Chapter 6
Multiplication and Division Patterns

Essential Question
What is the importance of patterns in learning multiplication and division?

Let's Collect!

Watch a video!
Operations and Algebraic Thinking

3.OA.1 Interpret products of whole numbers, e.g., interpret $5 \times 7$ as the total number of objects in 5 groups of 7 objects each.

3.OA.2 Interpret whole-number quotients of whole numbers, e.g., interpret $56 \div 8$ as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each.

3.OA.3 Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.

3.OA.4 Determine the unknown whole number in a multiplication or division equation relating three whole numbers.

3.OA.5 Apply properties of operations as strategies to multiply and divide.

3.OA.6 Understand division as an unknown-factor problem.

3.OA.7 Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that $8 \times 5 = 40$, one knows $40 \div 5 = 8$) or properties of operations. By the end of Grade 3, know from memory all products of two one-digit numbers.

3.OA.9 Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations.

Number and Operations in Base Ten This chapter also addresses this standard:

3.NBT.3 Multiply one-digit whole numbers by multiples of 10 in the range 10-90 (e.g., $9 \times 80$, $5 \times 60$) using strategies based on place value and properties of operations.

Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

= focused on in this chapter
Multiply.
1. $6 \times 4 = \underline{\hspace{2cm}}$
2. $1 \times 5 = \underline{\hspace{2cm}}$
3. $7 \times 2 = \underline{\hspace{2cm}}$

Draw an array for each. Multiply.
4. $4 \times 5 = \underline{\hspace{2cm}}$
5. $1 \times 6 = \underline{\hspace{2cm}}$
6. $2 \times 9 = \underline{\hspace{2cm}}$

Identify a pattern. Then find the missing numbers.
7. $\underline{\hspace{2cm}}, \underline{\hspace{2cm}}, 30, 25, 20, 15$
8. $\underline{\hspace{2cm}}, \underline{\hspace{2cm}}, 16, 14, 12, 10$

The pattern is ________________.

The pattern is ________________.

9. Louis has 2 quarters. Yellow whistles cost 5¢ each. Louis wants to buy 8 whistles. Does he have enough money? Explain.


10. Nine trees lined each side of a street. Some trees were cut down leaving a total of 7 trees. How many trees were cut down?
Review Vocabulary

bar diagram  factor  partition  product

Making Connections
Choose one review vocabulary word. Use the graphic organizer below to write about and draw examples of the word.

My Description

When I Use This in Math

My Example

My Non-Example
multiple

multiples of 10:
0, 10, 20, 30, 40
Ideas for Use

- Write a tally mark each time you read the word in this chapter or use the word in your writing. Challenge yourself to making at least ten tally marks for the word.

- Use the blank cards to write review vocabulary cards. Choose review words from this chapter, such as factor, product, or partition.

A multiple of a number is the product of that number and any other number.

How can the term multiplication help you remember what a multiple is?
Follow the steps on the back to make your Foldable.
Patterns in the multiplication table can help you remember products and find unknown factors.

Math in My World

Example 1

Enrique noticed he could find the product of two factors in the multiplication table. What is the product of 2 × 3?

The black numbers in the table are products. The column and row of blue numbers are factors.

1. Look at the two circled factors. Follow the numbers across and down until they meet. This is the product. Complete the number sentence.

   2 × 3 = product

2. Draw a triangle around the product in the multiplication table that has the same factors. Follow left and above to its factors. Draw a triangle around each factor. Complete the number sentence.

   2 × 3 = 6

The two number sentences are examples of the Property of Multiplication.
Example 2
Enrique found a pattern when he multiplied 4 by any factor.

Use a yellow crayon to finish Enrique’s pattern. Write the numbers.

0, 4, 8, 12, 16, 20, 24, 28, 32, 36, 40

Circle whether the product of 4 and any number is even or odd.

even odd

The product of 4 and 5 is 20. Write this product as the sum of two equal numbers.

\[ \_ \_ \_ + \_ \_ \_ = 20 \]

Example 3
Use a blue crayon to color the products with a factor of 3.

What do you notice about these products?

The list of products with a factor of \( \_ \_ \_ \_ \) increase by \( \_ \_ \_ \_ \).

It is as if you are counting by 3s.

Guided Practice

1. Use an orange crayon to color the products with a factor of 5. What do you notice about the products in this row and column?

   The products with a factor of \( \_ \_ \_ \_ \_ \_ \_ \_ \) end in \( \_ \_ \_ \_ \) or \( \_ \_ \_ \_ \) .

2. Use a purple crayon to color the products with a factor of 10. What do you notice about the products in this row and column?

   The products with a factor of \( \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \) end in \( \_ \_ \_ \_ \) .
Independent Practice

3. Shade a row of numbers blue that show the products with a factor of 2. What do you notice about the products in this row?

The 2s products end in __________, __________, __________, or __________.

Are all the products in this row even or odd?

4. Shade a column of numbers green that show the products with a factor of 3. Describe the pattern of even and odd products.

5. Shade a row of numbers yellow that show the products with a factor of 1. What do you notice about this row?

6. Look at the product shaded gray. Circle the two factors that make this product. Complete the number sentence.

\[ 4 \times \underline{\hspace{1cm}} = 36 \]

Draw a triangle around the product that has the same factors. Draw a triangle around each factor. Complete the number sentence.

\[ 9 \times \underline{\hspace{1cm}} = 36 \]

The two number sentences show the Property of Multiplication.
Problem Solving

7. Layne packed 3 toy cars in each of 4 cases. Circle the factors and shade the product to find how many toy cars Layne packed.

Joey packed 4 toy cars in each of 3 cases. Circle the other two factors and shade the product to find how many toy cars Joey packed.

8. Write the two number sentences that show the ways each boy packed the toy cars in Exercise 7.

Which property is this an example of?

Property of

HOT Problems

9. Identify Structure Write a real-world problem for which you can use the multiplication table and the Commutative Property of Multiplication to solve. Then solve.

10. Building on the Essential Question How can a multiplication table help you multiply?
Homework Helper

Find the product of $3 \times 4$.

1. Find 3 in the far left column.
2. Find 4 in the row along the top.
3. Follow the numbers across and down until they meet. This is the product.

$3 \times 4 = 12$ ← product

The Commutative Property tells you that you can change the order of the factors without changing the product.

$4 \times 3 = 12$ ← product

Practice

1. Look at the products with a factor of 5. What pattern do you see? The products with a factor of 5 end in _______ or _______.

2. Look at the products with a factor of 0. What do you notice? The products with a factor of 0 end in _______.

Lesson 1  My Homework  299
3. Find $10 \times 5$. Circle the factors and the product. Write the product.

4. Shade a row of numbers yellow to show the products with a factor of 10. What do you notice about this row? The products with a factor of 10 end in ________.

**Problem Solving**

5. **Model Math** Mason has 1 notebook for science and 1 notebook for reading. He put 9 stickers on each notebook. How many stickers did Mason use in all? Write two multiplication sentences.

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**Vocabulary Check**

6. Label each with the correct word.

- factors
- product

$4 \times 2 = 8$

---

**Test Practice**

7. Which property states the order in which two numbers are multiplied does not change the product?

A. Associative Property of Addition

B. Commutative Property of Multiplication

C. Inverse Operations

D. Identity Property of Addition
Multiply by 2

Math in My World

Example 1
The students in an art class are working on a project. How many students are there in the art class if there are 8 groups of 2?

Find 8 groups of 2.

Write 8 groups of 2 as $8 \times 2$.

One Way Use an array.
Draw an array with 8 rows and 2 columns.

Another Way Draw a picture.
Draw 8 equal groups of 2.

Write an addition sentence and multiplication sentence.

$+ + + + + + + + = \times =$

So, $8 \times 2 = \underline{}$. There are \underline{} students in the art class.

You can write it vertically, also.

