

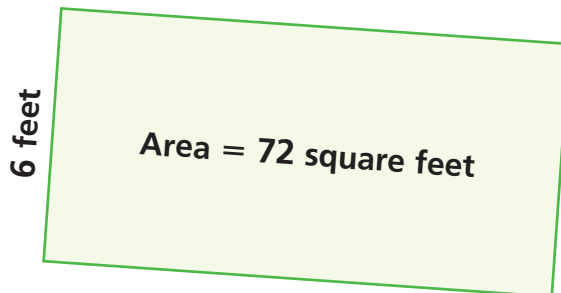
13 Division

Dear Student,

By now you should be very proud that you know so many multiplication facts. You even know about strategies for multiplying larger numbers. In this chapter you'll use all of this knowledge to divide larger numbers.

How can you use multiplication to do division? Well, you already know what a fact family is, so how do you think you can use $12 \times 6 = 72$ to find $72 \div 6$?

How can this picture help you solve this problem?



In this chapter, you'll review and develop your approaches for solving problems like these. Have fun!

Mathematically yours,
The authors of *Think Math!*



Denim Data

In 1873, Jacob Davis and Levi Strauss turned denim, thread, and metal into the most popular clothing product in the world. Although denim work pants had been around since the 1600s, it wasn't until tailor Davis used metal rivets to strengthen points of strain that these pants became popular.

Today, a regular pair of denim jeans has 5 rivets and 5 buttons and requires about $1\frac{3}{4}$ yards of 60-inch wide denim fabric.



FACT • ACTIVITY 1

Use the information above for problems 1–3.

- 1 Write a multiplication sentence to show how many pairs of denim jeans can be made using 60 rivets.
- 2 Fabric is usually purchased by the yard. The buyer checks the width of the fabric and then asks for the number of yards desired. Estimate how many pairs of jeans can be made from 135 yards of denim based on 60-inch width fabric? Explain.
- 3 What if a new style of jeans were made that required 9 rivets per pair? Show how you can find the number of jeans that can be made from 342 rivets. Write the number of jeans you can make.



FACT • ACTIVITY 2

One bale of cotton weighs about 500 pounds and can make more than 225 pairs of denim jeans.

Answer the questions.

A tailor, Mrs. Elliott, has purchased some yards of 60-inch wide denim to make denim jeans.

- 1 Mrs. Elliott has 360 inches of denim to make regular denim jeans. If it takes exactly 63 inches of denim to make a pair of men's jeans, will she be able to make 6 pairs of jeans? Use estimation to explain.
- 2 Mrs. Elliott uses 324 inches of denim to make 6 different styles of women's jeans. If each style requires the same number of inches of denim, how many inches of denim per pair of jeans does she use?
- 3 About how many bales of cotton are needed to manufacture 925 pairs of jeans?



CHAPTER PROJECT

Some people make quilts from discarded denim jeans. A patchwork quilt can be made from equal-sized square patches of denim sewn together.

- Decide on and draw a design for a rectangular quilt up to 4 feet by 6 feet in size.
- How many inches long will it be? How many inches wide will it be?
- How many equal-sized patches will fit across and down? Try several variations before you decide on one.
- Use division to show the size of each patch in the width and length of your quilt.
- Draw a picture of your final design. You may want to decorate the patches with symbols, letters, or words.

ALMANAC Fact

Levi Strauss always disliked the term "jeans." The denim work pants were called "waist-high overalls." Not until the mid-1930s did the company ever refer to them as jeans.

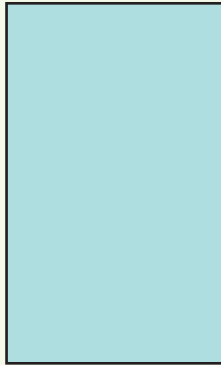
EXPLORE

Making Quilts

Andrea is making a quilt with an area of 15 square feet.



Lynn is making a quilt with an area of 35 square feet.



Before they began their quilts, they bought fabric together. Fabric is sold in various lengths, but always with a 5-foot width.

- 1 What length of fabric should they buy to make both of their quilts? (You may use square tiles to help you answer this question.)

Andrea and Lynn decided to sew their quilts together.

