 foot are equivalent.

Exercises

Complete the unit multiplier.
Write the equal unit multiplier.

1. $\frac{8\text{ oz}}{1\text{ c}}$ or $\frac{1\text{ c}}{8\text{ oz}}$
2. $\frac{1000\text{ mL}}{1\text{ L}}$ or $\frac{1\text{ L}}{1000\text{ mL}}$
3. $\frac{36\text{ in.}}{1\text{ yd}}$ or $\frac{1\text{ yd}}{36\text{ in.}}$
4. $\frac{1\text{ mi}}{1{,}760\text{ yd}}$ or $\frac{1{,}760\text{ yd}}{1\text{ mi}}$
5. $\frac{2\text{ c}}{1\text{ pt}}$ or $\frac{1\text{ pt}}{2\text{ c}}$
6. $\frac{60\text{ sec}}{1\text{ min}}$ or $\frac{1\text{ min}}{60\text{ sec}}$

Use the pattern above to write the unit multiplier 2 ways in fraction form.

7. 1 yd = 3 ft
8. 1 kg = 1000 g
9. 1 mi = 5,280 ft
10. 1 lb = 16 oz
11. 1 yd = 36 in.
12. 1 hr = 60 min
13. 1 gal = 4 qt
14. 1 m = 100 cm
15. 1 g = 1000 mg
16. 1 tn = 2,000 lb

7. $\frac{1\text{ yd}}{3\text{ ft}}; \frac{3\text{ ft}}{1\text{ yd}}$
8. $\frac{1\text{ kg}}{1000\text{ g}}; \frac{1000\text{ g}}{1\text{ kg}}$
9. $\frac{1\text{ mi}}{5{,}280\text{ ft}}; \frac{5{,}280\text{ ft}}{1\text{ mi}}$
10. $\frac{1\text{ lb}}{16\text{ oz}}; \frac{16\text{ oz}}{1\text{ lb}}$
11. $\frac{1\text{ yd}}{36\text{ in.}}; \frac{36\text{ in.}}{1\text{ yd}}$
12. $\frac{1\text{ hr}}{60\text{ min}}; \frac{60\text{ min}}{1\text{ hr}}$
13. $\frac{1\text{ gal}}{4\text{ qt}}; \frac{4\text{ qt}}{1\text{ gal}}$
14. $\frac{1\text{ m}}{100\text{ cm}}; \frac{100\text{ cm}}{1\text{ m}}$
15. $\frac{1\text{ g}}{1000\text{ mg}}; \frac{1000\text{ mg}}{1\text{ g}}$
16. $\frac{1\text{ tn}}{2{,}000\text{ lb}}; \frac{2{,}000\text{ lb}}{1\text{ tn}}$

Measurements can be transformed to different units. Some animals, such as a frog, also transform or change as they develop through the process of metamorphosis.

The unit multiplier is used to *transform* one unit to another unit.

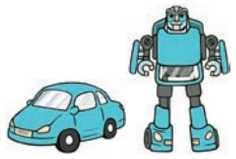
Transform 4.5 feet into inches.

4.5 ft = ___ in.

1. Write 4.5 feet as a fraction. $\frac{4.5\text{ ft}}{1}$
2. Find a unit multiplier. (1 ft = 12 in.) $\frac{1\text{ ft}}{12\text{ in.}}$ or $\frac{12\text{ in.}}{1\text{ ft}}$
3. Choose the unit multiplier form that has the unit being transformed in the denominator. $\frac{12\text{ in.}}{1\text{ ft}}$
4. Write a multiplication equation. Solve. Use cancellation if possible. $\frac{4.5\text{ ft}}{1} \times \frac{12\text{ in.}}{1\text{ ft}} = \frac{54.0\text{ in.}}{1}$

4.5 ft = 54 in.

The car is transformed into a robot.



In this problem only the labels cancel.

Exercises

Write the unit multiplier 2 ways in fraction form.
Choose the unit multiplier needed.
Convert the unit.

17. 7 yd = ___ in. 252
18. 64 oz = ___ lb 4
19. 8 gal = ___ qt 32
20. 3 hr = ___ min 180
21. 3 kg = ___ g 3000
22. 2500 mL = ___ L 2.5
23. 450 cm = ___ m 4.5
24. 3 c = ___ oz 24

Use a unit multiplier to change the unit.

