Chapter

15 Multiplication and Division

Dear Student,

In this chapter, you are going to go further with multiplication than you have ever gone before. You are going to look ahead to things you will learn about in fourth grade and beyond.

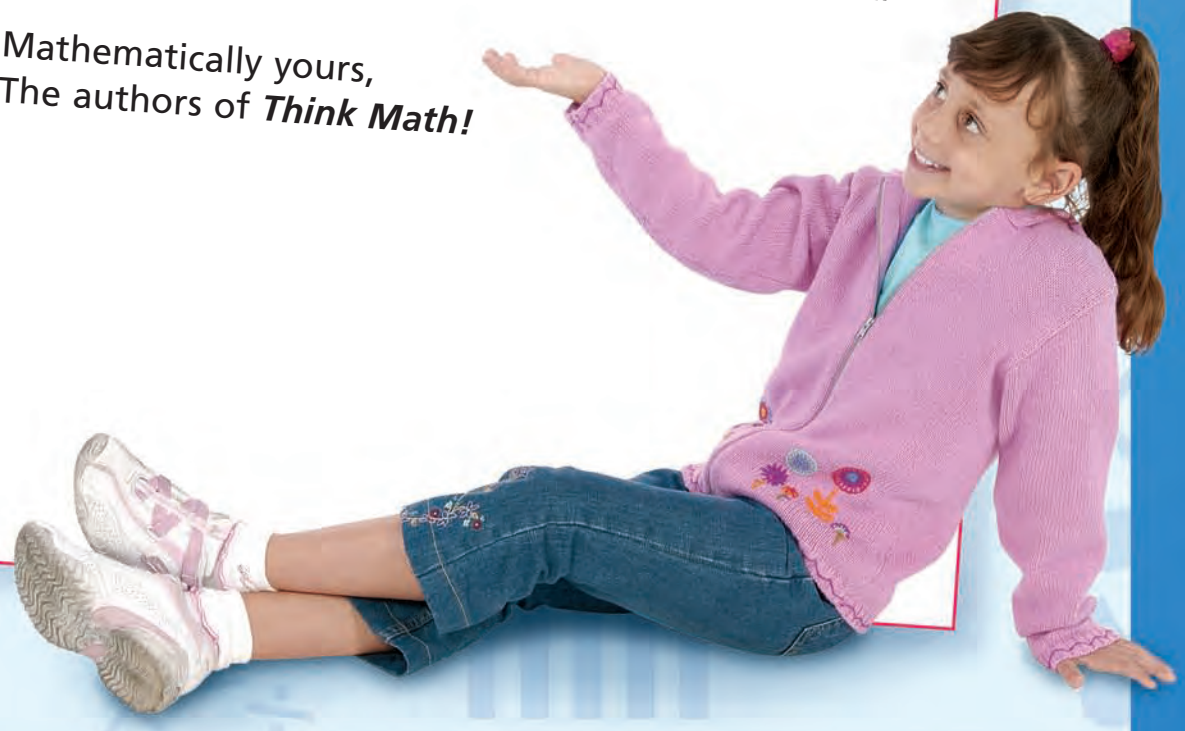
You will be multiplying and dividing larger numbers, and you will learn to answer questions like these:

Suppose there are 23 students in a class, and each student has read 48 books. How many books has the class read altogether?

Suppose there are 126 days until Dominick's birthday. How many weeks until his birthday?

We hope you enjoy this look into your mathematical future!

Mathematically yours,
The authors of ***Think Math!***



THE WORLD ALMANAC FOR KIDS

Butterflies

Monarch

Orange Tiger

Would you like to be indoors and have beautiful butterflies circle around you and maybe even land on your hand? You can at an indoor butterfly garden. One such place is *Butterfly World* in Florida. There, you can see 50 different kinds of butterflies at any one time among the 5,000 that are on display.

