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Getting the Idea

A whole number can be written in different forms:

- **base-ten numeral:** 134,582
- **number name:** one hundred thirty-four thousand, five hundred eighty-two
- **expanded form:** $100,000 + 30,000 + 4,000 + 500 + 80 + 2$

**Place value** is the value of a digit in a number based on its location.

You can use a place-value chart to find the value of each digit.

The digit 3 is in the ten thousands place. It has a value of 30,000.

<table>
<thead>
<tr>
<th>Hundred Thousands</th>
<th>Ten Thousands</th>
<th>Thousands</th>
<th>Hundreds</th>
<th>Tens</th>
<th>Ones</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>4</td>
<td>,</td>
<td>5</td>
<td>8</td>
</tr>
</tbody>
</table>

The value of a digit is 10 times the value of the digit to its right.

The models below represent the number 2,222.

The 2 in the thousands place has a value of 2,000.
That is 10 times the value of the 2 in the hundreds place.

The 2 in the hundreds place has a value of 200.
That is 10 times the value of the 2 in the tens place.

The 2 in the tens place has a value of 20.
That is 10 times the value of the 2 in the ones place.

$2,000 \div 200 = 10$
$200 \div 20 = 10$
$20 \div 2 = 10$
Example 1
A singer on a show received 45,698 votes from viewers. What is the value of the 5 in 45,698?

Strategy Use a place-value chart.

Step 1 Write each digit of the number in a chart.

<table>
<thead>
<tr>
<th></th>
<th>Ten Thousands</th>
<th>Thousands</th>
<th>,</th>
<th>Hundreds</th>
<th>Tens</th>
<th>Ones</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
<td>9</td>
<td>8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Step 2 Find the value of the 5.
The 5 is in the thousands place.
The value of the 5 is 5,000.

Solution The value of the 5 in 45,698 is 5,000.

Example 2
A company has 312,775 employees. What is the number name for 312,775?

Strategy Use place value. Look at the comma.

Step 1 Find the value of the digits before the comma.
There are 312 thousands.
Write three hundred twelve thousand.

Step 2 Find the value of the digits after the comma.
There are 775.
Write seven hundred seventy-five.

Step 3 Write the number name.
Put a comma after the thousands.
three hundred twelve thousand, seven hundred seventy-five

Solution The number name for 312,775 is three hundred twelve thousand, seven hundred seventy-five.
Example 3
How can you write the number 954,362 in expanded form?

**Strategy**  Use a place-value chart.

**Step 1**  Write each digit of the number in a chart.

<table>
<thead>
<tr>
<th>Hundred Thousands</th>
<th>Ten Thousands</th>
<th>Thousands</th>
<th>,</th>
<th>Hundreds</th>
<th>Tens</th>
<th>Ones</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>5</td>
<td>4</td>
<td>,</td>
<td>3</td>
<td>6</td>
<td>2</td>
</tr>
</tbody>
</table>

**Step 2**  Write the value of each digit.

- 9 hundred thousands = 900,000
- 5 ten thousands = 50,000
- 4 thousands = 4,000
- 3 hundreds = 300
- 6 tens = 60
- 2 ones = 2

**Step 3**  List the values. Use a + between each value.

900,000 + 50,000 + 4,000 + 300 + 60 + 2

**Solution**  In expanded form, 954,362 is 900,000 + 50,000 + 4,000 + 300 + 60 + 2.
Coached Example

Laura bought a new home for $239,807.

Write the expanded form and the number name for this dollar amount.

Write the value of each digit.

What is the value of the 2? _______________

What is the value of the 3? _______________

What is the value of the 9? _______________

What is the value of the 8? _______________

What is the value of the 0? _______________

What is the value of the 7? _______________

The expanded form of 239,807 is ________________________________.

Find the value of the digits before the comma.

There are _____________ thousands.

Write the value in words.

________________________________________________________________________

Find the value of the digits after the comma.

There are ____________.

Write the value in words. __________________________________________

Place a comma after the thousands.

The number name for 239,807 is

_______________________________________________________________________.
Domain 1  •  Lesson 2

Compare and Order Whole Numbers

Getting the Idea

You can compare numbers using place value.

Use these symbols to compare numbers.

The symbol $>$ means **is greater than**.

The symbol $<$ means **is less than**.

The symbol $=$ means **is equal to**.

Example 1

Which symbol makes this sentence true? Write $>$, $<$, or $=$.

$65,912 \underline{\hspace{1cm}} 65,879$

**Strategy**  
Use a place-value chart. Start with the digits in the greatest place.

**Step 1**  
Write the numbers in a place-value chart.

<table>
<thead>
<tr>
<th>Ten Thousands</th>
<th>Thousands</th>
<th>Hundreds</th>
<th>Tens</th>
<th>Ones</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>5</td>
<td>9</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>8</td>
<td>7</td>
<td>9</td>
</tr>
</tbody>
</table>

**Step 2**  
Compare the digits in the ten thousands place.

Both numbers have 6 in the ten thousands place.

Compare the next greatest place.

**Step 3**  
Compare the digits in the thousands place.

Both numbers have 5 in the thousands place.

Compare the next greatest place.

**Step 4**  
Compare the digits in the hundreds place.

9 hundreds are greater than 8 hundreds.

So, 65,912 is greater than 65,879.

**Step 5**  
Choose the correct symbol.

$>$ means **is greater than**.

**Solution**  
$65,912 \underbrace{>} 65,879$
Example 2
A city’s budget for maintaining its parks for one year was $718,325. The town spent $718,352 that year. Did the city spend more or less than the budgeted amount?

$718,325 \bigcirc \ 718,352

Strategy  
Line up the numbers on the ones place.  
Then compare the digits from left to right.

\[
\begin{align*}
718,325 \\
718,352
\end{align*}
\]

Step 1  
Compare the digits in the hundred thousands place.  
Since 7 = 7, compare the next greatest place.

Step 2  
Compare the digits in the ten thousands place.  
Since 1 = 1, compare the next greatest place.

Step 3  
Compare the digits in the thousands place.  
Since 8 = 8, compare the next greatest place.

Step 4  
Compare the digits in the hundreds place.  
Since 3 = 3, compare the next greatest place.

Step 5  
Compare the digits in the tens place.  
Since 2 < 5, then 718,325 < 718,352.

Solution  
The city spent more than the budgeted amount.
When you order numbers, find the greatest number and the least number. Compare two numbers at a time, and then order the numbers.

**Example 3**
Order the following numbers from least to greatest.

527,877  528,371  527,918

**Strategy**
- Line up the numbers on the ones place.
- Start comparing the digits in the greatest place.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>527,877</td>
<td>528,371</td>
<td>527,918</td>
</tr>
</tbody>
</table>

**Step 1**
Compare the digits in the hundred thousands place.
All the digits are 5s.

**Step 2**
Compare the digits in the ten thousands place.
All the digits are 2s.

**Step 3**
Compare the digits in the thousands place.
Since 8 > 7, then 528,371 > 527,877 and 527,918. 528,371 is the greatest number.

**Step 4**
For the remaining numbers, compare the digits in the hundreds place.
Since 8 < 9, then 527,877 < 527,918.

**Solution**
The order of the numbers from least to greatest is 527,877; 527,918; 528,371.
Which symbol makes this sentence true? Write $>$, $<$, or $=$.

$693,041 \bigcirc 693,582$

Use a place-value chart. Write the numbers in the chart.

<table>
<thead>
<tr>
<th>Hundred Thousands</th>
<th>Ten Thousands</th>
<th>Thousands</th>
<th>,</th>
<th>Hundreds</th>
<th>Tens</th>
<th>Ones</th>
</tr>
</thead>
</table>

Compare the digits in the hundred thousands place.
Are the digits in the hundred thousands place the same? _______

Compare the digits in the ten thousands place.
Are the digits in the ten thousands place the same? _______

Compare the digits in the thousands place.
Are the digits in the thousands place the same? _______

Compare the digits in the hundreds place.
Are the digits in the hundreds place the same? _______

0 hundreds is _________________ than 5 hundreds.
So, 693,041 is _________________ than 693,582.

Which symbol should you use? __________

$693,041 \bigcirc 693,582$
You can multiply to find the total number of equal groups.

Here are the parts in a multiplication sentence.

\[ 5 \times 4 = 20 \]

- **factor**
- **factor**
- **product**

You can use an array to show multiplication. An **array** has the same number of objects in each row.

**Example 1**

What multiplication sentence does this array show?

\[ \begin{array}{ccc}
\bigcirc & \bigcirc & \bigcirc \\
\bigcirc & \bigcirc & \bigcirc \\
\bigcirc & \bigcirc & \bigcirc \\
\bigcirc & \bigcirc & \bigcirc \\
\bigcirc & \bigcirc & \bigcirc \\
\bigcirc & \bigcirc & \bigcirc \\
\end{array} \]

**Strategy**

Count the number of rows. Then count the number of counters in each row.

**Step 1**

Count the number of rows and the number of counters in each row.

There are 6 rows and 7 counters in each row.

**Step 2**

Find the number of counters in all.

There are 42 counters in all.

**Step 3**

Write the number sentence.

The factors are 6 and 7 and the product is 42.

\[ 6 \times 7 = 42 \]

**Solution**

The array shows \( 6 \times 7 = 42 \).
You can also use repeated addition to solve a multiplication problem. Repeated addition is adding the same number over and over again. Multiplication is a shortcut for repeated addition.

To find $3 \times 4$, you can add 4 three times: $4 + 4 + 4 = 12$

Repeated addition is similar to skip counting.

To find $3 \times 4$, you can skip count by 4 three times: 4, 8, 12

Example 2
Stephanie baked 4 pies for her school’s bake sale. She cut each pie into 8 slices. How many slices did Stephanie make in all?

**Strategy** Use repeated addition.

**Step 1** Write the multiplication sentence for the problem.
She made 4 pies. Each pie has 8 slices.
Find 4 groups of 8.
$4 \times 8 = \underline{32}$

**Step 2** Write the repeated addition for the multiplication sentence.
$4 \times 8$ is the same as adding 8 four times.
$4 \times 8 = 8 + 8 + 8 + 8$

**Step 3** Find the sum.
$8 + 8 + 8 + 8 = 32$

**Solution** Stephanie made 32 slices of pie in all.
A **variable** is a letter or symbol used to represent a value that is unknown.

You can use a variable to represent an unknown value in a number sentence.

**Example 3**
Darren bought a T-shirt for $5. Matt bought a jacket that cost 6 times as much as Darren’s T-shirt. Wilmer bought a jacket that cost $22 more than Darren’s T-shirt. Who spent more money on their jacket? How much more?

**Strategy**  
**Find the cost of each jacket and compare the prices.**

**Step 1**  
Write a number sentence to find the cost of Matt’s jacket.  
Let $m$ represent the cost, in dollars, of Matt’s jacket.  
Matt’s jacket cost 6 times as much as $5.  
Multiply: $5 \times 6 = m$

**Step 2**  
Find the value of $m$.  
$5 \times 6 = 30$  
Matt spent $30 on his jacket.

**Step 3**  
Write a number sentence to find the cost of Wilmer’s jacket.  
Let $w$ represent the cost, in dollars, of Wilmer’s jacket.  
Wilmer’s jacket cost $22$ more than $5$.  
Add: $5 + 22 = w$

**Step 4**  
Find the value of $w$.  
$5 + 22 = 27$  
Wilmer spent $27$ on his jacket.

**Step 5**  
Find the difference in costs.  
Matt spent $30$ and Wilmer spent $27$.  
$30 - 27 = 3$

**Solution**  
Matt’s jacket cost $3$ more than Wilmer’s jacket.
You can use a multiplication table to help you learn basic multiplication facts. The factors are along the first column and the top row. The box where the row and the column meet is the product.

### Example 4

Naomi is 11 years old. Naomi’s great grandmother is 9 times Naomi’s age. How old is Naomi’s great grandmother?

**Strategy**  
Use a multiplication table.

**Step 1**  
Write the multiplication sentence for the problem.  
Naomi is 11. Her great grandmother is 9 times Naomi’s age.  
Find 11 groups of 9.  
\[11 \times 9 = n\]

**Step 2**  
Look at the 11s column.

**Step 3**  
Find the 9s row.

**Step 4**  
Find the box where the 11s column and the 9s row meet.  
The number 99 is in the box.  
So, \(11 \times 9 = 99\).

**Solution**  
Naomi’s great grandmother is 99 years old.
Kate gives her dog 3 biscuits each day. How many biscuits does Kate give her dog in 7 days?

Write the multiplication sentence for the problem.
Find ______ groups of ______ biscuits.

\[ ______ \times ______ = \square \]

Use the multiplication table.
Find the ______ column.
Find the ______ row.
Find the box where the row and the column meet.
The number ______ is in the box.
So, ______ \times ______ = ______.

Kate gives her dog _______ biscuits in 7 days.
### Getting the Idea

You can multiply greater numbers by using basic facts and regrouping. Sometimes using models can help you multiply.

#### Example 1

Multiply.  
\[3 \times 24 = \square\]

**Strategy** Use an array model.

**Step 1** Use an array.

\[
\begin{array}{c}
3 \\
10 \\
10 \\
4
\end{array}
\]

**Step 2** Decompose \(3 \times 24\) into the sum of lesser numbers.  
\[3 \times 24 = (3 \times 10) + (3 \times 10) + (3 \times 4)\]

**Step 3** Find the partial products and then add.  
\[3 \times 24 = 30 + 30 + 12\]
\[3 \times 24 = 72\]

**Solution**  
\[3 \times 24 = 72\]

#### Example 2

Washington Elementary School has 4 sections of seats in the cafeteria. Each section has 48 seats. How many seats in all are in the cafeteria?

**Strategy** Multiply by the ones. Then multiply by the tens.

**Step 1** Write a multiplication sentence for the problem.

The cafeteria has 4 sections of seats.  
There are 48 seats in each section.  
There are \(n\) seats in all.  
\[4 \times 48 = n\]
Step 2
Write the problem in vertical form.

\[
\begin{array}{c}
48 \\
\times 4
\end{array}
\]

Step 3
Multiply the ones: \(4 \times 8 = 32\).
Write the 2 and regroup the 3 tens.

\[
\begin{array}{c}
3 \\
48 \\
\times 4 \\
\hline
2
\end{array}
\]

Step 4
Multiply the tens: \(4 \times 4 = 16\).
Add the regrouped tens: \(16 + 3 = 19\).
Write the 19.

\[
\begin{array}{c}
3 \\
48 \\
\times 4 \\
\hline
192
\end{array}
\]

Solution
There are 192 seats in all in the cafeteria.

Example 3
Tasha bought 7 rolls of paper streamers for the school dance. Each roll is 328 inches long. How many inches of paper streamers did Tasha buy in all?

Strategy
Multiply each place by 7, regrouping when necessary.

Step 1
Write the problem vertically.

\[
\begin{array}{c}
328 \\
\times 7
\end{array}
\]

Step 2
Multiply the ones.
\(7 \times 8 = 56\)
Write the 6 and regroup 5 tens.

\[
\begin{array}{c}
5 \\
328 \\
\times 7 \\
\hline
6
\end{array}
\]
Lesson 4: Multiply Greater Numbers

Step 3

Multiply the tens and add the regrouped tens.

\[
\begin{align*}
7 \times 2 &= 14 \\
14 + 5 &= 19 \\
\end{align*}
\]

Write the 9 and regroup 1 hundred.

\[
\begin{array}{c}
15 \\
\downarrow \\
328 \\
\downarrow 7 \\
\hline \\
96
\end{array}
\]

Step 4

Multiply the hundreds and add the regrouped hundreds.

\[
\begin{align*}
7 \times 3 &= 21 \\
21 + 1 &= 22 \\
\end{align*}
\]

Write the 22 hundreds.

\[
\begin{array}{c}
15 \\
\downarrow \\
328 \\
\downarrow 7 \\
\hline \\
2,296
\end{array}
\]

Solution

Tasha bought 2,296 inches of paper streamers.

Example 4

Mrs. Rivera earned $1,635 each week for 4 weeks. How much money did she earn in all?

Strategy

Multiply each place by 4, regrouping when necessary.

Step 1

Write the multiplication sentence for the problem.

She earned $1,635 each week for 4 weeks.

Use \( n \) for the unknown product.

\[
1,635 \times 4 = n
\]

Step 2

Write the problem vertically.

\[
\begin{array}{c}
1,635 \\
\downarrow \\
\times 4
\end{array}
\]
Step 3  Multiply the ones.

4 \times 5 = 20

Write the 0 and regroup 2 tens.

\[
\begin{array}{c}
\phantom{0}2 \\
1,635 \\
\times \phantom{1}4 \\
\hline
0
\end{array}
\]

Step 4  Multiply the tens and add the regrouped tens.

4 \times 3 = 12

12 + 2 = 14

Write the 4 and regroup 1 hundred.

\[
\begin{array}{c}
\phantom{0}1 \phantom{2}2 \\
1,635 \\
\times \phantom{1}4 \\
\hline
40
\end{array}
\]

Step 5  Multiply the hundreds and add the regrouped hundreds.

4 \times 6 = 24

24 + 1 = 25

Write the 5 hundreds and regroup 2 thousands.

\[
\begin{array}{c}
\phantom{0}2 \phantom{1}1 \phantom{2}2 \\
1,635 \\
\times \phantom{1}4 \\
\hline
540
\end{array}
\]

Step 6  Multiply the thousands and add the regrouped thousands.

4 \times 1 = 4

4 + 2 = 6

Write the 6 thousands.

\[
\begin{array}{c}
\phantom{0}2 \phantom{1}1 \phantom{2}2 \\
1,635 \\
\times \phantom{1}4 \\
\hline
6,540
\end{array}
\]

Solution  Mrs. Rivera earned $6,540 in all.
When multiplying two-digit numbers, first multiply a factor by the ones digit of the other factor. Then multiply the same factor by the tens digit of the other factor. Finally, add the partial products to find the final product.

**Example 5**

Multiply.

\[ 45 \times 28 = \square \]

**Strategy**  Multiply each place value. Regroup when necessary.

**Step 1**  Write the problem in vertical form.

\[
\begin{array}{r}
45 \\
\times 28 \\
\end{array}
\]

**Step 2**  Multiply 45 by the ones digit of 28: 8 ones \times 45.

\[ 4 \\
\begin{array}{r}
45 \\
\times 28 \\
\end{array} \\
\begin{array}{r}
360 \\
\searrow \\
\text{partial product}
\end{array} \]

**Step 3**  Multiply 45 by the tens digit of 28: 2 tens \times 45.

Write a 0 in the ones place because you are multiplying the tens.

\[ 1 \\
\begin{array}{r}
45 \\
\times 28 \\
\end{array} \\
\begin{array}{r}
360 \\
\searrow \\
\text{partial product}
\end{array} \\
\begin{array}{r}
900 \\
\searrow \\
\text{partial product}
\end{array} \]

**Step 4**  Add the partial products.

\[ \begin{array}{r}
45 \\
\times 28 \\
\hline
360 \\
\hline
900 \\
\hline
1,260
\end{array} \]

**Solution**  \[ 45 \times 28 = 1,260 \]
A student ticket to a theme park costs $34. A class of 26 fourth-grade students went to the theme park. How much did the tickets for the students cost in all?

Write the multiplication sentence for the problem.

A student ticket costs $__________.

A class of ___________ students went to the park.

Find ___________ \times ___________ = [ ].

Write the problem in vertical form.

Multiply 34 by the ________________ digit of 26.

_____ ones \times 34. Regroup.

What is the first partial product? __________

Multiply 34 by the ________________ digit of 26.

_____ tens \times 34. Regroup.

What is the second partial product? __________

Add the two partial products.

_________ + ___________ = ___________

The tickets for the students cost $__________ in all.
Getting the Idea

There are some mathematical properties that can help make multiplication easier for you. Properties are rules.

Commutative Property of Multiplication
The order of the factors can be changed.
The product does not change.

\[
12 \times 18 = 18 \times 12 \\
216 = 216
\]

Example 1
Which number makes this number sentence true?

\[
13 \times \_ = 23 \times 13
\]

Strategy | Use the commutative property of multiplication.

Step 1 | Look at the number sentence.
The left side of the equal sign shows \(13 \times \_\).
The right side of the equal sign shows \(23 \times 13\).
The equal sign means that they have the same product.

Step 2 | Think about the commutative property of multiplication.
The order of the factors does not change the product.
\[
13 \times 23 = 23 \times 13
\]

Solution | The number 23 makes the number sentence true.
**Multiplicative Identity Property of 1**
When you multiply any number by 1, the product is that number.

\[ 1 \times 57 = 57 \]

**Example 2**
Which number makes this number sentence true?

\[ \square \times 1 = 82 \]

**Strategy**  Use the multiplicative identity property of 1.

**Step 1**
Look at the number sentence.
- The left side of the equal sign shows \( \square \times 1 \).
- The right side of the equal sign shows 82.

**Step 2**
Use the multiplicative identity property of 1.
- Any number multiplied by 1 is that number.
- Since one of the factors is 1, the other factor is 82.

\[ 82 \times 1 = 82 \]

**Solution**  The number 82 makes the number sentence true.
Associative Property of Multiplication

Factors can be grouped in different ways.
The product will be the same.

\[(12 \times 7) \times 14 = 12 \times (7 \times 14)\]
\[84 \times 14 = 12 \times 98\]
\[1,176 = 1,176\]

Example 3

Multiply.

\[8 \times (12 \times 10) = \square\]

Strategy  Use the associative property of multiplication.

Step 1  Think about the associative property of multiplication.

The grouping of the factors does not change the product.

Step 2  Regroup the factors.

\[8 \times (12 \times 10) = (8 \times 12) \times 10\]

Step 3  Use mental math to multiply.

Multiply inside the parentheses. Then find the final product.

\[(8 \times 12) \times 10 = \square\]
\[96 \times 10 = 960\]

Solution  \[8 \times (12 \times 10) = 960\]
Coached Example

A bag has 5 packets of jellybeans. Each packet has 14 jellybeans. Joey bought 2 bags. How many jellybeans did Joey buy in all?

\[ 5 \times 14 \times 2 = \square \]

Use the __________________________ property of multiplication to change the order of the factors.

\[ \square \times \square \times \square = \square \]

Use the __________________________ property of multiplication to group the factors.

\[(\square \times \square) \times \square = \square \]

Multiply inside the parentheses.

\[(\square) \times \square = \square \]

Multiply that factor and the other factor.

\[\square \times \square = \square \]

So, \[5 \times 14 \times 2 = \square \]

Joey bought __________ jellybeans in all.
Distributive Property of Multiplication

Getting the Idea

The distributive property of multiplication can help you multiply numbers using mental math. The property uses the expanded form of numbers.

Area models can help you understand the distributive property of multiplication.

Distributive Property of Multiplication

When you multiply a number by a sum, you can multiply the number by each addend of the sum and then add the products.

\[
5 \times 14 \\
5 \times (10 + 4) \\
(5 \times 10) + (5 \times 4) \\
50 + 20 = 70 \\
5 \times 14 = 70
\]

Example 1

Fred has 3 shelves of books. Each shelf has 18 books. How many books in all are on the shelves?

Strategy Use the distributive property of multiplication and mental math.

Step 1 Write the multiplication sentence for the problem.

There are 3 shelves. There are 18 books on each shelf. There are \(x\) books in all.

\[3 \times 18 = x\]
**Step 2**
Express 18 in expanded form.

\[ 18 = 10 + 8 \]

**Step 3**
Rewrite the sentence with 18 in expanded form.

\[ 3 \times 18 = 3 \times (10 + 8) \]

**Step 4**
Distribute the 3 to each addend.

\[ 3 \times (10 + 8) = (3 \times 10) + (3 \times 8) \]

**Step 5**
Find each product.

\[ (3 \times 10) + (3 \times 8) = x \]

\[ 30 + 24 = x \]

**Step 6**
Add the products.

\[ 30 + 24 = 54 \]

**Solution**
There are 54 books in all on the shelves.

---

**Example 2**
Multiply.

\[ 12 \times 34 = \square \]

**Strategy**
Use the distributive property and mental math.

**Step 1**
Express 34 in expanded form.

\[ 34 = 30 + 4 \]

**Step 2**
Rewrite the sentence with 34 in expanded form.

\[ 12 \times 34 = 12 \times (30 + 4) \]

**Step 3**
Distribute the 12 to each addend.

\[ 12 \times (30 + 4) = (12 \times 30) + (12 \times 4) \]
Step 4  Find each product.
\[(12 \times 30) + (12 \times 4) = \square\]
\[360 + 48 = \square\]

Step 5  Add the products.
\[360 + 48 = 408\]

Solution  \[12 \times 34 = 408\]

Example 3
A Blu-Ray DVD costs $25. Ms. Ely ordered 15 Blu-Ray DVDs. How much did Ms. Ely spend in all on the DVDs?

Strategy  Use an area model.

Step 1  Make an area model.
Decompose 25 into 20 + 5.
Decompose 15 into 10 + 5.

Step 2  Write multiplication sentences and find the product for each box.
\[
\begin{array}{|c|c|}
\hline
20 & 5 \\
\hline
10 & 20 \times 10 = 200 & 10 \times 5 = 50 \\
\hline
5 & 20 \times 5 = 100 & 5 \times 5 = 25 \\
\hline
\end{array}
\]

Step 3  Add the partial products
\[200 + 50 + 100 + 25 = 375\]

Solution  Ms. Ely spent $375 in all.
Monroe Elementary School has 32 classrooms. Each classroom has 24 students. How many students in all are at the school?