- 2 Draw a picture of this quilt to find the new length.
- 3 Write a number sentence to describe the area of the two joined quilts.

What's the length of the new quilt?

EXPLORE

"Missing-Factor" Puzzles

0

1

2

4

8

16

Some of these number sentences can be completed using the numbers from the green block above. Copy and complete those sentences.

1

$$5 \times \blacksquare = 20$$

2

$$9 \times \blacksquare = 18$$

3

$$3 \times \blacksquare = 24$$

4

$$6 \times \blacksquare = 6$$

5

$$5 \times \blacksquare = 15$$

6

$$4 \times \blacksquare = 28$$

7 How can you complete the other number sentences using a *sum* of numbers from the green block?

REVIEW MODEL

Finding Missing Factors

You can solve missing-factor problems in several steps. First, look for a multiple of the given factor that is close to but less than the product. Subtract to find how close to the product you were. Repeat the process until you find the missing factor.

Find the missing factor: $16 \times \blacksquare = 208$

Step 1 Estimate a multiple of 16 that is less than or equal to 208. Try 10, 20, 30, or some other multiple of 10.

Think: $16 \times 1 = 16$, so $16 \times 10 = 160$
 $16 \times 2 = 32$, so $16 \times 20 = 320$
 Since 320 is greater than 208, we'll use **10** as the first partial factor.

Step 2 Subtract the multiple of 16 from 208:

$$\begin{array}{r} 208 \\ -160 \\ \hline 48 \end{array}$$

Step 3 Estimate or calculate exactly a multiple of 16 that is less than or equal to 48.

Think: $16 \times 1 = 16$, $16 \times 2 = 32$, and $16 \times 3 = 48$
 Since 48 is equal to 48, we'll use **3** as the second partial factor.

Step 4 Subtract the multiple of 16 from 48:

$$\begin{array}{r} 48 \\ -48 \\ \hline 0 \end{array}$$

Step 5 Repeat the steps. When you find a difference of zero, add the partial products. $10 + 3 = 13$, so $16 \times 13 = 208$

✓ Check for Understanding

Find the missing factor.

1 $18 \times \blacksquare = 288$

2 $12 \times \blacksquare = 288$

3 $\blacksquare \times 25 = 775$

4 $\blacksquare \times 34 = 510$

5 $23 \times \blacksquare = 759$

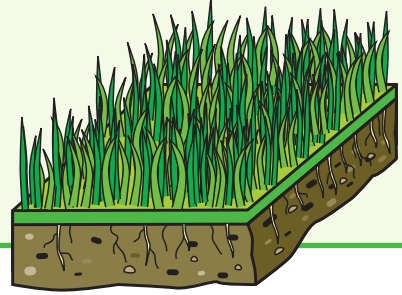
6 $\blacksquare \times 42 = 882$

EXPLORE

A Division Story

The area of Angi's lawn is 126 square feet.
The lawn is rectangular and 7 feet wide.

Angi wants to buy sod to plant her lawn with grass. The garden store she goes to sells sod in 1-foot by 1-foot squares.



1 Draw a picture to represent this situation.

2 How long is Angi's lawn?

3 How many square feet of sod should Angi buy?

REVIEW MODEL

Recording Division Steps

To record division problems using the new format, solve a series of missing-factor problems. Each time you find a missing factor, write it in two places in the format. Then subtract. Use the difference to write a new missing factor problem.

Divide: $168 \div 6$

Step 1 Draw the division “box.” Write the number you are **dividing** inside. Write the number you are **dividing by** outside.

Step 2 Find the greatest factor that is a multiple of 10 with a product less than 168. Write it (20) here and above 168, as shown.

Step 3 Subtract. Write the difference (48) here.

Step 4 Find a factor with a product less than or equal to the difference (48). Write it (5) here and above 168, as shown.

Step 5 Subtract. Write the difference (18) here.

Step 6 Find a factor with a product less than the difference (18). Write it (3) here and above 168, as shown.

Step 7 Continue until the difference is zero.

Step 8 Add the factors: $20 + 5 + 3 = 28$, so $168 \div 6 = 28$.