Queen Alexandra's Birdwing

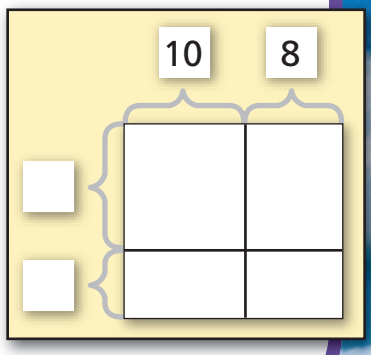
Blue Pansy

FACT·ACTIVITY 1

Solve.

1. Suppose you see 10 each of 9 different kinds of butterflies at *Butterfly World*. How many butterflies will you see in all?
2. Suppose you see 10 each of 24 different kinds of butterflies at *Butterfly World*. How many butterflies will you see in all?
3. *Butterfly World* provides guided tours. Suppose the tour guide gives 50 tours of 20 students each in a year. How many students does the tour guide lead in one year?
4. Adults can arrange to have children's birthday parties at *Butterfly World*. The cost is $18 per child with a minimum of 12 children. (That is, there must be at least 11 children.) Suppose it is your party. How many people do you want to have at your party? You may use the model at the right to help you find the total cost for that number of children.

Graphium Weiski



An artist has collected different types of butterflies and put them in display cases. The table below shows the number of different butterflies in a case.

FACT·ACTIVITY 2

Use the information in the table for 1–3.

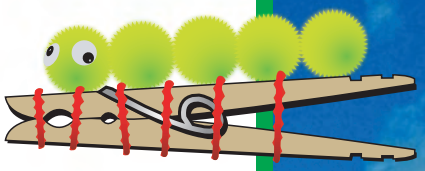
1. A museum store buys 25 displays of Birdwing butterflies. Write two related multiplication sentences to show the total number of butterflies in the display. Then write two related division sentences.
2. If the artist had 126 Zebra Swallowtail butterflies, how many cases could he make?
3. The artist has collected 44 Paris Peacock butterflies. How many cases can he make? Does he have any Paris Peacocks left over?

Butterfly Display Cases

Type of Butterfly	Number of Butterflies per Case
Birdwing	14
Paris Peacock	3
White Dragontail	8
Zebra Swallowtail	6

CHAPTER PROJECT

In the butterfly life cycle, caterpillars turn into butterflies. Make a caterpillar. You need 5 pompoms, 2 wiggly eyes, 1 pipe cleaner, and 1 clothespin for each caterpillar.



Directions: Cut the pipe cleaners into 1-inch-long pieces. Wrap 6 pieces of the pipe cleaner around the clothespin. Glue 5 pompoms together on top of the clothespin. Glue 1 pair of wiggly eyes on the face of the caterpillar.

How many of each material do you need to make 25 caterpillars? How many caterpillars can you make with 1 pack of pompoms? 1 pack of wiggly eyes? 1 pack of pipe cleaners? 1 pack of clothespins? You may use sketches or base-ten blocks to help you.

Materials	Number per Pack
$\frac{1}{2}$- to 1-inch craft pompoms	300
wiggly eyes	152
12-inch long pipe cleaners	12
3-inch clothespins	36

Chapter 15

Lesson 1

EXPLORE
Dime Arrays

You want to make an array to help you find 8 × 60, but you do not have hundreds of counters. Think of a way to use dimes as counters so you can do this with fewer than 50 dimes.

1. Draw your array.

2. Complete the number sentence.

   $8 \times 60 = \blacksquare$

Now use fewer than 50 dimes to make an array that represents 6 × 80.

3. Draw your array.

4. Complete the number sentence.

   $6 \times 80 = \blacksquare$

Chapter 15

Lesson 3

REVIEW MODEL
Adding Partial Products

You can use a diagram and simpler problems to find a product.

Example **Find 32 × 24.**

	30	2
20	20 × 30 = **600**	20 × 2 = **40**
4	4 × 30 = **120**	4 × 2 = **8**

Each product in the diagram (600, 40, 120, and 8) is a **partial product.**

Think of the partial products as parts of the total product. They can be added together to find the total product.