Write the multiplication sentence for the problem.
There are ___________ classrooms.
There are ___________ students in each class.
There are \( n \) students in all.
\[
\text{____________} \times \text{____________} = \text{____________}
\]

Use the distributive property of multiplication.
Express 24 in expanded form.
\[
24 = \text{____________} + \text{____________}
\]
Rewrite the sentence with 24 in expanded form.
\[
32 \times 24 = 32 \times (\text{_______} + \text{_______})
\]
Distribute 32 to each addend.
\[
32 \times (\text{_______} + \text{_______}) = (32 \times \text{_______}) + (32 \times \text{_______})
\]
Find each product.
\[
(32 \times \text{_______}) + (32 \times \text{_______}) = n
\]
\[
\text{____________} + \text{____________} = n
\]
Add the products.
\[
\text{____________} + \text{____________} = \text{____________}
\]
There are ___________ students in all at the school.
Division Facts

Getting the Idea

You can divide to find the number of equal groups or the number in each group.

Here are the parts in a division sentence.

\[
\begin{align*}
54 & \div 9 = 6 \\
\text{dividend} & \quad \text{divisor} \quad \text{quotient}
\end{align*}
\]

You can use an array to show division.

Example 1

Michael bagged 32 cans of soup in 4 bags. Each bag has the same number of cans. How many cans are in each bag?

Strategy Make an array.

Step 1 Write the division sentence for the problem.

There are 32 cans in all. There are 4 bags.
There are \( n \) cans in each bag.

\[32 \div 4 = n\]

Step 2 Use 32 counters. Put the counters in 4 equal rows.

\[
\begin{array}{cccc}
\bigcirc & \bigcirc & \bigcirc & \bigcirc \\
\bigcirc & \bigcirc & \bigcirc & \bigcirc \\
\bigcirc & \bigcirc & \bigcirc & \bigcirc \\
\bigcirc & \bigcirc & \bigcirc & \bigcirc
\end{array}
\]

Step 3 Find the number of counters in each row.

There are 8 counters in each row.

Solution There are 8 cans in each bag.
Division is the opposite, or the **inverse operation**, of multiplication. You can use a multiplication table to solve division.

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<td>96</td>
<td>108</td>
<td>120</td>
<td>132</td>
<td>144</td>
</tr>
</tbody>
</table>

**Example 2**

Frank is 72 years old. That is 8 times his granddaughter’s age. What is Frank’s granddaughter’s age?

**Strategy**  Use the multiplication table.

**Step 1** Write the division sentence for the problem.

Frank is 72 years old.

72 is 8 times his granddaughter’s age.

His granddaughter is \(n\) years old.

\[72 \div 8 = n\]

**Step 2** Look at the 8s column.

**Step 3** Move down the column and look for 72.

**Step 4** Move to the left and look for the row number.

The row is 9.

**Solution** Frank’s granddaughter is 9 years old.
You can solve multistep problems by using multiplicative comparison and additive comparison. To find the number in each group or how many groups, use multiplicative comparison to divide. To find the number left in a group, use additive comparison to subtract.

**Example 3**
There are 48 students on the track and field team. That is 6 times as many as the number of students that are on the tennis team and 30 more students that are on the softball team. Does the softball team or the tennis team have a greater number of students? How many more students does that team have?

**Strategy** Find the number of students on each team and compare.

**Step 1** Write a number sentence to find the number of students on the tennis team.

Let $t$ represent the number of students on the tennis team.

48 is 6 times as many as $t$.

Divide: $48 \div 6 = t$

**Step 2** Find the value of $t$.

$48 \div 6 = 8$

There are 8 students on the tennis team.

**Step 3** Write a number sentence to find the number of students on the softball team.

Let $s$ represent the number of students on the softball team.

48 is 30 more than 18.

Subtract: $48 - 30 = s$

**Step 4** Find the value of $s$.

$48 - 30 = 18$

There are 18 students on the softball team.

**Step 5** Find the difference between the number of students on each team.

The softball team has 18 students and the tennis team has 8 students.

$18 - 8 = 10$

**Solution** The softball team has 10 more students than the tennis team.
Related multiplication and division facts create a **fact family**.

Related facts use the same numbers.

\[
\begin{align*}
5 \times 6 &= 30 & 6 \times 5 &= 30 \\
30 \div 5 &= 6 & 30 \div 6 &= 5
\end{align*}
\]

**Example 4**

A log is 49 inches long. Mr. Childs cuts the log into 7 equal pieces. What is the length of one piece?

**Strategy**  **Use a related multiplication fact.**

**Step 1** Write the division sentence for the problem.
- The log is 49 inches long.
- It was cut into 7 equal pieces.
- Each piece is \( p \) inches long.
- \( 49 \div 7 = p \)

**Step 2** Use a related multiplication fact.
- Related facts use the same numbers.
- Since \( 7 \times 7 = 49 \), then \( 49 \div 7 = 7 \).

**Solution**  **The length of one piece is 7 inches.**
Lesson 7: Division Facts

Coached Example

Ms. Lopez has a total of 35 desks in her classroom. That is 5 times the number of desks in each equal row of desks. How many desks are in each row?

Write a division sentence for the problem.

Use \( d \) for the number of desks in each row.

There are \( \_ \_ \_ \_ \_ \_ \_ \_ \_ \) desks in \( \_ \_ \_ \_ \_ \_ \_ \_ \_ \) equal rows.

\( \_ \_ \_ \_ \_ \_ \_ \_ \_ \) \( \div \) \( \_ \_ \_ \_ \_ \_ \_ \_ \_ \) = \( \_ \_ \_ \_ \_ \_ \_ \_ \_ \)

Use a related multiplication fact.

\( \_ \_ \_ \_ \_ \_ \_ \_ \_ \times 5 = 35 \)

Since \( \_ \_ \_ \_ \_ \_ \_ \_ \_ \times 5 = 35 \), then \( 35 \div 5 = \_ \_ \_ \_ \_ \_ \_ \_ \_ \).

There are \( \_ \_ \_ \_ \_ \_ \_ \_ \_ \) desks in each row.
Divide Greater Numbers

Getting the Idea

Division problems can be written in another way.

\[
\frac{\text{quotient}}{\text{divisor}} = \frac{\text{dividend}}{}
\]

You can use models to help you divide.

Example 1

Divide.

\[56 \div 4 = \square\]

Strategy

Use counters to make an array.

Step 1

Use 56 counters. Put them in 4 equal rows.

Step 2

Count the number of counters in each row.

There are 14 counters in each row.

Solution

\[56 \div 4 = 14\]

Remember, inverse operations are operations that “undo” each other. Multiplication and division are inverse operations. You can use multiplication to check a division problem.

For Example 1, you can use \(4 \times 14 = 56\) to check \(56 \div 4 = 14\).

The product 56 matches the dividend 56, so the answer is correct.
When you divide greater numbers, divide each place of the dividend from left to right.

**Example 2**
Alex has 72 baseball cards that he wants to store in three cases. If he stores the same number of cards in each case, how many cards will be in each case?

**Strategy**   **Write a division sentence, then solve.**

**Step 1** Write a division sentence for the problem.
He has 72 cards. He has 3 cases. There are \( n \) cards in each case.
\[
72 \div 3 = n
\]

**Step 2** Write the problem another way.
\[
3 \overline{\longdiv{72}}
\]

**Step 3** Divide.
\[
\begin{align*}
2 \\
3 \overline{\longdiv{72}} \\
-6 \\
1 \leftarrow \text{Multiply: } 3 \times 2 = 6 \\
\end{align*}
\]

**Step 4** Bring down the 2 ones.
\[
\begin{align*}
2 \\
3 \overline{\longdiv{72}} \\
-6 \downarrow \\
12 \leftarrow \text{Subtract: } 7 - 6 = 1 \\
\end{align*}
\]

**Step 5** Divide.
\[
\begin{align*}
24 \\
3 \overline{\longdiv{72}} \\
-6 \downarrow \\
12 \\
-12 \leftarrow \text{Multiply: } 3 \times 4 = 12 \\
0 \leftarrow \text{Subtract: } 12 - 12 = 0 \\
\end{align*}
\]

**Step 6** Use multiplication to check the quotient.
\[
3 \times 24 = 72 \leftarrow \text{This matches the dividend.} \\
\text{The quotient is correct.}
\]

**Solution** There will be 24 baseball cards in each case.
When dividing greater numbers, first look at the digit in the greatest place of the dividend. Sometimes you will need to look at the first two places of the dividend.

**Example 3**
Divide.

\[ \frac{456}{6} \]

**Strategy**  Divide each place from left to right.

**Step 1**  Look at the digit in the greatest place of the dividend.

The digit is 4.

Because 4 < 6, look at the digits in the first two places of the dividend.

\[ \frac{456}{6} \]

**Step 2**  Divide 45 tens by 6.

\[
\begin{array}{c|c}
7 & \\
6 & 456 \\
\hline
& 42 \\
\hline
& 3 \\
\end{array}
\]

\[ \text{Multiply: } 6 \times 7 = 42 \]

\[ \text{Subtract: } 45 - 42 = 3 \]

**Step 3**  Bring down the ones. Divide 36 ones by 6.

\[
\begin{array}{c|c}
76 & \\
6 & 456 \\
\hline
& 42 \\
\hline
& 36 \\
\hline
& 0 \\
\end{array}
\]

\[ \text{Multiply: } 6 \times 6 = 36 \]

\[ \text{Subtract: } 36 - 36 = 0 \]

**Step 4**  Use multiplication to check the quotient.

\[ 6 \times 76 = 456 \]  \[ \text{This matches the dividend.} \]

The quotient is correct.

**Solution**  \[ 456 \div 6 = 76 \]
Example 4
Will raised $648 and Dara raised $522 for their favorite charities. They combined their money and donated the same amount to each of 3 charities. How much did each charity receive?

Strategy    Decide how to solve the problem. Find the total amount of money raised. Then divide the sum by 3.

Step 1    Add to find the total amount of money raised.

$$648 + 522 = 1,170$$

Step 2    Divide to find how much each charity received.

$$1,170 \div 3 = \square$$

Divide each place from left to right.

$$390$$

$$3)1,170$$

$$-9$$

$$27$$

$$-27$$

$$00$$

$$-00$$

$$0$$

Step 3    Use multiplication to check the quotient.

$$3 \times 390 = 1,170$$

Solution    Each charity received $390.
The circus has 8 equal sections of seats. There are 8,240 seats in all.

How many seats, $s$, are in each section?

Write a division sentence for the problem.

There are _____________ seats in all.
There are _____________ equal sections.
There are $s$ seats in each section.

$\frac{\text{___________}}{\text{___________}} = \text{___________}$

Write the problem another way.
Divide each place from left to right.

$$8 \div 8,240$$

So, $8,240 \div 8 = \text{___________}$.
There are _____________ seats in each section.
The remainder is a number that is left after division has been completed. You can write the remainder with the letter R. A remainder must be less than the divisor.

To check an answer with a remainder, first multiply the divisor by the quotient. Then add that product to the remainder.

Look at the following example.

$$13 \div 3 = 4 \text{ R}\ 1$$

The remainder 1 is less than the divisor 3.

To check the answer, multiply the divisor 3 by the quotient 4. $3 \times 4 = 12$

Then add the product 12 to the remainder 1. $12 + 1 = 13$

**Example 1**

Divide.

$$61 \div 7 = \boxed{}$$

**Strategy** 
Divide each place from left to right.

**Step 1** 
Write the problem another way. Divide.

$$\begin{array}{c}
8 \\
7 \overline{)61} \\
-56 \\
\hline \\
5
\end{array}$$

$\leftarrow \text{ Multiply } 7 \times 8 = 56$

$\leftarrow \text{ Subtract } 61 - 56 = 5$

There are 5 left over. This is the remainder.

**Step 2** 
Write the remainder.

$$\begin{array}{c}
8 \text{ R} 5 \\
7 \overline{)61} \\
-56 \\
\hline \\
5
\end{array}$$
Step 3

Check the answer.

Multiply the divisor by the quotient. Then add the remainder.

\[(7 \times 8) + 5 = \]

\[56 + 5 = 61 \quad \leftarrow \text{This matches the dividend.}
\]

\[
\text{The answer is correct.}
\]

Solution \[61 \div 7 = 8 \text{ R}5\]

Example 2

Divide.

\[531 \div 4 = \square\]

Strategy

Divide each place from left to right.

Step 1

Set up the division. Start by dividing 5 hundreds by 4.

\[
\begin{array}{c}
4)531 \\
-4 \\
\hline
1 \\
\end{array}
\]

\[
\text{Multiply } 4 \times 1 = 4
\]

\[
\begin{array}{c}
\hline
1 \\
-12 \\
\hline
11 \\
-8 \\
\hline
3 \\
\end{array}
\]

\[
\text{Subtract } 5 - 4 = 1
\]

Step 2

Continue dividing and write the remainder.

\[132 \text{ R}3\]

\[
\begin{array}{c}
4)531 \\
-4 \\
\hline
13 \\
\end{array}
\]

\[
\begin{array}{c}
\hline
13 \\
-12 \\
\hline
1 \\
\end{array}
\]

\[
\text{Step 3}
\]

Check the quotient.

\[(4 \times 132) + 3 = \]

\[528 + 3 = 531 \quad \leftarrow \text{This matches the dividend.}
\]

\[
\text{The answer is correct.}
\]

Solution \[531 \div 4 = 132 \text{ R}3\]
In a division word problem with remainders, you may need to interpret the remainder. There are three ways to interpret the remainder.

1. Drop the remainder.
2. The remainder is the answer.
3. Add 1 to the quotient.

**Example 3**

A group of 124 chorus members is going to a concert. A van can take 9 members. How many vans are needed to get all of the members to the concert?

**Strategy** Divide. Then interpret the remainder.

**Step 1** Write the division sentence for the problem.

There are 124 members. Each van can take 9 members.
Let $v$ represent the number of vans needed.

$$124 \div 9 = v$$

**Step 2** Divide each place from left to right. Write the remainder.

$$9 \overline{)124}$$

$\underline{\text{9}}$

$\text{13 R7}$

$\underline{\text{9}}$

$\text{34}$

$\underline{\text{27}}$

$\text{7}$

**Step 3** Check the answer.

$$(9 \times 13) + 7 = 117 + 7 = 124 \quad \text{This matches the dividend.}$$

The answer is correct.

**Step 4** Interpret the remainder.

The answer, 13 R7, means 13 full vans with 7 members left over. Those 7 members remaining need to be driven. So one more van is needed. Add 1 to the quotient.

$$13 + 1 = 14$$

**Solution** To get all the members to the concert, 14 vans are needed.
Example 4
A factory made 2,285 tea candles to be shipped to 8 different stores. Each store will receive the same number of candles with some left over. How many candles will each store receive?

Strategy  
**Divide. Then interpret the remainder.**

**Step 1** Write the division sentence for the problem.

There are 2,285 candles to be shipped to 8 stores.
Let \( c \) represent the number of candles each store will receive.

\[
2,285 \div 8 = c
\]

**Step 2** Set up the division. Divide each place from left to right.

\[
\begin{align*}
8) &\underline{2285} \\
-16 &\underline{} \\
\underline{-16} \\
68 &\underline{} \\
-64 &\underline{} \\
\underline{-64} \\
45 &\underline{} \\
-40 &\underline{} \\
\underline{-40} \\
\hline
5
\end{align*}
\]

**Step 3** Check the quotient.

\[
(8 \times 285) + 5 =
\]

\[
2,280 + 5 = 2,285 \quad \text{This matches the dividend.}
\]

The quotient is correct.

**Step 4** Interpret the remainder.

The answer, 285 R5, means 285 candles for each store with 5 candles left over. Since the question asks for the number of candles each store will receive, drop the remainder.

**Solution** Each store will receive **285 candles**.
Lesson 9: Division with Remainders

Coached Example

Nita has a 250-inch roll of ribbon. She needs to cut as many 9-inch pieces as she can from the roll. How many 9-inch pieces can Nita cut? What is the length of the ribbon left over?

Write the division sentence for the problem.
Nita has __________ inches of ribbon.
Each piece she will cut is __________ inches long.
Let \( p \) represent ______________________________________________________.
_________ \( \div \) ___________ \( = p \)
Set up the division. Divide each place from left to right.

\[
9 \div 250
\]

Check the quotient.
Multiply the divisor by the quotient. Add that product to the remainder.
\[
(9 \times \underline{\phantom{0}}) + \underline{\phantom{0}} = p
\]
\[
\underline{\phantom{0}} + \underline{\phantom{0}} = \underline{\phantom{0}}
\]
Does that match the dividend? ___________ Is your answer correct? ___________
Interpret the remainder.
The answer, ___________ R_____, means Nita can cut ___________ 9-inch pieces with ___________ inches left over.

Nita can cut __________ 9-inch pieces.
The length of the ribbon left over is __________ inches.
Multiply and Divide by Multiples of 10, 100, and 1,000

Getting the Idea

A multiple of 10 is any counting number multiplied by 10.
A multiple of 100 is any counting number multiplied by 100.
A multiple of 1,000 is any counting number multiplied by 1,000.

To multiply a number by a multiple of 10, 100, or 1,000, multiply the number by the nonzero digit of the multiple of 10, and put one, two, or three zeros at the end of the product.

- $8 \times 20 = 160$
- $8 \times 200 = 1,600$
- $8 \times 2,000 = 16,000$

You can use mental math to multiply a number by multiples of 10, 100, and 1,000.

Example 1
What is $2 \times 90$?

**Strategy** Use mental math.

**Step 1** Multiply 2 by the nonzero digit of the multiple of 10.
9 is the nonzero digit of the multiple of 10. $2 \times 9 = 18$

**Step 2** There is one zero in 90.
Put one zero at the end of the product: 180

**Solution** $2 \times 90 = 180$

Example 2
A netbook computer costs $300. A desktop computer costs 5 times as much as the netbook computer. How much does the desktop computer cost?

**Strategy** Use mental math.

**Step 1** Write a multiplication sentence for the problem.
The netbook costs $300.
The desktop costs 5 times as much.
Let $n$ represent the cost of the desktop.

$300 \times 5 = n$
Step 2  Multiply 5 by the nonzero digit of the multiple of 100.
3 is the nonzero digit of the multiple of 100. \(5 \times 3 = 15\)

Step 3  There are 2 zeros in 300.
Put two zeros at the end of the product: \(1500\)
So, \(5 \times 300 = 1500\).

Solution  The desktop computer costs $1,500.

Example 3
A store ordered 6 boxes of gumballs. Each box has 4,000 gumballs. How many gumballs in all did the store order?

Strategy  Use mental math.

Step 1  Write the multiplication sentence for the problem.
There are 6 boxes.
Each box has 4,000 gumballs.
Let \(g\) represent the total number of gumballs.
\(6 \times 4000 = g\)

Step 2  Multiply 6 by the nonzero digit of the multiple of 1,000.
\(6 \times 4 = 24\)

Step 3  There are 3 zeros in 4,000.
Put 3 zeros at the end of the product: \(24000\)
So, \(6 \times 4000 = 24000\).

Solution  The store ordered 24,000 gumballs in all.

Dividing a number by 10 is the opposite of multiplying by 10.
Instead of putting a zero at the end of a number, you take away a zero.
For example, \(140 \div 10 = 14\).
To divide a number by 100, take away two zeros from the dividend.
For example, \(1400 \div 100 = 14\).
Example 4
Tanya has collected 90 dimes in a jar. She wrapped the dimes in rolls of 10 to bring to the bank. How many rolls of dimes did Tanya wrap?

Strategy  Use mental math.

Step 1  Write the division sentence for the problem.
There are 90 dimes.
There are 10 dimes in each roll.
Let \( r \) represent the number of rolls.

\[
90 \div 10 = r
\]

Step 2  Divide.
The divisor is 10, so take away a zero from the dividend.

\[
90 \div 10 = 9
\]

Solution  Tanya wrapped 9 rolls of dimes.

Coached Example
Mr. Cassidy typed 8,200 words in a report. He can type 100 words a minute. How many minutes did it take Mr. Cassidy to type his report?

Write the division sentence for the problem.

He typed \( \underline{\hspace{2cm}} \) words in a report.
He can type \( \underline{\hspace{2cm}} \) words a minute.

Let \( m \) represent the number of \( \underline{\hspace{2cm}} \) it took to type the report.

\[
\underline{\hspace{2cm}} \div \underline{\hspace{2cm}} = \underline{\hspace{2cm}}
\]

Use mental math.
The divisor is \( \underline{\hspace{2cm}} \), so take away \( \underline{\hspace{2cm}} \) zeros from the dividend.

\[
8,200 \div 100 = \underline{\hspace{2cm}}
\]

It took Mr. Cassidy \( \underline{\hspace{2cm}} \) minutes to type his report.
Factors and Multiples

Getting the Idea

Factors are numbers that are multiplied together to get a product. Every whole number greater than 1 has at least one pair of factors: 1 and itself. For example, 1 and 10 is a factor pair of 10. Another factor pair of 10 is 2 and 5. You can use an area model to find factor pairs.

Example 1
What are the factor pairs of 8?

Strategy Use area models.

Step 1 Draw an area model that has 8 squares.

The area model shows 1 square by 8 squares.
One factor pair is 1 and 8.

Step 2 Draw another area model that has 8 squares.

The area model shows 2 squares by 4 squares.
Another factor pair is 2 and 4.

Step 3 You cannot make a different area model that has 8 squares.
List the factor pairs from the two area models.

Solution There are two factor pairs of 8: 1 and 8, 2 and 4.

You can write a factor pair using braces. For example, one factor pair of 14 is \{2, 7\}.
Example 2
List the factor pairs of 24.

Strategy  Use a multiplication table.

Step 1  Write the first factor pair of 24.

Every whole number greater than 1 has 1 and itself as factors.

\[ 1 \times 24 = 24 \]

So, 1 and 24 is one factor pair.

Step 2  Find all the 24s inside the multiplication table.

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<td>4</td>
<td>0</td>
<td>4</td>
<td>8</td>
<td>12</td>
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<td>36</td>
<td>40</td>
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<td>48</td>
</tr>
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<td>5</td>
<td>10</td>
<td>15</td>
<td>20</td>
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<td>70</td>
<td>77</td>
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<td>8</td>
<td>16</td>
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<td>48</td>
<td>56</td>
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<td>9</td>
<td>18</td>
<td>27</td>
<td>36</td>
<td>45</td>
<td>54</td>
<td>63</td>
<td>72</td>
<td>81</td>
<td>90</td>
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<td>108</td>
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<td>30</td>
<td>40</td>
<td>50</td>
<td>60</td>
<td>70</td>
<td>80</td>
<td>90</td>
<td>100</td>
<td>110</td>
<td>120</td>
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<td>0</td>
<td>11</td>
<td>22</td>
<td>33</td>
<td>44</td>
<td>55</td>
<td>66</td>
<td>77</td>
<td>88</td>
<td>99</td>
<td>110</td>
<td>121</td>
<td>132</td>
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<tr>
<td>12</td>
<td>0</td>
<td>12</td>
<td>24</td>
<td>36</td>
<td>48</td>
<td>60</td>
<td>72</td>
<td>84</td>
<td>96</td>
<td>108</td>
<td>120</td>
<td>132</td>
<td>144</td>
</tr>
</tbody>
</table>

Step 3  Write a number sentence for each factor pair of 24.

\[ 2 \times 12 = 24 \]
\[ 3 \times 8 = 24 \]
\[ 4 \times 6 = 24 \]

Some factors are used more than once.

You only need to list them once.

Step 4  List all the factor pairs of 24.

1 and 24
2 and 12
3 and 8
4 and 6

Solution  The factor pairs of 24 are \{1, 24\}, \{2, 12\}, \{3, 8\}, and \{4, 6\}.
A **multiple** is the product of two factors. Multiples form a skip-counting pattern. To find the first few multiples of a number, keep that number as one factor, and multiply by 1, then 2, then 3, and so on. Here are eight multiples of 5:

\[
\begin{align*}
5 \times 1 &= 5 \\
5 \times 2 &= 10 \\
5 \times 3 &= 15 \\
5 \times 4 &= 20 \\
5 \times 5 &= 25 \\
5 \times 6 &= 30 \\
5 \times 7 &= 35 \\
5 \times 8 &= 40 \\
\end{align*}
\]

You can also use a multiplication table to find multiples of a number. Read down a column, or to the right along a row, to find multiples of a number.

You can use a square area model to show a multiple with two of the same factors, such as \(5 \times 5 = 25\).

**Example 3**

Is 36 a multiple of 6?

**Strategy** List multiples of 6.

\[
\begin{align*}
6 \times 1 &= 6 \\
6 \times 2 &= 12 \\
6 \times 3 &= 18 \\
6 \times 4 &= 24 \\
6 \times 5 &= 30 \\
6 \times 6 &= 36 \\
\end{align*}
\]

**Solution** Yes, 36 is a multiple of 6.
A **prime number** is a whole number that has exactly two factors, 1 and itself. A **composite number** is a whole number that has more than one factor pair. The number 1 is neither a prime number nor a composite number.

**Example 4**
Is 17 a prime number or a composite number?

**Strategy**  
Find the factors of 17.

**Step 1**  
Draw an area model that has 17 squares.

```
[Diagram of 17 squares]
```

The area model shows 1 square by 17 squares.  
Two factors of 17 are 1 and 17.

**Step 2**  
Decide if you can make a different area model with 17 squares.  
No, you cannot make another area model.  
Because 17 has exactly two factors, it is a prime number.