No matter which way you write a multiplication fact, you still read it the same way.
Example 2
Seth rides his bike to the park Mondays, Wednesdays, and Fridays. It is 2 miles round-trip. How many miles does he ride for the three days? Write a multiplication sentence with a symbol for the unknown. Then, use a bar diagram to solve.

\[ 3 \times 2 = \text{unknown} \]

1. Model 2 miles a day as one part.
   1 part = 2 miles

2. Since he rode the same amount for 3 days, model a total of 3 parts.

3. Write a multiplication sentence. \( \text{days} \times \text{miles a day} = \text{miles} \)
   So, \( 3 \times 2 = \text{miles} \).
   Seth rode \( \text{miles} \) for the 3 days. The unknown is \( \text{miles} \).

Guided Practice
Write an addition sentence and a multiplication sentence for each.

1. \[ \begin{array}{c}
   \text{4 groups of 2 is } \\
   2 + 2 + 2 + 2 = \\
   4 \times 2 =
\end{array} \]

2. \[ \begin{array}{c}
   \text{3 groups of 2 is } \\
   2 + 2 + 2 = \\
   3 \times 2 =
\end{array} \]

Talk MATH
Describe two strategies you can use to remember the multiplication facts for 2.
Independent Practice

Write an addition sentence and a multiplication sentence for each.

3. 2 groups of 2 is ______. 2
   \[ 2 + \_\_\_ = \_\_\_ \times 2 \]
   \[ 2 \times \_\_\_ = \_\_\_ \]

4. 6 groups of 2 is ______. 6
   \[ 2 + 2 + 2 + 2 + 2 + 2 = \_\_\_ \times 2 \]
   \[ 6 \times \_\_\_ = \_\_\_ \]

Draw an array for each. Then write a multiplication sentence.

5. 3 rows of 2
   \[ \_\_\_ \times \_\_\_ = \_\_\_ \]

6. 2 rows of 3
   \[ \_\_\_ \times \_\_\_ = \_\_\_ \]

7. The arrays in Exercises 5 and 6 show the ______ Property.

Algebra Write a multiplication sentence with a symbol for the unknown. Then solve.

8. How many ears are on 4 dogs?
   \[ \_\_\_ \times \_\_\_ = \_\_\_ \]
   There are ______ ears.

9. There are a total of 16 legs on 2 spiders. How many legs each?
   \[ \_\_\_ \times \_\_\_ = \_\_\_ \]
   Each spider has ______ legs.

Write a multiplication sentence.

10. \[
    \begin{array}{c|c|c|c}
        2 \text{ wheels} & 2 \text{ wheels} & 2 \text{ wheels} & 2 \text{ wheels} \\
        \hline
        \text{bicycles} & & & \\
    \end{array}
    \]

11. \[
    \begin{array}{c|c|c}
        5 \text{ buttons} & 5 \text{ buttons} \\
        \hline
        \text{coats} & \\
    \end{array}
    \]
Problem Solving

Mathematical Practice  Use Algebra Write a multiplication sentence with a symbol for the unknown. Then solve.

12. How many sides are there altogether on two squares?

\[ \times 2 = \square \]

There are \underline{} sides.

13. How many gloves are there altogether if Ryder has 6 pairs of gloves?

\[ \times 2 = \square \]

Ryder has \underline{} gloves altogether.

14. Paige has 24 magazines in her magazine collection. Each month she adds 2 more magazines to her collection. How many magazines will she have in 3 months? Write two number sentences to show how to solve.

She will have \underline{} magazines.

HOT Problems

Mathematical Practice Model Math Write a word problem about a real-world situation in which a number is multiplied by 2.

16. Building on the Essential Question What do you notice about all of the products of 2? Use the multiplication table.
Homework Helper

Helen buys 2 bunches of bananas. There are 10 bananas in each bunch. How many bananas does Helen buy in all?

Find $2 \times 10$.

This can be written vertically, also.

Use an array to model 2 groups of 10.

\[
\begin{array}{ccccccc}
& & & & & & \\
\hline
& & & & & & \\
& & & & & & \\
& & & & & & \\
& & & & & & \\
\end{array}
\]

You can write an addition sentence to represent the models.

\[10 + 10 = 20\]

OR

You can write a multiplication sentence to represent the models.

\[2 \times 10 = 20\]

So, Helen bought 20 bananas in all.

Practice

Write an addition sentence and a multiplication sentence.

1. 3 groups of 2 is ______.
   \[2 + \_ + \_ = \_
   \_
   \_
   \_ \times 2 = \_

2. 4 groups of 2 is ______.
   \[2 + \_ + \_ + \_ = \_
   \_
   \_
   \times 2 = \_

Lesson 2 My Homework
Draw an array for each. Then write a multiplication sentence.

3. 7 rows of 2

4. 2 rows of 5

\[ \times = \quad \times = \]

**Problem Solving**

**Mathematical Practice** Use Algebra Write a multiplication sentence with a symbol for the unknown. Then solve.

5. Franklin’s father gave him and his sister \$8 each to spend at the movies. How much money did Franklin’s father give the children altogether?

6. There are 7 people in the Watson family. They all keep their gloves in 1 box in the closet. If each person has a pair of gloves, how many gloves are in the box?

**Vocabulary Check**

7. Write or draw the meaning of a bar diagram.

**Test Practice**

8. James is jumping on a pogo stick. He is counting by twos. If he counts to 12, how many jumps has he made?

- A 2 jumps
- B 4 jumps
- C 6 jumps
- D 10 jumps
Divide by 2

You learned about the division symbol ÷.

Another symbol for division is \( \div \).

\[
\begin{align*}
\text{dividend} & \quad 10 \div 2 = 5 \\
\text{quotient} & \quad 5 \\
\text{divisor} & \quad 2 \quad 10 \\
\text{dividend} & \quad \text{divisor}
\end{align*}
\]

Math in My World

Example 1

Javier and Alexis share an apple equally. If there are 8 slices, how many slices will each of them get?

To share equally between \( \_ \) people means to divide by 2. So, find \( 8 \div 2 \) or \( 2)8 \). \( \rightarrow \) Read: eight divided by two

Partition one counter at a time into each group until the counters are gone. Draw the equal groups at the right.

The model shows \( 8 \div 2 = \underline{4} \) or \( 2)8 \). Each person will get \( \underline{4} \) apple slices.
A related multiplication fact can help you find an unknown in a division sentence.

**Example 2**

Max divided his collection of 12 feathers into 2 groups. How many feathers are in each group? Find the unknown.

Find $12 \div 2 = \square$ or $2\overline{)12}$.

$12 \div 2 = \square \quad 2 \times \square = 12$

A division sentence can be thought of as a multiplication sentence in which you are looking for an unknown factor.

You know that $2 \times 6 = 12$.

So, $12 \div 2 = \square$ or $2\overline{)12}$. The unknown is $\square$.

There are ______ feathers in each group.

**Guided Practice**

Divide. Write a related multiplication fact.

1. $\begin{array}{c}
\begin{array}{c}
\fbox{\phantom{12}} \\
2) \phantom{4}
\end{array} \\
\phantom{12}
\end{array}$

$\begin{array}{c}
\begin{array}{c}
\fbox{\phantom{12}} \\
2) \phantom{4}
\end{array} \\
\phantom{12}
\end{array} \times \phantom{12} = \phantom{12}$

2. $\begin{array}{c}
\begin{array}{c}
\fbox{\phantom{12}} \\
2) \phantom{4}
\end{array} \\
\phantom{12}
\end{array}$

$\begin{array}{c}
\begin{array}{c}
\fbox{\phantom{12}} \\
2) \phantom{4}
\end{array} \\
\phantom{12}
\end{array} \times \phantom{12} = \phantom{12}$

3. $\begin{array}{c}
\begin{array}{c}
\fbox{\phantom{12}} \\
2) \phantom{4}
\end{array} \\
\phantom{12}
\end{array}$

$\begin{array}{c}
\begin{array}{c}
\fbox{\phantom{12}} \\
2) \phantom{4}
\end{array} \\
\phantom{12}
\end{array} \times \phantom{12} = \phantom{12}$

What are two different ways to find $16 \div 2$?
Independent Practice

Divide. Write a related multiplication fact.