You can record the partial products in a column to make it easier to add.

You can record the partial products in any order.

	32
	× 24
(20 × 30)	**600**
(20 × 2)	**40**
(4 × 30)	**120**
(4 × 2)	+ **8**
	768

Be sure to align the place values (ones, tens, and hundreds) to add.

Check for Understanding

Use the diagram to find the partial products. Then add the partial products to find the total product.

1

	30	6
10	■	■
8	■	■

36
× 18

2

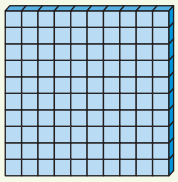
	40	3
20	■	■
5	■	■

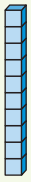
43
× 25

Chapter 15

Lesson 4

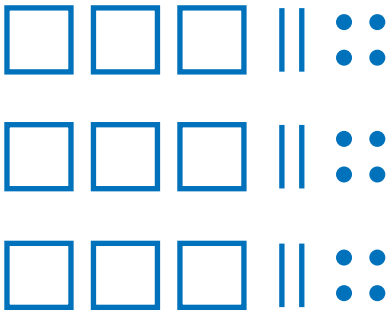
EXPLORE
Multiplying with Blocks and Money

Key: ☐ Stands for a base-ten block flat: 

| Stands for a rod: 

• Stands for a unit: 

1 Nina was solving a multiplication problem using base-ten blocks. This is what she wrote:



What do you think the problem was?
What is the product?

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2 Nina started to solve **243 × 3** by making **243** with dollars $1, dimes (D), and pennies (P).

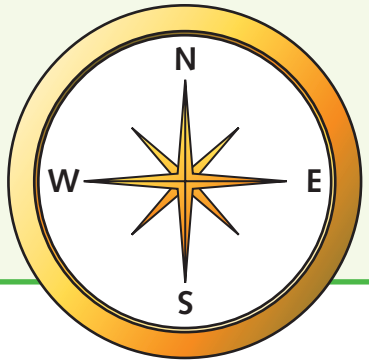
How could Nina continue to solve **243 × 3?**

Chapter 15

Lesson 6

EXPLORE
Finding Missing Streets

Trina counted 126 intersections on the 7 streets that run east to west on the map of her town.



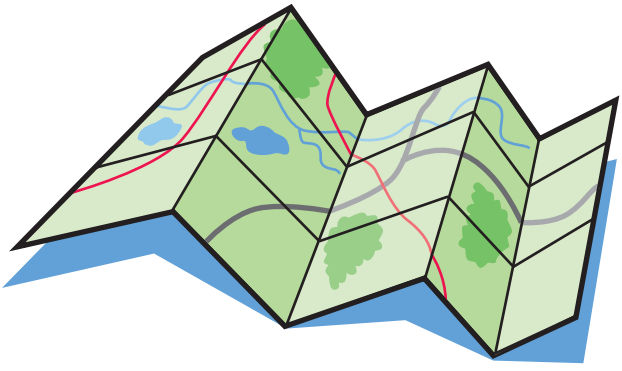
1. On a separate piece of paper, draw a map of the town.

2. How many streets on your map run north to south?

Mario counted 144 intersections on the 9 streets that run north to south on the map of his town.

3. Draw a map of the town on a separate piece of paper.

4. How many streets on your map run east to west?



Chapter 15

Lesson 7

EXPLORE
A Division Puzzle Challenge

Keesha's teacher gave the class this challenge.

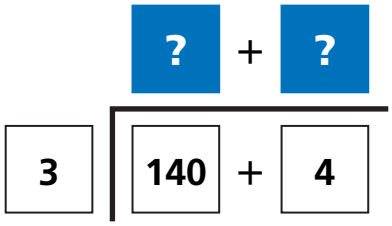
Find a division puzzle for **144 ÷ 3** that splits **144** into two parts.

A The first part must be a multiple of 10.