**Solution**  
17 is a prime number.

**Example 5**
Is 4 a prime number or a composite number?

**Strategy**  
Find the factors of 4.

List the factors of 4.  
The factors of 4 are 1, 2, and 4.

**Solution**  
Because 4 has more than two factors, it is a composite number.
Coached Example

Paige has some dollar bills that she wants to exchange for quarters. She can exchange each dollar for 4 quarters. Can she get exactly 25 quarters by exchanging her dollar bills?

Decide whether 25 is a multiple of 4.

Use the pattern of multiples of 4.

\[
\begin{align*}
4 \times 1 &= \_\_\_\_ \\
4 \times 2 &= \_\_\_\_ \\
4 \times 3 &= \_\_\_\_ \\
4 \times 4 &= \_\_\_\_ \\
4 \times 5 &= \_\_\_\_ \\
4 \times 6 &= \_\_\_\_ \\
4 \times 7 &= \_\_\_\_
\end{align*}
\]

The number 25 is between the products \_\_\_\_ and \_\_\_\_.

25 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a multiple of 4.

Paige \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ get exactly 25 quarters by exchanging dollar bills.
Add Whole Numbers

Getting the Idea

You can add to find the total when two or more groups are joined. Here are the parts in an addition sentence.

\[
\begin{align*}
2,411 & \quad + \quad 3,524 & \quad = \quad 5,935 \\
\text{addend} & \quad \text{addend} & \quad \text{sum}
\end{align*}
\]

When you use paper and pencil to add, line up the digits on the ones place. Add the digits from right to left. If the sum of the digits in a column is 10 or greater, you will need to regroup.

Example 1

The table shows the number of miles Ms. Davis flew on each flight one day.

<table>
<thead>
<tr>
<th>Miles Flown</th>
<th>From</th>
<th>To</th>
<th>Number of Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boston, MA</td>
<td>Houston, TX</td>
<td>1,868</td>
</tr>
<tr>
<td></td>
<td>Houston, TX</td>
<td>Los Angeles, CA</td>
<td>1,524</td>
</tr>
</tbody>
</table>

How many miles did Ms. Davis fly in all?

Strategy Write an addition sentence, then solve.

Step 1 Write the addition sentence for the problem.

Let \( m \) represent the total number of miles.

\[ 1,868 + 1,524 = m \]

Step 2 Line up the digits on the ones place. Add from right to left.

Add the ones: \( 8 + 4 = 12 \).

Regroup 12 ones as 1 ten 2 ones.

\[
\begin{align*}
1,868 \\
+ 1,524 \\
\hline
2
\end{align*}
\]
Step 3  Add the tens: $1 + 6 + 2 = 9$.

\[
\begin{array}{c}
1 \\
1,868 \\
+ 1,524 \\
\hline
92
\end{array}
\]

Step 4  Add the hundreds: $8 + 5 = 13$.
Regroup 13 hundreds as 1 thousand 3 hundreds.

\[
\begin{array}{c}
1 \\
1,868 \\
+ 1,524 \\
\hline
392
\end{array}
\]

Step 5  Add the thousands: $1 + 1 + 1 = 3$.

\[
\begin{array}{c}
1 \\
1,868 \\
+ 1,524 \\
\hline
3,392
\end{array}
\]

Solution  Ms. Davis flew 3,392 miles in all.

Example 2  Add.

\[
8,715 + 6,409 = \square
\]

Strategy  Line up the digits on the ones place. Add from right to left.

\[
\begin{array}{c}
1 \\
8,715 \\
+ 6,409 \\
\hline
15,124
\end{array}
\]

Solution  \(8,715 + 6,409 = 15,124\)
Example 3

The table shows the number of points needed to trade for prizes.

<table>
<thead>
<tr>
<th>Prize</th>
<th>Number of Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>$100 Gift Card</td>
<td>5,950</td>
</tr>
<tr>
<td>MP3 Player</td>
<td>10,135</td>
</tr>
<tr>
<td>DVD Player</td>
<td>5,885</td>
</tr>
</tbody>
</table>

Alex has 13,050 points. For which two prizes can Alex trade his points?

**Strategy**  Find the sum of the points for two prizes. Then compare the sum to Alex’s points.

**Step 1**  Find the sum for the $100 gift card and MP3 player.

\[
\begin{align*}
5,950 & \\
+ 10,135 & \\
\hline
16,085 & \\
\end{align*}
\]

Alex does not have enough points because 16,085 > 13,050.

**Step 2**  Find the sum for the $100 gift card and DVD player.

\[
\begin{align*}
5,950 & \\
+ 5,885 & \\
\hline
11,835 & \\
\end{align*}
\]

Alex does have enough points because 11,835 < 13,050.

**Step 3**  Find the sum for the MP3 player and DVD player.

\[
\begin{align*}
10,135 & \\
+ 5,885 & \\
\hline
16,020 & \\
\end{align*}
\]

Alex does not have enough points because 16,020 > 13,050.

**Solution**  Alex can trade his points for the gift card and the DVD player.
Last year, a club had 12,468 members. This year, the club has 8,271 more members. How many members are in the club this year?

Write the addition sentence for the problem.
The club had __________ members last year.
The club has __________ more members this year.
Let \( m \) represent the total number of members in the club this year.

\[
\begin{align*}
\text{Last year members} & \quad + \quad \text{Increase in members} \\
\quad & \quad = \quad \text{Total members this year}
\end{align*}
\]

Set up the problem.
Line up the digits on the ones place.
Add each place from right to left. Regroup if necessary.

The sum is ____________.
There are ____________ members in the club this year.
Subtract Whole Numbers

Getting the Idea

You can subtract to find how many are left when you take something away.

Here are the parts in a subtraction sentence.

\[
\begin{array}{ccc}
3,667 & - & 1,243 \\
\text{minuend} & & \text{subtrahend} \\
\end{array} = 2,424 \\
\text{difference}
\]

When you use paper and pencil to subtract, remember to line up the digits on the ones place. Subtract each digit from right to left. If the digit in the minuend is less than the digit in the subtrahend, you have to regroup.

Example 1

Peter scored 5,189 points playing a video game. Jacob scored 1,778 points playing the same game. How many more points did Peter score than Jacob?

Strategy  Write a subtraction sentence, then solve.

Step 1  Write the subtraction sentence for the problem.

Peter scored 5,189 points.
Jacob scored 1,778 points.
Let \( p \) represent how many more points Peter scored than Jacob.

\[
5,189 - 1,778 = p
\]

Step 2  Line up the digits on the ones place. Subtract from right to left.

Subtract the ones: \( 9 - 8 = 1 \)

\[
\begin{array}{c}
5,189 \\
- 1,778 \\
\hline
1
\end{array}
\]

Step 3  Subtract the tens: \( 8 - 7 = 1 \)

\[
\begin{array}{c}
\phantom{5,189} \\
- 1,778 \\
\hline
11
\end{array}
\]
Step 4  
There are not enough hundreds to subtract.
Regroup 1 thousand as 10 hundreds. Now there are 11 hundreds.

\[
\begin{array}{c}
4 \, 11 \\
3, \, 18 \, 9 \\
\hline
1 \, 7 \, 8 \, 11 \\
\end{array}
\]

Step 5  
Subtract the hundreds: \(11 - 7 = 4\)

\[
\begin{array}{c}
4 \, 11 \\
3, \, 18 \, 9 \\
\hline
1 \, 7 \, 7 \, 8 \\
4 \, 1 \, 1 \\
\end{array}
\]

Step 6  
Subtract the thousands: \(4 - 1 = 3\)

\[
\begin{array}{c}
4 \, 11 \\
3, \, 18 \, 9 \\
\hline
1 \, 7 \, 7 \, 8 \\
3, \, 4 \, 1 \, 1 \\
\end{array}
\]

Solution  
Peter scored 3,411 more points than Jacob.

When subtracting with zeros in the minuend, you may have to regroup from more than one place.

Example 2  
Subtract.

\[4,007 - 1,526 = \square\]

Strategy  
Line up the digits on the ones place. Subtract from right to left.

Step 1  
Line up the digits on the ones place.
Subtract the ones: \(7 - 6 = 1\)

\[
\begin{array}{c}
4,007 \\
\hline
1,526 \\
\hline
1 \\
\end{array}
\]

When subtracting with zeros in the minuend, you may have to regroup from more than one place.
Lesson 13: Subtract Whole Numbers

Step 2
There are not enough tens to subtract and no hundreds to regroup.
Regroup 1 thousand as 10 hundreds.
Then regroup 1 hundred as 10 tens.

\[
\begin{array}{c}
9 \\
3 \text{,}1\text{,}0\text{,}7 \\
\text{,}0\text{,} \text{,}0 \text{,}7 \\
\hline
1, \text{,}5\text{,}2\text{,}6
\end{array}
\]

Step 3
Subtract the tens: \(10 - 2 = 8\)

\[
\begin{array}{c}
9 \\
3 \text{,}1\text{,}0\text{,}7 \\
\text{,}0\text{,} \text{,}0 \text{,}7 \\
\hline
8 \text{,}1
\end{array}
\]

Step 4
Subtract the hundreds: \(9 - 5 = 4\)

\[
\begin{array}{c}
9 \\
3 \text{,}1\text{,}0\text{,}7 \\
\text{,}0\text{,} \text{,}0 \text{,}7 \\
\hline
4\text{,}8 \text{,}1
\end{array}
\]

Step 5
Subtract the thousands: \(3 - 1 = 2\)

\[
\begin{array}{c}
9 \\
3 \text{,}1\text{,}0\text{,}7 \\
\text{,}0\text{,} \text{,}0 \text{,}7 \\
\hline
2, \text{,}4\text{,}8 \text{,}1
\end{array}
\]

Solution \(4,007 - 1,526 = 2,481\)

Addition is the inverse operation of subtraction.
You can check the answer to a subtraction problem using addition.

\[
\begin{array}{c}
2,481 \\
+ \text{,}1\text{,}5\text{,}2\text{,}6 \\
\hline
4,007 \\
- \text{,}1\text{,}5\text{,}2\text{,}6 \\
\hline
2,481
\end{array}
\]

The sum is 4,007, which matches the minuend. So, the answer is correct.
Example 3
In a survey about favorite movies, 4,893 male students and 5,203 female students gave a response. There were also responses from 1,572 adults. How many more students than adults responded to the survey?

Strategy  Write number sentences to represent the problem. Then solve.

Step 1  Write an addition sentence to find the total number of students.
There were 4,893 male students.
There were 5,203 female students.
Let \( s \) represent the total number of students.
\[
4,893 + 5,203 = s
\]

Step 2  Find the total number of students.
Add. Regroup if necessary.
\[
\begin{array}{c}
1 \\
4,893 \\
+ 5,203 \\
\hline
10,096
\end{array}
\]

Step 3  Write a subtraction sentence to find how many more students than adults responded to the survey.
There were 10,096 students.
There were 1,572 adults.
Let \( n \) represent how many more students.
\[
10,096 - 1,572 = n
\]

Step 4  Find how many more students than adults responded to the survey.
Subtract. Regroup if necessary.
\[
\begin{array}{c}
9 \\
0 \underline{1} \underline{0} \\
\hline
\underline{9}, \underline{0} \underline{9} 6 \\
- 1, 5 \underline{7} 2 \\
\hline
8, 5 \underline{2} 4
\end{array}
\]
Lesson 13: Subtract Whole Numbers

Step 5  Use addition to check the subtraction.

\[
\begin{array}{c}
1 \\
8,524 \\
+ 1,572 \\
\hline
10,096 \quad \rightarrow \text{This matches the minuend.}
\end{array}
\]

The answer is correct.

Solution  8,524 more students than adults responded to the survey.

Coached Example

Lynn had $2,812 in her checking account. She spent $1,150 on a television and $665 on a video camera. How much does Lynn have left in her checking account?

Decide how to solve the problem.

\[ \underline{\text{Add}} \] to find the total amount Lynn spent on the television and the video camera.

Then \[ \underline{\text{Subtract}} \] the sum from the amount Lynn had in her checking account.

Add to find the total amount Lynn spent.

Add from right to left. Regroup if necessary.

Subtract to find how much Lynn has left in her checking account.

Subtract from right to left. Regroup if necessary.

Use addition to check the subtraction.

Lynn has $\underline{\text{______________________}}$ left in her checking account.
Getting the Idea

You can **round** a number to the nearest 10 or 100. When rounding, you replace a number with one that tells *about* how much or *about* how many. Rounding gives a number close to the exact amount.

You can use a number line to help you round numbers.

A number line can help you decide which 10 or 100 a number is closer to.

**Example 1**

What is 128 rounded to the nearest 10?

**Strategy** Use a number line.

**Step 1**

Place 128 on a number line.

```
0 10 20 30 40 50 60 70 80 90 100 110 120 130
```

128

**Step 2**

Decide whether 128 is closer to 120 or 130.

- 128 is closer to 130 than to 120.
- 128 rounds up to 130.

**Solution** 128 rounded to the nearest 10 is 130.
You can also use rounding rules to round numbers.

**Rounding Rules**

1. Look at the digit to the right of the place you are rounding to.
2. If the digit is less than 5, round down.
   Leave the digit in the rounding place as is.
3. If the digit is greater than or equal to 5, round up.
   Increase the digit in the rounding place by 1.
4. Change the digits to the right of the rounding place to zeros.

**Example 2**

A chandelier has 1,723 crystal pieces. To the nearest hundred, about how many crystal pieces does the chandelier have?

**Strategy** Use rounding rules to round to the nearest hundred.

**Step 1** Find the rounding place.
Underline the digit in the place you want to round to, the hundreds place.

1,723

**Step 2** Decide to round up or down.
Look at the digit to the right of the rounding place, in the tens place.

1,723
The digit is 2. It is less than 5, so round down.

**Step 3** Round 1,723 down to the nearest hundred.
Leave the digit in the hundreds place.
Change the digits to the right of the hundreds place to 0.

1,723 → 1,700

**Solution** To the nearest hundred, the chandelier has about 1,700 crystal pieces.
Example 3
Quinn has 23,867 frequent flyer miles. To the nearest thousand, about how many frequent flyer miles does Quinn have?

Strategy  Use rounding rules to round to the nearest thousand.

Step 1  Find the place you want to round to. Look at the digit to the right.
       You are rounding to the nearest thousand, so find the thousands digit.
       Then look at the hundreds digit.
       23,867

Step 2  Decide to round up or down.
        8 is greater than 5, so round up.

Step 3  Round 23,867 up to the nearest thousand.
        Increase the thousands digit by 1.
        Change the digits to the right of the thousands place to 0.
        23,867 → 24,000

Solution  To the nearest thousand, Quinn has about 24,000 frequent flyer miles.

Example 4
Martin’s Music Shop earned $12,445 in April, $15,125 in May, and $14,675 in June. During which two months did Martin’s Music Shop earn about the same amount of money?

Strategy  Round to the nearest thousand. Then compare.

Step 1  Round each money amount to the nearest thousand.
        April: $12,445 rounds down to $12,000.
        May: $15,125 rounds down to $15,000.
        June: $14,675 rounds up to $15,000.

Step 2  Compare the amounts.
        The amounts for May and June both rounded to $15,000.

Solution  Martin’s Music Shop earned about the same amount of money in May and June.
A game Web site received 129,354 hits in one day. To the nearest ten thousand, about how many hits did the game Web site receive that day?

The place to be rounded to is _________________.

The digit in this place is ________.

The digit to the right of the rounding place is ________.

This digit is ______________ than 5.

Since the digit to the right is greater than 5, round ________________.

Change all the digits to the right of the rounding place to ________.

129,354 rounds to ________________.

To the nearest ten thousand, the game Web site received about ________________ hits that day.
Estimate Sums and Differences

Getting the Idea

You can use rounded numbers to estimate sums and differences. Your estimates will vary depending on what place you round to.

<table>
<thead>
<tr>
<th>Rounding to tens</th>
<th>Rounding to hundreds</th>
<th>Rounding to thousands</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,252</td>
<td>4,252</td>
<td>4,252</td>
</tr>
<tr>
<td>1,607</td>
<td>1,607</td>
<td>1,607</td>
</tr>
<tr>
<td>5,860</td>
<td>5,900</td>
<td>6,000</td>
</tr>
</tbody>
</table>

Example 1

Kendra scored 9,235 points in the first round of a computer game. She scored 8,790 points in the second round. About how many points did she score in all?

**Strategy** Round each number to its greatest place and then solve.

**Step 1** Round each number to its greatest place: thousands.
- The number 9,235 rounds down to 9,000 because 2 < 5.
- The number 8,790 rounds up to 9,000 because 7 > 5.

**Step 2** Add the rounded numbers.

\[9,000 + 9,000 = 18,000\]

**Solution** Kendra scored about 18,000 points in all.
Example 2

Lee has 4,837 building blocks. He gave 1,175 building blocks to Sarah. To the nearest thousand, about how many blocks does Lee have left?

**Strategy**  Round each number to the thousands place and then solve.

**Step 1** Round each number to the thousands place.
- 4,837 rounds up to 5,000 because 8 > 5.
- 1,175 rounds down to 1,000 because 1 < 5.

**Step 2** Subtract the rounded numbers.
- \(5,000 - 1,000 = 4,000\)

**Solution** To the nearest thousand, Lee has about 4,000 building blocks left.

When you need an exact answer, estimating before you add or subtract is a good way to see if your answer is reasonable. You can quickly tell if you made an error when adding or subtracting the numbers.

Example 3

Pam said that 37,249 + 46,867 is equal to 74,126. Is her answer reasonable?

**Strategy** Estimate to check whether an answer is reasonable.

**Step 1** Estimate by rounding to thousands.
- 37,249 rounds down to 37,000 because 2 < 5.
- 46,867 rounds up to 47,000 because 8 > 5.

**Step 2** Add the rounded numbers.
- \(37,000 + 47,000 = 84,000\)

**Step 3** Compare the estimate to the answer.
- 84,000 is not close to 74,126.

**Solution** Pam’s answer is not reasonable.
A theme park had 74,868 visitors last month. This month, the park had 79,967 visitors. About how many more visitors did the theme park have this month than last month?

Estimate by rounding to thousands.

The number 74,868 rounds to _________________.
The number 79,967 rounds to _________________.

Subtract the rounded numbers.

_________________ – _________________ = _________________

About ________________ more people visited the theme park this month than last month.
As with addition and subtraction problems, sometimes you do not need an exact answer to solve multiplication and division problems.

To estimate a product, round the numbers given in the problem. Then use mental math to find the estimated answer.

Example 1
Phil delivers 38 newspapers each Sunday. About how many Sunday newspapers does he deliver in a year? There are about 52 weeks in a year.

Strategy Round each number. Use mental math to multiply.

Step 1 Decide how to solve the problem.
He delivers 38 newspapers each Sunday.
There are 52 weeks in a year.
Estimate $52 \times 38$.

Step 2 Round each number to the nearest 10.

\[
\begin{array}{c}
52 \\
\downarrow \\
50
\end{array} \times \begin{array}{c}
38 \\
\downarrow \\
40
\end{array} = \square
\]

Step 3 Use mental math to multiply the rounded numbers.
Think: $5 \times 4 = 20$
$50 \times 40 = 2,000$

Solution Phil delivers about 2,000 Sunday newspapers a year.

You can use estimation to decide if an answer is reasonable. Before you find the exact answer, find the estimated product. Then compare the estimate to the exact answer to see if the answer makes sense.
Example 2
Ms. Barrows pays $479 to rent a car for a month. How much will Ms. Barrows pay to rent a car for 3 months?

Strategy  
Find the estimated answer. Then compare it to the exact answer.

Step 1  
Write the multiplication sentence for the problem.
She pays $479 for 1 month.
She rents the car for 3 months.
Let \( n \) represent the total amount she will pay for 3 months.
\[ 3 \times 479 = n \]

Step 2  
Estimate the answer.
$479 rounds up to $500.
\[ 3 \times 500 = 1500 \]
The answer should be about $1,500.

Step 3  
Find the exact answer.
\[
\begin{array}{c}
22 \\
\times 479 \\
\times 3 \\
\hline \\
1437
\end{array}
\]

Step 4  
Compare the exact answer to the estimated answer.
$1,437 is close to $1,500.
The answer is reasonable.

Solution  
Ms. Barrows will pay $1,437 to rent a car for 3 months.

You can use compatible numbers and mental math to estimate quotients. Compatible numbers are close to the exact numbers and are easy to compute with. To estimate 55 \( \div \) 7, think of a number close to 55 that can be evenly divided by 7. 56 is close to 55 and 56 \( \div \) 7 = 8. So, 55 \( \div \) 7 is about 8.

Example 3
A basketball team scored 143 points in 3 games. If the team scored the same number of points in each game, about how many points did the team score in one game?
Lesson 16: Estimate Products and Quotients

**Strategy**  
Use compatible numbers to estimate the quotient.

**Step 1**  
Decide how to solve the problem.  
The team scored 143 points in 3 games.  
Estimate $143 \div 3 = \underline{\hspace{2cm}}$.

**Step 2**  
Find a number close to 143 that is compatible with 3.  
150 is close to 143 and can be evenly divided by 3.

**Step 3**  
Estimate the quotient.  
$15 \div 3 = 5$, so $150 \div 3 = 50$.

**Solution**  
The basketball team scored about 50 points a game.

Sometimes you may need to change both numbers to find compatible numbers.

**Example 4**  
Adele orders 135 roses for a reception. She wants to put the same number of roses in each vase. If she has 9 vases, how many roses will Adele put in each vase?

**Strategy**  
Use compatible numbers to find the estimated answer.  
Then compare it to the exact answer.

**Step 1**  
Write the division sentence for the problem.  
She has 135 roses and 9 vases.  
Find $135 \div 9 = \underline{\hspace{2cm}}$.

**Step 2**  
Use compatible numbers to estimate the answer.  
135 is close to 140. 9 is close to 10.  
$140 \div 10 = 14$  
The answer should be about 14.

**Step 3**  
Find the exact answer.  
$135 \div 9 = 15$

**Step 4**  
Compare the exact answer to the estimated answer.  
15 is close to 14. The answer is reasonable.

**Solution**  
Adele will put 15 roses in each vase.
A T-shirt factory shipped 7 boxes of shirts. Each box had 275 shirts. How many shirts did the factory ship in all?

Write the number sentence for the problem.
Find

Write the number sentence for the problem.
Find

Estimate the answer.
Round 275 to the nearest 100.
275 rounds to

Multiply the rounded numbers.

The answer should be about

Find the exact answer.

Is the exact answer close to the estimated answer? _____________
Is the answer reasonable? _____________

The factory shipped _____________ shirts in all.
A pattern is a series of numbers or figures that follows a rule. In a number pattern, the numbers are the terms. The rule describes how each term is related to the next term.

This number pattern has 5 terms. The rule of the pattern is “add 4.”

\[
27 \ 31 \ 35 \ 39 \ 43
\]

You can find the next term in a number pattern by finding the rule. Some patterns increase, so try adding or multiplying by the same number. Some patterns decrease, so try subtracting or dividing by the same number.

**Example 1**

What is the next term of this pattern?

\[
15 \ 22 \ 29 \ 36 \ ?
\]

**Strategy**  
Find the rule of the pattern.

**Step 1** Decide if the terms increase or decrease.

The numbers increase.

**Step 2** Find how many are between each term.

Since the numbers increase, use addition or multiplication.

Try addition.

\[
15 + ? = 22 \quad \rightarrow \quad 15 + 7 = 22
\]

\[
22 + ? = 29 \quad \rightarrow \quad 22 + 7 = 29
\]

\[
29 + ? = 36 \quad \rightarrow \quad 29 + 7 = 36
\]

Each number is 7 more than the previous number.

**Step 3** Find a rule.

A rule is “add 7.”

**Step 4** Use the rule to find the next term.

Add 7 to the last number.

\[
36 + 7 = 43
\]

**Solution**  
The next term of this pattern is 43.
Notice another pattern of the numbers in Example 1.

15  22  29  36  42
odd  even  odd  even  odd

The terms in the pattern alternate between odd and even numbers.

The rule of the pattern is “add 7” and 7 is an odd number.

This rule will create alternating odd and even numbers because:

odd number + odd number = even number
even number + odd number = odd number

Example 2
The table shows how much money Martin had in his school lunch account at the end of each week for four weeks.

<table>
<thead>
<tr>
<th>Week 1</th>
<th>Week 2</th>
<th>Week 3</th>
<th>Week 4</th>
<th>Week 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>$150</td>
<td>$135</td>
<td>$120</td>
<td>$105</td>
<td>?</td>
</tr>
</tbody>
</table>

If the pattern continues, how much money will Martin have in his account at the end of Week 5?

Strategy  Find the rule of the pattern.

Step 1  Decide if the terms increase or decrease.

The numbers decrease.

Step 2  Find the rule.

Since the numbers decrease, use subtraction or division.

Try subtraction.

150 – ? = 135  →  150 – 15 = 135
135 – ? = 120  →  135 – 15 = 120
120 – ? = 105  →  120 – 15 = 105

The rule is “subtract 15.”

Step 3  Use the rule to find the next term.

Subtract 15 from the last number.

105 – 15 = 90

Solution  If the pattern continues, Martin will have $90 in his account at the end of Week 5.
Notice that the terms in the pattern in Example 2 also alternate between even and odd numbers. Remember that:

- even number $- odd$ number = odd number
- odd number $- odd$ number = even number

**Example 3**

Jenny is making a number pattern with 6 terms. The first term is 2. The rule of the pattern is “multiply by 2.” What are the six terms in Jenny’s pattern?

