Main Idea
Change units of length and measure length in the customary system.

Mini Lab

**Step 1** Find three objects in your classroom that are best measured in inches.

**Step 2** Estimate the length of each object to the nearest inch.

**Step 3** Measure each object and record your measurements in a table like the one shown at the right.

**Step 4** Repeat Steps 1–3 with different objects using feet and then yards.

1. Compare the objects measured in inches with those measured in feet and yards. How are they different?
2. Would you measure the distance from one city to another in yards? Explain.

The most commonly used customary units of length are shown below.

<table>
<thead>
<tr>
<th>Customary Units of Length</th>
<th>Key Concept</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit</strong></td>
<td><strong>Model</strong></td>
</tr>
<tr>
<td>1 inch (in.)</td>
<td>width of a quarter</td>
</tr>
<tr>
<td>1 foot (ft) = 12 in.</td>
<td>length of a large adult foot</td>
</tr>
<tr>
<td>1 yard (yd) = 3 ft</td>
<td>length from nose to fingertip</td>
</tr>
<tr>
<td>1 mile (mi) = 1,760 yd</td>
<td>10 city blocks</td>
</tr>
</tbody>
</table>

You can use a customary ruler to measure length in inches or parts of an inch.

The smallest mark on this ruler represents \( \frac{1}{8} \) inch. The next larger mark represents \( \frac{1}{4} \) inch, and the next larger mark represents \( \frac{1}{2} \) inch. The longest mark on a ruler represents an inch.
Draw a Line Segment

Draw a line segment measuring $\frac{7}{8}$ inches.

Draw a line segment from 0 to $\frac{7}{8}$.

CHECK Your Progress

a. Draw a line segment measuring $1\frac{3}{4}$ inches.

Real-World EXAMPLE Measure Length

ELECTRONICS Measure the MP3 player’s length to the nearest eighth inch.

The MP3 player is between $1\frac{3}{4}$ inches and $1\frac{5}{8}$ inches. It is closer to $1\frac{3}{4}$ inches.

CHECK Your Progress

b. BOOKS Measure the width of the cover of this textbook to the nearest eighth inch.

Change Larger Units to Smaller Units

$3 \text{ ft} = \boxed{36} \text{ in.}$

METHOD 1 Use a ratio table.

You know that 1 foot is equal to 12 inches. Set up the ratio table with the measures you know.

\[
\begin{array}{c|c|c}
\hline
\text{Feet} & 1 & 3 \\
\hline
\text{Inches} & 12 & 36 \\
\hline
\end{array}
\]

Since $1 \times 3 = 3$, multiply each quantity by 3.

So, 3 feet = 36 inches.

Lesson 8-1 Length in the Customary System 419
Measurement When changing from larger units to smaller units, there will be a greater number of smaller units than larger units. So, multiply. When changing from smaller units to larger units, there will be fewer larger units than smaller units. So, divide.

**Method 2** Select an appropriate operation.

Since 1 foot = 12 inches, multiply 3 by 12.
3 \times 12 = 36
So, 3 feet = 36 inches.

**Choose Your Method**

c. 5 ft = \_ \_ \_ in.

d. 3 yd = \_ \_ \_ ft

e. 2 mi = \_ \_ \_ yd

**Example**

Change Smaller Units to Larger Units

20 ft = \_ \_ \_ yd

Since 3 feet = 1 yard, divide 20 by 3.
20 \div 3 = 6 \frac{2}{3}
So, 20 feet = 6 \frac{2}{3} yards.

**Check Your Progress**

t. 36 ft = \_ \_ \_ yd

g. 54 in. = \_ \_ \_ ft

**Test Example**

A bookcase is 59 inches tall. The distance between the top of the bookcase and the ceiling is about 4 feet. Which is closest to the distance between the floor and the ceiling?

A 4 ft  B 5 ft  C 8 ft  D 9 ft

**Read the Item**

You need to find the distance from the floor to the ceiling.

**Solve the Item**

The bookcase is about 60 inches. This is 60 \div 12, or 5 feet tall. So, the distance between the floor and the ceiling is 5 + 4, or 9 feet. The answer is D.

**Check Your Progress**

i. Kylee hiked 118 feet and then another 7 yards before resting. Which is closest to the distance Kylee hiked before resting?

F 7 yd  G 15 yd  H 45 yd  J 47 yd
### Example 1 (p. 419)

Draw a line segment of each length.

1. \(1\frac{1}{4}\) in.
2. \(\frac{5}{8}\) in.

### Example 2 (p. 419)

Measure the length of each object to the nearest eighth inch.

3. 
4. 

### Examples 3, 4 (pp. 419–420)

Complete.