25. 5 tn = ___ lb 10,000
26. 13 gal = ___ qt 52
27. 20 c = ___ pt 10
28. 8 mi = ___ yd 14,080
29. 108 in. = ___ ft 9
30. 120 oz = ___ c 15
31. 4 yd = ___ in. 144
32. 128 oz = ___ lb 8

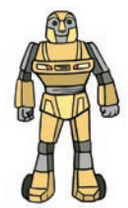
33. Use cancellation to convert.

2 mi = ___ in.

$\frac{2\text{ mi}}{1} \times \frac{5{,}280\text{ ft}}{1\text{ mi}} \times \frac{12\text{ in.}}{1\text{ ft}} = 126{,}720$ in.

12 gal = ___ c

$\frac{12\text{ gal}}{1} \times \frac{4\text{ qt}}{1\text{ gal}} \times \frac{2\text{ pt}}{1\text{ qt}} \times \frac{2\text{ c}}{1\text{ pt}} = \frac{192\text{ c}}{1} = 192$ c



Complete DAILY REVIEW 6 on page 456.

6. Follow a similar procedure for these problems.
   540 mL = ___ L $\frac{540\text{ mL}}{1} \times \frac{1\text{ L}}{1000\text{ mL}} = 0.54\text{ L}$
   32 yd = ___ ft $\frac{32\text{ yd}}{1} \times \frac{3\text{ ft}}{1\text{ yd}} = 96\text{ ft}$
   68 oz = ___ lb $\frac{68\text{ oz}}{1} \times \frac{1\text{ lb}}{16\text{ oz}} = 4.25\text{ lb}$
7. Write *4 hr = ___ sec* for display. Arrange the students in groups and instruct the students in each group to work together to solve the problem. Allow students from each group to share how they arrived at their answer. $\frac{4\text{ hr}}{1} \times \frac{60\text{ min}}{1\text{ hr}} = \frac{240\text{ min}}{1} = 240\text{ min}$; $\frac{240\text{ min}}{1} \times \frac{60\text{ sec}}{1\text{ min}} = \frac{14{,}400\text{ sec}}{1} = 14{,}400\text{ sec}$
   (***Note:*** Most students will solve this problem using the multi-step solution provided above. You may choose to show that the problem can also be solved using one equation with two unit multipliers: $\frac{4\text{ hr}}{1} \times \frac{60\text{ min}}{1\text{ hr}} \times \frac{60\text{ sec}}{1\text{ min}} = 14{,}400$ sec.)

Student Text pp. 324–25

Lesson 136 **Student Text** pp. 326–27

Chapter Review

Objectives

- Demonstrate an understanding of customary and metric units of measurement
- Determine the appropriate unit of measurement
- Convert units of measurement
- Set a Fahrenheit and a Celsius thermometer
- Identify standard Fahrenheit and Celsius temperatures
- Add, subtract, multiply, and divide measurements
- Solve measurement word problems
- Tell time to the minute
- Determine the elapsed time

Teacher Materials

- Chart 10: *Customary Measurement*
- Chart 12: *Metric Measurement: Length and Distance*
- Chart 13: *Metric Measurement: Capacity*
- Chart 14: *Metric Measurement: Mass*
- Rulers: Measuring Tapes (yard and meter)
- A ruler
- A spring scale
- A balance or metric scale
- Water (to measure capacity)
- Judy Clock (Or Clock from the Teacher Manipulatives Packet)

Student Materials

- Thermometer
- Red Strip

Notes

This lesson reviews the concepts presented in Chapter 14 to prepare the students for the Chapter 14 Test. Student Text pages 326–27 provide the students with an excellent study guide.

For this lesson, you will need the objects that were used in Lessons 126 and 128. You will also need objects that students can measure using a ruler and/or a Measuring Tape (yard and meter) (e.g., a 3 × 5 card, a book, a desk, a shelf, a door).