**Strategy** Use the rule.

**Step 1** Identify the information given in the problem.
- The pattern has 6 terms.
- The pattern starts with 2.
- The rule is “multiply by 2.”

\[ 2 \ ? \ ? \ ? \ ? \ ? \]

**Step 2** Use the rule to find the next term of the pattern.
- Multiply the first term, 2, by 2.
  - \[ 2 \times 2 = 4 \quad \text{second term} \]

**Step 3** Use the rule to find the rest of the terms in the pattern.
- \[ 4 \times 2 = 8 \quad \text{third term} \]
- \[ 8 \times 2 = 16 \quad \text{fourth term} \]
- \[ 16 \times 2 = 32 \quad \text{fifth term} \]
- \[ 32 \times 2 = 64 \quad \text{sixth term} \]

Notice that the terms are all even numbers.

The rule of the pattern is multiply by 2, so each term doubles the previous term.

**Solution** The six terms in Jenny’s pattern are 2, 4, 8, 16, 32, and 64.
A pattern made up of figures also uses a rule. Use the rule to continue the pattern. You can use a table to help you.

**Example 4**
What is the 17th figure in this pattern?

![Pattern of figures](image)

**Strategy** Use a table.

**Step 1** Find the rule of the pattern.
- This is a repeating pattern.
- 1 triangle, 1 rectangle, 2 circles

**Step 2** Use the table to extend the pattern.
- You know the first 8 figures.
- Make a table for figures 9 through 17.

<table>
<thead>
<tr>
<th>Figure</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape</td>
<td>△</td>
<td></td>
<td></td>
<td></td>
<td>△</td>
<td></td>
<td></td>
<td></td>
<td>△</td>
</tr>
</tbody>
</table>

**Solution** The 17th figure is a triangle.
Example 5
How many dots are in the 5th figure?

<table>
<thead>
<tr>
<th></th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dots</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

Strategy Find the rule of the pattern. Use a table.

Step 1 Count the number of dots in each figure.

<table>
<thead>
<tr>
<th>Figure</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Dots</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

Step 2 Find the rule.
Each figure has 1 row of 3 dots more than the previous figure.

<table>
<thead>
<tr>
<th>Figure</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Dots</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>1 \times 3</th>
<th>2 \times 3</th>
<th>3 \times 3</th>
<th>4 \times 3</th>
</tr>
</thead>
</table>

Step 3 Use the rule to find the number of dots in the next figure.
The next figure will have 3 more dots than the 4th figure.
It will have 5 rows of 3 dots. $5 \times 3 = 15$

Solution There will be 15 dots in the 5th figure.
A number pattern has 6 terms. The first term is 55. The rule of the pattern is “subtract 9.” What are the six terms in the number pattern?

Identify the information given in the problem.

The pattern has ________ terms.
The pattern starts with ________.
The rule is ____________________________.

Use the rule to find the rest of the terms.

Subtract ________ from 55.

_________ – _________ = __________ ← second term

_________ – _________ = __________ ← third term

_________ – _________ = __________ ← fourth term

_________ – _________ = __________ ← fifth term

_________ – _________ = __________ ← sixth term

The six terms in the number pattern are ______, ______, ______, ______, ______, and ______.
A fraction names parts of a whole or part of a group.

The denominator, the bottom number, tells how many equal parts in the whole or group.

The numerator, the top number, tells how many equal parts are being considered.

The diagram below shows 6 equal parts in the whole. Each part is \( \frac{1}{6} \) of the whole.

The figure is \( \frac{4}{6} \) shaded. You read the fraction \( \frac{4}{6} \) as four sixths.

Example 1

What fraction of the circle is shaded?

Strategy

Find the denominator and the numerator.

Step 1

Count the number of equal parts in the circle.

There are 5 equal parts. The denominator is 5.

Step 2

Count the number of shaded parts in the circle.

There are 3 shaded parts. The numerator is 3.

Step 3

Write the fraction.

\[ \frac{\text{numerator}}{\text{denominator}} = \frac{3}{5} \]

Solution

Three-fifths, or \( \frac{3}{5} \), of the circle is shaded.
Equivalent fractions are fractions that name the same value, but have different numerators and denominators. The models below show that $\frac{1}{2}$ and $\frac{2}{4}$ are equivalent fractions.

Example 2
What fraction with 12 as a denominator is equivalent to $\frac{2}{3}$?

Strategy Use fraction strips.

Step 1 Use $\frac{1}{3}$ fraction strips.

Show $\frac{2}{3}$.

Step 2 Use $\frac{1}{12}$ fraction strips.

Use as many strips as needed to make the same length as $\frac{2}{3}$.

Step 3 Count the number of $\frac{1}{12}$ strips.

There are 8 strips of $\frac{1}{12}$.

So, $\frac{8}{12}$ is equal to $\frac{2}{3}$.

Solution $\frac{2}{3} = \frac{8}{12}$
You can use number lines to find equivalent fractions.

**Example 3**

What fraction with 5 as a denominator is equivalent to \( \frac{6}{10} \)?

**Strategy** Use number lines.

**Step 1** Make a number line in tenths and another one in fifths.

Find \( \frac{6}{10} \).

**Step 2** Find the fraction on the number line in fifths that lines up with \( \frac{6}{10} \).

\( \frac{3}{5} \) lines up with \( \frac{6}{10} \).

**Solution** \( \frac{3}{5} \) is equivalent to \( \frac{6}{10} \).

Another way to find equivalent fractions is to multiply the numerator and the denominator by the same number. For example:

\[
\frac{3}{5} = \frac{3 \times 2}{5 \times 2} = \frac{6}{10}
\]
Example 4

What is an equivalent fraction of $\frac{3}{4}$?

**Strategy** Multiply the numerator and denominator by the same number.

**Step 1**
Multiply both the numerator and denominator by 2.

$$\frac{3}{4} \times \frac{2}{2} = \frac{6}{8}$$

**Step 2**
Use models to check.

The models for $\frac{3}{4}$ and $\frac{6}{8}$ have the same size.

**Solution** $\frac{6}{8}$ is an equivalent fraction of $\frac{3}{4}$.

A fraction is in **simplest form** if its numerator and denominator have only 1 as a common factor. A fraction and its simplest form are equivalent fractions.

You can simplify a fraction by dividing the numerator and denominator by the greatest common factor. The **greatest common factor (GCF)** is the greatest factor that is common to two or more numbers.

For example, simplify $\frac{6}{8}$.

2 is the GCF of 6 and 8.

So, divide the numerator and the denominator by 2.

$$\frac{6}{8} = \frac{6 \div 2}{8 \div 2} = \frac{3}{4}$$

$\frac{3}{4}$ is the simplest form of $\frac{6}{8}$. 
Example 5
Simplify the fraction $\frac{9}{12}$.

Strategy  Divide the numerator and denominator by the GCF.

Step 1  Find the GCF of 9 and 12.
The GCF is 3.

Step 2  Divide both the numerator and denominator by 3.

$$\frac{9}{12} = \frac{9 \div 3}{12 \div 3} = \frac{3}{4}$$

Solution  $\frac{9}{12}$ in simplest form is $\frac{3}{4}$.

Coached Example

What fraction with 12 as a denominator is equivalent to $\frac{3}{6}$?

What is the denominator of $\frac{3}{6}$? __________
What is the denominator of the equivalent fraction? __________
By what number can you multiply 6 to get 12? __________
To find the equivalent fraction, multiply the numerator and denominator by __________.

$$\frac{3 \times \_}{6 \times \_} = \_$$

__________ is a fraction with 12 as a denominator that is equivalent to $\frac{3}{6}$. 
Getting the Idea

You can write equivalent fractions for improper fractions.

Example 1
When simplified, what improper fraction is equivalent to the model?

```
\begin{array}{cccc}
\frac{1}{4} & \frac{1}{4} & \frac{1}{4} & \frac{1}{4}
\end{array}
```

Strategy
Write the fraction in the model. Then simplify the fraction.

Step 1
Write the denominator for the improper fraction.
Each bar shows fourths. The denominator is 4.

Step 2
Count the number of shaded parts.
There are 6 shaded parts. The numerator is 6.

Step 3
Write the fraction.
The fraction is $\frac{6}{4}$.

Step 4
Divide the numerator and denominator by 2.
$\frac{6}{4} \div \frac{2}{2} = \frac{3}{2}$

Solution
The improper fraction $\frac{3}{2}$ is equivalent to the model.
A **mixed number** has a whole number part and a fraction part. You use a mixed number when you say your age is $9\frac{1}{2}$ or your shoe size is $5\frac{1}{2}$.

**Example 2**

What mixed number does this model represent?

![Model diagram with fraction bars shaded]

**Strategy**  
**Decompose the fraction.**

**Step 1**  
Write the improper fraction as the sum of each part.  
There are 2 fractions bars that are completely shaded.  
\[
\frac{13}{5} = \frac{5}{5} + \frac{5}{5} + \frac{3}{5}
\]

Remember that $\frac{5}{5} = 1$.

The whole number part is 2.

**Step 2**  
Find the fraction part.  
The third fraction bar has 3 shaded parts out of 5 parts.  
The fraction part is $\frac{3}{5}$.

**Step 3**  
Write the mixed number.  
The whole number part is on the left.  
The fraction part is on the right.  
$2\frac{3}{5}$

**Solution**  
The model represents the mixed number $2\frac{3}{5}$. 
Example 3
Where is point C located on the number line? Write the answer as an improper fraction and as a mixed number.

Strategy
Decide what each tick mark represents. Then count.

Step 1
What does each tick mark represent?
Each tick mark shows $\frac{1}{4}$.

Step 2
To find the improper fraction, count the number of tick marks past 0.
Point C is 10 tick marks to the right of 0.
The improper fraction is $\frac{10}{4}$.

Step 3
To find the mixed number, count the number of tick marks past the whole number.
Point C is two marks to the right of 2.
The mixed number is $2\frac{2}{4}$.

Solution
Point C is located at $\frac{10}{4}$ or $2\frac{2}{4}$ or $2\frac{1}{2}$ on the number line.
You can change an improper fraction to a mixed number and a mixed number to an improper fraction. To change a mixed number to an improper fraction, multiply the whole number part by the denominator. Then add the numerator to that product. The denominator stays the same.

**Example 4**

Jamie brought a batch of pies to a potluck dinner. Each pie was cut into 6 equal pieces. After dinner, there were $3\frac{5}{6}$ pies left over. What is $3\frac{5}{6}$ as an improper fraction?

**Strategy**  Use multiplication and addition.

**Step 1** Multiply the whole number part by the denominator of the fraction part.

\[ 3 \times 6 = 18 \]

**Step 2** Add that product to the numerator of the fraction part.

\[ 18 + 5 = 23 \]

**Step 3** The denominator stays the same. Write the improper fraction.

\[ \frac{23}{6} \]

**Solution**  $3\frac{5}{6} = \frac{23}{6}$

To change an improper fraction to a mixed number, divide the numerator by the denominator. The quotient is the whole number; the remainder is the numerator of the fraction. The denominator stays the same.

**Example 5**

Flora made placemats using $\frac{13}{3}$ yards of fabric. What is $\frac{13}{3}$ as a mixed number?

**Strategy**  Divide the numerator by the denominator.

**Step 1** Divide the numerator by the denominator.

\[ 13 \div 3 = 4 \text{ R}1 \]

**Step 2** Write the mixed number.

- The quotient, 4, is the whole number part.
- The remainder, 1, is the numerator of the fraction part.
- The denominator, 3, stays the same.

**Solution**  $\frac{13}{3} = 4\frac{1}{3}$
Write an improper fraction and a mixed number to represent this model.

First, write an improper fraction.
Each figure is divided into __________ parts.
The denominator of the improper fraction is __________.
There are __________ shaded parts.
The improper fraction is __________.

Now write the mixed number.
How many figures are completely shaded? __________
The whole number part of the mixed number is __________.
The second figure has __________ parts in all and __________ shaded parts.
The fraction part of the mixed number is __________.
The mixed number is __________.

The model represents __________ or __________.
Getting the Idea

Remember to refer to the same whole, when comparing fractions.

For example,

\[
\frac{1}{2} \text{ of a square is equal to } \frac{1}{2} \text{ of the same size square.}
\]

\[
\frac{1}{2} \text{ of a square is not equal to } \frac{1}{2} \text{ of a circle.}
\]

To compare fractions with the same denominators, look at the numerators.
The greater fraction has the greater numerator.

For example, \(\frac{2}{3} > \frac{1}{3}\).

To compare fractions with the same numerator, look at the denominators.
The greater fraction has the lesser denominator.

For example, \(\frac{2}{3} > \frac{2}{5}\).

Example 1

Which symbol makes the sentence true? Write \(>, <, \text{ or } =\).

\[
\frac{1}{8} \bigcirc \frac{1}{4}
\]

Strategy  
Look at the denominators. Use fraction strips to check.

Step 1
Both fractions have the same numerator, 1.

Compare the denominators. \(8 > 4\)

Since 8 is the greater denominator, \(\frac{1}{8}\) is the lesser fraction.
Step 2 Use fraction strips to check.

The $\frac{1}{8}$ fraction strip is shorter than $\frac{1}{4}$ fraction strip.

Step 3 Use the correct symbol.

$<$ means is less than.

Solution $\frac{1}{8} < \frac{1}{4}$

You can use number lines to help, when comparing fractions. The fraction farther to the right is the greater fraction.

Example 2

Which symbol makes the sentence true? Write $>$, $<$, or $=$.

$\frac{2}{3} \bigcirc \frac{7}{12}$

Strategy Use number lines.

Step 1 Draw two number lines from 0 to 1.

Make one number line in thirds. Find $\frac{2}{3}$.

Make another number line in twelfths. Find $\frac{7}{12}$.

Step 2 Compare the fractions.

$\frac{2}{3}$ is farther to the right than $\frac{7}{12}$.

So, $\frac{2}{3}$ is the greater fraction.

Solution $\frac{2}{3} \bigcirc \frac{7}{12}$
For Example 2, you can also use a common denominator to compare \( \frac{2}{3} \) and \( \frac{7}{12} \). A **common denominator** is a common multiple of the denominators.

The **least common multiple (LCM)** of 3 and 12 is 12.

Change \( \frac{2}{3} \) to an equivalent fraction with 12 as the denominator.

\[
\frac{2}{3} = \frac{2 \times 4}{3 \times 4} = \frac{8}{12}
\]

Now compare the numerators.

Since 8 is greater, \( \frac{8}{12} \). So, \( \frac{2}{3} > \frac{7}{12} \).

**Example 3**

Shari and Billy each bought the same candy bar. Shari ate \( \frac{2}{5} \) of her candy bar. Billy ate \( \frac{1}{2} \) of his candy bar. Who ate more of their candy bar?

**Strategy**

**Use a common denominator.**

**Step 1** Find a common denominator for \( \frac{2}{5} \) and \( \frac{1}{2} \).

The LCM of 5 and 2 is 10.

**Step 2** Change \( \frac{2}{5} \) and \( \frac{1}{2} \) to equivalent fractions with 10 as the denominator.

\[
\frac{2}{5} = \frac{2 \times 2}{5 \times 2} = \frac{4}{10} \quad \frac{1}{2} = \frac{1 \times 5}{2 \times 5} = \frac{5}{10}
\]

**Step 3** Compare the numerators.

Since 4 is the lesser numerator, \( \frac{4}{10} < \frac{5}{10} \). So \( \frac{2}{5} < \frac{1}{2} \).

**Step 4** Use models to check.

**Solution** Billy ate more of his candy bar.
You can also use common numerators to compare fractions.

A common numerator is a common multiple of the numerators.

**Example 4**

Lilly needs $\frac{3}{8}$ cup of milk and $\frac{1}{3}$ cup of heavy cream to make pancakes. Does she need more milk or more heavy cream to make the pancakes?

**Strategy**  Use a common numerator.

**Step 1** Find a common numerator for $\frac{3}{8}$ and $\frac{1}{3}$.

The LCM of 3 and 1 is 3.

**Step 2** Change $\frac{1}{3}$ to an equivalent fraction with 3 as the numerator.

$$\frac{1}{3} = \frac{1 \times 3}{3 \times 3} = \frac{3}{9}$$

$\frac{3}{8}$ already has a 3 as the numerator.

**Step 3** Compare the denominators.

The fraction with the lesser denominator is the greater fraction.

Since 8 is the lesser denominator, $\frac{3}{8} > \frac{3}{9}$.

So $\frac{3}{8} > \frac{1}{3}$.

**Step 4** Use models to check.

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</table>

| 1/3 |       | 1/3 |

**Solution** Lilly needs more milk to make the pancakes.
Fractions can be compared using benchmarks. A benchmark is a common number that can be compared to another number. Three benchmarks are 0, \( \frac{1}{2} \), and 1. You can think of a number line when using a benchmark.

Example 5
What symbol makes this sentence true? Write >, <, or =.

\( \frac{4}{10} \bigcirc \frac{5}{6} \)

Strategy Use \( \frac{1}{2} \) as a benchmark.

**Step 1** Find \( \frac{4}{10} \) on a number line.

Compare \( \frac{4}{10} \) to \( \frac{1}{2} \).

\( \frac{4}{10} \) is less than \( \frac{1}{2} \).

**Step 2** Find \( \frac{5}{6} \) on a number line.

Compare \( \frac{5}{6} \) to \( \frac{1}{2} \).

\( \frac{5}{6} \) is greater than \( \frac{1}{2} \).

**Step 3** Compare \( \frac{5}{6} \) to \( \frac{4}{10} \).

Since \( \frac{4}{10} \) is less than \( \frac{1}{2} \) and \( \frac{5}{6} \) is greater than \( \frac{1}{2} \),

\( \frac{4}{10} \) is less than \( \frac{5}{6} \).

**Solution** \( \frac{4}{10} \bigcirc \frac{5}{6} \)
Coached Example

What symbol makes this sentence true?
Use benchmarks 0, \( \frac{1}{2} \), and 1 to compare.

Write \( > \), \( < \), or \( = \).

\[
\frac{4}{5} \bigcirc \frac{1}{6}
\]

Find \( \frac{4}{5} \) on a number line.

\[
\begin{array}{c}
0 \ \ | \ \ | \ \ | \ \ | \ \ | \ \ | \ 1
\end{array}
\]

Compare to 0, \( \frac{1}{2} \), and 1 on a number line.
\( \frac{4}{5} \) is closest to the benchmark _____.

Find \( \frac{1}{6} \) on a number line.

\[
\begin{array}{c}
0 \ \ | \ \ | \ \ | \ \ | \ \ | \ \ | \ 1
\end{array}
\]

Compare to 0, \( \frac{1}{2} \), and 1 on the number line.
\( \frac{1}{6} \) is closest to the benchmark _____.

Since \( \frac{4}{5} \) is closest to the benchmark _____, and \( \frac{1}{6} \) is closest to the benchmark _____, \( \frac{4}{5} \) is ______________ than \( \frac{1}{6} \).

\[
\frac{4}{5} \bigcirc \frac{1}{6}
\]
You can show a fraction as the sum of smaller fractions including unit fractions.

A **unit fraction** is a fraction that has a numerator of 1.

\[
\frac{3}{4} = \frac{1}{4} + \frac{1}{4} + \frac{1}{4}
\]

**Example 1**

Show \(\frac{3}{10}\) as \(\frac{1}{10} + \_\_\_\_\_\_\_\_\_\_\_.\)

**Strategy** Break the fraction into unit fractions.

**Step 1** Show the fraction as unit fractions.

\[
\frac{3}{10} = \frac{1}{10} + \frac{1}{10} + \frac{1}{10}
\]

**Step 2** Group the unit fractions.

\[
\frac{3}{10} = \frac{1}{10} + \left(\frac{1}{10} + \frac{1}{10}\right)
\]

**Solution** \(\frac{3}{10} = \frac{1}{10} + \frac{2}{10}\)
You can add fractions that have the same denominators, which are called **like denominators**. If fractions have like denominators, add the numerators. The denominator stays the same. If the sum is an improper fraction, rewrite it as a mixed number.

**Example 2**

Allison bought a pizza divided into 10 equal slices. Allison’s friends ate \( \frac{7}{10} \) of the pizza and she ate \( \frac{2}{10} \) of the pizza. What fraction of the pizza was eaten in all?

**Strategy**  
Use fraction strips to model the problem.

**Step 1**  
Write an addition sentence for the problem.  
Let \( p \) represent the total pizza eaten.  
\[ \frac{7}{10} + \frac{2}{10} = p \]

**Step 2**  
Show \( \frac{7}{10} \) with fraction pieces.

- 

**Step 3**  
Add on \( \frac{2}{10} \) with fraction pieces.

- 

**Step 4**  
Count the numbers of \( \frac{1}{10} \) fraction pieces.  
There are nine \( \frac{1}{10} \) fraction pieces in all.

**Step 5**  
Write the sum.  
\[ \frac{7}{10} + \frac{2}{10} = \frac{9}{10} \]

**Solution**  
Allison and her friends ate \( \frac{9}{10} \) of the pizza in all.
Example 3
Add.
\[ \frac{4}{6} + \frac{1}{6} = \square \]

**Strategy**  Add like fractions.

**Step 1**  Do the fractions have a like denominator?
Yes, both fractions have a denominator of 6.

**Step 2**  Add the numerators.
\[ 4 + 1 = 5 \]

**Step 3**  The denominator stays the same.
\[ \frac{4}{6} + \frac{1}{6} = \frac{5}{6} \]

**Step 4**  Use area models to check the sum.

Solution \[ \frac{4}{6} + \frac{1}{6} = \frac{5}{6} \]
You can write a sum in simplest form.

**Example 4**
Find the sum.
\[ \frac{5}{8} + \frac{7}{8} = \square \]

**Strategy**  
**Add the numerators.**

**Step 1**  
Add the numerators. The denominator stays the same.
\[ \frac{5}{8} + \frac{7}{8} = \frac{5 + 7}{8} = \frac{12}{8} \]

**Step 2**  
Write the sum as a mixed number.
\[ \frac{12}{8} = \frac{8}{8} + \frac{4}{8} \]
\[ \frac{8}{8} = 1 \]
So, \( \frac{12}{8} = 1\frac{4}{8} \)

**Step 3**  
Write the fraction part in simplest form.
\[ \frac{4}{8} \div \frac{4}{4} = \frac{1}{2} \]
So, \( 1\frac{4}{8} = 1\frac{1}{2} \)

**Solution**  
\[ \frac{5}{8} + \frac{7}{8} = 1\frac{1}{2} \]
Coached Example

Sam walked $\frac{1}{12}$ mile to Toni’s house. Then Toni and Sam walked $\frac{4}{12}$ mile to school. How far did Sam walk in all?

Write the addition sentence for the problem.
Sam walked ________ mile to Toni’s house.
Then Sam walked ________ mile to school.
Let $m$ represent the total miles Sam walked.

\[ \text{_______} + \text{_______} = \text{_______} \]

Find the sum.
Do the fractions have a like denominator?

____________________, both fractions have a denominator of ________.

Add the numerators.

\[ 1 + 4 = \text{_______} \]

The denominator stays the same.

\[ \frac{1}{12} + \frac{4}{12} = \text{_______} \]

Sam walked ________ mile in all.
When you subtract fractions with like denominators, subtract only the numerators. The denominator stays the same.

Example 1
Subtract.
\[
\frac{7}{8} - \frac{5}{8} = \square
\]

**Strategy** Use fraction strips to model the problem.

**Step 1** Show \(\frac{7}{8}\) with fraction pieces.

**Step 2** Subtract or cross out \(\frac{5}{8}\).

**Step 3** Count the number of \(\frac{1}{8}\) fraction pieces left.

There are two \(\frac{1}{8}\) pieces left. The numerator is 2.

**Step 4** The denominator is the same.

The denominator is 8.

**Solution** \(\frac{7}{8} - \frac{5}{8} = \frac{2}{8}\)
Sometimes the answer may not be in simplest form. Remember to simplify the fraction using the greatest common factor (GCF).

For example, for the fraction \( \frac{3}{12} \), 3 is the greatest common factor of 3 and 12.

\[
\frac{3}{12} = \frac{3 \div 3}{12 \div 3} = \frac{1}{4}
\]

**Example 2**

Rachel used \( \frac{5}{8} \) can of blue paint. She also used \( \frac{3}{8} \) can of yellow paint.

How much more blue paint than yellow paint did Rachel use?

**Strategy**  Subtract the numerators. Keep the same denominator.

**Step 1**  Write the subtraction sentence for the problem.

She used \( \frac{5}{8} \) can of blue paint.

She used \( \frac{3}{8} \) can of yellow paint.

Let \( b \) represent how much more blue paint she used.

\[
\frac{5}{8} - \frac{3}{8} = b
\]

**Step 2**  The denominators are the same, so subtract the numerators.

\[
\frac{5}{8} - \frac{3}{8} = \frac{5 - 3}{8} = \frac{2}{8}
\]

**Step 3**  Use fraction strips to check.

**Step 4**  Simplify the fraction \( \frac{2}{8} \).

2 is the GCF of 2 and 8.

\[
\frac{2}{8} = \frac{2 \div 2}{8 \div 2} = \frac{1}{4}
\]

**Solution**  Rachel used \( \frac{2}{8} \) or \( \frac{1}{4} \) can more blue paint than yellow paint.
Example 3
Tim had \( \frac{10}{12} \) roll of green streamer for a bulletin board. He used \( \frac{7}{12} \) roll for the border. What fraction of the roll of green streamer does Tim have left?

**Strategy**  Subtract the numerators. Keep the same denominator.

**Step 1**  Write the subtraction sentence for the problem.

He had \( \frac{10}{12} \) roll of streamer.