B Make the second part as small as possible.

C Use only whole numbers.

1 Keesha started with this puzzle.



Why won't her puzzle meet the challenge?

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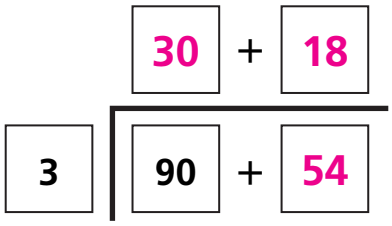
2 Keesha made this puzzle next.



Why won't this puzzle meet the challenge?

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3 Find and complete the puzzle that meets the challenge.

Chapter 15

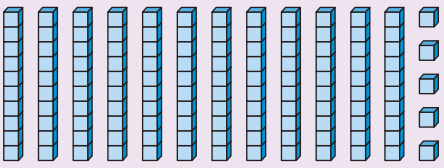
Lesson 8

REVIEW MODEL
Understanding Remainders

Sometimes you cannot divide objects evenly into groups.

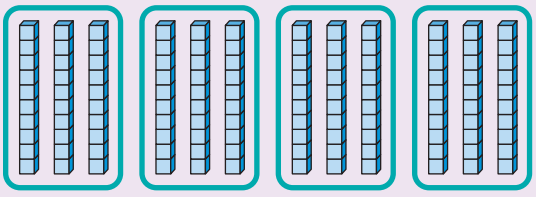
Example **Find 125 ÷ 4.**

Step 1 Use base-ten blocks to represent the number you are dividing.

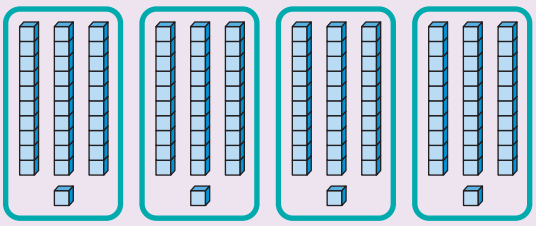


120 + 5
(10 × 12)

Step 2 Make 4 groups. Separate the tens into 4 equal groups by putting the same number of tens into each group.



Step 3 Separate the ones into your 4 equal groups by putting the same number of ones into each group.



The **quotient** is 31—the number in each of the 4 groups.

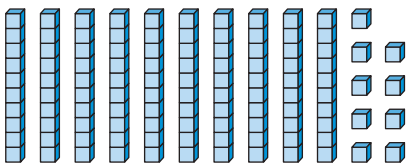
You started with 5 ones. You only used 4 ones to make equal groups. So, you have 1 left over.

The **remainder** is 1—the number left over. So, 125 ÷ 4 = 31 r1.

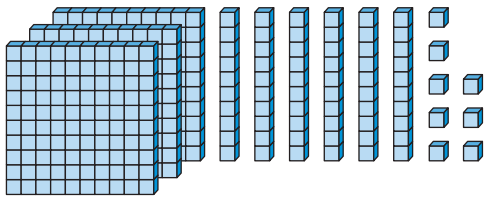
Check for Understanding

Use the picture to help you find the quotient and the remainder.

1. 109 ÷ 5 = ■



2. 368 ÷ 3 = ■



Chapter 15

Lesson 9

REVIEW MODEL

Problem Solving Strategy

Draw a Picture

Janice's small dog plays in a rectangular grassy space in her backyard. The play space is 18 feet long and 15 feet wide. What is the area of the play space?

Strategy: Draw a Picture

Read to Understand

What do you know from reading the problem?

The rectangular play space is 18 feet long and 15 feet wide.

Plan

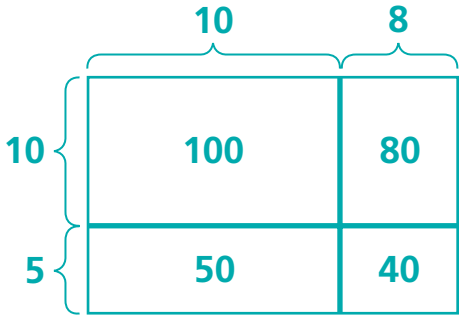
How can you solve this problem?