Teach for Understanding

Demonstrate an understanding of customary and metric units of measurement

1. Display the *Customary Measurement* chart and the *Metric Measurement* charts. Review the units of measurement, the standard equivalents, and the abbreviations throughout the following activity.
2. Display all of the objects. Choose a student to select an object and to tell whether he would measure the object's length, weight/mass, or capacity. Ask students to estimate the object's customary measurement and its metric measurement. Discuss which estimate the students think is the best estimate. (e.g., a bag of potatoes—***weight or mass, 4 kg or 4 lb***; length of a highlighter—***length, 12 cm or 5 in.***; two points on a map—***distance, 100 mi or 100 km***; water in a cooler—***capacity, 2–6 L or 2–5 gal***)

   Instruct one student to measure the object to find its customary measurement and another student to measure the object to find its metric measurement. Continue the activity until all of the units that are measurable within the classroom have been discussed.
3. Refer to the predetermined location used in Lesson 125 as you guide a review of the equivalencies for 1 mile.

➤ **What unit of metric measurement is used to measure distance?** ***kilometer***

➤ **How many meters are equivalent to 1 kilometer?** ***1000 meters***

Convert units of measurement

➤ **How do you know whether to multiply or divide when converting from larger units to smaller units?** ***Elicit that when you rename larger units as smaller units, it takes more smaller units to measure the same amount as 1 larger unit, so you multiply.***

➤ **How do you know whether to multiply or divide when converting from smaller units to larger units?** ***Elicit that when you rename smaller units to larger units, it takes less larger units to measure the same amount as smaller units, so you divide.***

➤ **How do you know what to multiply or divide by?** ***Elicit that you can think of the relationship in the standard equivalency for the units that are being converted, and then multiply or divide accordingly.***

1. Write the following problems for display. Elicit strategies for converting the units. Elicit that writing the standard equivalency in the same order that the units appear in the problem helps the students to see whether multiplication or division is needed to find the equivalent. Remind the students that the meaning of the metric prefix can help them determine metric equivalencies (e.g., 263 cm = __ m; 263 hundredths of a meter $[\frac{263}{100}]$ = 2.63 m).
2. Direct the students to find the equivalents.

5 gal = ***20*** qt	263 cm = ***2.63*** m	180 sec = ***3*** min
5 kg = ***5000*** g	4265 m = ***4.265*** km	2 c = ***16*** fl oz
3 yd = ***9*** ft	4138 g = ***4.138*** kg	2 L = ***2000*** mL
84 in. = ***7*** ft	240 oz = ***15*** lb	4 mi = ***7,040*** yd

Set a Fahrenheit and Celsius thermometer
Identify standard temperatures

1. Distribute the Thermometers and Red Strips. Direct each student to show $^{-}$2°C on his Thermometer.
2. Direct each student to show 37°C on his Thermometer.

➤ **What is the corresponding Fahrenheit temperature?** ***98.6 °F***

➤ **What do you know about 98.6°F?** ***It is the normal body temperature.***

3. Direct each student to show 0°C on his Thermometer.

➤ **What is the corresponding Fahrenheit temperature?** ***32°F***

➤ **What happens to water at this temperature?** ***Water freezes.***

➤ **At what Celsius and Fahrenheit temperatures does water boil?** ***100°C and 212 °F***

Add, subtract, and multiply measurements

1. Write *3 m 32 cm + 14 m 89 cm* vertically for display and instruct the students to solve it. Choose a student to demonstrate solving the problem. ***17 m 121 cm = 18 m 21 cm***
2. Repeat the procedure for the following problems.

66 kg 245 g	14 ft 8 in.
− 10 kg 763 g	× 5
55 kg 482 g	***70 ft 40 in.***
	73 ft 4 in.

CHAPTER 14 REVIEW

Write the equivalent unit of measurement.

1. 1 yd = 3 ft; 1 mi = 1,760 yd; 1 m = 100 cm
2. 1 gal = 4 qt; 1 c = 8 fl oz; 1 L = 1000 mL
3. 1 lb = 16 oz; 1 tn = 2,000 lb; 1 kg = 1000 g
4. 1 hr = 60 min; 1 d = 24 hr; 1 min = 60 sec
5. $\frac{1}{2}$ of a mile = ___ ft; $\frac{1}{5}$ of a kilometer = ___ m; $\frac{1}{4}$ of a meter = ___ cm
6. $\frac{1}{6}$ of an hour = ___ min; $\frac{1}{3}$ of a yard = ___ ft; $\frac{1}{8}$ of a pound = ___ oz

Choose the best unit of measurement.

7.	length of a pencil	liter	meter	**centimeter**	kilometer
8.	amount of liquid in a glass	meter	**milliliter**	gram	liter
9.	mass of a bunch of bananas	liter	centimeter	meter	**kilogram**
10.	distance to town	inches	gallons	**miles**	feet
11.	weight of a baby	ounces	feet	cups	**pounds**
12.	amount of sports drink for a team	cups	**gallons**	yards	tons

Rename to the given unit of measurement.