He used \( \frac{7}{12} \) roll of streamer.

Let \( s \) represent how much is left over.

\[
\frac{10}{12} - \frac{7}{12} = s
\]

**Step 2**  The denominators are the same, so subtract the numerators.

\[
\frac{10}{12} - \frac{7}{12} = \frac{10 - 7}{12} = \frac{3}{12}
\]

**Step 3**  Simplify the fraction \( \frac{3}{12} \).

3 is the GCF of 3 and 12.

\[
\frac{3}{12} = \frac{3 \div 3}{12 \div 3} = \frac{1}{4}
\]

**Solution**  Tim has \( \frac{3}{12} \) or \( \frac{1}{4} \) roll of green streamer left.

Remember, you can check the answer to a subtraction problem using addition.

\[
\frac{3}{12} + \frac{7}{12} = \frac{10}{12}
\]

The sum is \( \frac{10}{12} \), which matches the minuend. So, the answer is correct.
Coached Example

Alexandra wants to jog \( \frac{7}{10} \) mile. After jogging \( \frac{3}{10} \) mile, her shoelaces become untied and she stops to retie them. How much more does Alexandra need to jog to finish her run?

Write the subtraction sentence for the problem.

The words “how much more” tell you to ________________.

Alexandra wants to jog ________ mile.

She ties her shoelaces after ________ mile.

Let \( m \) represent how much more she needs to jog to finish her run.

\[ m \]  \( \frac{7}{10} \) \[ \frac{3}{10} \] = ________

Find the difference.

Do the fractions have a like denominator?

\[ \frac{7}{10} \] \[ \frac{3}{10} \] , both fractions have a denominator of ________.

Subtract the numerators.

\[ 7 - 3 = \] ________

The denominator stays the same.

\[ \frac{7}{10} - \frac{3}{10} = \] ________

Simplify the fraction. __________________________

Alexandra has ________mile more to jog to finish her run.
Add and Subtract Mixed Numbers

Getting the Idea

You can show a mixed number as a sum of smaller numbers.

\[
2 \frac{1}{4} = 1 + \frac{1}{4} + 1 + \frac{1}{4}
\]

\[
2 \frac{1}{4} = \frac{4}{4} + \frac{4}{4} + \frac{1}{4}
\]

Example 1

Show the mixed number \(1\frac{2}{5}\) as a sum of fractions.

Make a model to show the equation.

**Strategy**

Break the mixed number into whole numbers and fractions.

**Step 1**

Show the mixed number as whole numbers and fractions.

\[
1\frac{2}{5} = 1 + \frac{2}{5}
\]

**Step 2**

Show the 1 whole as a fraction with 5 as a denominator.

\[
1 = \frac{5}{5}
\]

\[
1\frac{2}{5} = \frac{5}{5} + \frac{2}{5}
\]

**Step 3**

Make a model.

Draw rectangles. Show each rectangle in fifths.

\[
1\frac{2}{5} = \frac{5}{5} + \frac{2}{5}
\]

Solution

\[
1\frac{2}{5} = \frac{5}{5} + \frac{2}{5}
\]
Remember that a unit fraction has a 1 in the numerator.

In Example 1, you could also use all unit fractions.

\[
1 \frac{2}{5} = \frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5}
\]

When you add mixed numbers, first add the fraction parts, then add the whole number parts.

**Example 2**

Add.

\[
1 \frac{1}{4} + 2 \frac{1}{4} = \quad \square
\]

**Strategy** Add the fractions. Then add the whole numbers.

**Step 1** Rewrite the problem.

Line up the whole numbers and fractions.

\[
\begin{array}{c}
1 \frac{1}{4} \\
+ 2 \frac{1}{4} \\
\hline
\end{array}
\]

**Step 2** Add the fraction parts: \( \frac{1}{4} + \frac{1}{4} \).

\[
\begin{array}{c}
1 \frac{1}{4} \\
+ 2 \frac{1}{4} \\
\hline
\frac{2}{4}
\end{array}
\]

**Step 3** Add the whole number parts: 1 + 2.

\[
\begin{array}{c}
1 \frac{1}{4} \\
+ 2 \frac{1}{4} \\
\hline
3 \frac{2}{4}
\end{array}
\]

**Step 4** Simplify the fraction part.

\[
\frac{2}{4} = \frac{2 \div 2}{4 \div 2} = \frac{1}{2}
\]

So, \( 3 \frac{2}{4} = 3 \frac{1}{2} \).

**Solution**

\[
1 \frac{1}{4} + 2 \frac{1}{4} = 3 \frac{1}{2}
\]
Another way to add mixed numbers is to write each mixed number as an equivalent improper fraction. Then add the improper fractions. Show the answer as a mixed number.

**Example 3**

Kelsey drank $1\frac{2}{3}$ cups of water in the morning and $2\frac{2}{3}$ cups of water in the afternoon.

**Morning Water**

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**Afternoon Water**

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How much water did Kelsey drink in all?

**Strategy**  Write each mixed number as an improper fraction. Then add.

**Step 1**  Write a number sentence for the problem.

Let $w$ represent the amount of water Kelsey drank in all.

$$1\frac{2}{3} + 2\frac{2}{3} = w$$

**Step 2**  Write $1\frac{2}{3}$ as an equivalent improper fraction.

$$1\frac{2}{3} = 1 + \frac{2}{3}$$

$$1 = \frac{3}{3}, \text{ because } \frac{1}{3} + \frac{1}{3} + \frac{1}{3} = \frac{3}{3}.$$  $$1\frac{2}{3} = \frac{3}{3} + \frac{2}{3} = \frac{5}{3}$$

**Step 3**  Write $2\frac{2}{3}$ as an equivalent improper fraction.

$$2\frac{2}{3} = 2 + \frac{2}{3}$$

$$2 = \frac{6}{3}, \text{ because } \frac{3}{3} + \frac{3}{3} = \frac{6}{3}.$$  $$2\frac{2}{3} = \frac{6}{3} + \frac{2}{3} = \frac{8}{3}$$

**Step 4**  Add the improper fractions.

$$\frac{5}{3} + \frac{8}{3} = \frac{13}{3}$$

**Step 5**  Change the sum to a mixed number.

Divide the numerator by the denominator.

$$13 \div 3 = 4 \text{ R}1$$

So, $\frac{13}{3} = 4\frac{1}{3}$.

**Solution**  Kelsey drank $4\frac{1}{3}$ cups of water in all.
When you subtract mixed numbers, first subtract the fraction parts, then subtract the whole number parts.

**Example 4**

Subtract.

\[ 3 \frac{5}{8} - 1 \frac{3}{8} = \]

**Strategy** Subtract the fractions. Then subtract the whole numbers.

**Step 1** Rewrite the problem. Line up the whole numbers and the fractions.

\[
\begin{align*}
3 \frac{5}{8} & - 1 \frac{3}{8} \\
\end{align*}
\]

**Step 2** Subtract the fraction parts: \( \frac{5}{8} - \frac{3}{8} \).

\[
\begin{align*}
\frac{5}{8} & - \frac{3}{8} \\
\end{align*}
\]

**Step 3** Subtract the whole number parts: \( 3 - 1 \).

\[
\begin{align*}
3 & - 1 \\
\end{align*}
\]

**Step 4** Simplify the fraction part.

\[
\frac{2}{8} = \frac{2}{8} \div 2 = \frac{1}{4}
\]

So, \( 2\frac{2}{8} = 2\frac{1}{4} \).

**Solution** \( 3 \frac{5}{8} - 1 \frac{3}{8} = 2\frac{1}{4} \)
You can use the relationship between addition and subtraction to find a missing number.

**Example 5**

What mixed number goes in the box to make the sentence true?

\[ \square - 2\frac{1}{3} = 3\frac{1}{3} \]

**Strategy** Use the relationship between addition and subtraction.

**Step 1** Addition and subtraction are inverse operations.

To find \( \square \), add \( 2\frac{1}{3} + 3\frac{1}{3} \).

**Step 2** Add \( 2\frac{1}{3} \) and \( 3\frac{1}{3} \).

Add the fraction parts.

Then add the whole number parts.

\[
\begin{align*}
2\frac{1}{3} \\
+ \ 3\frac{1}{3} \\
\hline
5\frac{2}{3}
\end{align*}
\]

**Step 3** Subtract to check your answer.

\[
\begin{align*}
5\frac{2}{3} \\
- \ 2\frac{1}{3} \\
\hline
3\frac{1}{3}
\end{align*}
\]

**Solution** \( 5\frac{2}{3} - 2\frac{1}{3} = 3\frac{1}{3} \)
Coached Example

Mr. Lee bought a 4\(\frac{1}{4}\)-feet-long wooden board. He wants to cut a piece that is 2\(\frac{3}{4}\) feet from the board. How long will the board be that Mr. Lee has left?

Write a number sentence for the problem.
The board is __________ feet long.
He will cut a __________ feet piece.
Let \(b\) represent the length of board left.

\[- \quad \frac{\text{a}}{\text{b}} = \text{c}\]

Write 4\(\frac{1}{4}\) as an equivalent improper fraction.
Write the whole number part as a fraction with a denominator of 4.
\[4 = \frac{4}{4} + \frac{\text{a}}{\text{b}} + \frac{\text{c}}{\text{d}} + \frac{\text{e}}{\text{f}}\]
Add the fractions.
\[4\frac{1}{4} = \frac{4}{4} + \frac{4}{4} + \frac{4}{4} + \frac{1}{4} = \text{g}\]
So, 4\(\frac{1}{4}\) = ________.

Write 2\(\frac{3}{4}\) as an equivalent improper fraction.
Write the whole number part as a fraction with a denominator of 4.
\[2 = \frac{\text{a}}{\text{b}} + \frac{\text{c}}{\text{d}}\]
Add the fractions.
\[2\frac{3}{4} = \frac{\text{a}}{\text{b}} + \frac{\text{c}}{\text{d}} + \frac{\text{e}}{\text{f}} = \text{g}\]
So, 2\(\frac{3}{4}\) = ________.

Subtract the improper fractions.
\[- \quad \frac{\text{a}}{\text{b}} - \frac{\text{c}}{\text{d}} = \text{g}\]
Change the improper fraction to mixed number.
Divide the numerator by the denominator.
\[\frac{\text{a}}{\text{b}} \div \frac{\text{c}}{\text{d}} = \text{g}\]
The mixed number is ________.
Simplify the fraction part of the mixed number. 

Mr. Lee has ________ feet of the board left.
Multiply Fractions with Whole Numbers

Getting the Idea

You can use models to help you multiply a fraction by a whole number.

Example 1
Multiply.
\[ 4 \times \frac{1}{2} = \square \]

Strategy Use models.

Step 1 Show 4 groups of \( \frac{1}{2} \).

\[
\begin{array}{cccc}
\frac{1}{2} & \frac{1}{2} & \frac{1}{2} & \frac{1}{2} \\
\end{array}
= \begin{array}{c}
\frac{4}{2} = 2
\end{array}
\]

Step 2 Find the product.

There are 4 halves, or 2 wholes, in all.

Solution \[ 4 \times \frac{1}{2} = \frac{4}{2} = 2 \]

Multiplication is the same as repeated addition. You can use repeated addition to multiply a fraction by a whole number.

For example, to multiply \( 5 \times \frac{1}{4} \), add \( \frac{1}{4} \) five times.

\[
\begin{array}{cccc}
\frac{1}{4} & \frac{1}{4} & \frac{1}{4} & \frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} \\
\end{array}
= \begin{array}{c}
\frac{5}{4}
\end{array}
\]

So, \( 5 \times \frac{1}{4} = \frac{5}{4} \).

Since \( \frac{5}{4} \) is the product of 5 and \( \frac{1}{4} \), \( \frac{5}{4} \) is a multiple of \( \frac{1}{4} \).
Example 2

Multiply.

\[ 3 \times \frac{2}{3} = \square \]

**Strategy**  Use repeated addition.

**Step 1**  Write the multiplication as repeated addition.

\[ 3 \times \frac{2}{3} = \frac{2}{3} + \frac{2}{3} + \frac{2}{3} \]

**Step 2**  Add the numerators. The denominator stays the same.

\[ \frac{2}{3} + \frac{2}{3} + \frac{2}{3} = \frac{2 + 2 + 2}{3} = \frac{6}{3} \]

**Step 3**  Simplify.

\[ \frac{6}{3} = 2 \]

**Step 4**  Use models to check.

Show 3 groups of \( \frac{2}{3} \).

\[
\begin{array}{ccccccc}
\frac{2}{3} & & & & & & \\
\frac{1}{3} & \frac{1}{3} & \frac{1}{3} & \frac{1}{3} & \frac{1}{3} & \frac{1}{3} \\
\end{array}
\]

\[ \frac{6}{3} = 2 \]

There are 2 groups of \( \frac{3}{3} \).

\[ \frac{3}{3} + \frac{3}{3} = 1 + 1 \]

\[ 1 + 1 = 2 \]

**Solution**  \[ 3 \times \frac{2}{3} = 2 \]
In Example 2, the product is $\frac{6}{3}$ or 2. So, 2 is a multiple of $\frac{2}{3}$.

You can also show $3 \times \frac{2}{3}$ as $6 \times \frac{1}{3}$. Both give the same product.

So, 2 is also a multiple of $\frac{1}{3}$.

When you multiply a fraction and a whole number, you can rename the whole number as a fraction. Then multiply the numerators and the denominators.

**Example 3**

Carrie and Eddie each ordered $\frac{3}{4}$ pound of chocolate. How much chocolate did they order in all? Between what two whole numbers does the answer lie?

**Strategy**  
Write the whole number as a fraction. Multiply.

**Step 1**  
Write the multiplication sentence for the problem.

Each person ordered $\frac{3}{4}$ pound.

Let $t$ represent the total number of pounds of chocolate ordered.

$2 \times \frac{3}{4} = t$

**Step 2**  
Write the whole number as a fraction.

$2 = \frac{2}{1}$

**Step 3**  
Multiply the numerators and denominators.

$\frac{2}{1} \times \frac{3}{4} = \frac{2 \times 3}{1 \times 4} = \frac{6}{4}$
Step 4 Use models to check.

\[ \frac{3}{4} + \frac{3}{4} = \frac{6}{4} \]

Step 5 Change the improper fraction to a mixed number.

\[
\frac{6}{4} = \frac{4}{4} + \frac{2}{4} \\
\frac{4}{4} + \frac{2}{4} = 1 + \frac{2}{4} \\
1 + \frac{2}{4} = 1\frac{2}{4}
\]

Step 6 Simplify the mixed number.

\[
\frac{2}{4} = \frac{2 \div 2}{4 \div 2} = \frac{1}{2} \\
\text{So } 1\frac{2}{4} = 1\frac{1}{2}.
\]

Step 7 Use a number line to find the two whole numbers the sum lies between.

Put a point at $1\frac{1}{2}$.

The sum is between 1 and 2.

Solution They ordered $1\frac{1}{2}$ pounds of chocolate in all.
The answer lies between 1 and 2.
Multiply.

\[ 4 \times \frac{3}{5} = \square \]

Write the multiplication as repeated addition.

\[ 4 \times \frac{3}{5} = \square + \square + \square + \square \]

Look at the denominators.

Are the denominators the same? _________

Add the numerators.

\[ \square + \square + \square + \square = \square \]

Write the sum over the denominator. _________

Change the sum to a mixed number.

Divide the numerator by the denominator.

\[ \frac{12}{5} = \square \]

Make a model of the problem to check your answer.
Decimals

Getting the Idea

A decimal can name part of a whole or part of a group. A decimal can have a whole number part and a decimal part that are separated by a decimal point (.)

Each grid below represents 1 whole. The decimal shows the shaded part of the whole.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

1.00 one
0.1 one tenth
0.01 one hundredth

Place values in decimals follow the same base-ten system as whole numbers. Each place has 10 times the value of the place to its right.

- 1 tenth = 10 hundredths
- 1 one = 10 tenths

When you put a 0 to the right of the last digit of a decimal, it does not change the value of the decimal.

For example, 0.1 = 0.10 and 0.5 = 0.50.

You can use a place-value chart to show the value of each digit in a decimal. The decimal 2.35 has 2 ones, 3 tenths, and 5 hundredths, or 2 ones and 35 hundredths.

<table>
<thead>
<tr>
<th>Ones</th>
<th></th>
<th>Tenths</th>
<th>Hundredths</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>.</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>
Example 1
What decimal names the shaded part of the grid?

Strategy  The entire grid equals 1 whole. Find the decimal for each part.

Step 1  Find the decimal that represents each part of the grid.
There are 10 parts in the grid.
Each part is 0.1 or one tenth.

Step 2  Count the number of shaded parts.
There are 6 shaded parts.
So, six tenths, or 0.6, of the grid is shaded.

Solution  The decimal 0.6 names the shaded part of the grid.

To read or write the word name of a decimal less than 1, read the number to the right of the decimal point as you would read a whole number. Then read the least place value.

0.4 is read as four tenths.
0.23 is read as twenty-three hundredths.

To read or write the word name of a decimal greater than 1, read the whole number, use the word and for the decimal point, and then read the decimal part.

3.6 is read as three and six tenths.
1.27 is read as one and twenty-seven hundredths.
Example 2
What decimal names the shaded part of the grid?

Strategy The entire grid equals 1 whole. Find the decimal for each part.

Step 1 Find the decimal that represents each part of the grid.
There are 100 parts in the grid.
Each part is 0.01 or one hundredth.

Step 2 Count the number of shaded parts.
There are 57 shaded parts.

Step 3 Write the decimal in a place-value chart.

<table>
<thead>
<tr>
<th>Ones</th>
<th>.</th>
<th>Tenths</th>
<th>Hundredths</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>.</td>
<td>5</td>
<td>7</td>
</tr>
</tbody>
</table>

Solution The decimal 0.57, or fifty-seven hundredths, names the shaded part of the grid.
Example 3
What decimal do the models show? What is the word name for the decimal?

Strategy Use a place-value chart.

Step 1 Find the decimal represented by the models.
There is 1 whole grid shaded.
The other grid has 24 out of 100 parts shaded.
So, 0.24 of the other grid is shaded.

Step 2 Write the decimal in a place-value chart.

<table>
<thead>
<tr>
<th>Ones</th>
<th>.</th>
<th>Tenths</th>
<th>Hundredths</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

Step 3 Write the part to the left of the decimal point in words.
The whole number part is one.
The decimal point is and.

Step 4 Write the part to the right of the decimal point in words.
The decimal part is twenty-four.
The least place value is hundredths.

Solution The models show the decimal 1.24.
The word name is one and twenty-four hundredths.
You can represent decimals on a number line. Count the equal parts between marked numbers to decide what each tick mark represents.

**Example 4**

What decimal does point $H$ represent on the number line?

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Decide what each tick mark represents.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Count the equal parts between marked numbers.</td>
</tr>
<tr>
<td></td>
<td>There are 10 equal parts between 1 and 2.</td>
</tr>
<tr>
<td></td>
<td>So, each tick mark represents 0.1 or one tenth.</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Count the spaces from 1 to point $H$.</td>
</tr>
<tr>
<td></td>
<td>Point $H$ is at the fourth mark after 1.</td>
</tr>
<tr>
<td></td>
<td>Since each mark represents 0.1, point $H$ is at 1.4.</td>
</tr>
</tbody>
</table>

**Solution** Point $H$ represents 1.4.

**Example 5**

What decimal does point $J$ represent on the number line?

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Decide what each tick mark represents.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Count the equal parts between marked numbers.</td>
</tr>
<tr>
<td></td>
<td>There are 10 equal parts between 2.10 and 2.20.</td>
</tr>
<tr>
<td></td>
<td>So, each tick mark represents 0.01 or one hundredth.</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Count the spaces from 2.10 to point $J$.</td>
</tr>
<tr>
<td></td>
<td>Point $J$ is at the sixth mark after 2.10.</td>
</tr>
<tr>
<td></td>
<td>Since each mark represents 0.01, point $J$ is at 2.16.</td>
</tr>
</tbody>
</table>

**Solution** Point $J$ represents 2.16.
Lesson 25: Decimals

**Coached Example**

What decimal do the models show? What is the word name for the decimal?

There are ________ whole grids shaded.

The other grid has ________ out of ________ parts shaded.

So, ________ of the other grid is shaded.

Write the decimal in a place-value chart.

<table>
<thead>
<tr>
<th>Ones</th>
<th>.</th>
<th>Tenths</th>
<th>Hundredths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Write the part to the left of the decimal point in words.

The whole number part is ____________.

The decimal point is ____________.

Write the part to the right of the decimal point in words.

The decimal part is ____________.

The least place value is ____________.

The models show the decimal ____________.

The word name is ____________________________________________________.
Decimals and fractions are related. Both can name part of a whole. A decimal in tenths can be written as a fraction with a denominator of 10. A decimal in hundredths can be written as a fraction with a denominator of 100.

Each grid below represents 1 whole. The decimal and fraction both name the shaded part of each grid.

\[
\begin{align*}
3 \text{ shaded parts out of 10 equal parts} & \quad 0.3 = \text{three tenths} = \frac{3}{10} \\
3 \text{ shaded parts out of 100 equal parts} & \quad 0.03 = \text{three hundredths} = \frac{3}{100}
\end{align*}
\]

**Example 1**
What fraction is equal to 0.8?

**Strategy** Use the place value of the decimal.

**Step 1** Find the place value of the decimal.
   - The decimal shows 8 tenths.

**Step 2** Write the fraction.
   - The denominator is 10. The numerator is 8.
   \[
   \frac{8}{10}
   \]

**Solution** \[0.8 = \frac{8}{10}\]
Example 2
What fraction is equal to 0.07?

Strategy  Use the place value of the decimal.

Step 1  Find the place value of the decimal.
The decimal shows 7 hundredths.

Step 2  Write the fraction.
The denominator is 100. The numerator is 7.
\[
\frac{7}{100}
\]

Solution  \(0.07 = \frac{7}{100}\)

You can express a fraction with a denominator of 10 as an equivalent fraction with a denominator of 100. Multiply the numerator and denominator by 10.

Example 3
What decimal is equivalent to the sum of \(\frac{5}{10}\) + \(\frac{3}{100}\)?

Strategy  Rename the fraction and add.

Step 1  Rename \(\frac{5}{10}\) so that it has 100 as a denominator.
\[
\frac{5}{10} \times \frac{10}{10} = \frac{50}{100}
\]
\[
\frac{5}{10} = \frac{50}{100}
\]

Step 2  Add the fractions.
\[
\frac{50}{100} + \frac{3}{100} = \frac{53}{100}
\]

Step 3  Rename the sum as a decimal.
\[
\frac{53}{100} = 0.53
\]

Solution  \(\frac{5}{10} + \frac{3}{100} = 0.53\)
Example 4

The shaded part of the grid shows 0.79.

What fraction is equal to that decimal? Write the fraction as an equation.

**Strategy** Break the shaded part into tenths and hundredths.

**Step 1** Show the decimal in tenths and hundredths.

```
70 hundredths = 7 tenths
9 hundredths
```

```
0.79 = 79 hundredths = 7 tenths 9 hundredths
```

**Step 2** Show the parts as fractions.

- 7 tenths $= \frac{7}{10}$
- 9 hundredths $= \frac{9}{100}$

$\text{So, } 79 \text{ hundredths } = \frac{7}{10} + \frac{9}{100}$

**Step 3** Show $\frac{7}{10}$ as an equivalent fraction with a denominator of 100.

$\frac{7}{10} = \frac{7 \times 10}{10 \times 10} = \frac{70}{100}$

**Step 4** Write the decimal as a sum of two fractions.

$0.79 = \frac{79}{100}$

$\frac{79}{100} = \frac{70}{100} + \frac{9}{100}$

**Solution** The fraction $\frac{79}{100}$ is equal to 0.79.

$\frac{79}{100} = \frac{70}{100} + \frac{9}{100}$
The shaded part of the grid shows 0.56.

What fraction is equal to that decimal? Write the fraction as an equation.

Show the decimal in tenths and hundredths.

0.56 = _________ hundredths = _________ tenths _________ hundredths

Show the parts as fractions.

5 tenths = _________
6 hundredths = _________
So, 56 hundredths = _________ + _________.

Show \( \frac{5}{10} \) as an equivalent fraction with a denominator of 100.

\( \frac{5}{10} = \) _________

Write the decimal as a sum of two fractions.

0.56 = 56 hundredths = _________

\( \frac{56}{100} = \) _________ + _________

The fraction _________ is equal 0.56.

\( \frac{56}{100} = \frac{56}{100} + \frac{56}{100} \)
Compare and Order Decimals

Getting the Idea

Compare decimals as you would whole numbers. Refer to the same whole when comparing decimals.

Use the same symbols to compare decimals.

Example 1

What symbol makes this sentence true? Write $>$, $<$, or $=$.

$0.62$ $0.57$

Strategy  Make a model for each decimal.

Step 1  Use 10-by-10 grids. Shade the squares to show each decimal.

Each grid represents 1 whole.

$0.62 = 62$ hundredths

$0.57 = 57$ hundredths

Step 2  Compare the shaded parts.

$0.62$ has more shaded parts.

$0.62$ is greater than $0.57$.

Step 3  Choose the correct symbol.

$>$ means is greater than.

Solution  $0.62 > 0.57$
You can compare decimals with different numbers of places. Align the numbers on the decimal point. You can write an equivalent decimal by writing a 0 to the right of the last decimal place. Then start comparing the digits in the greatest place.