In Steps 4 and 6, many different factors are possible. In the example above, the factors 5 and 3 are shown, but others are possible.

	<div style="border: 1px solid #ccc; display: inline-block; padding: 2px 10px;">3</div> <div style="border: 1px solid #ccc; display: inline-block; padding: 2px 10px;">5</div> <div style="border: 1px solid #ccc; display: inline-block; padding: 2px 10px;">20</div>
	$6 \overline{) 168}$
$6 \times$	<div style="border: 1px solid #ccc; display: inline-block; padding: 2px 10px;">20</div> $= \underline{120}$
	<div style="border: 1px solid #ccc; display: inline-block; padding: 2px 10px; color: green;">48</div>
$6 \times$	<div style="border: 1px solid #ccc; display: inline-block; padding: 2px 10px;">5</div> $= \underline{30}$
	<div style="border: 1px solid #ccc; display: inline-block; padding: 2px 10px; color: green;">18</div>
$6 \times$	<div style="border: 1px solid #ccc; display: inline-block; padding: 2px 10px;">3</div> $= \underline{18}$
	<div style="border: 1px solid #ccc; display: inline-block; padding: 2px 10px; color: green;">0</div>

✓ Check for Understanding

Find the quotient.

1 $136 \div 8$

2 $110 \div 5$

3 $189 \div 7$

4 $306 \div 9$

EXPLORE

Exploring Division

Without solving any of these problems, decide which problem has the smallest answer and which problem has the largest answer.

$$808 \div 8 = \blacksquare$$

$$590 \div 10 = \blacksquare$$

$$87 \div 1 = \blacksquare$$

$$234 \div 9 = \blacksquare$$

$$84 \div 4 = \blacksquare$$

$$33 \div 33 = \blacksquare$$

How did you decide?

REVIEW MODEL

Problem Solving Strategy
Work Backward

Gina is painting a fence with 150 posts. When she has painted three times as many posts as she has already painted, she'll have 12 more posts to paint. How many posts has she painted?

Strategy: Work Backward**Read to Understand**

What do you know from reading the problem?

There are 150 fence posts. When Gina has painted three times as many posts as she has already painted, she'll have just 12 more to paint.

What do you need to find out?

the number of fence posts that Gina has painted

Plan

How can you solve this problem?

You could use the information in the problem to work backward from the end to the beginning.

Solve

How can you work backward to solve the problem?

Think: At the end, Gina will have painted 150 posts.

Just before that, she painted the last 12 posts. That means she must have painted $150 - 12 = 138$ posts before that.

138 posts is three times the number of posts she has already painted. So, she must have painted $138 \div 3$ posts so far.

$$138 \div 3 = 46$$

So, Gina must have painted 46 posts so far.

Check

Look back at the problem. Did you answer the questions that were asked? Does the answer make sense?

Problem Solving Practice

Use the strategy *work backward* to solve.

- 1 Brittany wants to save \$400 for her vacation. When she has saved four times as much as she has saved already, she will need only \$72 more. How much has she saved?
- 2 Dennis, Vicky, and Beth divided up the houses in their neighborhood to conduct a survey. Dennis interviewed the owners of half the houses. Vicky interviewed the owners of one-third of the houses that remained. Beth interviewed the 12 remaining owners. How many houses were in the neighborhood?

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 an Equation

Mixed Strategy Practice

Use any strategy to solve. Explain.

- 3 Anton bought 33 apples and bananas. He bought 7 more bananas than apples. How many apples did he buy?
- 4 The area of a rectangular garden is 36 square yards. Its width is 4 yards. What is its perimeter?
- 5 There are four candidates for class president. In how many different orders can they stand in a line to have their photos taken?
- 6 A rectangular rug measures 2 yards by 3 yards. What is the area of the rug in square feet?
- 7 Sunday's temperature was 6 degrees higher than Saturday's. On Monday the temperature fell 11 degrees. On Tuesday it rose 17 degrees to 46 degrees. What was the temperature on Saturday?
- 8 Peaches cost \$2.10 a pound. Apples cost \$1.55 a pound. Each week the price of peaches goes down \$0.08 a pound and the price of apples goes up \$0.03 a pound. How much will each cost when their prices are the same?
- 9 At a book sale, Annie bought five hardcover books at \$3 apiece, and some paperbacks at \$2 apiece. She spent \$27. How many paperbacks did she buy?
- 10 Jodie has a penny, a nickel, and a dime. How many different values can she make using one, two, or three coins?