4. \[ \begin{array}{cccc}
\bullet \\
\bullet \\
\bullet \\
\bullet \\
\bullet \\
\bullet \\
\bullet \\
\bullet \\
\end{array} \] \[ \begin{array}{cccc}
\bullet \\
\bullet \\
\bullet \\
\bullet \\
\bullet \\
\bullet \\
\bullet \\
\bullet \\
\end{array} \]

\[ 14 \div 2 = \quad \times \quad = \]

5. \[ \begin{array}{cccc}
\square \\
\square \\
\square \\
\square \\
\square \\
\square \\
\square \\
\square \\
\square \\
\end{array} \]

\[ 2) 1 8 \]

\[ \begin{array}{cccc}
\square \\
\square \\
\square \\
\square \\
\square \\
\square \\
\square \\
\square \\
\square \\
\end{array} \]

\[ \begin{array}{cccc}
\square \\
\square \\
\square \\
\square \\
\square \\
\square \\
\square \\
\square \\
\square \\
\end{array} \]

\[ 14 \div 2 = \quad \times \quad = \]

6. \( 4 \div 2 = \)

7. \( 16 \div 2 = \)

8. \( 18 \div 2 = \)

9. \( 2) 2 \)

10. \( 2) 2 0 \)

11. \( 2) 6 \)

Match the division sentence to the related multiplication sentence.

12. \( 16 \div 8 = 2 \)

13. \( 12 \div 2 = 6 \)

14. \( 10 \div 5 = 2 \)

15. \( 8 \div 2 = 4 \)

- \( 6 \times 2 = 12 \)
- \( 2 \times 5 = 10 \)
- \( 4 \times 2 = 8 \)
- \( 2 \times 8 = 16 \)

Algebra Find the unknown. Then write a related multiplication sentence.

16. \( 12 \div 6 = \square \)

17. \( 14 \div \square = 2 \)

18. \( \square \div 2 = 3 \)

The unknown is \( \square \). The unknown is \( \square \). The unknown is \( \square \).
Problem Solving

**Algebra** Write a division sentence with a symbol for the unknown for Exercises 19–20. Then solve.

19. Damian will plant 12 seeds in groups of 2. How many groups of 2 will he have?

20. Kyle and Alan equally divide a package of 14 erasers. How many erasers will each person get?

21. Lydia shared her 16 bottle caps equally with Pilar. Pilar then shared her caps equally with Timothy. How many caps do Pilar and Timothy each have?

22. **Mathematical PRACTICE** Be Precise You have learned that when any number is multiplied by 2 the product is even. Is the same true for division of an even number divided by 2? Explain.

**HOT Problems**

23. **Mathematical PRACTICE** Find the Error Blake says that $8 \div 2 = 16$ because $2 \times 8 = 16$. Is Blake correct? Explain.

24. **Building on the Essential Question** How does the relationship between division and multiplication help you find the unknown?
Homework Helper

The school van can carry 12 passengers. There are 2 passengers to a seat. How many seats are in the van?

Find $12 \div 2$, or $2\overline{12}$.

Partition 12 counters between 2 groups until there are none left.

There are 6 counters in each group.

$\therefore 6$

So, $12 \div 2 = 6$ or $2\overline{12}$. There are 6 seats in the van.

Practice

Divide. Write a related multiplication fact.

1. 

   

   $8 \div 2 = \underline{} \times \underline{} = \underline{}$

2. 

   

   $18 \div 2 = \underline{} \times \underline{} = \underline{}$
Divide. Write a related multiplication fact.

3. 20 ÷ 2 =

4. 6 ÷ 2 =

5. 12 ÷ 2 =

6. 2) 8

7. 2) 14

8. 2) 4

**Problem Solving**

9. **Algebra** Britt spent $12 equally at 2 stores. How much did she spend at each store? Write a number sentence with a symbol for the unknown. Then solve.

10. **Mathematical Practice ➤ Keep Trying** Ian picked up 16 red cars and 12 black cars from the floor of his room. He put the same number of each color car into 2 boxes. How many cars did he put in each box?

**Vocabulary Check**

11. Write or draw a definition of the word partition.

**Test Practice**

12. Casey bought a box of 18 granola bars. She kept some and gave the rest to her brother. If Casey and her brother have the same number of granola bars, how many did Casey give her brother?

- A 1 granola bar
- B 8 granola bars
- C 9 granola bars
- D 7 granola bars
Multiply by 5

You can use patterns to multiply by 5. Multiplying by a number is the same as skip counting by that number.

Math in My World

Example 1

Leandro has 7 nickels. How much money does he have?

One nickel equals 5¢. Skip count by fives to find $7 \times 5¢$.

7 nickels is $\underline{35}$. $7 \times 5¢ = \underline{35}¢$

So, Leandro has $\underline{35}¢$.

Notice the pattern in the products.

$0 \times 5 = \underline{0}$ -- All of the products end in 0 or 5.
$1 \times 5 = \underline{5}$
$2 \times 5 = \underline{10}$
$3 \times 5 = \underline{15}$

Extend the pattern.

$4 \times 5 = \underline{20}$
$5 \times \underline{5} = \underline{25}$
$6 \times \underline{5} = \underline{30}$
$7 \times \underline{5} = \underline{35}$
Example 2

A watermelon patch has 6 rows of watermelons. Each row has 5 watermelons. How many watermelons are in the farmer’s patch? Write a multiplication sentence with a symbol for the unknown.

\[6 \times 5 = \square\]

1. Draw an array with 6 rows.

2. Use the Commutative Property to draw another array with 5 rows.

My Drawing!

There are \_ \_ \_ rows of \_ \_ \_.

There are \_ \_ \_ rows of \_ \_ \_.

So, \[6 \times 5 = \_ \_ \_\] .

So, \[5 \times 6 = \_ \_ \_\] .

The unknown is \_ \_ \_.

The unknown is \_ \_ \_.

There are \_ \_ \_ watermelons in the farmer’s patch.

Guided Practice

Skip count by fives to find each product. Draw lines to match.

1. \[4 \times 5 = \square\]
   \[5 + 5 + 5 + 5 + 5\]

2. \[3 \times 5 = \square\]
   \[5 + 5 + 5 + 5\]

3. \[8 \times 5 = \square\]
   \[5 + 5 + 5 + 5 + 5 + 5 + 5 + 5\]

4. \[7 \times 5 = \square\]
   \[5 + 5 + 5\]

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Independent Practice

Write an addition sentence to help find each product.

5. \(2 \times 5 = \) 5 + =
6. \(3 \times 5 = \) 5 + + =

7. \(7 \times 5 = \)

8. \(8 \times 5 = \)

9. \(5 \times 5 = \)

10. \(9 \times 5 = \)

Draw an array for each. Then write a multiplication sentence.

11. 7 rows of 5 12. 3 rows of 5 13. 4 rows of 5

\(7 \times \) =
\( \times \) =
\( \times \) =

Algebra Find each unknown. Use the Commutative Property.

14. \(\_ \times 6 = 30\) 15. \(5 \times \_ = 10\) 16. \(9 \times \_ = \)
\(6 \times \_ = 30\) \(\_ \times 5 = 10\) \(5 \times 9 = \)

The unknown is The unknown is The unknown is
Problem Solving


18. **Mathematical Practice** Explain to a Friend A sunflower costs $6. Evelyn wants to buy 2. Does she have enough money if she has three $5 bills? Explain.

19. There are 82 members in a band. Part of the band divides into 9 equal groups of 5. How many members are not in a group of 5?

HOT Problems

20. **Mathematical Practice** Reason Circle the strategy that will not help you find $6 \times 5$. Explain.