**Example 2**
Which symbol makes this sentence true? Write $>$, $<$, or $=$

![Place-value chart](image)

0.76 $>$ 0.7

**Strategy** Use a place-value chart.

**Step 1** Write an equivalent decimal for 0.7.

0.7 = 0.70

**Step 2** Make a place-value chart.

<table>
<thead>
<tr>
<th>Ones</th>
<th>·</th>
<th>Tenths</th>
<th>Hundredths</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>·</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>0</td>
<td>·</td>
<td>7</td>
<td>0</td>
</tr>
</tbody>
</table>

**Step 3** Compare the digits in the ones place.

0 ones = 0 ones

**Step 4** Compare the digits in the tenths place.

7 tenths = 7 tenths

**Step 5** Compare the digits in the hundredths place.

6 hundredths $>$ 4 hundredths

0.76 $>$ 0.7.

**Solution** 0.76 $>$ 0.7
When using place value to compare, line up the decimals on the decimal points. Compare the place values from left to right.

**Example 3**

List the decimals below in order from greatest to least.

- 0.81
- 1.03
- 0.88

**Strategy**  
Line up the decimals on the decimal points.

\[
\begin{align*}
0.81 \\
1.03 \\
0.88 \\
\end{align*}
\]

**Step 1**  
Compare the digits in the ones place.

\[
\begin{align*}
0.81 \\
1.03 \\
0.88 \\
\end{align*}
\]

1 > 0, so 1.03 is the greatest decimal.

**Step 2**  
Compare the digits in the tenths place.

\[
\begin{align*}
0.81 \\
0.88 \\
\end{align*}
\]

8 = 8, so compare the next place.

**Step 3**  
Compare the digits in the hundredths place.

\[
\begin{align*}
0.81 \\
0.88 \\
\end{align*}
\]

1 < 8, so 0.81 is the least decimal.

**Solution**  
From greatest to least, the order of the decimals is 1.03, 0.88, 0.81.
Lesson 27: Compare and Order Decimals

Coached Example

Order the decimals below from least to greatest.

0.40 0.52 0.48

Use place value to order the decimals.

Write the decimals in a place-value chart.

<table>
<thead>
<tr>
<th>Ones</th>
<th>·</th>
<th>Tenths</th>
<th>Hundredths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Compare the digits in the greatest place, the _________________.

______ ones = ______ ones = ______ ones

All of the digits in the greatest place are ________________.

Compare the digits in the next greatest place, the _________________.

______ tenths > ______ tenths, so _____________ is the greatest decimal.

Compare the remaining two decimals.

Compare the digits in the next greatest place, the _________________.

______ hundredths < ______ hundredths, so _____________ is the least decimal.

From least to greatest, the order of the decimals is

_____________, _____________, _____________.
Money

Getting the Idea
Money is used to buy things. Below are coins and bills that are used most often in the United States.

<table>
<thead>
<tr>
<th>Coin/Currency</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penny</td>
<td>1¢</td>
</tr>
<tr>
<td></td>
<td>$0.01</td>
</tr>
<tr>
<td>Nickel</td>
<td>5¢</td>
</tr>
<tr>
<td></td>
<td>$0.05</td>
</tr>
<tr>
<td>Dime</td>
<td>10¢</td>
</tr>
<tr>
<td></td>
<td>$0.10</td>
</tr>
<tr>
<td>Quarter</td>
<td>25¢</td>
</tr>
<tr>
<td></td>
<td>$0.25</td>
</tr>
<tr>
<td>Half Dollar</td>
<td>50¢</td>
</tr>
<tr>
<td></td>
<td>$0.50</td>
</tr>
<tr>
<td>Dollar</td>
<td>$1.00</td>
</tr>
<tr>
<td></td>
<td>$1</td>
</tr>
<tr>
<td>Five Dollars</td>
<td>$5.00</td>
</tr>
<tr>
<td></td>
<td>$5</td>
</tr>
<tr>
<td>Ten Dollars</td>
<td>$10.00</td>
</tr>
<tr>
<td></td>
<td>$10</td>
</tr>
<tr>
<td>Twenty Dollars</td>
<td>$20.00</td>
</tr>
<tr>
<td></td>
<td>$20</td>
</tr>
</tbody>
</table>

There is also a dollar coin and a $2 bill, but they are not used often.

To find the value of a group of bills and coins, count from the bill with the greatest value to the coin with the least value.

Example 1
Eda has these bills and coins.

How much money does Eda have?

Strategy  Start with the bill with the greatest value.
Step 1  Count the bills from the greatest value to least value.

$20.00  ➔  $25.00  ➔  $26.00  ➔  $27.00

Step 2  Count the coins from the greatest value to the least value.

Continue from $27.00.

$27.25  ➔  $27.50  ➔  $27.60  ➔  $27.65

Solution  Eda has $27.65.

When you buy something at a store, you may not have the exact amount of money. You often give the cashier more money than the cost of your purchase and then get back change.

One way to make change is to count up from the price of the item to the amount of money you gave to the cashier.

Example 2
DeShawn bought a book for $8.59. He gave the cashier a $10 bill. How much change should DeShawn receive from the cashier?

Strategy  Count up from the price of the book to the amount given.

Step 1  Start with the price of the book and count up to $10.

$8.59  ➔  $8.60  ➔  $8.65  ➔  $8.75  ➔  $9.00  ➔  $10.00

Step 2  Count the coins and bill to find the value of the change.

$1.00  ➔  $1.25  ➔  $1.35  ➔  $1.40  ➔  $1.41

Solution  DeShawn should receive $1.41 in change.
You can also make change by subtracting the amount of a purchase from the amount given to the cashier.

Subtracting money amounts is similar to subtracting whole numbers, except that money amounts have decimal points. Line up the decimal points and subtract as you would with whole numbers. Be sure to include the decimal point and the dollar sign in the difference.

\[
\begin{align*}
9.9 & \quad 0.1010 \\
\$ & \quad \$ \ 0.00 \\
- \quad \$ 8.59 & \\
\$ & \quad \$ 1.41
\end{align*}
\]

**Example 3**

Lana bought a sweater for $27.36. She gave the cashier $30.00. How much change should Lana receive?

**Strategy** Subtract as you would with whole numbers.

**Step 1** Write the number sentence for the problem.

Lana used $30.00 to buy a sweater that costs $27.36.
Let \(c\) represent the change Lana should receive.

\[
\begin{align*}
$30.00 & \quad 27.36 \\
\$ & \quad \$ \ 0.00 \\
\hline
\$ & \quad \$ 2.64
\end{align*}
\]

**Step 2** Set up the problem.

\[
\begin{align*}
$30.00 & \quad 27.36 \\
\hline
\$ & \quad \$ 2.64
\end{align*}
\]

Line up the decimal points.

**Step 3** Subtract from right to left. Regroup if necessary.

\[
\begin{align*}
9.9 & \quad 2.010 \\
0.010 & \quad 0.00 \\
- \quad 8.59 & \\
2.64 & \quad 2.64
\end{align*}
\]

**Solution** Lana should receive $2.64 in change.
Lesson 28: Money

Example 4
Kim has 4 library books that are all one day overdue. The library charges a late fee of $0.05 for each day a book is overdue. How much will Kim have to pay for the late fees?

Strategy  Decide which operation to use.

Step 1  Write the number sentence for the problem.
Kim has 4 books. Each book will be charged 5 cents.
Let $f$ represent the total late fees.

\[ 5 + 5 + 5 + 5 = f \text{ or } 4 \times 5 = f \]

Step 2  Multiply.

\[ 4 \times 5 = 20 \text{ cents} \]

Step 3  Write the amount.

20 cents = $0.20

Solution  Kim will have to pay $0.20 in late fees.
Marvin has $20.00. He bought 2 books that cost $6.00 each and a bookmark that cost $1.50. How much money does Marvin have left?

Decide how to solve the problem.

Find the total amount Marvin spent.

Then subtract that amount from ____________.

Marvin bought 2 books that cost ____________ each.

So, 2 books cost ____________.

Add the cost of 2 books to the cost of the bookmark.

____________ + ____________ = ____________

Marvin spent ____________ in all.

Subtract the total amount from the amount Marvin has.

____________ – ____________ = ____________

Show your work.

Marvin has $____________ left.
Elapsed time is the amount of time that has passed from a beginning time to an end time. To find the elapsed time, count the hours (hr) then the minutes (min).

Example 1
Shawna started and finished her homework at the times shown on the clocks.

How long did it take Shawna to do her homework?

Strategy Find the elapsed time.

Step 1 Read the start and finish times on the clocks.

The start time is 4:35. The finish time is 5:50.

Step 2 Count the hours.

1 hr

4:35 → 5:35

There is one hour from 4:35 to 5:35.

Step 3 Count the minutes.

15 min

5:35 → 5:50

There are 15 minutes from 5:35 to 5:50.

Step 4 Add the times.

1 hr + 15 min = 1 hr 15 min

Solution Shawna took 1 hour 15 minutes to do her homework.
The time from midnight to noon is called \textbf{A.M.}.
The time from noon to midnight is called \textbf{P.M.}

\textbf{Example 2}
Soccer practice began at 10:30 \textbf{A.M.} It lasted 2 hours 40 minutes.
At what time did soccer practice end?

\textbf{Strategy} \hspace{2em} \textbf{Add the hours and minutes.}

\textbf{Step 1} \hspace{2em} \text{Add 2 hours to 10:30 A.M.}
\begin{align*}
1 \text{ hr} & \quad 1 \text{ hr} \\
\text{10:30 A.M.} & \rightarrow \text{11:30 A.M.} & \rightarrow \text{12:30 P.M.}
\end{align*}

\textbf{Step 2} \hspace{2em} \text{Add 40 minutes to 12:30 P.M.}
\begin{align*}
30 \text{ min} & \quad 10 \text{ min} \\
\text{12:30 P.M.} & \rightarrow \text{1:00 P.M.} \rightarrow \text{1:10 P.M.}
\end{align*}

\textbf{Solution} \hspace{2em} \text{Soccer practice ended at 1:10 P.M.}

The table shows the relationships of some units of time.

<table>
<thead>
<tr>
<th>Units of Time</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 minute (min)</td>
<td>60 seconds (sec)</td>
</tr>
<tr>
<td>1 hour (hr)</td>
<td>60 minutes</td>
</tr>
<tr>
<td>1 day (d)</td>
<td>24 hours</td>
</tr>
<tr>
<td>1 week (wk)</td>
<td>7 days</td>
</tr>
<tr>
<td>1 year (yr)</td>
<td>12 months (mo)</td>
</tr>
</tbody>
</table>

When you change from a larger unit to a smaller unit, use multiplication.
Example 3
Emily slept for 8 hours last night. How many minutes did Emily sleep last night?

Strategy    Use multiplication to change from hours to minutes.

Step 1    Find the relationship between hours and minutes.
           1 hour = 60 minutes

Step 2    Multiply 8 hours by 60 minutes.
           $8 \times 60 = 480$ minutes
           So 8 hours = 480 minutes.

Solution    Emily slept for 480 minutes.

Example 4
The table shows the relationship between the number of days and the number of weeks. Complete the table.

<table>
<thead>
<tr>
<th>Week</th>
<th>Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

Strategy    Use the relationship between weeks and days.

Step 1    Find the relationship between weeks and days.
           1 week = 7 days

Step 2    Multiply 2 weeks by 7 days.
           $2 \times 7 = 14$ days
           2 weeks = 14 days

Step 3    Find the number of days in 3 to 5 weeks.
           Multiply the number of weeks by 7.
           $3 \times 7 = 21$ days
           $4 \times 7 = 28$ days
           $5 \times 7 = 35$ days
Step 4 Complete the table.

<table>
<thead>
<tr>
<th>Week</th>
<th>Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>21</td>
</tr>
<tr>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td>5</td>
<td>35</td>
</tr>
</tbody>
</table>

Solution The table is shown in Step 4.

Some word problems use fractions to show amounts of time. The table shows the relationships between hours and minutes.

<table>
<thead>
<tr>
<th>Units of Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\frac{1}{4}$ hour = 15 minutes</td>
</tr>
<tr>
<td>$\frac{1}{2}$ hour = 30 minutes</td>
</tr>
<tr>
<td>$\frac{3}{4}$ hour = 45 minutes</td>
</tr>
<tr>
<td>1 hour = 60 seconds</td>
</tr>
</tbody>
</table>

Example 5

Malia had 5 workouts. They all lasted $\frac{1}{2}$ hour. How many minutes did Malia spend doing yoga?

Strategy Rename hours to minutes.

Step 1 Rename $\frac{1}{2}$ hour to minutes.

$\frac{1}{2}$ hour = 30 minutes

Each workout lasted 30 minutes.

Step 2 Multiply the number of minutes times the number of workouts.

$5 \times 30 \text{ min} = 150 \text{ min}$

Solution Malia spent 150 minutes doing yoga.
You can show intervals of time on a number line.

**Example 6**
Use the information in Example 5.
Show the time, in hours, that Malia spent doing yoga on a number line.

**Strategy**  
Label a number line in halves.

**Step 1**  
Draw a number line. Label it in halves.
Label the units.

![Number line diagram](image)

**Step 2**  
Label the time Malia spent doing yoga.
She spent $2\frac{1}{2}$ hours doing yoga.
So label a point at $2\frac{1}{2}$ on the number line.

![Number line diagram](image)

**Solution**  
The number line is shown in Step 2.
A music video is 5 minutes long. How many seconds long is the music video?

Find the relationship between minutes and seconds.

1 minute = ___________ seconds

Which is the larger unit? _________________________

Which is the smaller unit? _________________________

When you change from a larger unit to a smaller unit, which operation do you use?

_________________________

Show your work.

There are ____________ seconds in 5 minutes.

The music video is ____________ seconds long.
Weight and Mass

Getting the Idea

**Weight** is the measure of how heavy an object is. You can measure weight using a scale or a balance. Units of weight are in the **customary system**.

You can use these benchmarks to estimate weight.

- A slice of bread weighs about 1 ounce.
- A loaf of bread weighs about 1 pound.

**Example 1**

Kenika has a cell phone in her pocket. Does her cell phone weigh about 8 pounds or about 8 ounces?

**Strategy**

Use benchmarks.

**Step 1**

Think about something that weighs about 1 pound.

A loaf of bread weighs 1 pound.

**Step 2**

Does a cell phone weigh as much as 8 loaves of bread?

No, a cell phone weighs less than 8 pounds.

**Step 3**

Think about something that weighs about 1 ounce.

A slice of bread weighs about 1 ounce.

**Step 4**

Does a cell phone weigh as much as 8 slices of bread?

Yes, a cell phone weighs about 8 ounces.

**Solution**

Kenika’s cell phone weighs about 8 ounces.
When you solve a word problem about weight, write a number sentence to represent the problem.

**Example 2**

Alex bought 2 bags of potatoes. Each bag weighs 2$\frac{1}{2}$ pounds.

How many pounds of potatoes in all did Alex buy?

**Strategy** Write a number sentence.

**Step 1** Write a number sentence to represent the problem.

He bought 2 bags of potatoes that weighed 2$\frac{1}{2}$ pounds each.

Let $p$ represent the total weight of the potatoes.

\[ 2\frac{1}{2} + 2\frac{1}{2} = p \]

**Step 2** Add the mixed numbers.

Add the fraction parts first.

Then add the whole number parts.

\[ \begin{align*}
2\frac{1}{2} + 2\frac{1}{2} &= 4\frac{2}{2} \\
&= 5
\end{align*} \]

**Step 3** Simplify the mixed number $4\frac{2}{2}$.

Simplify $\frac{2}{2} = 1$.

Add to the whole number, $4 + 1 = 5$.

**Solution** Alex bought 5 pounds of potatoes in all.
You can show a weight on a number line.

**Example 3**

Terry ordered $1\frac{1}{4}$ pounds of roast beef at the deli counter.

Show the amount of roast beef on a number line.

**Strategy**  
Label a number line in fourths.

**Step 1**  
Draw a number line from 0 to 2. Label it in fourths.

Label the units.

```
0  \frac{1}{4}  \frac{2}{4}  \frac{3}{4}  1  \frac{1}{4}  \frac{2}{4}  \frac{3}{4}  2
```

**Step 2**  
Label the amount of roast beef that Terry bought.

She bought $1\frac{1}{4}$ pounds of roast beef.

So label a point at $1\frac{1}{4}$ on the number line.

```
0  \frac{1}{4}  \frac{2}{4}  \frac{3}{4}  1  \frac{1}{4}  \frac{2}{4}  \frac{3}{4}  2
```

**Solution**  
The number line is shown in Step 2.

The table shows the relationship between pounds and ounces.

<table>
<thead>
<tr>
<th>Customary Units of Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 pound (lb) = 16 ounces (oz)</td>
</tr>
</tbody>
</table>

When you change from a larger unit to a smaller unit, use multiplication.
**Example 4**
Drew weighed 7 pounds 9 ounces when he was born.

How many ounces are in 7 pounds 9 ounces?

**Strategy** Use multiplication to change from pounds to ounces. Then add the extra ounces.

1. **Step 1** Find the relationship between pound and ounces.
   
   1 pound = 16 ounces

2. **Step 2** Multiply 7 pounds by 16 ounces.
   
   \(7 \times 16 = 112\) ounces
   
   So, 7 pounds = 112 ounces.

3. **Step 3** Add the extra ounces.
   
   \(112 + 9 = 121\) ounces

**Solution** There are 121 ounces in 7 pounds 9 ounces.

**Mass** measures the amount of matter in an object. It also measures how heavy an object is, except it is not affected by gravity. Units of mass are in the metric system.

<table>
<thead>
<tr>
<th>Metric Units of Mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 kilogram (kg) = 1,000 grams (g)</td>
</tr>
</tbody>
</table>

You can use these benchmarks to estimate mass.

- A pen cap has a mass of about 1 gram.
- A textbook has a mass of about 1 kilogram.
Example 5

The table shows the relationship between the number of kilograms and the number of grams. Complete the rest of the table.

<table>
<thead>
<tr>
<th>Kilograms</th>
<th>Grams</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1,000</td>
</tr>
<tr>
<td>2</td>
<td>2,000</td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

Strategy

Use the relationship between kilograms and grams.

Step 1
Find the relationship between kilograms and grams.

1 kilogram = 1,000 grams

Step 2
Multiply 2 kilograms by 1,000 grams.

2 \times 1,000 = 2,000 grams

So, 2 kilograms = 2,000 grams.

Step 3
Find the number of grams in 3 to 5 kilograms.

Multiply the number of kilograms by 1,000 grams.

3 \times 1,000 = 3,000 grams

4 \times 1,000 = 4,000 grams

5 \times 1,000 = 5,000 grams

Step 4
Complete the table.

<table>
<thead>
<tr>
<th>Kilograms</th>
<th>Grams</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1,000</td>
</tr>
<tr>
<td>2</td>
<td>2,000</td>
</tr>
<tr>
<td>3</td>
<td>3,000</td>
</tr>
<tr>
<td>4</td>
<td>4,000</td>
</tr>
<tr>
<td>5</td>
<td>5,000</td>
</tr>
</tbody>
</table>

Solution

The table is shown in Step 4.
Example 6
Jake caught a fish with a mass of 2 kilograms. Matthew caught a fish with a mass of 1,750 grams. Whose fish has a greater mass?

Strategy  Change 2 kilograms to grams. Then compare.

Step 1  Multiply to change 2 kilograms to grams.
        \[ 2 \times 1,000 \text{ grams} = 2,000 \text{ grams} \]

Step 2  Compare the masses.
        Jake’s fish: 2 kilograms or 2,000 grams
        Matthew’s fish: 1,750 grams
        2,000 grams > 1,750 grams

Solution  Jake’s fish has a greater mass.

Coached Example

Deanna has 3 pounds of peanuts and 45 ounces of raisins. Does she have more peanuts or raisins?

Which is the smaller unit, pounds or ounces? _________________________

Find the relationship between pound and ounces.
        1 pound = _________ ounces

Multiply to change 3 pounds to ounces.
        3 \times _________ = _________ ounces

Compare the weights.
Peanuts: 3 pounds or _________ ounces
Raisins: 45 ounces
        _________ ounces
45 ounces

Deanna has more _________________________ than _________________________.
Capacity or liquid volume measures how much liquid a container holds. You can use these benchmarks to estimate capacity.

**Customary Units of Capacity**
- 1 gallon
- 1 quart
- 1 pint
- 1 cup

**Metric Units of Capacity**
- 1 milliliter
- 1 liter
Example 1
Which is the best estimate for the amount of water a kitchen sink can hold?

5 gallons  5 pints  5 cups

Strategy  Compare an actual sink to 1 gallon.

Step 1  Think about an actual kitchen sink.
   A kitchen sink is big and can hold at least
   1 gallon.

Step 2  Pick the best choice.
   A kitchen sink can hold much more than
   5 cups and 5 pints.
   5 gallons is the most reasonable estimate.

Solution  A kitchen sink can hold about 5 gallons of water.

Example 2
Which is the best estimate for the capacity of this soda bottle?

3 milliliters  3 liters  30 liters

Strategy  Use benchmarks.

Step 1  Think about benchmarks for capacity.
   3 to 4 drops of liquid are about 1 milliliter.
   A mouthwash bottle holds about 1 liter.

Step 2  Compare a benchmark to 3 milliliters.
   The soda bottle holds much more than a few drops of liquid.

Step 3  Compare a benchmark to 3 liters.
   The soda bottle could hold the liquid in 3 mouthwash bottles.

Step 4  Compare a benchmark to 30 liters.
   The soda bottle holds much less than the liquid in
   30 mouthwash bottles.

Solution  The best estimate for the capacity of the soda bottle is 3 liters.
The table shows the relationships of the customary units of capacity.

<table>
<thead>
<tr>
<th>Customary Units of Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 pint (pt) = 2 cups (c)</td>
</tr>
<tr>
<td>1 quart (qt) = 2 pints</td>
</tr>
<tr>
<td>1 gallon (gal) = 4 quarts</td>
</tr>
</tbody>
</table>

When you change from a larger unit to a smaller unit, use multiplication or addition. When you change from a smaller unit to a larger unit, use division or subtraction.

Example 3

Jason has 8 quarts of water at home. He buys 2 gallons of water at the store. How many gallons of water does Jason have now?

**Strategy**  
Use division to change from quarts to gallons. Then add the gallons.

**Step 1**  
Find the relationship between quarts and gallons.  
4 quarts = 1 gallon

**Step 2**  
Divide 8 quarts by 4 quarts.  
8 ÷ 4 = 2 gallons  
So, Jason bought 8 quarts or 2 gallons of water at the store.

**Step 3**  
Add the gallons.  
2 + 2 = 4 gallons

**Solution**  
Jason has 4 gallons of water now.

The table shows the relationships of the metric units of capacity.

<table>
<thead>
<tr>
<th>Metric Units of Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 liter (L) = 1,000 milliliters (mL)</td>
</tr>
</tbody>
</table>
Example 4
The table shows the relationship between the number of liters and the number of milliliters. Complete the table.

<table>
<thead>
<tr>
<th>Liters</th>
<th>Milliliters</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

**Strategy**
Use the relationship between liters and milliliters.

**Step 1**
Find the relationship between liters and milliliters.
1 liter = 1,000 milliliters

**Step 2**
How many milliliters are in 2 liters?
Multiply 2 liters by 1,000 milliliters.
2 \( \times \) 1,000 = 2,000 milliliters

**Step 3**
Find the number of milliliters in 4, 6, and 8 liters.
Multiply the number of liters by 1,000 milliliters.
4 \( \times \) 1,000 = 4,000 milliliters
6 \( \times \) 1,000 = 6,000 milliliters
8 \( \times \) 1,000 = 8,000 milliliters

**Step 4**
Complete the table.

<table>
<thead>
<tr>
<th>Liters</th>
<th>Milliliters</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2,000</td>
</tr>
<tr>
<td>4</td>
<td>4,000</td>
</tr>
<tr>
<td>6</td>
<td>6,000</td>
</tr>
<tr>
<td>8</td>
<td>8,000</td>
</tr>
</tbody>
</table>

**Solution**
The table is shown in Step 4.

Example 5
Mrs. O’Brien poured 3 liters of paint into 5 canisters. She poured the same amount of paint into each canister. About how much paint, in milliliters, is in each canister?

**Strategy**
Multiply to change liters to milliliters. Then divide.
Lesson 31: Capacity

Step 1  Use multiplication to change 3 liters to milliliters.

1 liter = 1,000 milliliters

$3 \times 1,000 = 3,000$ milliliters

So 3 liters = 3,000 milliliters.

Step 2  Find the amount of paint in each canister.

There is a total of 3,000 milliliters. There are 5 canisters.

Let $c$ represent the amount of paint in each canister.

Find $3,000 \div 5 = c$.

$3,000 \div 5 = 600$ milliliters

Solution  Each canister has about 600 milliliters of paint.

Coached Example

A bottle has a capacity of 2 liters. A bucket has a capacity that is 4 times as great as the bottle. What is the capacity, in milliliters, of the bucket?

Write a number sentence for the problem.

The bottle has a capacity of _________ liters.

The bucket has a capacity that is _________ times more than the bottle.

Which operation should you use to find the capacity of the bucket? _________

Let $b$ represent the capacity of the bucket.

Find _________ $\times$ _________ = $b$

Multiply.

$\hspace{1cm} _________ \times _________ = _________$ liters

Change the capacity of the bucket in liters to milliliters.

1 liter = _________ milliliters

Multiply to change from liters to milliliters.

$\hspace{1cm} _________ \times _________ = _________$ milliliters

The capacity of the bucket is _________ milliliters.
Length

Getting the Idea

Length measures how long, wide, or tall an object is. It also measures distances. The table below shows some units of length in the customary system.