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

- 1 The number that is to be divided in a division problem is the ____?
- 2 The number that divides the dividend is the ____?
- 3 The ____? is the result of multiplication.
- 4 To replace a number with another number that tells about how many or how much is to ____? a number.
- 5 A set of related multiplication and division equations is a(n) ____?
- 6 The process of finding the total number of items in equal-sized groups is called ____?
- 7 Numbers that are easy to compute mentally are called ____?

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

- 8 Addend is to addition as ____? is to multiplication.
- 9 Product is to multiplication as ____? is to division.

Word List A

compatible
numbers
dividend
divisor
fact family
factor
multiple
multiplication
product
quotient
round

Word List B

divisor
estimate
factor
quotient

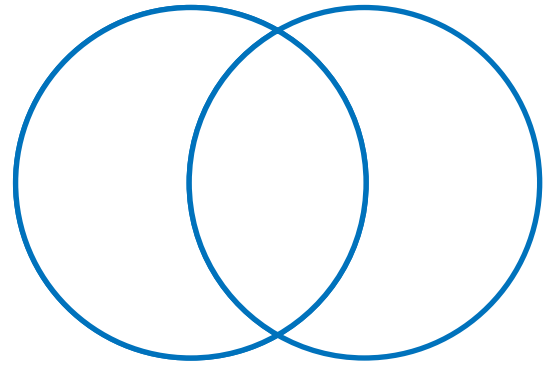
Talk Math

Discuss with a partner what you have learned about multiplication and division. Use the vocabulary terms *factor* and *product*.

- 10 How can you solve a missing-factor problem?
- 11 How can you write a missing-factor problem as a division problem?
- 12 Suppose you have a missing-factor problem and you know that the missing factor is greater than 10. How can you estimate the missing factor?

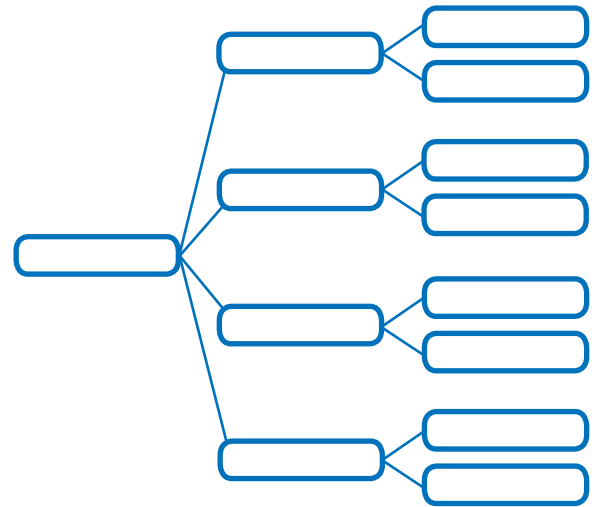
Venn Diagram

- 13 Create a Venn diagram for multiplication and division terms. Use the terms *dividend*, *divisor*, *fact family*, *factor*, *product*, and *quotient*.



Tree Diagram

- 14 Create a tree diagram using the terms *operations*, *addition*, *subtraction*, *multiplication*, and *division*. Use what you know and what you have learned about the operations.



What's in a Word?



ESTIMATE The word *estimate* can be a verb or a noun. The verb usually means to round numbers before computing with them. The noun means the sum, difference, product, or quotient of the rounded numbers. A house painter might *estimate* the cost of supplies needed to paint a house. Then the painter will give an *estimate* of the total cost to paint the house.