13. 120 min = 2 hr *120 ÷ 60 = 2*
14. 2 mi = 10,560 ft
15. 15 qt = 3 gal 3 qt
16. 3,000 lb = 1 tn 1,000 lb
17. 250 cm = 2.5 m
18. $2\frac{1}{2}$ hr = 150 min
19. $1\frac{1}{2}$ yd = 4 ft 6 in.
20. 10 gal = 40 qt *10 • 4 = 40*
21. $1\frac{1}{4}$ lb = 20 oz *$\frac{5}{4}$ • 16 = 20*
22. 3.5 kg = 3500 g
23. 1 hr 45 min = 105 min
24. 30 in. = 2 ft 6 in.
25. 32 oz = 2 lb *32 ÷ 16 = 2*
26. 10 pt = 1 gal 1 qt
27. 4000 mL = 4 L

5. *2,640 ft; 200 m; 25 cm*
6. *10 min; 1 ft; 2 oz*
14. *2 × 5,280 ft = 10,560 ft*
15. *15 qt ÷ 4 = 3 gal r3 qt*
16. *3,000 lb ÷ 2,000 = 1 tn r1,000 lb*
17. *250 cm ÷ 100 = 2.5 m*
18. *$\frac{5}{2}$ hr • 60 = 150 min*
19. *$\frac{3}{2}$ yd • 3 = $\frac{9}{2}$ ft = 4 $\frac{1}{2}$ ft*
22. *3.5 kg • 1000 = 3500 g*
23. *60 min + 45 min = 105 min*
24. *30 in. ÷ 12 = 2 ft r6 in.*
26. *10 pt ÷ 2 = 5 qt; 5 qt ÷ 4 = 1 gal r1 qt*
27. *4000 mL ÷ 1000 = 4 L*

Choose the more reasonable temperature.

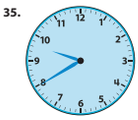
28. a child with a fever: **100°F** | 100°C
29. a cup of boiling soup: 95°F | **100°C**
30. a glass of ice water: 50°F | **0°C**
31. a comfortable room: **70°F** | 40°C

Write the time.
Write the elapsed time.

32. 
Write the time 2 hours later. *4:15; 6:15*

33. 
Write the time 45 minutes later. *6:25; 7:10*

34. 
Write the time $3\frac{1}{2}$ hours later. *11:50; 3:20*

35. 
Write the time 1 hour 20 minutes later. *9:40; 11:00*

Solve.

36. 10 hr 25 min 20 sec + 4 hr 35 min 52 sec = *14 hr 60 min 72 sec = 15 hr 1 min 12 sec*
37. 12 ft 10 in. + 3 ft 8 in. = *15 ft 18 in. = 16 ft 6 in.*
38. 8 m 20 cm + 3 m 45 cm = *11 m 65 cm*
39. 8 hr − 3 hr 25 min = *4 hr 35 min*
40. 15 gal 2 qt − 4 gal 3 qt = *10 gal 3 qt*
41. 9 lb 7 oz + 3 lb 10 oz = *12 lb 17 oz = 13 lb 1 oz*
42. 23.5 L × 4 = *94.0 L*
43. 3457 kg − 2149 kg = *1308 kg*
44. 4 lb − 2 lb 10 oz = *1 lb 6 oz*

Rename to the given unit of measurement.

45. 54 in. = ___ ft *4 $\frac{1}{2}$*; *54 ÷ 12 = 4 $\frac{1}{2}$*
46. $1\frac{1}{2}$ gal = ___ qt *6*; *$\frac{3}{2}$ • 4 = 6*
47. 3.5 m = ___ cm *350*; *3.5 • 100 = 350*

Solve measurement word problems

Carson played soccer for $\frac{1}{2}$ of an hour, ran for 45 minutes, and practiced with his team for an hour. How many hours was Carson involved in sports activities? *2 hr 15 min or 2 $\frac{1}{4}$ hr*

➤ **How can you solve this problem?** *Elicit that you add the different times to find the total number of hours.*

1. Read the word problem again and instruct the students to solve it.
2. Choose students to write their problem for display and to explain their problem-solving strategy. *possible solutions: 30 min + 45 min + 60 min = 135 min = 2 hr 15 min; $\frac{1}{2}$ hr + $\frac{3}{4}$ hr + 1 hr = 2 $\frac{1}{4}$ hr or 2 hr 15 min*
3. Follow a similar procedure for this word problem.