You can use the strategy *draw a picture.*

Solve

How can you use this strategy?

You can draw a picture of the play space. Draw a rectangle and label it with the length and width. Separate the rectangle into 4 parts and solve simpler problems by breaking the numbers into tens and ones. Find the area of each part, and add the 4 products to find the total area.



$10 \times 10 = 100$, $10 \times 8 = 80$, $5 \times 10 = 50$, and $5 \times 8 = 40$

$100 + 80 + 50 + 40 = 270$. So, the play space is 270 sq ft.

Check

Look back at the problem. Did you answer the question that was asked? Does the answer make sense?

Problem Solving Practice

Use the strategy *draw a picture.*

1. Jerry looked at a map of the town he was visiting and saw that the streets form 36 intersections. Some streets run east to west, and the other streets run north to south. How many streets could there be in the town?

2. Elena is decorating her bedroom. Her paint color choices are white, yellow, gray, or brown. She can choose red, green, blue, purple, orange, or pink curtains. How many choices does Elena have if she chooses one paint color and one curtain color?

Problem Solving Strategies

- ✔ Act It Out
- ✔ **Draw a Picture**
- ✔ Guess and Check
- ✔ Look for a Pattern
- ✔ Make a Graph
- ✔ Make a Model
- ✔ Make an Organized List
- ✔ Make a Table
- ✔ Solve a Simpler Problem
- ✔ Use Logical Reasoning
- ✔ Work Backward
- ✔ Write a Number Sentence

Mixed Strategy Practice

Use any strategy to solve. Explain.

3. Shakira has nickels, dimes, and quarters in her pocket. She pulls out 1 quarter. Then she pulls out 2 more coins. What are all the possible amounts of money Shakira could have pulled out of her pocket?

4. Tony and Fran were decorating cupcakes. Tony was faster than Fran. Every time Fran decorated one cupcake, Tony decorated two cupcakes. Together they decorated 48 cupcakes. How many cupcakes did each person decorate?

5. Becky drinks 6 glasses of water each day. She drinks 8 ounces each time she has a glass of water. How many ounces of water does Becky drink in a week?

6. Mr. Yang owns 4 pet stores. He ordered 216 bags of dog food. He wants each store to have the same number of bags of food. How many bags will each store receive?

Chapter 15 Vocabulary

Choose the best vocabulary term from Word List A for each sentence.

1. A(n) ___?___ is an arrangement that shows objects in rows and columns.
2. A number that is multiplied by another number to find a product is called a(n) ___?___.
3. A(n) ___?___ of a whole number is a product of that number and another whole number.
4. The answer to a division problem is called the ___?___.
5. A(n) ___?___ is one of the set of numbers 0, 1, 2, 3, . . ., which continues without end.
6. The amount left over when a number cannot be divided equally is a(n) ___?___.
7. The ___?___ is the number to be divided in a division problem.

Word List A

- array
- column
- diagram
- dividend
- divisor
- factor
- horizontal
- intersecting lines
- multiple
- partial product
- product
- quotient
- remainder
- whole number

Complete each analogy using the best term from Word List B.

8. River is to horizontal as tree is to ___?___.
9. Multiplication is to product as division is to ___?___.

Word List B

- factor
- remainder
- quotient
- vertical

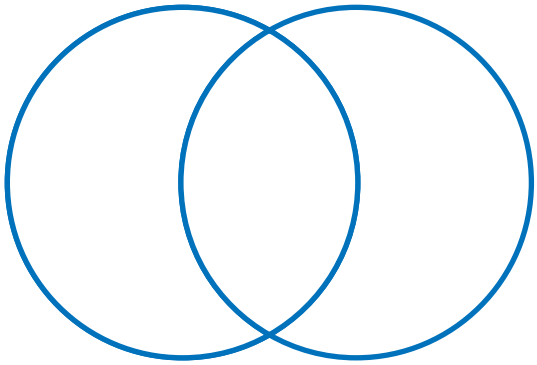
Talk Math

Discuss with a partner what you have learned about multiplication and division. Use the vocabulary terms *factor, multiple,* and *whole number.*