Technology

Multimedia Math Glossary
www.harcourtschool.com/thinkmath

GAME

Greatest Factors

Game Purpose

To explore strategies for finding missing factors efficiently

Materials

- Activity Masters:
Greatest Factors Games I–III



How To Play The Game

- 1** This is a game for two players. The goal is to collect points by choosing large factors of given numbers. Each game has four puzzles. Take turns choosing which puzzle to use. The player who does not choose the puzzle gets to go first.
- 2** You are trying to reach the starting number. Take turns filling in the steps. To fill in a step, choose a factor from the large block. Write it in the hexagonal box to complete the multiplication sentence. Tell how much is left.
 - If you are filling in the first step, the amount left is the difference between the starting number and the product from the multiplication sentence.
 - After the first step, the amount left is the difference between the previous step and the new product.
 - If the chosen factor is too large and would give a negative number, do not do the subtraction.
- 3** Each player earns points equal to the factor chosen from the large block. But if your chosen factor was too large, you get zero points. Keep track of your points on scratch paper.
- 4** Once the amount left is zero, the remaining steps must use zero as the missing factor. No one gets any points for those steps.
- 5** After you have filled in all four puzzles, add up your points. The player with more points is the winner.

GAME

The Greatest Answer

Game Purpose

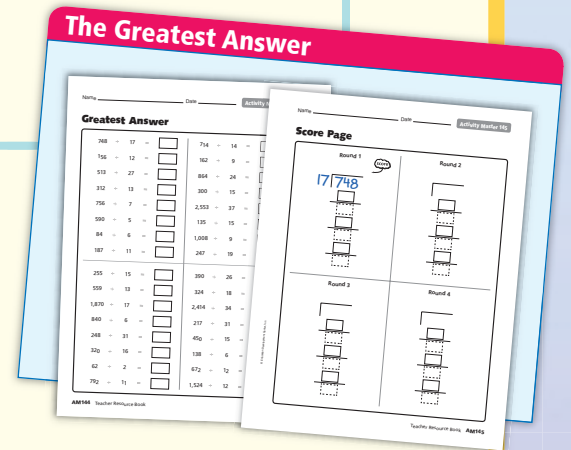
To practice estimating quotients

Materials

- Activity Master: Greatest Answer
- Activity Master: Score Page

How To Play The Game

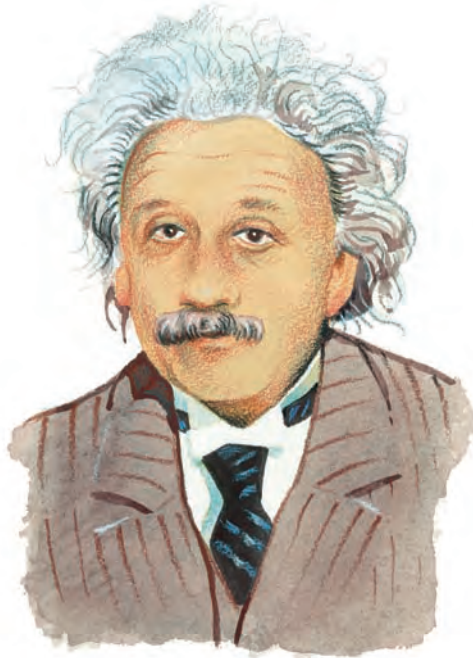
- 1** This is a game for two players. The object is to estimate which problems in four sets of division problems have the largest quotients. Together, choose one of the four sets of division problems.
- 2** One player uses estimation to choose a division problem with a large quotient from the set. Then the second player chooses a division problem in the same way.
 - Solve your division problem.
 - Check the other player's work.
 - Your score is the answer to the problem. Record your score on the Score Page.
- 3** Choose one of the remaining sets and repeat Step 2, with the second player choosing a problem first this time. Record your scores.
- 4** After you have played four rounds, with each player completing one problem from each set, add up all your points. The player with more points is the winner.



CHALLENGE

Albert Einstein was a famous twentieth-century mathematician. Solve the puzzle below to find the word that is missing from this quote by Einstein.

___ ? ___ is more important than knowledge.



- 1 Estimate or find each quotient exactly.

N $210 \div 5$

I $324 \div 2$

A $52 \div 4$

I $62 \div 62$

N $624 \div 2$

T $444 \div 4$

G $63 \div 3$

I $174 \div 6$

O $630 \div 3$

A $300 \div 5$

M $48 \div 6$

- 2 Order the quotients from least to greatest.
- 3 Spell out the missing word by matching each letter to the correct quotient. What is the missing word?