- skip counting
- rounding
- make an array
- draw a picture

21. **Building on the Essential Question** What do you notice about all the products of 5? Use the multiplication table if needed.
There are 6 students. Each student donates $5 to a school fundraiser. How much money did the students donate in all?

Find \(6 \times 5\).

**One Way** Skip count by fives.

\[
\begin{array}{ccccccc}
\$5 & + & \$5 & + & \$5 & + & \$5 & + & \$5 & + & \$5 = \$30 \\
\$5 & & \$10 & & \$15 & & \$20 & & \$25 & & \$30
\end{array}
\]

**Another Way** Draw an array.

6 rows of 5 = 30

So, the 6 students donated a total of $30.

**Practice**

Write an addition sentence to help find each product.

1. \(3 \times 5 = \) ______ 

2. \(8 \times 5 = \) ______

3. \(5 \times 5 = \) ______
Write a multiplication sentence for each array.

4. 1 row of 5
   
5. 5 rows of 4
   
6. 5 rows of 9
   

**Problem Solving**

7. Each pair of tennis shoes costs $25. If Andrea has four $5-bills, does she have enough money to buy one pair? Write a number sentence. Then solve.

8. For each balloon game you win at the fair, you get 5 tickets. Jamal won 9 balloon games. Gary won 6 balloon games. Do they have enough tickets altogether for a prize that is worth 100 tickets? Explain.

**Mathematical Practice**

9. **Make Sense of Problems** For a craft, each student will need 5 rubber bands. There are 8 students. Rubber bands come in bags of 9. How many bags will be needed? How many rubber bands will be left over?

**Test Practice**

10. Shawn has 4 nickels. How many walnuts can he buy if he spends all 4 nickels?
    - (A) 1 walnut
    - (B) 4 walnuts
    - (C) 5 walnuts
    - (D) 20 walnuts
Divide by 5

Use what you know about patterns and multiplying by 5 to divide by 5.

Math in My World

Example 1
A group of 5 friends sold a total of 20 glasses of lemonade. They each sold the same number of glasses. How many glasses of lemonade did they each sell?

Find $20 \div 5$.

One Way Use counters and partition.
Partition 20 counters into 5 equal groups. Draw the equal groups.

My Drawing!

There are ____ counters in each group.

$20 \div 5 = ____$

So, they each sold ____ glasses of lemonade.

Another Way Use repeated subtraction.
Subtract groups of 5 until you reach 0.

Count the number of groups you subtracted.

Groups of ____ were subtracted ____ times.

There are ____ groups. So, $20 \div 5 = ____$. 

Online Content at connectED.mcgraw-hill.com
Think of division as an unknown factor problem. Use a related multiplication fact.

Example 2

The school store is selling pencils for 5¢ each. If Corey has 45¢, how many pencils can he buy with his money?

Find the unknown in $45\div5\,\text{¢} = \square$ or $5\,\text{¢}\longdiv{45\,\text{¢}}$.

Draw an array. Then use the inverse operation to find the unknown.

Think $\square \times 5 = 45$

You know that $\square \times 5 = 45$.

So, $45\div5\,\text{¢} = \square$ or $5\,\text{¢}\longdiv{45\,\text{¢}}$.

The unknown is $\square$. Corey can buy $\square$ pencils.

Guided Practice

Use counters to find the number of equal groups or how many are in each group.

1. 35 counters
   
   5 equal groups

   $\square$ in each group

   $35\div5 = \square$

2. 10 counters
   
   5 equal groups

   $\square$ in each group

   $10\div5 = \square$

3. Use repeated subtraction to find $30\div5$.

   $30$
   $\underline{-5}$
   $\underline{-5}$
   $\underline{-5}$
   $\underline{-5}$
   $\underline{-5}$

   $30\div5 = \square$

320 Chapter 6 Multiplication and Division Patterns
Independent Practice

Use counters to find the number of equal groups or how many are in each group.

4. 15 counters
   5 equal groups
   __________ in each group
   $15 \div 5 =$

5. 10 counters
   _____ equal groups
   5 in each group
   $10 \div _____ =$ 5

6. 25 counters
   5 equal groups
   _____ in each group
   $25 \div 5 =$

Use repeated subtraction to divide.

7. $10 \div 5 =$

8. $5 \div 1 =$

Algebra Draw an array and use the inverse operation to find each unknown.

9. $\square \times 5 = 20$
   $\square \div 4 = 5$
   $\square =$
   $\square =$
   $\square =$

10. $5 \times \square = 40$
    $40 \div \square =$ 8

Use the recipe for Buttermilk Corn Bread. Find how much of each ingredient is needed to make 1 loaf of corn bread.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Buttermilk Corn Bread</th>
</tr>
</thead>
<tbody>
<tr>
<td>cornmeal</td>
<td>10 cups cornmeal</td>
</tr>
<tr>
<td>flour</td>
<td>5 cups flour</td>
</tr>
<tr>
<td>eggs</td>
<td>1 cup sugar</td>
</tr>
<tr>
<td>vanilla extract</td>
<td>5 Tbsp baking powder</td>
</tr>
<tr>
<td></td>
<td>4 tsp salt</td>
</tr>
<tr>
<td></td>
<td>Makes: 5 loaves</td>
</tr>
</tbody>
</table>

|                  | 3 cups butter                 |
|                  | 8 cups buttermilk              |
|                  | 5 tsp vanilla extract          |
|                  | 15 eggs                       |
|                  | 2 tsp baking soda              |
Problem Solving

15. Rose had a 30-inch piece of ribbon. She divided the ribbon into 5 equal pieces. How many inches long is each piece?

16. Garrison collected 45 flags. He displays them in his room in 5 equal rows. How many flags does Garrison have in each row?

HOT Problems

17. Keep Trying Addison got 40 points on yesterday's 10-question math quiz. Each question is worth 5 points and there is no partial credit. How many questions did she miss?

18. Stop and Reflect Circle the division sentence that does not belong. Explain your reasoning.

\[
\begin{align*}
20 \div 2 &= 10 \\
30 \div 5 &= 6 \\
20 \div 2 &= 10 \\
30 \div 6 &= 5 \\
35 \div 5 &= 7
\end{align*}
\]

19. Building on the Essential Question How can an array help you solve a related multiplication and division problem?
Homework Helper

Rudy spent $30 for 5 car models. Each model costs the same amount. How much did each car model cost?

Find $30 \div 5$, or $5)\bar{3}0$.

**One Way**  Use counters and partition.
Partition 30 counters equally among 5 groups until there are none left.

There are 5 equal groups of 6.

**Another Way**  Use repeated subtraction.
Subtract 5 until you get to 0. Count the number of times you subtracted.

\[
\begin{array}{cccccccc}
1 & 2 & 3 & 4 & 5 & 6 \\
30 & 25 & 20 & 15 & 10 & 5 \\
\downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\
25 & 20 & 15 & 10 & 5 & 0
\end{array}
\]

Groups of 5 were subtracted 6 times.

Since $30 \div 5 = 6$, each model cost $6$.

**Practice**

Partition to find the number of equal groups or how many are in each group.

1. 45 counters
   5 equal groups
   __________ in each group

2. 5 counters
   __________ equal groups
   1 in each group

3. 20 counters
   5 equal groups
   __________ in each group

4. 50 counters
   __________ equal groups
   5 in each group
5. **Algebra** Draw an array and use the inverse operation to find the unknown.

- \( \times 5 = 15 \)
- \( ? \div 3 = 5 \)
- \( ? = \)

**Problem Solving**

**Write a division sentence with a symbol for the unknown for Exercises 6 and 7. Then solve.**

6. Antonio scored 40 points on his math test. There were 5 questions on the test, and each was worth the same number of points. How many points did Antonio score for each question?

7. Lunch costs $5. Marcus has $35. How many days can he buy lunch?

8. **Mathematical PRACTICE Model Math** Today 25 girls and 20 boys rode their bikes to school. Each bike rack at school holds 5 bikes. How many bike racks were filled?