10. How can you use an array to multiply two numbers?
11. How does division relate to multiplication?

Venn Diagram

12 **Create a Venn diagram for the words and terms related to multiplication and division. Label one circle *Multiplication* and the other circle *Division.***



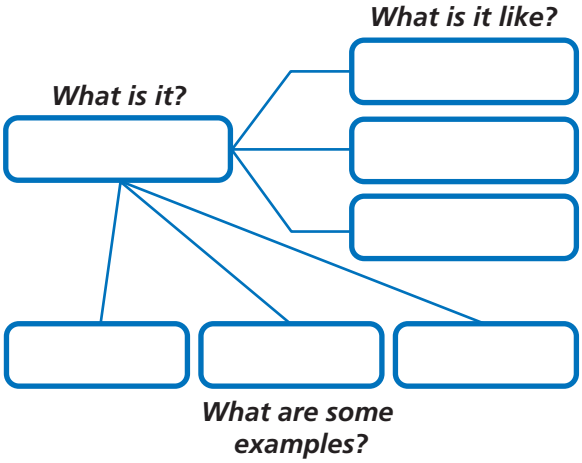
Word Definition Map

13 **Create a word definition map for the term *array.***

A What is it?

B What is it like?

C What are some examples?



PRODUCT A *product* is a result. In math, a product is the result of multiplying two or more factors. In everyday life, there are other types of *products.* The *product* of a factory might be cars. The *product* of a farm might be corn. The *product* of a writer might be a book. The *product* of a musician might be a song. Each *product* is the result of performing an action.

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GAME

Factor Factory

Game Purpose
To practice multiplying two-digit numbers using arrays

Materials
- 2 Number cubes
- 2 Colored pencils
- Centimeter grid paper, tape
- Calculator

How to Play the Game

1. This is a game for 2 players. Tape together 4 sheets of centimeter grid paper to make a 2-by-2 array. Choose your color of pencil.

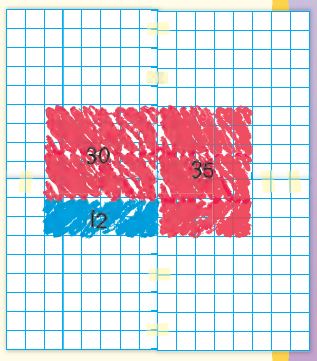
2. To start, each player tosses one number cube. The two numbers tossed are the length and width of an array. The player who tossed the larger number draws the array on the grid paper and finds the number of squares in the array. That number is his or her score for the round. Remember to keep a record of your scores.

3. Now take turns. Toss one number cube. Decide whether to add that number of rows or columns to the array. Then figure out the new total number of squares. Your partner can use a calculator to check the answer. If it is correct, you get the number of squares that you added to the array as your points for the round.

4. Play until adding a row or column would make one side of the new array greater than 50. There is no score for that round. The game is over.

5. Add all your points. The player with more points wins.

Example:



Sue's points	Bob's points
30	12
35	

GAME

Partial Claim

Game Purpose
To practice using partial products to find the product of 2 two-digit numbers

Materials
- Number cards (1–9, four sets)
- Calculator

How to Play the Game

1. This is a game for 2 players. Mix up the number cards. Place them in a stack face down.

2. Each player takes 2 cards to make a factor. The first number picked is the tens digit. The second number is the ones digit. Multiply the factors using partial products.
   - Take turns. "Claim" (say aloud) and record the partial products of the two factors.
   - Find the sum of your "claimed" partial products.
   - Calculate and record the total product. Check your work with the calculator.