Travis needs 3 pieces of wire for a science project. Each piece of wire must be 2 meters long. He has a roll of wire that contains 1000 cm. Does the roll contain enough wire for his science project? Will Travis have wire left over? *3 × 2 m = 6 m, 6 m = 600 cm; 1000 cm − 600 cm = 400 cm; the roll contains more than enough wire; there will be 400 cm of wire left over.*

Tell time to the minute

1. Set the demonstration clock for the following times and choose students to tell the times: 1:34, 5:17, and 12:39.
2. Set the clock for 12:00.

➤ **When the clock shows 12:00 and it is lunch time, is it 12 noon or 12 midnight?** *12 noon* **Is 12 noon 12 AM or 12 PM? Why?** *12 PM; elicit that the minutes following 12 noon begin the afternoon hours.*

➤ **When the clock shows 12:00 at night, is it 12 noon or 12 midnight?** *12 midnight* **Is 12 midnight 12 AM or 12 PM? Why?** *12 AM; elicit that the minutes following 12 midnight begin the morning hours.*

➤ **What abbreviation refers to the hours from 12 midnight to 12 noon?** *AM* **from 12 noon to 12 midnight?** *PM*

Determine the elapsed time

Distribute the Clocks. Instruct each student to use his Clock to determine the elapsed time for the following problems.

Jodi went to the park from 11:20 AM to 1:37 PM. How much time did she spend at the park? *2 hr 17 min*

Mr. Jones took his suit to the dry cleaners at 9:10 AM. The clerk said that his suit would be ready to pick up in 6 hours. What time can Mr. Jones pick up his suit? *3:10 PM*

Student Text pp. 326–27

(***Note:*** You may choose to allow the students to use their Clocks to find the elapsed time for problems 32–35.)

Lesson 137

Student Text pp. 328–31

Chapter 14 Test

Cumulative Review

For a list of the skills reviewed in the Cumulative Review, see the Lesson Objectives for Lesson 137 in the Chapter 14 Overview on page 303 of this Teacher's Edition.

Student Materials

- Clock (optional)
- Cumulative Review Answer Sheet, page IA9 (CD)

Note

You may choose to allow the students to use their Clocks to solve the elapsed time problems on the Chapter 14 Test.

Use the Cumulative Review on Student Text pages 328–30 to review previously taught concepts and to determine which students would benefit from your reteaching of the concepts. To prepare the students for the format of achievement tests, instruct them to work on a separate sheet of paper, if necessary, and to mark the answers on the Cumulative Review Answer Sheet.

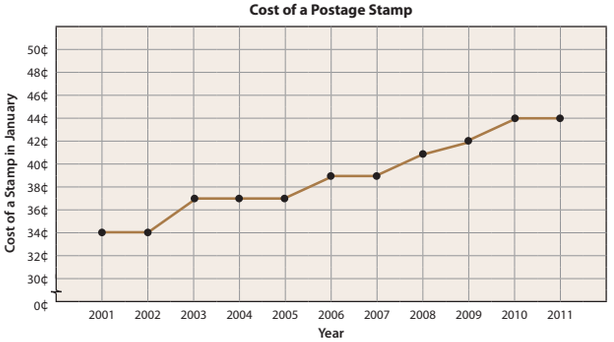
Read aloud the Career Link on Student Text page 331 (page 329 of this Teacher's Edition) and discuss the value of math as it relates to a pharmacist.

CUMULATIVE REVIEW

Test Prep

Use the data from the line graph to find the answer.

The line graph shows the cost of a first-class postage stamp in January of the given year.



1. What is the difference in the cost of the 2001 and the 2011 stamps?
A. 10 cents
B. 15 cents
C. 20 cents
D. 25 cents

2. How many times is a price increase shown between 2001 and 2011?
A. 0 times
B. 2 times
C. 5 times
D. 10 times

3. How many times is a price decrease shown between 2001 and 2011?
A. 0 times
B. 2 times
C. 5 times
D. 10 times

4. Between which two years was the greatest increase in the cost of a stamp?
A. 2002 to 2003
B. 2005 to 2006
C. 2008 to 2009
D. 2010 to 2011

5. In which three years was the price of stamps the same?
A. 2001, 2002, 2003
B. 2003, 2004, 2005
C. 2006, 2007, 2008
D. 2009, 2010, 2011

6. What does this graph indicate about the cost of a postage stamp?
A. The cost stayed the same.
B. The cost steadily decreased.
C. The cost steadily increased.
D. There is not enough data represented.