**Test Practice**

9. Which number sentence represents this repeated subtraction exercise?

\[
\begin{align*}
20 - 5 &\quad 15 - 5 &\quad 10 - 5 &\quad 5 - 5 \\
15 &\quad 10 &\quad 5 &\quad 0
\end{align*}
\]

- A 20 ÷ 5 = 4  C 20 - 20 = 0
- B 20 ÷ 2 = 10  D 20 - 10 = 10

**Need more practice?** Download Extra Practice at [connectED.mcgraw-hill.com](https://connectED.mcgraw-hill.com)
Vocabulary Check

Label each with the correct word(s).

1. \[4 \times 5 = 20\]

2. \[\text{partition}\]
   \[\text{product}\]
   \[\text{2 miles}\text{, }2 \text{ miles}\text{, }2 \text{ miles}\]
   \[\text{3 days}\]

3. [Diagram with circles and arrows]

Concept Check

4. Shade the product of the two circled factors. Complete the number sentence.
   \[6 \times 4 = \]

5. Draw a triangle around the product that has the same factors. Write the number sentence that shows the Commutative Property of Multiplication.
Write an addition sentence and a multiplication sentence for each.

6. 5 groups of 2 is

\[ \begin{align*}
+ & + + + + = \\
\times & =
\end{align*} \]

7. \[ \text{? pencils} \]

\[ \begin{align*}
\text{2 pencils} & \quad \text{2 pencils} & \quad \text{2 pencils}
\end{align*} \]

3 groups of 2 is

\[ \begin{align*}
+ & + + = \\
\times & =
\end{align*} \]

Divide. Write a related multiplication fact.

8. 6 ÷ 3 =

9. 10 ÷ 5 =

Problem Solving

10. A postal worker makes 8 trips to deliver some packages. She carries 2 packages at a time. How many packages are delivered?

Test Practice

11. Five times as many students bought lunch than packed lunch. Three students packed lunch. Which of the following could be used to find how many students bought lunch?

A 5 — 3  B 5 × 3  C 5 + 3  D 5 ÷ 3
Lesson 6

ESSENTIAL QUESTION
What is the importance of patterns in learning multiplication and division?

Problem-Solving Investigation
STRATEGY: Look for a Pattern

Learn the Strategy

In the first row of her tile pattern, Christina uses 2 tiles. She uses 4 tiles in the second row, 8 tiles in the third row, and 16 tiles in the fourth row. If she continues the pattern, how many tiles will be in the sixth row?

1 Understand
What facts do you know?

There will be _______ tiles in the first row, _______ in the second row, _______ in the third row, and _______ tiles in the fourth row.

What do you need to find?

The number of tiles that will be in row _______.

2 Plan

I will make a table for the information. Then I will look for a pattern.

3 Solve

<table>
<thead>
<tr>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
<th>6th</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>4</td>
<td>8</td>
<td>16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Put the information in a table. Look for a pattern. The numbers double. Now I can continue the pattern. There will be _______ tiles in the sixth row.

4 Check

Does your answer make sense? Explain.
Practice the Strategy
Jacy mows lawns every other day. He earns $5 the first day. After that, he earns $1 more than the day before. If he starts mowing on the first day of the month, how much money will he earn the 9th day of the month?

1 Understand
What facts do you know?

What do you need to find?

2 Plan

3 Solve

4 Check
Does your answer make sense? Explain.
Apply the Strategy

Solve each problem by looking for a pattern.

1. A collection of bears is shown. If there are 3 more rows, how many bears are there in all? Identify the pattern.

<table>
<thead>
<tr>
<th>Row</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bears</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Look for a Pattern

Yutaka is planting 15 flowers. He uses a pattern of 1 daisy and then 2 tulips. If the pattern continues, how many tulips will he use? Explain.

<table>
<thead>
<tr>
<th>Daisies</th>
<th>Tulips</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Review the Strategies

For Exercises 3–5, use the sign shown.

**HEALTH SHACK'S SNACKS**

- Sunflower seeds $10 per package
- Dried fruit $10 per 10 pieces
- Juice $20 each
- Yogurt $2 for 80¢

3. Julius spent 70¢ on sunflower seeds. How many packages did he buy?

4. How much did Neila pay for 1 yogurt?

5. How much would it cost to buy 1 of everything, including 1 piece of dried fruit?

6. Orlon collected 40 comic books. He keeps 10 comic books for himself and divides the rest equally among his 5 friends. How many comic books does each friend get?

7. **Mathematical Practice** Use Math Tools The amount of light given off by a light bulb is measured in lumens. Each of the 2 light bulbs in Hudson's room gives 1,585 lumens of light. Together, about how many lumens do both light bulbs give off?
At the arcade, Kelly began with 48 tokens. She gave 24 to Kuri. Then she gave 12 to Tonya. If this pattern continues, how many tokens will Kelly give away next?

1. Understand
   What facts do you know?
   Kelly began with 48 tokens.
   She gave away 24 tokens, then 12 tokens.

   What do you need to find?
   how many tokens Kelly will give away next

2. Plan
   I will look for a pattern.

3. Solve
   The pattern is 48, 24, 12, . . .
   Each number is half as much as the one before it.
   The pattern is divide by 2.
   \[12 \div 2 = 6\]
   So, Kelly will give away 6 tokens next.

4. Check
   Does the answer make sense?
   Half of 12 is 6. The answer makes sense.
Problem Solving

Solve each problem by looking for a pattern.

1. Adam is lining up his toy train cars. If he continues this color pattern, what color will the 18th car be?

2. Marissa delivers newspapers on Highview Drive. The first house number is 950, the next is 940, and the third is 930. If the pattern continues, what will the next house number be?

3. Kyle is training for a bike race. He rides 5 miles one day, 10 miles the next day, and 15 miles the third day. If Kyle repeats this schedule, what is the total distance he will have ridden after 5 days?

4. The Hornets basketball team won their first game by 18 points, their second game by 15 points, and their third game by 12 points. If the pattern continues, by how many points will they win their fifth game?

5. Darcy wears brown pants to work one day, blue pants the next day, and a skirt on the third day. If this pattern continues every three days, what will she wear to work on the seventh day?
Example 1

**Orlando found 8 dimes. How much money did Orlando find?**
A dime equals 10¢. Count by tens to find $8 \times 10¢$.

**Addition sentence:**

\[10¢ + 10¢ + 10¢ + 10¢ + 10¢ + 10¢ + 10¢ + 10¢ = 80¢\]

**Skip count:**

\[10¢ \quad 20¢ \quad 30¢ \quad 40¢ \quad 50¢ \quad 60¢ \quad 70¢ \quad 80¢\]

8 dimes is ___. \[8 \times 10¢ = ___¢\] So, Orlando found ___.

Notice the pattern in the products.

\[1 \times 10 = 10\quad \text{The ones digit of the product is zero.}\]
\[2 \times 10 = 20\quad \text{same}\]

Extend the pattern.

\[3 \times 10 = ___\]
\[4 \times 10 = ___\]
\[5 \times ____ = ___\]
\[6 \times ____ = ___\]
\[7 \times ____ = ___\]
\[8 \times ____ = ___\]
Example 2
Andrew saw footprints on the beach. He counted 10 toes on each of 3 sets of footprints. How many toes did Andrew count in all? Write a multiplication sentence with a symbol for the unknown.

\[ 3 \times 10 = \quad \text{unknown} \]

Skip count on a number line. Count three equal jumps of 10.

The number line shows that \( 3 \times 10 = \quad \). The unknown is \( \quad \).

So, Andrew counted \( \quad \) toes in the sand.

Guided Practice
Skip count by tens to find each product. Draw lines to match.