<table>
<thead>
<tr>
<th>Customary Units of Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 foot (ft) = 12 inches (in.)</td>
</tr>
<tr>
<td>1 yard (yd) = 3 feet</td>
</tr>
<tr>
<td>1 mile (mi) = 1,760 yards</td>
</tr>
</tbody>
</table>

You can use these benchmarks to estimate lengths.

- A 12-inch ruler measures 1 foot.
- A yardstick measures 1 yard.
- An adult can walk 1 mile in about 20 minutes.

Example 1

Which real object is most likely to be 150 feet long?

Strategy

Think about the length of 1 foot.

Step 1

Think about how long 150 feet will be.

The length of this book is about 1 foot.

Imagine lining up 150 books to get 150 feet.
Step 2  Review the choices.

A pair of scissors is much shorter than 150 feet.
A 4-door car is shorter than 150 feet.
A building could be 150 feet long.

Solution  The building is most likely about 150 feet.

The table below shows some units of length in the metric system.

<table>
<thead>
<tr>
<th>Metric Units of Length</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 centimeter (cm)</td>
<td>10 millimeters (mm)</td>
</tr>
<tr>
<td>1 meter (m)</td>
<td>100 centimeters</td>
</tr>
<tr>
<td>1 kilometer (km)</td>
<td>1,000 meters</td>
</tr>
</tbody>
</table>

This line measures 1 centimeter. __________

1 meter is a little shorter than 1 yard.
An adult can walk 1 kilometer in about 10 minutes.

Example 2
Which real object is most likely to be 20 milliliters long?

Strategy  Think about the length of 1 millimeter.

Step 1  Think about how long 20 millimeters will be.
1 millimeter is about the thickness of a dime.
20 millimeters will be about the height of 20 stacked dimes.

Step 2  Review the choices.
A stapler is longer than 20 millimeters.
The pushpin could be about 20 millimeters.
A calculator is about the length of a stapler, so it is longer than 20 millimeters.

Solution  The pushpin is most likely about 20 millimeters.
You can use the relationship between units to change from one unit to another. When you change a larger unit to a smaller unit, use multiplication. To change 3 feet to inches, multiply $3 \times 12$. So 3 feet = 36 inches.

**Example 3**
Mr. Conroy is 6 feet and 3 inches tall. How tall is Mr. Conroy in inches?

**Strategy**  Multiply to change feet to inches. Then add the extra inches.

**Step 1**  Find the relationship between feet and inches.

1 foot = 12 inches

**Step 2**  Multiply 6 feet by 12 inches.

$6 \times 12 = 72$ inches

**Step 3**  Add the extra inches.

$72 + 3 = 75$ inches

**Solution**  Mr. Conroy is 75 inches tall.

**Example 4**
The table shows the relationship between the number of meters and the number of centimeters. Complete the table.

<table>
<thead>
<tr>
<th>Meters</th>
<th>Centimeters</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

**Strategy**  Use the relationship between meters and centimeters.

**Step 1**  Find the relationship between meters and centimeters.

1 meter = 100 centimeters
Lesson 32: Length

Step 2
How many centimeters are in 2 meters?
Multiply 2 meters by 100 centimeters.
\[ 2 \times 100 = 200 \text{ centimeters}. \]
So 2 meters = 200 centimeters.

Step 3
Find the number of centimeters in 4, 6, and 8 meters.
\[ 4 \times 100 = 400 \text{ centimeters} \]
\[ 6 \times 100 = 600 \text{ centimeters} \]
\[ 8 \times 100 = 800 \text{ centimeters} \]

Step 4
Complete the table.

<table>
<thead>
<tr>
<th>Meters</th>
<th>Centimeters</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>200</td>
</tr>
<tr>
<td>4</td>
<td>400</td>
</tr>
<tr>
<td>6</td>
<td>600</td>
</tr>
<tr>
<td>8</td>
<td>800</td>
</tr>
</tbody>
</table>

Solution
The table is shown in Step 4.

You can use a number line to represent length.

Example 5
Troy jogged \(1\frac{2}{3}\) miles this morning.
Show the distance Troy jogged on a number line.

Strategy
Make equal parts of fractional lengths on a number line.

Step 1
Draw a number line from 0 to 2.
The denominator is 3, so draw the number line in thirds.

Step 2
Find \(1\frac{2}{3}\) on the number line. Draw a point.

Solution
The number line is shown in Step 2.
When you solve a real world problem, write a number sentence to represent the problem.

**Example 6**
A window curtain is $3\frac{3}{8}$ feet wide. What is the total width of two window curtains side by side?

**Strategy**  
Write a number sentence for the problem.

**Step 1**  
Write a number sentence.  
Each curtain is $3\frac{3}{8}$ feet wide.  
To find the total width, use addition.  
Let $w$ represent the total width of two curtains.  
Find $3\frac{3}{8} + 3\frac{3}{8} = w$.

**Step 2**  
Find the sum.  
Add the fraction parts.  
Then add the whole number parts.  
\[
\begin{align*}
3\frac{3}{8} \\
+ 3\frac{3}{8} \\
\hline
6\frac{6}{8}
\end{align*}
\]

**Step 3**  
Simplify.  
\[
\frac{6}{8} = \frac{6}{8} \div 2 = \frac{3}{4}
\]
So $6\frac{6}{8} = 6\frac{3}{4}$.

**Solution**  
The total width of two curtains is $6\frac{3}{4}$ feet.
Nicole lives 3 kilometers from the mall and 1.6 kilometers from her school. How far, in meters, does Nicole live from the mall? On the number line below, show the distance Nicole lives from her school.

\[\begin{array}{ccccc}
\vdots & \vdots & \vdots & \vdots & \vdots \\
| & | & | & | & | \\
\text{Kilometers} & & & & \\
\end{array}\]

Find how far Nicole lives from the mall.
She lives \underline{\phantom{0000} \phantom{0000}} kilometers from the mall.

To change from kilometers to meters, should you use multiplication or division?
\underline{\phantom{000} \phantom{000} \phantom{000} \phantom{000}}

1 kilometer = \underline{\phantom{000} \phantom{000}} meters

\[3 \times \underline{\phantom{000} \phantom{000}} \text{ meters} = \underline{\phantom{000} \phantom{000}} \text{ meters}\]

So \underline{3} kilometers = \underline{\phantom{000} \phantom{000}} meters.

Show the distance Nicole lives from school on the number line.
She lives \underline{\phantom{0000} \phantom{0000}} kilometers from the school.

The number line is in tenths. Label 0, 1, and 2 on the number line.

Find 1.6 on the number line. Draw a point.

Nicole lives \underline{\phantom{0000} \phantom{0000}} meters from the mall. The point on the number line above shows the distance, in kilometers, Nicole lives from school.
Perimeter

Getting the Idea

Perimeter is the measure of the distance around a figure. The perimeter is measured in customary or metric units of length, such as inches, feet, centimeters, or meters.

To find the perimeter of a figure, add the lengths of all the sides.

Example 1

What is the perimeter of this rectangle?

![Rectangle with sides 6 cm and 10 cm]

Strategy Add the lengths of the sides.

Step 1 Find all the side lengths of the rectangle.

A rectangle has 4 sides, with opposite sides having equal lengths.

The length is 10 centimeters and the width is 6 centimeters.

So, two sides are 10 cm each and two sides are 6 cm each.

Step 2 Add the lengths of the four sides.

10 cm + 10 cm + 6 cm + 6 cm = 32 cm

Solution The perimeter of the rectangle is 32 centimeters.

For Example 1, you could also use the formula for the perimeter of a rectangle.

Perimeter = (2 × length) + (2 × width)

P = (2 × 10) + (2 × 6)

P = 20 + 12

P = 32 cm
You can use a variable, such as \( l \) or \( w \), to represent the length or the width of a rectangle.

**Example 2**
The rectangle below has a perimeter of 30 inches.

![Rectangle with perimeter](image)

What is the width of the rectangle?

**Strategy**
Use the formula for the perimeter of a rectangle.

**Step 1**
Substitute the values into the formula for perimeter.
- The perimeter is 30 feet.
- The length is 8 feet.
- Use \( w \) to represent the width.

Perimeter = \((2 \times \text{length}) + (2 \times \text{width})\)
\[
30 = (2 \times 8) + (2 \times w)
\]

**Step 2**
Multiply the values inside the parentheses.
\[
30 = (2 \times 8) + (2 \times w)
30 = 16 + 2 \times w
\]

**Step 3**
Subtract 16 on both sides of the equal sign.
\[
30 = 16 + 2 \times w
30 - 16 = 16 - 16 + 2 \times w
14 = 2 \times w
\]

**Step 4**
Divide both sides of the equal sign by 2 to solve for \( w \).
\[
14 = 2 \times w
14 \div 2 = 2 \div 2 \times w
7 = 1 \times w
7 = w
\]

**Solution**
The width of the rectangle is 7 inches.
For Example 2, you can check the answer by substituting 7 inches for the width in the perimeter formula.

\[
\text{Perimeter} = (2 \times \text{length}) + (2 \times \text{width})
\]
\[
P = (2 \times 8) + (2 \times 7)
\]
\[
P = 16 + 14
\]
\[
P = 30 \text{ in.}
\]

The perimeter is 30 inches. So, the answer is correct.

A square is a rectangle with all 4 sides equal in length. To find the perimeter of a square, add the lengths of all the sides. You could also multiply the length of one side by 4.

Here is the formula for the perimeter of a square:

\[
\text{Perimeter} = 4 \times \text{length of a side}
\]
\[
P = 4 \times s
\]

**Example 3**

What is the perimeter of this square?

10 inches

**Strategy** Use the formula for the perimeter of a square.

\[
P = 4 \times s
\]
\[
P = 4 \times 10
\]
\[
P = 40 \text{ inches}
\]

**Solution** The perimeter of the square is 40 inches.
Example 4
A balcony has a perimeter of 28 meters. The balcony is in the shape of a square. What is the length of one side of the balcony?

Strategy  Use the formula for the perimeter of a square.

Step 1 The balcony is a square. Write the formula for the perimeter.
\[ P = 4 \times s \]

Step 2 Substitute the values you know into the formula.
The perimeter is 28 meters.
Use the variable \( s \) to represent the side length.
\[ P = 4 \times s \]
\[ 28 = 4 \times s \]

Step 3 Divide both sides of the equal sign by 4 to solve for \( s \).
\[ 28 = 4 \times s \]
\[ 28 \div 4 = 4 \div 4 \times s \]
\[ 7 = 1 \times s \]
\[ 7 = s \]

Solution The length of one side of the balcony is 7 meters.
The rectangle below has a perimeter of 60 inches and a width of 10 inches.

What is the length of the rectangle?

Write the formula for the perimeter of a rectangle.

\[ P = (2 \times \_\_\_\_\_\_\_) + (2 \times \_\_\_\_\_\_) \]

Substitute the values you know into the formula.

Use the variable \( l \) to represent the _____________.

\[ 60 = (2 \times \_\_\_) + (2 \times \_\_) \]

Solve for the length.

Check your answer by substituting ________ inches for the length in the formula.

\[ P = (2 \times \_\_\_) + (2 \times \_\_) \]

\[ P = \_\_\_\_\_\_ + \_\_\_\_\_\_ \]

\[ P = \_\_\_\_\_\_\_\_\_\_\_ \]

The length of the rectangle is ________ inches.
Area

Getting the Idea

Area is the measure of the region inside a figure. Area is measured in square units, such as square inches, square feet, and square centimeters. A square inch, for example, is a square with a side length of 1 inch.

To find the area of a figure, count the number of square units inside the figure. A scale tells what each square unit represents.

Example 1
What is the area of this rectangle?

Strategy  Count the number of square units inside the figure.

Step 1  Count the square units.
There are 24 square units inside the rectangle.

Step 2  Look at the scale to find what each square unit represents.
Each square unit is 1 square meter.
So, 24 square units = 24 square meters.

Solution  The area of the rectangle is 24 square meters.

You can use formulas to find the areas of rectangles and squares.
To find the area of a rectangle, multiply the length by the width.

\[
\text{Area} = \text{length} \times \text{width}
\]

\[
A = l \times w
\]
Example 2
What is the area of this rectangle?

**Strategy**  
Use the formula for the area of a rectangle.

**Step 1**  
Write the formula for the area of a rectangle.
\[ A = l \times w \]

**Step 2**  
Multiply the length by the width.
- The length is 5 centimeters.
- The width is 8 centimeters.
\[ A = 5 \times 8 = 40 \text{ square centimeters} \]

**Solution**  
The area of the rectangle is 40 square centimeters.

To find the area of a square, multiply the length of one side by itself.

\[ A = \text{side} \times \text{side} \]
\[ A = s \times s \]

Example 3
What is the area of this square?

**Strategy**  
Use the formula for the area of a square.

**Step 1**  
Write the formula for the area of a square.
\[ A = s \times s \]

**Step 2**  
Multiply the length of one side by itself.
- The length is 5 inches.
\[ A = 5 \times 5 = 25 \text{ square inches} \]

**Solution**  
The area of the square is 25 square inches.
Example 4
What is the area of the figure below?

Strategy Break the figure into 2 rectangles. Find the area of each rectangle. Add to find the total area.

Step 1 Break the figure into rectangle A and rectangle B.

Step 2 Multiply to find the area of each rectangle.
Rectangle A has a length of 10 inches and a width of 4 inches.
10 inches \( \times \) 4 inches = 40 square inches
Rectangle B has a length of 4 inches and a width of 6 inches.
4 inches \( \times \) 6 inches = 24 square inches

Step 3 Add to find the total area.
40 square inches + 24 square inches = 64 square inches

Solution The area of the figure is 64 square inches.
Coached Example

A playground is 80 feet long and 45 feet wide. What is the area of the playground?

To find the area of the rectangle, multiply the ______________ by the ______________.

Write the area formula. Use \( l \) for length and \( w \) for width.

\[
A = \underline{\hphantom{0}} \times \underline{\hphantom{0}} 
\]

Substitute the values into the formula.

\[
A = \underline{\hphantom{0}} \times \underline{\hphantom{0}} 
\]

Multiply.

\[
A = \underline{\hphantom{0}} 
\]

Label the product with the correct units.

The units are ________________ ________________.

The playground has an area of ________________.
Getting the Idea

An angle (\(\angle\)) is formed by two rays that meet at the same endpoint. That endpoint is the vertex of the angle. An angle can be named by its vertex. The angle below can be named as angle \(Y\) or \(\angle Y\).

![Diagram of an angle with vertex \(Y\) and rays]

The vertex of an angle can be at the center of a circle. A degree (\(^\circ\)) is the angle made by \(\frac{1}{360}\) of a full turn around a circle. A full turn around a circle is 360 degrees.

![Diagram of a circle with 360\(^\circ\)]

The measure of an angle is the fraction of the circle between the points where the two rays intersect the circle. Below are some examples.

![Examples of angles with their measures as fractions of a circle]

- 10\(^\circ\) is \(\frac{10}{360}\) of a circle
- 90\(^\circ\) is \(\frac{90}{360}\) of a circle
- 145\(^\circ\) is \(\frac{145}{360}\) of a circle
You can use a **protractor** to measure angles. A protractor often has two scales. The scales increase from 0° to 180°, but in opposite directions.

To help you decide which scale to read when measuring an angle, compare the angle to 90°.

For example, if the scales read 120° and 60°, and the angle is less than 90°, then the measure of the angle is 60°. If the angle is greater than 90°, then the measure of the angle is 120°.

**Example 1**

What is the measure of angle $B$?
Strategy

**Use a protractor.**

**Step 1**
Place the center mark of the protractor on the vertex of the angle.
Line up one ray of the angle with the $0^\circ$ mark on one of the scales.

**Step 2**
Look at the scale at the point where the other ray of the angle crosses it.
Read the degree mark on the same scale used in Step 1.
The ray crosses the scale at $125^\circ$.
It crosses the other scale at $55^\circ$.

**Step 3**
Decide which scale to use.
Angle $B$ appears greater than $90^\circ$, so it makes sense that the measure would be $125^\circ$, not $55^\circ$.

**Solution**
The measure of angle $B$ is $125^\circ$. 
Example 2

Draw an angle $S$ that measures 45°.

**Strategy**  Use a ruler and a protractor.

**Step 1**
Draw the vertex of the angle and one ray.
Use a ruler to draw the ray. Label the vertex $S$.

**Step 2**
Use a protractor to get the measure of 45°.
Put the center mark of the protractor on the vertex.
Line up the ray with the 0° mark on one of the scales.
Then find the 45° mark. Place a dot above the protractor.

**Step 3**
Remove the protractor. Draw the other ray.
Use a ruler to draw a ray from the vertex to the dot.

**Solution**
Angle $S$ is shown in Step 3.
Example 3

The measure of angle $D$ is $135^\circ$. A part of angle $D$ measures $65^\circ$.

What is the measure of the other part of angle $D$?

Strategy Write a number sentence.

Step 1 Use a variable to represent the measure of the missing part.
Choose the letter $m$ for the missing part.

Step 2 Write a number sentence.

$65^\circ + m = \angle D$
$65^\circ + m = 135^\circ$

Step 3 Solve for $m$.

Subtract $65^\circ$ from both sides of the equal sign.

$65^\circ + m = 135^\circ$

$65^\circ - 65^\circ + m = 135^\circ - 65^\circ$

$0 + m = 70^\circ$

$m = 70^\circ$

Solution The measure of the other part of angle $D$ is $70^\circ$. 
What is the measure of angle $T$?

Put the center mark of the protractor on the ___________ of the angle.
Line up one ray of the angle with the ___________° mark on one of the scales.
Look at the scale where the other ray of the angle crosses it.
The ray crosses the scale at ___________°.
It crosses the other scale at ___________°.
Check your answer.
Angle $T$ appears ___________ than $90°$, so the measure is ___________°, not ___________°.

The measure of angle $T$ is ___________°.
A line plot is a graph that uses Xs above a number line to record data. To read a line plot, count the number of Xs above the number on the number line.

Example 1
Dana and Josiah measured the widths of books in a shelf. They made the line plot below.

How many books were less than $\frac{7}{8}$ inch thick?

**Strategy**  Count the number of Xs above each number less than $\frac{7}{8}$.

**Step 1** Determine which Xs to count.

The fractions less than $\frac{7}{8}$ are to the left of it on the number line.

Do not count the Xs above $\frac{7}{8}$.

**Step 2** Count the number of Xs above the numbers that are less than $\frac{7}{8}$.

- There are 2 Xs above $\frac{3}{8}$.
- There are 3 Xs above $\frac{4}{8}$.
- There is 1 X above $\frac{5}{8}$.

**Step 3** Add to find the total.

$$2 + 3 + 1 = 6$$

**Solution** There were 6 books that were less than $\frac{7}{8}$ inch thick.
Example 2
Use the line plot in Example 1.

What is the difference in thickness between the thickest and thinnest books?

**Step 1** Find the thickness of the thickest book.

The thickest book is $1\frac{6}{8}$ inches thick.

**Step 2** Find the thickness of the thinnest book.

The thinnest book is $\frac{3}{8}$ inches thick.

**Step 3** Subtract

$$1\frac{6}{8} - \frac{3}{8} = 1\frac{3}{8}$$

**Solution** The difference between the thickest and thinnest books is $1\frac{3}{8}$ inches.

Example 3
Janelle asked some friends about the amount of orange juice they drank one day. She listed the results below.

She listed the results below.

<table>
<thead>
<tr>
<th>0 cups</th>
<th>$\frac{1}{2}$ cup</th>
<th>1 cup</th>
<th>1 cup</th>
<th>0 cups</th>
<th>1 cup</th>
<th>$\frac{1}{2}$ cup</th>
<th>1 cup</th>
<th>$\frac{1}{2}$ cup</th>
<th>1 cup</th>
</tr>
</thead>
</table>

Make a line plot of Janelle’s results.

**Strategy** Count each amount. Draw a number line to make the line plot.
Step 1  Look at the amounts of juice.
   The greatest amount is 1 cup. The least amount is 0 cups.
   There are also $\frac{1}{2}$ cups.

Step 2  Make a number line from 0 to 1 in halves.
   Label the number line.

\[ \begin{array}{c}
| 0 | \frac{1}{2} | 1 |
\end{array} \]

   Cups

Step 3  Count the number for each amount.
   2 friends drank 0 cups of juice.
   4 friends drank $\frac{1}{2}$ cup of juice.
   6 friends drank 1 cup of juice.

Step 4  Draw an X to represent each friend above each amount.
   Write a title for the line plot.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{orange-juice-amounts}
\end{figure}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{orange-juice-amounts}
\end{figure}

   Orange Juice Amounts

   \begin{array}{c}
   X \\
   X \\
   X \\
   X \\
   X \\
   X \\
   X \\
   \end{array}

   Cups

Solution  The line plot is shown in Step 4.
Isaac asked some students how long they spent reading last night. He made the line plot below.

**Time Spent Reading**

- X
- X
- X
- X
- X
- X

**Hours**

0 1/4 2 3/4 1

**How many students spent \( \frac{1}{4} \) hour reading last night?**

- Count the number of Xs above the time of ________ hour on the number line.
- There are ________ Xs above that time.
- So, ________ students spent \( \frac{1}{4} \) hour reading last night.

**To find how much time in all those students spent reading, which operation should you use?**

\[
\frac{1}{4} + \text{________} = \text{_______}
\]

**So, ________ students spent \( \frac{1}{4} \) hour reading last night.**

**In all, those students spent ________ hour reading.**
A point is a particular place or location.
A line is a straight path that goes in two directions without end.
This line with points S and T can be written as $\overline{ST}$ or $\overline{TS}$.

A ray is part of a line with one endpoint and goes in the other direction without end.
A ray is named by its endpoint first. This ray is named $\overrightarrow{YZ}$.

A line segment is part of a line with two endpoints.
This line segment can be named $\overline{MN}$ or $\overline{NM}$.

Example 1
How can you name this figure?

Strategy  Look for endpoints or arrows.

Step 1  Identify the figure.
        The figure has arrows on both sides.
        It shows a straight path without end in both directions.
        The figure is a line.

Step 2  Identify points on the line.
        The points B and C are on the line.

Step 3  Name the line.
        Use the points on the line to name the figure.

Solution  The figure is line $BC$ or line $CB$. 
Example 2

Draw \( \overrightarrow{DE} \).

**Strategy**
Identify the symbol. Then use the definition to draw the figure.

**Step 1**
Identify the symbol in the name.
- The symbol above \( \overrightarrow{DE} \) is \( \overrightarrow{\text{___}} \).
- The figure is a ray with points \( D \) and \( E \).

**Step 2**
Draw and label the endpoint.
- The endpoint is the first point listed in the name.
- Point \( D \) is the endpoint.

**Solution**
Ray \( \overrightarrow{DE} \) is shown in Step 4.

Pairs of lines or line segments can be identified as parallel, intersecting, or perpendicular.

**Parallel lines** are lines that remain the same distance apart and never meet.

**Intersecting lines** are lines that cross at exactly one point.
**Perpendicular lines** are intersecting lines that cross to form 4 square corners.

Example 3
Which street is parallel to 2nd Avenue?

Strategy  Use the definition of parallel lines.

- **Step 1** Define parallel lines.
  - Parallel lines are lines that remain the same distance apart.

- **Step 2** Find the street that is parallel to 2nd Avenue.
  - 1st Avenue and 2nd Avenue do not intersect.
  - They appear to remain the same distance apart.

Solution  1st Avenue is parallel to 2nd Avenue.
You can draw parallel or perpendicular lines by using a ruler.

**Example 4**

Draw a pair of perpendicular lines.

**Strategy**  
Use a ruler and an object that forms a square corner.

**Step 1**  
Use a ruler to draw a straight line.

**Step 2**  
Use an object with a square corner and place it on the line. You can use a book, an index card, or an envelope.

**Step 3**  
Draw a straight line that crosses the first line and forms a square corner.

**Solution**  
A pair of perpendicular lines is shown in Step 3.
Angles can be identified as acute, right, or obtuse.

A **right angle** forms a square corner. It measures exactly \(90^\circ\).

An **acute angle** forms an angle less than a right angle. It measures more than \(0^\circ\), but less than \(90^\circ\).

An **obtuse angle** forms an angle greater than a right angle. It measures more than \(90^\circ\), but less than \(180^\circ\).

**Example 5**

Name the angle shown below.

**Strategy**  
Compare the angle to a right angle.

**Step 1**  
Think about a right angle.  
A right angle measures \(90^\circ\) and forms a square corner.

**Step 2**  
Compare this angle to a right angle.  
This angle is smaller than a right angle.

**Solution**  
The angle is an acute angle.
What type of angle is \( \angle A \)?

Compare the angle to a right angle.

Does \( \angle A \) appear to be exactly 90°? ________________

Is \( \angle A \) a right angle? ________________

Does \( \angle A \) appear to be less than 90°? ________________

Is \( \angle A \) an acute angle? ________________

Does \( \angle A \) appear to be greater than 90°? ________________

Is \( \angle A \) an obtuse angle? ________________

Angle \( A \) is a(n) ________________ angle.
Two-Dimensional Shapes

Getting the Idea

A **two-dimensional shape** is a flat figure. A **polygon** is a closed two-dimensional shape with straight sides. Polygons are classified, or sorted, by the number of sides and angles. Each side of a polygon is a line segment. The line segments meet at points that form the angles of the polygon.