5. \(4 \text{ yd} = \square \text{ ft}\)
6. \(4 \text{ mi} = \square \text{ yd}\)
7. \(72 \text{ in.} = \square \text{ yd}\)
8. \(54 \text{ ft} = \square \text{ yd}\)

### Example 5 (p. 420)

**MULTIPLE CHOICE**

Brianna’s brother is about 25 inches shorter than she is. If Brianna is 5 feet tall, which is closest to her brother’s height in feet?

A. 2 ft  
B. 3 ft  
C. 4 ft  
D. 5 ft

### Practice and Problem Solving

**HOMEWORK HELP**

Draw a line segment of each length.

10. \(2\frac{1}{2}\) in.
11. \(3\frac{1}{4}\) in.
12. \(\frac{3}{4}\) in.
13. \(1\frac{3}{8}\) in.

Measure the length of each line segment or object to the nearest eighth inch.

14. 
15. 
16. 

17. 
18. 
19. 

Complete.

20. \(5 \text{ yd} = \square \text{ in.}\)
21. \(6 \text{ yd} = \square \text{ ft}\)
22. \(6 \text{ ft} = \square \text{ in.}\)
23. \(3 \text{ mi} = \square \text{ ft}\)
24. \(48 \text{ in.} = \square \text{ ft}\)
25. \(10 \text{ ft} = \square \text{ yd}\)
26. \(6,160 \text{ yd} = \square \text{ mi}\)
27. \(510 \text{ in.} = \square \text{ ft}\)

28. **SPACE SCIENCE** The largest telescope in the world is powerful enough to identify a penny that is 5 miles away. How many yards is this?

Lesson 8-1 Length in the Customary System
29. **ROLLER COASTERS**  Kingda Ka at Six Flags Great Adventure in Jackson, New Jersey, is the tallest roller coaster in the United States. It has a height of 456 feet. What is this height in yards?

Determine the greater measurement. Explain your reasoning.

30. $1 \frac{1}{2}$ yards or 48 inches  
31. 54 inches or $4 \frac{1}{3}$ feet

32. **ANIMALS**  The length with tail of a bighorn sheep ranges from 50 inches to 62 inches long. What is the range of this length in feet?

33. **BACKPACKS**  Kathy estimates that her backpack is 30 inches long. Is this a reasonable estimate? Why or why not?

Determine whether you would measure each length or distance in inches, feet, yards, or miles. Explain your reasoning.

34. length of a computer monitor  
35. distance from your home to school  
36. distance from home plate to the pitchers mound on a baseball field

**ESTIMATION** Estimate the length of each object. Then measure to find the actual length.

37. the length of your bedroom to the nearest foot  
38. the width of your student ID card to the nearest eighth inch  
39. the height of your dresser to the nearest foot  
40. the height of a classroom wall to the nearest yard  
41. the length of a new pencil to the nearest half inch

**FIND THE DATA**  Refer to a newspaper or the Internet. Choose some data and write a real-world problem in which you would convert a customary measurement of length.

43. **REASONING**  Eight inches is what part of a foot?

44. **OPEN ENDED**  Draw a segment that measures between $1 \frac{1}{2}$ inches and $2 \frac{1}{4}$ inches long. State the measure of the segment to the nearest fourth inch. Then state the measure to the nearest eighth inch.

45. **CHALLENGE**  How many sixteenths of an inch are in one foot? How many half inches are in one yard?
46. **FIND THE ERROR** Liseli and Huang are changing 168 inches to feet. Who is correct? Explain your reasoning.

Liseli: \[168 \div 12 = 14 \text{ ft}\]

Huang: \[168 \times 12 = 2,016 \text{ ft}\]

47. **WRITING IN MATH** Suppose your friend says that 24 feet is equal to 2 inches. Is this reasonable? Explain.

48. The diagram below shows the dimensions of a football field.

What is the width of the field expressed in feet?

- A \(3\frac{1}{2}\) ft
- B \(13\frac{1}{4}\) ft
- C 120 ft
- D 480 ft

49. Mr. Cortez’s car is about 71 inches wide. His garage door is 9 feet wide. How much wider is the garage door than Mr. Cortez’s car?

- F 1 ft
- G 2 ft
- H 3 ft
- J 4 ft

50. Estimate each percent. (Lesson 7-8)

- 23% of 97
- 34% of 117
- 44% of 39
- 78% of 83

54. **TENNIS** Christina hit the ball over the net 3 out of her last 5 attempts. Find the probability of Christina hitting the ball over the net on her next attempt. Suppose Christina attempts 15 hits. About how many hits over the net will she make? (Lesson 7-6)

55. **SALES** What type of display would be most appropriate to show the change in the number of magazines Wade sold over each of the last 5 days? (Lesson 2-8)

56. **PREREQUISITE SKILL** Multiply or divide. (Page 744)

- 4 \times 8
- 16 \times 5
- 5,000 \div 2,000
- 400 \div 8

Lesson 8-1 Length in the Customary System 423