1. \( 5 \times 10 = \quad \) \( 10 + 10 \)

2. \( 2 \times 10 = \quad \) \( 10 \)

3. \( 7 \times 10 = \quad \) \( 10 + 10 + 10 + 10 + 10 + 10 + 10 \)

4. \( 1 \times 10 = \quad \) \( 10 + 10 + 10 + 10 + 10 \)

5. Complete the pattern.
   \( 10, 20, \quad, \quad, 50, 60, 70, \quad, \quad, 100 \)
Independent Practice

Skip count to find each product. Write the addition sentence.

6. \(4 \times 10 = \) \(10 + \) \( + \) \( + \) \( + \) \( = \)

7. \(6 \times 10 = \) \(10 + \) \( + \) \( + \) \( + \) \( + \) \( + \) \( = \)

8. \(3 \times 10 = \) \( + \) \( + \) \( + \) \( = \)

9. \(5 \times 10 = \) \( + \) \( + \) \( + \) \( + \) \( = \)

Algebra Use the number line to find each unknown.

\(0\) \(10\) \(20\) \(30\) \(40\) \(50\) \(60\) \(70\) \(80\) \(90\) \(100\)

10. \(\Box \times 6 = 60\) \(6 \times \Box = 60\)
11. \(10 \times \Box = 10\) \(\Box \times 10 = 10\)
12. \(9 \times 10 = \) \(10 \times 9 = \)

The unknown is \(\) \(\) \(\) \(\).

The unknown is \(\) \(\) \(\) \(\).

The unknown is \(\) \(\) \(\) \(\).

Multiply.

13. \(10 \times 2 = \)
14. \(10 \times 6 = \)
15. \(10 \times 5 = \)

16. \(\frac{10}{3} \)
17. \(9 \times 10\)
18. \(10 \times \)

Use the Commutative Property to find each product. Draw a line to match.

19. \(8 \times 10 = \)
20. \(10 \times 5 = \)
21. \(6 \times 10 = \)

\(\cdot 10 \times 6 = 60\)
\(\cdot 10 \times 8 = 80\)
\(\cdot 5 \times 10 = 50\)
Problem Solving

Some of the world’s largest glass sculptures are found in the United States. Use the clues in Exercises 22–25 to find the length of each sculpture.

22. Fiori di Como: 5 less than $7 \times 10$

23. Chihuly Tower: 5 more than $10 \times 5$

24. Cobalt Blue Chandelier: 9 more than $2 \times 10$

25. River Blue: 4 more than $10 \times 1$

26. **Mathematical PRACTICE**
   **Use Number Sense**
   There are 5 giraffes and 10 birds. How many legs are there altogether?

27. **Mathematical PRACTICE**
   **Reason**
   Explain how you know that a multiplication sentence with a product of 25 cannot be a $10$s fact.

28. **Building on the Essential Question**
   How can I use patterns to multiply numbers by 10?
Homework Helper

There are 8 players on the tennis team. Each family contributes $10 toward a gift for the coach. What is the total amount collected for the coach's gift?

Find $8 \times 10$.

Skip count by tens.

$\$10 + \$10 + \$10 + \$10 + \$10 + \$10 + \$10 + \$10 = \$80$

$\$10 \quad \$20 \quad \$30 \quad \$40 \quad \$50 \quad \$60 \quad \$70 \quad \$80$

So, the total amount collected from 8 families was $\$80$.

Practice

Skip count by tens to find each product. Write the addition sentence.

1. $5 \times 10 =$

2. $2 \times 10 =$

3. $7 \times 10 =$

4. $3 \times 10 =$
Algebra  Use the number line to find each unknown.

5. □ × 4 = 40  
4 × □ = 40

6. 10 × □ = 20  
□ × 10 = 20

7. 10 × □ = 50  
□ × 10 = 50

The unknown is  . The unknown is  . The unknown is  .

Problem Solving

For Exercises 8–9, write a multiplication sentence to solve.

8. Fiona's class went on a field trip to the art museum. The class rode in vans with 10 people in each van. How many people went on the field trip if they took 4 full vans?

9. **Mathematical Practice** Use Math Tools  During the football game, Carlos ran with the ball 3 times. Each time, he ran 10 yards. How many yards did Carlos run altogether?

10. Each time Allison goes to the recycling center, she takes 10 bags of cans. She will go twice this month, 3 times next month, and once the following month. How many bags of cans will Allison take to the recycling center in these three months?

Test Practice

11. Byron has 70 pennies. He stacks them in groups of 10. How many stacks of pennies can Byron make?

   A  7 stacks  
   B  8 stacks  
   C  9 stacks  
   D  10 stacks
Multiples of 10

The product of a given number, such as 10, and any other number is a **multiple**. You can use a basic fact and patterns of zeros to mentally find multiples of 10.

**Math in My World**

**Example 1**

A new hotel has 3 floors. There are 20 rooms on each floor. What is the total number of rooms in the hotel?

Find $3 \times 20$. $\rightarrow$ **20 is a multiple of 10, since $2 \times 10 = 20$**

**One Way** Use a basic fact and patterns.

$3 \times 2 = 6 \quad \rightarrow \quad \text{basic fact}$

$3 \times 20 = 3 \times 2 \times 10 = 3 \times 20 = 60$

**Another Way** Use place value.

Think of $3 \times 20$ as $3 \times 2$ tens.

Use base-ten blocks to model 3 equal groups of 2 tens. Draw your model at the right.

$3 \times 2 \text{ tens} =$ ____ tens

$\Rightarrow$ **6 tens = 60**

$3 \times 20 =$ ____

**Check for Reasonableness**

Use repeated addition.

$20 + \_ + \_ = \_\_$
Properties can be used to multiply a number by a multiple of 10.

**Example 2**

**Ellie is buying 2 bags of beads to add to her bead collection. Each bag has 40 beads. How many beads is Ellie buying?**

**Find** $2 \times 40$.

\[
2 \times 40 = 2 \times (4 \times 10) \quad \text{Write 40 as } 4 \times 10.
\]

\[
= (2 \times 4) \times 10 \quad \text{Find } 2 \times 4 \text{ first.}
\]

\[
= _{\phantom{0}} \times 10 \quad \text{Multiply.}
\]

So, Ellie is buying ____ beads.

**Example 3**

**Find the unknown in** $4 \times 50 = \square$.

\[4 \times 50 = 200 \quad 4 \times 5 \text{ tens} = 20 \text{ tens}\]

Sometimes the basic fact has a zero. Keep that zero, then add the other zero.

So, $4 \times 50 = \square$. The unknown is _____.

**Guided Practice**

**Multiply. Use place value.**

1. $2 \times 20 = 2 \times \underline{}$ tens

\[
= \underline{} \text{ tens}
\]

So, $2 \times 20 = \square$.

2. $5 \times 60 = 5 \times \underline{}$ tens

\[
= \underline{} \text{ tens}
\]

So, $5 \times 60 = \square$.
Independent Practice

Multiply. Use a basic fact.

3. \(5 \times 5 = \) 
   So, \(5 \times 50 = \) 

4. \(6 \times 2 = \) 
   So, \(6 \times 20 = \) 

5. \(5 \times 7 = \) 
   So, \(5 \times 70 = \) 

Multiply. Use place value.

6. \(5 \times 20 = \) 
   \( \times \text{tens} = \text{tens} \) 
   So, \(5 \times 20 = \) 

7. \(2 \times 70 = \) 
   \( \times \text{tens} = \text{tens} \) 
   So, \(2 \times 70 = \) 

8. \(8 \times 50 = \) 
   \( \times \text{tens} = \text{tens} \) 
   So, \(8 \times 50 = \) 

9. \(2 \times 80 = \) 
   \( \times \text{tens} = \text{tens} \) 
   So, \(2 \times 80 = \) 

Multiply to find each product. Draw lines to match.

10. \(2 \times 90 = \) 
    \( 5 \times (4 \times 10) = (5 \times 4) \times 10 \)
    \( = 20 \times 10 \)
    \( = \) 

11. \(5 \times 40 = \) 
    \( 5 \times (9 \times 10) = (5 \times 9) \times 10 \)
    \( = 45 \times 10 \)
    \( = \) 

12. \(5 \times 90 = \) 
    \( 2 \times (9 \times 10) = (2 \times 9) \times 10 \)
    \( = 18 \times 10 \)
    \( = \) 

Algebra Find each unknown.