<table>
<thead>
<tr>
<th>Shape</th>
<th>Sides</th>
<th>Angles</th>
</tr>
</thead>
<tbody>
<tr>
<td>triangle</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>quadrilateral</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>pentagon</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>hexagon</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>octagon</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

A circle is a two-dimensional shape in which all points are an equal distance from the center. A circle is not a polygon because it does not have straight sides.

Example 1

What is the name of this two-dimensional shape?

**Strategy**  
**Count the number of sides and angles.**

**Step 1**  
Decide if the shape is a polygon.  
Yes, it is a polygon because it has all straight sides.

**Step 2**  
Count the number of sides and angles.  
There are 3 sides and 3 angles.

**Step 3**  
Identify the shape.  
A polygon with 3 sides and 3 angles is a triangle.

**Solution**  
The two-dimensional shape is a triangle.
Look at the three angles in the triangle in Example 1. There is 1 right angle and 2 angles that are smaller than right angles. Any triangle with a right angle is called a right triangle.

**Example 2**
What is the name of this two-dimensional shape?

![Polygon](image)

**Strategy** Count the number of sides and angles.

**Step 1** Decide if the shape is a polygon.
Yes, it is a polygon because it has all straight sides.

**Step 2** Count the number of sides and angles.
There are 5 sides and 5 angles.

**Step 3** Identify the shape.
A polygon with 5 sides and 5 angles is a pentagon.

**Solution** The two-dimensional shape is a pentagon.

**Example 3**
Describe the sides and angles of the pentagon in Example 2.

**Strategy** Identify the types of angles and sides.

**Step 1** Describe the types of angles.
The angles on the left side of the pentagon form square corners.
So, there are 2 right angles.
There are also 2 obtuse angles.
The angle on the right side is an acute angle.
**Step 2** Describe the sides.

The top and bottom sides are parallel.
The left side meets the top and bottom sides at right angles.
So, there are 2 pairs of perpendicular sides.
The 2 right sides of the pentagon intersect.
They form 2 obtuse angles and 1 acute angle.

**Solution** The pentagon has 2 right angles, 2 obtuse angles, and 1 acute angle. It has parallel, perpendicular, and intersecting sides.

Quadrilaterals have 4 sides and 4 angles. They are classified by the lengths of their sides and the types of angles. Here are some quadrilaterals you should know.

<table>
<thead>
<tr>
<th>Name</th>
<th>Diagram</th>
<th>Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parallelogram</td>
<td><img src="parallelogram.png" alt="Diagram" /></td>
<td>It has two pairs of parallel sides. The opposite sides are equal.</td>
</tr>
<tr>
<td>Rhombus</td>
<td><img src="rhombus.png" alt="Diagram" /></td>
<td>It is a parallelogram with 4 equal sides.</td>
</tr>
<tr>
<td>Rectangle</td>
<td><img src="rectangle.png" alt="Diagram" /></td>
<td>It is a parallelogram with 4 right angles.</td>
</tr>
<tr>
<td>Square</td>
<td><img src="square.png" alt="Diagram" /></td>
<td>It is a rectangle with 4 equal sides.</td>
</tr>
<tr>
<td>Trapezoid</td>
<td><img src="trapezoid.png" alt="Diagram" /></td>
<td>It has exactly 1 pair of parallel sides.</td>
</tr>
</tbody>
</table>
Example 4
What is the name of this polygon? Be as specific as possible.

Strategy  
Look at the sides and angles.

Step 1  
Decide if the polygon is a quadrilateral.
   The polygon has 4 straight sides.
   It is a quadrilateral.

Step 2  
Decide if the polygon is a parallelogram.
   The polygon has 2 pairs of parallel sides.
   It is a parallelogram.

Step 3  
Look at the angles.
   The polygon does not have any right angles.
   It has 2 angles that are smaller than right angles.
   It also has 2 angles that are greater than right angles.
   So, there are 2 acute angles and 2 obtuse angles.

Step 4  
Decide if the sides are the same length.
   The polygon appears to have 4 equal sides.

Step 5  
Name the polygon.
   A rhombus is a quadrilateral with 4 sides that are the same length and 2 pairs of parallel sides.

Solution  
The polygon is a rhombus.
What is the name of this two-dimensional shape? Be as specific as possible.

Decide if the shape is a polygon.
Does the shape have straight sides? ________________
Is the shape a polygon? ________________

Count the number of sides and angles.
How many straight sides does the shape have? ______
How many angles does the shape have? ______
Is the shape a quadrilateral? ________________
Does the shape have any right angles? ________________
Is the shape a rectangle? ________________
What types of angles does the shape have?
_______________ angles and _________________ angles

Does the shape have parallel sides? ________________
How many pairs of parallel sides does the shape have? ______
Which quadrilateral has only 1 pair of parallel sides? ________________
The name of this two-dimensional shape is ________________.
Getting the Idea

A figure with **line symmetry** can be divided into two matching parts.

The line that divides the figure is a **line of symmetry**. Some figures have 1 line of symmetry and others have more than 1 line of symmetry.

The equilateral triangle below has 3 lines of symmetry.

![Lines of Symmetry](image)

Example 1

Which figure(s) shows a line of symmetry?

- Figure A
- Figure B
- Figure C
- Figure D

**Strategy** Imagine folding each figure along the line so that the parts match exactly.

**Step 1** Look at Choice A.

Imagine folding the figure along the line. The parts do not match. Choice A does not show a line of symmetry.
Step 2  Look at Choice B.
Imagine folding the figure along the line. The parts do not match.

Choice B does not show a line of symmetry.

Step 3  Look at Choice C.
Imagine folding the figure along the line. The parts match.

Choice C shows a line of symmetry.

Step 4  Look at Choice D.
Imagine folding the figure along the line. The parts match.

Choice D shows a line of symmetry.

Solution  Figures C and D show a line of symmetry.
Example 2
Which figure has line symmetry?

Strategy

Draw lines on each figure.
Imagine folding on the lines to see if the parts match.

Step 1
Draw different lines on the first figure.

The parts do not match.
The figure does not have line symmetry.

Step 2
Draw different lines on the second figure.

The parts do not match.
The figure does not have line symmetry.

Step 3
Draw different lines on the third figure.

The parts match.
Both dashed lines are lines of symmetry.
The figure has line symmetry.

Solution
The third figure has line symmetry.
### Example 3

Does this figure have line symmetry? If so, how many lines of symmetry does it have?

#### Strategy

Test different lines on the rectangle. Imagine folding on the lines to see if the parts match.

#### Step 1

Draw a horizontal line through the middle of the figure.

The parts match.

The dashed line is a line of symmetry.

The figure has line symmetry.

#### Step 2

Draw a vertical line through the middle of the figure.

The parts match.

The dashed line is a line of symmetry.

#### Step 3

Draw a diagonal line across the figure.

When folded across the line, the parts do not match.

The dashed line is not a line of symmetry.

#### Solution

The rectangle has 2 lines of symmetry.
Which block letters have line symmetry?

Look at the letter E.
Draw lines to see if it has line symmetry.
It has _______ line of symmetry.
Does the letter E have line symmetry? ___________________

Look at the letter S.
Draw lines to see if it has line symmetry.
It has _______ lines of symmetry.
Does the letter S have line symmetry? ___________________

Look at the letter H.
Draw lines to see if it has line symmetry.
It has _______ lines of symmetry.
Does the letter H have line symmetry? ___________________

The letters _______ and _______ have line symmetry.
Lesson 1
Coached Example
What is the value of the 2? 200,000
What is the value of the 3? 30,000
What is the value of the 9? 9,000
What is the value of the 8? 800
What is the value of the 0? 0
What is the value of the 7? 7
The expanded form of 239,807 is 200,000 + 30,000 + 9,000 + 800 + 7.
There are 239 thousands.
Write the value in words. **two hundred thirty-nine thousand**
There are 807.
Write the value in words. **eight hundred seven**
The number name of 239,807 is **two hundred thirty-nine thousand, eight hundred seven**.

Lesson 2
Coached Example
693,041 < 693,582
Are the digits in the hundred thousands place the same? **yes**
Are the digits in the ten thousands place the same? **yes**
Are the digits in the thousands place the same? **yes**
Are the digits in the hundreds place the same? **no**
0 hundreds is less than 5 hundreds.
So, 693,041 is less than 693,582.
Which symbol should you use? <
693,041 < 693,582

Lesson 3
Coached Example
Find 7 groups of 3 biscuits.
7 \times 3 =
Find the 7s column.
Find the 3s row.
The number 21 is in the box.
So, 7 \times 3 = 21.
Kate gives her dog 21 biscuits in 7 days.

Lesson 4
Coached Example
A student ticket costs $34.
A class of 26 students went to the park.
Find 34 \times 26 =
Write the problem in vertical form.
\[
\begin{align*}
34 & \quad \times 26 \\
\hline
204 & \\
+680 & \\
\hline
884 &
\end{align*}
\]
Multiply 34 by the **ones** digit of 26.
6 ones \times 34, Regroup.
What is the first partial product? 204
Multiply 34 by the **tens** digit of 26.
2 tens \times 34, Regroup.
What is the second partial product? 680
Add the two partial products.
204 + 680 = 884
The tickets for the students cost $884 in all.

Lesson 5
Coached Example
Use the **commutative** property of multiplication to change the order of the factors.
5 \times 2 \times 14 =
Use the **associative** property of multiplication to group the factors.
(5 \times 2) \times 14 =
Multiply inside the parentheses.
(10) \times 14 =
Multiply that factor and the other factor.
10 \times 14 = 140
So, 5 \times 14 \times 2 = 140
Joey bought 140 jellybeans in all.

Lesson 6
Coached Example
There are 32 classrooms.
There are 24 students in each class.
32 \times 24 = n
Express 24 in expanded form.

\[ 24 = 20 + 4 \]

Rewrite the sentence with 24 in expanded form.

\[ 32 \times 24 = 32 \times (20 + 4) \]

Distribute 32 to each addend.

\[ 32 \times (20 + 4) = (32 \times 20) + (32 \times 4) \]

Find each product.

\[ (32 \times 20) + (32 \times 4) = n \]

\[ 640 + 128 = n \]

Add the products.

\[ 640 + 128 = 768 \]

There are 768 students in all at the school.

**Lesson 7**

**Coached Example**

There are 35 desks in 5 equal rows.

\[ 35 \div 5 = d \]

\[ 7 \times 5 = 35 \]

Since \( 7 \times 5 = 35 \), then \( 35 \div 5 = 7 \).

There are 7 desks in each row.

**Lesson 8**

**Coached Example**

There are 8,240 seats in all.

There are 8 equal sections.

\[ 8,240 \div 8 = s \]

Divide each place from left to right.

\[
\begin{array}{c}
1030 \\
8)8240 \\
- 8 \\
- 24 \\
- \underline{24} \\
00 \\
- 0 \\
\hline \\
0 \\
\end{array}
\]

So, \( 8,240 \div 8 = 1,030 \).

There are 1,030 seats in each section.

**Lesson 9**

**Coached Example**

Nita has 250 inches of ribbon. Each piece she will cut is 9 inches long.

Let \( p \) represent the number of 9-inch pieces she will cut.

\[ 250 \div 9 = p \]

\[
\begin{array}{c}
27 \text{ R7} \\
9)250 \\
- 18 \\
- \underline{70} \\
- 63 \\
\hline \\
7 \\
\end{array}
\]

Check the quotient.

\[ (9 \times 27) + 7 = p \]

\[ 243 + 7 = 250 \]

Does that match the dividend? yes

Is your answer correct? yes

The answer, 27 R7, means Nita can cut 27 9-inch pieces with 7 inches left over.

Nita can cut 27 9-inch pieces.

The length of the ribbon left over is 7 inches.

**Lesson 10**

**Coached Example**

He typed 8,200 words in a report.

He can type 100 words a minute.

Let \( m \) represent the number of minutes it took to type the report.

\[ 8,200 \div 100 = m \]

The divisor is 100, so take away 2 zeros from the dividend.

\[ 8,200 \div 100 = 82 \]

It took Mr. Cassidy 82 minutes to type his report.

**Lesson 11**

**Coached Example**

\[ 4 \times 1 = 4 \]

\[ 4 \times 2 = 8 \]

\[ 4 \times 3 = 12 \]

\[ 4 \times 4 = 16 \]

\[ 4 \times 5 = 20 \]

\[ 4 \times 6 = 24 \]

\[ 4 \times 7 = 28 \]

The number 25 is between the products 24 and 28.

25 is not a multiple of 4.

Paige cannot get exactly 25 quarters by exchanging dollar bills.
Lesson 12
Coached Example
The club had 12,468 members last year.
The club has 8,271 more members this year.
12,468 + 8,271 = m

12,468
+ 8,271
20,739

The sum is 20,739.
There are 20,739 members in the club this year.

Lesson 13
Coached Example
Add to find the total amount Lynn spent on the television and the video camera.
Then subtract the sum from the amount Lynn had in her checking account.
Add from right to left.

$1,150
+ 665
$1,815

Subtract to find how much Lynn has left in her checking account.

$2,812
− 1,815
$ 997

Use addition to check the subtraction.

$ 997
+ 1,815
$2,812

Lynn has $997 left in her checking account.

Lesson 14
Coached Example
The place to be rounded to is ten thousands.
The digit in this place is 2.
The digit to the right of the rounding place is 9.
This digit is greater than 5.
Since the digit to the right is greater than 5, round up.
Change all the digits to the right of the rounding place to 0.
129,354 rounds to 130,000.
To the nearest ten thousand, the game Web site received about 130,000 hits that day.

Lesson 15
Coached Example
The number 74,868 rounds to 75,000.
The number 79,967 rounds to 80,000.
Subtract the rounded numbers.

80,000 − 75,000 = 5,000
About 5,000 more people visited the theme park this month than last month.

Lesson 16
Coached Example
Find 7 × 275 = □.
Round 275 to the nearest 100.
275 rounds to 300.
Multiply the rounded numbers.

7 × 300 = 2,100
The answer should be about 2,100.
Find the exact answer.

53
275
× 7
1,925

Is the exact answer close to the estimated answer? yes
Is the answer reasonable? yes
The factory shipped 1,925 shirts in all.

Lesson 17
Coached Example
The pattern has 6 terms.
The pattern starts with 55.
The rule is subtract 9.
Subtract 9 from 55.

55 − 9 = 46 ← second term
46 − 9 = 37 ← third term
37 − 9 = 28 ← fourth term
28 − 9 = 19 ← fifth term
19 − 9 = 10 ← sixth term
The six terms in the number pattern are 55, 46, 37, 28, 19, and 10.
Lesson 18
Coached Example
What is the denominator of \( \frac{3}{6} \)?
What is the denominator of the equivalent fraction? \( 12 \)
By what number can you multiply 6 to get 12? \( 2 \)
To find the equivalent fraction, multiply the numerator and denominator by \( 2 \).
\[
\frac{3 \times 2}{6 \times 2} = \frac{6}{12}
\]
\( \frac{6}{12} \) is a fraction with 12 as a denominator that is equivalent to \( \frac{3}{6} \).

Lesson 19
Coached Example
Each figure is divided into 8 parts.
The denominator of the improper fraction is 8.
There are 11 shaded parts.
The improper fraction is \( \frac{11}{8} \).
How many figures are completely shaded? 1
The whole number part of the mixed number is 1.
The second figure has 8 parts in all and 3 shaded parts.
The fraction part of the mixed number is \( \frac{3}{8} \).
The mixed number is \( 1 \frac{3}{8} \).
The model represents \( \frac{11}{8} \) or \( 1 \frac{3}{8} \).

Lesson 20
Coached Example
Find \( \frac{4}{5} \) on a number line.
Check students’ answers. Number line should be labeled in fifths with a point on \( \frac{4}{5} \).
\( \frac{4}{5} \) is closest to the benchmark 1.
Find \( \frac{1}{6} \) on a number line.
Check students’ answers. Number line should be labeled in sixths with a point on \( \frac{1}{6} \).
\( \frac{1}{6} \) is closest to the benchmark 0.
Since \( \frac{4}{5} \) is closest to the benchmark 1, and \( \frac{1}{6} \) is closest to the benchmark 0, \( \frac{4}{5} \) is greater than \( \frac{1}{6} \).

Lesson 21
Coached Example
Sam walked \( \frac{1}{12} \) mile to Toni’s house.
Then Sam walked \( \frac{4}{12} \) mile to school.
\[
\frac{1}{12} + \frac{4}{12} = m
\]
Yes, both fractions have a denominator of 12.
Add the numerators.
\[
1 + 4 = 5
\]
The denominator stays the same.
\[
\frac{1}{12} + \frac{4}{12} = \frac{5}{12}
\]
Sam walked \( \frac{5}{12} \) mile in all.

Lesson 22
Coached Example
The words “how much more” tell you to subtract.
Alexandra wants to jog \( \frac{7}{10} \) mile.
She ties her shoelaces after \( \frac{3}{10} \) mile.
\[
\frac{7}{10} - \frac{3}{10} = m
\]
Yes, both fractions have a denominator of 10.
Subtract the numerators.
\[
7 - 3 = 4
\]
The denominator stays the same.
\[
\frac{7}{10} - \frac{3}{10} = \frac{4}{10}
\]
Simplify the fraction.
\[
\frac{4}{10} = \frac{4 + 2}{10 + 2} = \frac{2}{5}
\]
Alexandra has \( \frac{2}{5} \) mile more to jog to finish her run.

Lesson 23
Coached Example
The board is \( 4 \frac{1}{4} \) feet long.
He will cut a \( 2 \frac{3}{4} \) feet piece.
\[
4 \frac{1}{4} - 2 \frac{3}{4} = b
\]
\[
4 = \frac{4}{4} + \frac{4}{4} + \frac{4}{4} + \frac{4}{4}
\]
\[
4 \frac{1}{4} = \frac{4}{4} + \frac{4}{4} + \frac{4}{4} + \frac{4}{4} + \frac{1}{4} = \frac{17}{4}
\]
So, \( 4 \frac{1}{4} = \frac{17}{4} \).
\[
2 = \frac{4}{4} + \frac{4}{4}
\]
So, \(2 \frac{3}{4} = 4 + \frac{3}{4} = 4 + \frac{3}{4} = \frac{11}{4}\)

So, \(2 \frac{3}{4} = \frac{11}{4}\).

Subtract the improper fractions.
\[
\frac{17}{4} - \frac{11}{4} = \frac{6}{4}
\]
Change the improper fraction to mixed number.
\[
6 \div 4 = 1 \text{ R}2
\]
The mixed number is \(1 \frac{2}{4}\).

Simplify the fraction part of the mixed number.
\[
\frac{2}{4} = \frac{2 \div 2}{4 \div 2} = \frac{1}{2}
\]
Mr. Lee has \(1 \frac{1}{2}\) feet of the board left.

Lesson 24
Coached Example
Write the multiplication as repeated addition.
\[
4 \times \frac{3}{5} = \frac{3}{5} + \frac{3}{5} + \frac{3}{5} + \frac{3}{5}
\]
Are the denominators the same? yes
Add the numerators.
\[
3 + 3 + 3 + 3 = 12
\]
Write the sum over the denominator. \(\frac{12}{5}\)
Change the sum to a mixed number.
\[
\frac{12}{5} = 2 \frac{2}{5}
\]
Make a model of the problem to check your answer.

Check students’ models. Models could show 4 groups of \(\frac{3}{5}\) or \(\frac{12}{5}\) in all.
\[
4 \times \frac{3}{5} = 2 \frac{2}{5}
\]

Lesson 25
Coached Example
There are 2 whole grids shaded.
The other grid has 6 out of 100 parts shaded.
So, 0.06 of the other grid is shaded.
Write the decimal in a place-value chart.

\[
\begin{array}{ccc}
\text{Ones} & . & \text{Tenths} & \text{Hundredths} \\
0 & . & 4 & 0 \\
0 & . & 5 & 2 \\
0 & . & 4 & 8 \\
\end{array}
\]

Compare the digits in the greatest place, the ones.
0 ones = 0 ones = 0 ones
All of the digits in the greatest place are equal.

Compare the digits in the next greatest place, the tenths.
5 tenths > 4 tenths, so 0.52 is the greatest decimal.

Compare the digits in the next greatest place, the hundredths.
0 hundredths < 8 hundredths, so 0.40 is the least decimal.

From least to greatest, the order of the decimals is 0.40, 0.48, 0.52.

Lesson 28
Coached Example
Find the total amount Marvin spent.
Then subtract that amount from $20.00.
Marvin bought 2 books that cost $6.00 each.
So, 2 books cost $12.00.
Add the cost of 2 books to the cost of the bookmark.
$12.00 + $1.50 = $13.50
Marvin spent $13.50 in all.
Subtract the total amount from the amount Marvin has.
$20.00 − $13.50 = $6.50
Show your work.

<table>
<thead>
<tr>
<th>1</th>
<th>3</th>
<th>5</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>−</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>$</td>
<td>6</td>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>
Marvin has $6.50 left.

Lesson 29
Coached Example
1 minute = 60 seconds
Which is the larger unit? minutes
Which is the smaller unit? seconds
When you change from a larger unit to a smaller unit, which operation do you use? multiplication
Show your work.

\[ 5 \times 60 = 300 \]
There are 300 seconds in 5 minutes.
The music video is 300 seconds long.

Lesson 30
Coached Example
Which is the smaller unit, pounds or ounces? ounces
1 pound = 16 ounces
Multiply to change 3 pounds to ounces.
\[ 3 \times 16 = 48 \text{ ounces} \]
Peanuts: 3 pounds or 48 ounces
48 ounces < 45 ounces
Deanna has more peanuts than raisins.

Lesson 31
Coached Example
The bottle has a capacity of 2 liters.
The bucket has a capacity that is 4 times more than the bottle.
Which operation should you use to find the capacity of the bucket? multiplication

Find \( 2 \times 4 = b \)
Multiply.
\[ 2 \times 4 = 8 \text{ liters} \]
Change the capacity of the bucket in liters to milliliters.
1 liter = 1,000 milliliters
Multiply to change from liters to milliliters.
\[ 8 \times 1,000 = 8,000 \text{ milliliters} \]
The capacity of the bucket is 8,000 milliliters.

Lesson 32
She lives 3 kilometers from the mall.
To change from kilometers to meters, should you use multiplication or division? multiplication
1 kilometer = 1,000 meters
3 \times 1,000 \text{ meters} = 3,000 \text{ meters}
So 3 kilometers = 3,000 meters.
She lives 1.6 kilometers from the school.
Find 1.6 on the number line. Draw a point.

Kilometers
Nicole lives 3,000 meters from the mall. The point on the number line above shows the distance, in kilometers, Nicole lives from school.

Lesson 33
Coached Example
\[ P = (2 \times \text{length}) + (2 \times \text{width}) \]
Use the variable \( l \) to represent the length.
\[ 60 = (2 \times l) + (2 \times 10) \]
Solve for the length.
\[ 60 = (2 \times l) + 20 \]
\[ 60 − 20 = 2 \times l + 20 − 20 \]
\[ 40 = 2 \times l \]
\[ 40 ÷ 2 = 2 ÷ 2 \times l \]
\[ 20 = 1 \times l \]
\[ 20 = l \]
Check your answer by substituting 20 inches for the length in the formula.
Lesson 34
Coached Example
To find the area of the rectangle, multiply the length by the width.
Write the area formula. Use \( l \) for length and \( w \) for width.
\[ A = l \times w \]
Substitute the values into the formula.
\[ A = 80 \times 45 \]
Multiply.
\[ A = 3,600 \]
The units are square feet.
The playground has an area of 3,600 square feet.

Lesson 35
Coached Example
Put the center mark of the protractor on the vertex of the angle.
Line up one ray of the angle with the 0° mark on one of the scales.
The ray crosses the scale at 80°.
It crosses the other scale at 100°.
Check your answer.
Angle \( T \) appears less than 90°, so the measure is 80°, not 100°.
The measure of \( \angle T \) is 80°.

Lesson 36
Coached Example
Count the number of Xs above the time of \( \frac{1}{4} \) hour on the number line.
There are 2 Xs above that time.
So, 2 students spent \( \frac{1}{4} \) hour reading last night.
To find how much time in all those students spent reading, which operation should you use? addition
\[ \frac{1}{4} + \frac{1}{4} = \frac{2}{4} \]
So, 2 students spent \( \frac{1}{4} \) hour reading last night.
In all, those students spent \( \frac{2}{4} \) or \( \frac{1}{2} \) hour reading.

Lesson 37
Coached Example
Does \( \angle A \) appear to be exactly 90°? no
Is \( \angle A \) a right angle? no
Does \( \angle A \) appear to be less than 90°? no
Is \( \angle A \) an acute angle? no
Does \( \angle A \) appear to be greater than 90°? yes
Is \( \angle A \) an obtuse angle? yes
Angle \( A \) is an obtuse angle.

Lesson 38
Coached Example
Does the shape have straight sides? yes
Is the shape a polygon? yes
How many straight sides does the shape have? 4
How many angles does the shape have? 4
Is the shape a quadrilateral? yes
Does the shape have any right angles? no
Is the shape a rectangle? no
What types of angles does the shape have? 2 acute angles and 2 obtuse angles
Does the shape have parallel sides? yes
How many pairs of parallel sides does the shape have? 1
Which quadrilateral has only 1 pair of parallel sides? trapezoid
The name of this two-dimensional shape is trapezoid.

Lesson 39
Coached Example
Look at the letter E.
It has 1 line of symmetry.
Does the letter E have line symmetry? yes
Look at the letter S.
It has 0 lines of symmetry.
Does the letter S have line symmetry? no
Look at the letter H.
It has 2 lines of symmetry.
Does the letter H have line symmetry? yes
The letters E and H have line symmetry.