Mark the answer.

7. Round 13.43 to the nearest whole number.
A. 10
B. 13
C. 14
D. 15

8. Estimate the quotient for 3,625 ÷ 43.
A. 80
B. 85
C. 90
D. 900

9. Use front-end estimation to find the sum.
283,498 + 690,785
A. 500,000
B. 600,000
C. 873,000
D. 970,000

10. Round 987,642 to the nearest one thousand.
A. 987,600
B. 988,000
C. 990,000
D. 1,000,000

11. If $\frac{1}{4}$ of 60 is 15, what is $\frac{3}{4}$ of 60?
A. 20
B. 30
C. 45
D. 90

12. What is the price of 10 pounds of grapes if they cost $1.79 a pound?
A. $17.90
B. $28.40
C. $34.00
D. $179

13. $3n + 8$ if $n = 1.6$
A. 5.6
B. 12.8
C. 32.4
D. 40

14. $9.83 \div n$ if $n = 10$
A. 0.983
B. 98.3
C. 983
D. 9,830

15. $n - 56 = 49$
A. 7
B. 13
C. 99
D. 105

16. $3y = 108$
A. 25
B. 30
C. 36
D. 105

17. $y + y + y + y$
A. $y + 4$
B. $4y$
C. $4 - y$
D. $y \div 4$

18. $4.99 + m = 5$
A. 0.1
B. 0.01
C. 0.001
D. 1

Mark the answer.

19. What factors are common to 18 and 24?
A. 3, 6, 9
B. 2, 3, 6
C. 3, 4, 6
D. 2, 4, 6

20. What is the least common multiple of 6 and 4?
A. 6
B. 12
C. 18
D. 24

21.

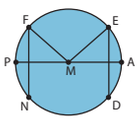
n		
3.8	6.7	0.4

A. $n = 1.8$
B. $n = 7.2$
C. $n = 9.9$
D. $n = 10.9$

22. Use the factor tree to choose the prime factorization.

A. $2 \cdot 3 \cdot 7$
B. $4 \cdot 7$
C. $2^2 \cdot 3 \cdot 7$
D. $2 \cdot 3^2 \cdot 7$

23. Mark the true statement about circle M.

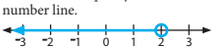


A. The diameter is $\overline{PA}$.
B. $\overline{MA} = \overline{MF}$
C. $\overline{FN}$ and $\overline{ED}$ are chords.
D. all of the above

24. Name the figure.

A. rectangular pyramid
B. square prism
C. rectangular prism
D. none of the above

25. Choose the inequality statement for the number line.



A. $x > 2$
B. $x < 2$
C. $x = 2$
D. $x > 3$

CAREER LINK

Pharmacist

What occupation uses math skills such as basic counting, converting metric and standard measurements, multiplication, working with money, equations and calculations, and can affect you directly as a sixth grader?

A pharmacist uses math throughout each workday by carefully preparing medication for her patients. She must fill prescriptions exactly as written by a physician. Tablets must be counted accurately, and liquid medication must be mixed precisely. A patient will receive the full benefit of medication that is correctly prepared.

How do you know the correct amount of medication to take? An adult checks the information on a medicine label to determine the correct dose for your age and weight. Since dosage is often determined by body weight, you do not take the same amount of medication as an infant brother or a teenage sister. A pharmacist is aware of the dosages for medications and converts those dosages based on the body weight of the patient.

A pharmacist must read to keep up to date on medications and their side effects in order to give good counsel to her patients. She must also know the cost of medication. Sometimes it is cheaper for her patient to buy a ninety-day supply than to buy the medication each month.

During His earthly ministry, Jesus helped people and He spent a lot of time caring for the sick. As He cared for them, He showed them God's love and told them about God's salvation. A Christian pharmacist has daily opportunities to help people with medicine that can help to heal their earthly sicknesses and at the same time she can tell them of God's gift of eternal life.