13. \(2 \times \_ = 100 \)
    The unknown is \(\) 

14. \(2 \times \_ = 60 \)
    The unknown is \(\) 

15. \(6 \times 50 = \) 
    The unknown is \(\)
Problem Solving

Write a multiplication sentence with a symbol for the unknown for Exercises 16–17. Then solve.

16. **Use Algebra** Demont’s card album has 20 pages, and 6 trading cards are on each page. How many cards are there in all?

17. There are 90 houses with 10 windows each. How many windows are there in all?

18. Carlita collected 2 boxes of teddy bears. Each box holds 20 bears. She sells each bear for $2. How much money did she earn?

HOT Problems

19. **Model Math** Write a multiplication sentence that uses a multiple of 10 and has a product of 120.

20. **Look for a Pattern** Describe the pattern you see when multiplying $5 \times 30$.

What is the product of $5 \times 300$?

21. **Building on the Essential Question** How do basic facts and patterns help me multiply a number by a multiple of 10?
There are 3 shelves in the cabinet. Each shelf holds 40 cans. How many cans will fit in the cabinet? You need to find $3 \times 40$.

**One Way** Use a basic fact and patterns.

$3 \times 4 = 12$  

$3 \times 40 = 120$  

**Another Way** Use place value.

Use base-ten blocks to model 3 groups of 4 tens.

$3 \times 4 \text{ tens} = 12 \text{ tens}$; $12 \text{ tens} = 120$.

So, $3 \times 40 = 120$.

So, 120 cans will fit in the cabinet.

**Practice**

Multiply. Use place value.

1. $2 \times 40 = \phantom{00}$
   
   $2 \times \underline{\phantom{10}} \text{ tens} = \underline{\phantom{10}} \text{ tens}$
   
   So, $2 \times 40 = \underline{\phantom{0}}$.

2. $5 \times 60 = \phantom{00}$
   
   $5 \times \underline{\phantom{10}} \text{ tens} = \underline{\phantom{10}} \text{ tens}$
   
   So, $5 \times 60 = \underline{\phantom{0}}$.

3. $5 \times 30 = \phantom{00}$
   
   $5 \times \underline{\phantom{10}} \text{ tens} = \underline{\phantom{10}} \text{ tens}$
   
   So, $5 \times 30 = \underline{\phantom{0}}$.

4. $10 \times 20 = \phantom{00}$
   
   $10 \times \underline{\phantom{10}} \text{ tens} = \underline{\phantom{10}} \text{ tens}$
   
   So, $10 \times 20 = \underline{\phantom{0}}$. 
Multiply. Use a basic fact.

5. $10 \times 3 = \underline{\hspace{2cm}}$ 6. $2 \times 9 = \underline{\hspace{2cm}}$
   So, $10 \times 30 = \underline{\hspace{2cm}}$ So, $2 \times 90 = \underline{\hspace{2cm}}$

7. $2 \times 8 = \underline{\hspace{2cm}}$ 8. $5 \times 5 = \underline{\hspace{2cm}}$
   So, $2 \times 80 = \underline{\hspace{2cm}}$ So, $5 \times 50 = \underline{\hspace{2cm}}$

Problem Solving

Write a multiplication sentence to solve.

9. Harlan has 5 antique watches. Each watch has a value of $90. How much are Harlan’s watches worth in all?

10. **Mathematical Practice ▶ Keep Trying** Trey uses 40 nails to put up the frame around each window. There are 5 windows in the bedroom. How many nails will Trey use in the bedroom?

11. Chloe uses 80 candy wrappers to make a paper necklace. She is making necklaces for herself and 9 friends. How many candy wrappers will Chloe need?

Vocabulary Check

12. Circle the number sentence that shows 20 is a multiple of 2.

   $2 \times 10 = 20$  $2 + 10 = 12$
   $2 \times 5 = 10$  $10 \div 2 = 5$

Test Practice

13. Which is equal to 52 tens?

   A. 52,010  C. 5,200
   B. 5,210  D. 520

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Divide by 10

Math in My World

Example 1

The third grade class needs 50 juice bars. How many boxes of juice bars will they need if there are 10 bars in each box?

Find $50 \div 10$.

One Way Use a number line.

Start at 50 and count back by 10s.

Groups of 10 were counted back ______ times.

Another Way Use repeated subtraction.

Subtract groups of ______ until you reach ______.

Groups of ______ were subtracted ______ times.

Either way, $50 \div 10 = ______$.

The third grade class will need ______ boxes of juice bars.
Think of division as an unknown factor problem. Use a related multiplication fact.

**Example 2**

A quarterback threw the football for a total of 70 yards. Each time he threw the ball, the team gained 10 yards. How many throws did the quarterback make? Write a division sentence with a symbol for the unknown.

Find $70 \div 10 = \square$.

You know that $10 \times \square = 70$. The unknown factor is $\square$.

Since division and multiplication are inverse operations,

$70 \div 10 = \square$

The unknown is $\square$.

The quarterback made $\square$ throws.

**Guided Practice**

Use repeated subtraction to divide.

1. $90 \div 10 = \square$

   0 10 20 30 40 50 60 70 80 90

2. $40 \div 10 = \square$

   0 10 20 30 40

3. $60 \div 10 = \square$

   \[ \begin{array}{ccccccc}
   60 & 50 & 40 & \square & \square & \square & \square \\
   -10 & -10 & -10 & \square & \square & \square & \square
   \end{array} \]
Independent Practice

Use repeated subtraction to divide.

4. \(20 \div 10 = \) 

\[
\begin{array}{c|c|c|c|c|c}
0 & 5 & 10 & 15 & 20 \\
\end{array}
\]

5. \(10 \div 10 = \) 

\[
\begin{array}{c|c|c|c|c|c}
0 & 5 & 10 & 15 & 20 \\
\end{array}
\]

6. \(30 \div 10 = \)

\[
\begin{array}{c}
30 \\
- 10 \\
\hline
0
\end{array}
\]

7. \(80 \div 10 = \)

\[
\begin{array}{c}
80 \\
- 10 \\
\hline
0
\end{array}
\]

Algebra Use a related multiplication fact to find each unknown.

8. \(50 \div 10 = \)

\[
\begin{array}{c}
10 \times \_ = 50
\end{array}
\]

9. \(70 \div \_ = 7\)

\[
\begin{array}{c}
\_ \times 7 = 70
\end{array}
\]

10. \(90 \div 10 = \)

\[
\begin{array}{c}
10 \times \_ = 90
\end{array}
\]

The unknown is \_. \ The unknown is \_. \ The unknown is \_.

11. \(60 \div \_ = 6\)

\[
\begin{array}{c}
\_ \times 6 = 60
\end{array}
\]

12. \(100 \div 10 = \)

\[
\begin{array}{c}
10 \times \_ = 100
\end{array}
\]

13. \(\_ \div 10 = 4\)

\[
\begin{array}{c}
10 \times 4 = 
\end{array}
\]

The unknown is \_. \ The unknown is \_. \ The unknown is \_.

Lesson 9  Divide by 10  347
**Problem Solving**

**Algebra** Write a division sentence with a symbol for the unknown, for Exercises 14–15. Then solve.

14. Ken wants to divide 40 flowers equally into 10 vases. How many flowers go in each vase?

15. Rona saw 60 cars at a car show. If she saw 10 of each kind of car, how many different kinds of cars were there?

**Mathematical PRACTICE Use Math Tools** The table shows the amount of money each child has saved in $10-bills.

What is the difference in the least amount of money saved and the greatest amount of money saved?

How many $10-bills is the difference equal to?

How many $10-bills have the children saved together?