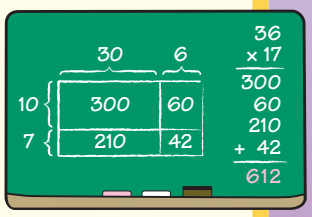
3. Play 6 rounds. Find the sum of your partial products from each round. The player with the higher total wins.

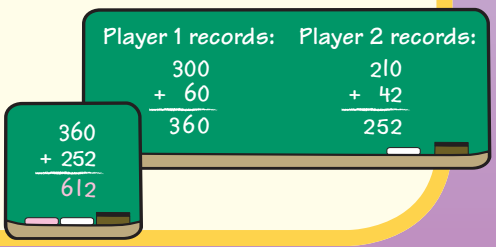
Here's a Sample Round

Suki picks 3 and 6 to form 36. Cal picks 1 and 7 to form 17. Suki and Cal multiply 36 × 17.

Suki claims the partial product 10 × 30 = 300. Cal claims 7 × 30 = 210. Suki claims 10 × 6 = 60. Cal claims 7 × 6 = 42.

Suki and Cal record the total product. They check the answer with a calculator.





CHALLENGE

Somebody erased some of the numbers from Trevor's math homework. Can you help Trevor find all the missing numbers?

For 1 to 4, find the missing factors.

1

$$\begin{array}{r} 482 \\ \times\ \blacksquare \\ \hline 1200 \\ 240 \\ 6 \\ \hline 1{,}446 \end{array}$$

2

$$\begin{array}{r} 264 \\ \times\ \blacksquare \\ \hline 1600 \\ 480 \\ 32 \\ \hline 2{,}112 \end{array}$$

3

$$\begin{array}{r} 718 \\ \times\ \blacksquare \\ \hline 4200 \\ 60 \\ 48 \\ \hline 4{,}308 \end{array}$$

4

$$\begin{array}{r} 963 \\ \times\ \blacksquare \\ \hline 4500 \\ 300 \\ 15 \\ \hline 4{,}815 \end{array}$$

For 5 to 8, find the missing partial products.

5

$$\begin{array}{r} 39 \\ \times\ 35 \\ \hline 900 \\ 270 \\ \blacksquare\blacksquare\blacksquare \\ 45 \\ \hline 1{,}365 \end{array}$$

6

$$\begin{array}{r} 52 \\ \times\ 14 \\ \hline \blacksquare\blacksquare\blacksquare \\ 20 \\ 200 \\ 8 \\ \hline 728 \end{array}$$

7

$$\begin{array}{r} 47 \\ \times\ 63 \\ \hline 2400 \\ \blacksquare\blacksquare\blacksquare \\ 120 \\ 21 \\ \hline 2{,}961 \end{array}$$

8

$$\begin{array}{r} 26 \\ \times\ 37 \\ \hline 600 \\ 180 \\ 140 \\ \blacksquare\blacksquare \\ \hline 962 \end{array}$$

For 9 to 12, find all the missing digits.

9

$$\begin{array}{r} 1\blacksquare \\ \times\ 57 \\ \hline 500 \\ \blacksquare\blacksquare\blacksquare \\ 70 \\ 56 \\ \hline 1{,}026 \end{array}$$

10

$$\begin{array}{r} \blacksquare 3 \\ \times\ 28 \\ \hline \blacksquare\blacksquare\blacksquare\blacksquare \\ 60 \\ 480 \\ 24 \\ \hline 1{,}764 \end{array}$$

11

$$\begin{array}{r} \blacksquare 1 \\ \times\ 23 \\ \hline 1800 \\ 20 \\ \blacksquare\blacksquare\blacksquare \\ 3 \\ \hline 2{,}093 \end{array}$$

12

$$\begin{array}{r} 56 \\ \times\ \blacksquare 3 \\ \hline \blacksquare\blacksquare\blacksquare\blacksquare \\ 240 \\ 150 \\ 18 \\ \hline 2{,}408 \end{array}$$