<table>
<thead>
<tr>
<th>Name</th>
<th>Saved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rebecca</td>
<td>$70</td>
</tr>
<tr>
<td>Bret</td>
<td>$30</td>
</tr>
<tr>
<td>Monsa</td>
<td>$60</td>
</tr>
<tr>
<td>Hakeem</td>
<td>$90</td>
</tr>
</tbody>
</table>

**HOT Problems**

**Mathematical PRACTICE Use Number Sense** Use the numerals 0, 7, and 8 to write two 2-digit numbers that can each be divided by 10. The numerals can be used more than one time.

**Building on the Essential Question** How can skip counting by 10s help you find the quotient of 10s facts?
Ms. Mickle’s classroom has 30 desks with 10 desks in each row. How many rows of desks are there?

Find 30 ÷ 10.

Subtract groups of 10 until you reach 0.

**One Way Use a number line.**

```
0   10   20   30
```

**Another Way Use repeated subtraction.**

1. 30  
   - 10  
   20  
2. 20  
   - 10  
   10  
3. 10  
   - 10  
   0

3 groups of 10 were subtracted and you know that 10 × 3 = 30.
So, 30 ÷ 10 = 3. There are 3 rows of desks.

**Practice**

Use repeated subtraction to divide.

1. 70 ÷ 10 =

```
0   10   20   30   40   50   60   70
```

2. 60 ÷ 10 =

```
60  
− 10  
− 10  
− 10  
− 10  
− 10  
− 10
```
Algebra Use a related multiplication fact to find each unknown.

3. $80 \div 10 = \phantom{10}$
   $10 \times \phantom{10} = 80$
   The unknown is $\phantom{10}$.

4. $\phantom{10} \div 10 = 3$
   $10 \times 3 = \phantom{10}$
   The unknown is $\phantom{10}$.

5. $\phantom{10} \div 10 = 10$
   $10 \times 10 = \phantom{10}$
   The unknown is $\phantom{10}$.

6. $20 \div 10 = \phantom{10}$
   $10 \times \phantom{10} = 20$
   The unknown is $\phantom{10}$.

Problem Solving

7. Morgan has 90 cents in her pocket. All of the change is in dimes. How many dimes does Morgan have in all?

8. Ricky spent $90 at the supermarket. He bought $30 worth of fruit. He spent the rest of the money on steaks. If he bought 10 steaks and they each cost the same amount, what was the price of each steak?

9. Make Sense of Problems Annie bought a bag of 80 mini-carrots. She eats 5 carrots with lunch each day and eats another 5 each night as a snack. In how many days will the bag of carrots be gone?

Test Practice

10. Bill has a collection of 60 books he wants to donate to the library. Which number sentence shows how Bill can divide the books equally as he packs them in boxes?

   A. $60 \div 6 = 10$
   B. $60 - 10 = 50$
   C. $60 + 60 + 60 = 180$
   D. $60 \times 1 = 60$
## Fluency Practice

### Multiply.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. $2 \times 9 = $</td>
<td>2. $5 \times 3 = $</td>
<td>3. $2 \times 4 = $</td>
<td>4. $10 \times 6 = $</td>
</tr>
<tr>
<td>5. $2 \times 3 = $</td>
<td>6. $2 \times 5 = $</td>
<td>7. $2 \times 2 = $</td>
<td>8. $5 \times 1 = $</td>
</tr>
<tr>
<td>9. $5 \times 4 = $</td>
<td>10. $2 \times 6 = $</td>
<td>11. $2 \times 7 = $</td>
<td>12. $10 \times 2 = $</td>
</tr>
<tr>
<td>13. $10 \times 3 $</td>
<td>14. $5 \times 6 $</td>
<td>15. $2 \times 8 $</td>
<td>16. $10 \times 4 $</td>
</tr>
<tr>
<td>17. $5 \times 7 $</td>
<td>18. $5 \times 5 $</td>
<td>19. $10 \times 6 $</td>
<td>20. $5 \times 8 $</td>
</tr>
<tr>
<td>21. $2 \times 1 $</td>
<td>22. $5 \times 2 $</td>
<td>23. $5 \times 9 $</td>
<td>24. $10 \times 5 $</td>
</tr>
</tbody>
</table>
Fluency Practice

Divide.

1. $10 \div 5 = \underline{\hspace{1cm}}$
2. $20 \div 5 = \underline{\hspace{1cm}}$
3. $30 \div 10 = \underline{\hspace{1cm}}$
4. $8 \div 2 = \underline{\hspace{1cm}}$

5. $16 \div 2 = \underline{\hspace{1cm}}$
6. $50 \div 10 = \underline{\hspace{1cm}}$
7. $35 \div 5 = \underline{\hspace{1cm}}$
8. $25 \div 5 = \underline{\hspace{1cm}}$

9. $45 \div 5 = \underline{\hspace{1cm}}$
10. $60 \div 10 = \underline{\hspace{1cm}}$
11. $40 \div 5 = \underline{\hspace{1cm}}$
12. $10 \div 2 = \underline{\hspace{1cm}}$

13. $2 \div 12$
14. $5 \div 30$
15. $10 \div 20$
16. $5 \div 15$

17. $10 \div 70$
18. $2 \div 14$
19. $2 \div 18$
20. $5 \div 5$

21. $10 \div 40$
22. $2 \div 20$
23. $2 \div 6$
24. $2 \div 4$

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Use the clues and word bank below to complete the crossword puzzle.

bar diagram  factor  multiple
partition  product

Across:
1. The answer to a multiplication problem.
2. A drawing that helps to organize your information.
3. The product of a given number and any other whole number.
4. A number that is multiplied by another number.

Down:
1. To separate a number of objects into equal groups.
Concept Check

Write an addition sentence and a multiplication sentence. Then draw an array.

5. 2 rows of 3 is _______.

+ =

× =

6. 5 rows of 2 is _______.

+ + + + + =

× =

Multiply.

7. 7 × 10 = _______. 8. 6 × 5 = _______. 9. 1 × 5 = _______.
10. 2 × 10 = _______. 11. 9 × 10 = _______. 12. 4 × 5 = _______.

Algebra Use a related multiplication fact to find each unknown.

13. 30 ÷ 10 = _______. 14. 60 ÷ _______ = 6. 15. 40 ÷ 5 = _______.

× 10 = 30. _______ × 6 = 60. _______ × 5 = 40.

The unknown is _______. The unknown is _______. The unknown is _______.

Find each product or quotient.

16. 5 ÷ 1 = _______. 17. 50 ÷ 10 = _______. 18. 9 × 5 = _______.
19. 30 × 2 = _______. 20. 2 × 80 = _______. 21. 5 × 70 = _______.

354 Chapter 6 Multiplication and Division Patterns
Problem Solving

Algebra Write a number sentence with a symbol for the unknown for Exercises 22 and 23. Then solve.

22. Lucia's classroom has tables that are a total of 25 feet long. If there are 5 tables, how long is each table?

23. Julian bought 8 books this year. He gets a free book every time he buys 1. How many books altogether did he get this year?

24. Robert wrote this division sentence.

\[ 20 \div 2 = 10 \]

Write a number sentence that he could use to check his work.

25. The table below shows the cost of movie tickets.

<table>
<thead>
<tr>
<th>Movie Tickets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input: 1 2 3 4 5</td>
</tr>
<tr>
<td>Output: $8 $16 $24 ? ?</td>
</tr>
</tbody>
</table>

What is the cost for 5 movie tickets?

Test Practice

26. When Xavier buys his lunch, he saves the nickel he gets as change. How much money will Xavier have if he buys his lunch 6 times?

A) 5¢  B) 6¢  C) 25¢  D) 30¢
Use what you learned about multiplication and division patterns to complete the graphic organizer.

**ESSENTIAL QUESTION**
What is the importance of patterns in learning multiplication and division?

**Multiplication Patterns**

**Division Patterns**

Reflect on the ESSENTIAL QUESTION? Write your answer below.