

CCSS Focus



Domain

Operations and Algebraic Thinking

Cluster

A. Represent and solve problems involving multiplication and division.

Standard

3.OA.A.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.

Additional Standards

3.OA.A.4, 3.OA.B.6, 3.OA.C.7, 3.MD.C.7a, 3.MD.C.7b

(See Standards Correlations at the end of the book for full text.)

Standards for Mathematical Practice (SMP)

SMPs 1, 2, 3, 4, 5, and 6 are integrated in every lesson through the *Try-Discuss-Connect* routine.*

In addition, this lesson particularly emphasizes the following SMPs:

- 2** Reason abstractly and quantitatively.
- 4** Model with mathematics.
- 5** Use appropriate tools strategically.
- 7** Look for and make use of structure.

*See page 1i to see how every lesson includes these SMPs.

Lesson Objectives

Content Objectives

- Solve multiplication and division word problems involving equal groups.
- Solve multiplication and division word problems involving arrays.
- Solve multiplication and division word problems involving area.

Language Objectives

- Draw an array or other diagram to represent multiplication or division word problems, and explain how the diagram relates to the problem.
- Write equations, using a letter for the unknown number, to represent multiplication and division word problems and explain how the equation relates to the problem.
- Compare the different approaches used by others and identify connections among the approaches.

Prerequisite Skills

- Understand the similarities, differences, and relationship between multiplication and division.
- Write fact families for basic multiplication facts for 0 through 10.
- Understand how the concepts of equal groups and arrays relate to multiplication and division.
- Understand how the concept of area relates to multiplication.

Lesson Vocabulary

There is no new vocabulary. Review the following key terms.

- **array** a set of objects arranged in equal rows and equal columns.
- **division** an operation used to separate a number of items into equal-sized groups.
- **division equation** an equation with a division symbol and an equal sign. For example, $15 \div 3 = 5$.
- **multiplication** an operation used to find the total number of items in a given number of equal-sized groups.
- **multiplication equation** an equation with a multiplication symbol and an equal sign. For example, $3 \times 5 = 15$.

Learning Progression

In Grade 2 students used drawings and equations to represent and solve word problems involving addition and subtraction. They also learned how to use addition of equal addends to find the total number of objects in arrays and were introduced to ideas about equal groups.

In earlier lessons in Grade 3 students were introduced to multiplication and division.

In this lesson students apply all of these understandings to solving one-step multiplication and division word problems that involve equal groups, arrays, and area. Students use drawings, words, and

equations to represent situations in word problems, writing equations using a letter for the unknown number. Students recognize that the same situation can be represented with both a multiplication equation and a division equation.

In the next lesson students will model and solve two-step word problems involving all four operations: addition, subtraction, multiplication, and division.

In Grade 4 students will interpret situations in order to solve multi-step word problems involving the four operations, including situations involving multiplicative comparison.

Lesson Pacing Guide

Teacher Toolbox

Whole Class Instruction

SESSION 1

Explore

45–60 min

Solving One-Step Word Problems Using Multiplication and Division

- Start 5 min
- Try It & Discuss It 20 min
- Connect It 15 min
- Close: Exit Ticket 5 min

Additional Practice

Lesson pages 361–362

SESSION 2

Develop

45–60 min

Solving Problems About Equal Groups

- Start 5 min
- Try It & Discuss It 20 min
- Picture It & Model It 5 min
- Connect It 10 min
- Close: Exit Ticket 5 min

Additional Practice

Lesson pages 367–368

Fluency

Solving Problems About Equal Groups

SESSION 3

Develop

45–60 min

Solving Problems About Arrays

- Start 5 min
- Try It & Discuss It 20 min
- Picture It & Model It 5 min
- Connect It 10 min
- Close: Exit Ticket 5 min

Additional Practice

Lesson pages 373–374

Fluency

Solving Problems About Arrays

SESSION 4

Develop

45–60 min

Solving Problems About Area

- Start 5 min
- Try It & Discuss It 20 min
- Picture It & Model It 5 min
- Connect It 10 min
- Close: Exit Ticket 5 min

Additional Practice

Lesson pages 379–380

Fluency

Solving Problems About Area

SESSION 5

Refine

45–60 min

Solving One-Step Word Problems Using Multiplication and Division

- Start 5 min
- Example & Problems 1–3 15 min
- Practice & Small Group Differentiation 20 min
- Close: Exit Ticket 5 min

Lesson Quiz

or Digital Comprehension Check

Small Group Differentiation

PREPARE

Ready Prerequisite Lesson

Grade 2

- Lesson 3 Solve One-Step Word Problems

RETEACH

Tools for Instruction

Grade 2

- Lesson 3 Solve One-Step Addition and Subtraction Word Problems

Grade 3

- Lesson 17 Multiply and Divide to Solve One-Step Word Problems

REINFORCE

Math Center Activities

Grade 3

- Lesson 17 Solve Word Problems
- Lesson 17 Writing Equations

EXTEND

Enrichment Activity

Grade 3

- Lesson 17 Race Training

i-Ready

Independent Learning

PERSONALIZE

i-Ready Lesson*

Grade 3

- Solve One-Step Word Problems Using Multiplication and Division

Learning Game

- Cupcake

Lesson Materials

Lesson *Per student:* 15 unit tiles, 12 sticky notes
(Required)

Activities *Per student:* 1 index card
Per pair: 42 counters, 50 small objects
Per group: 21 counters, 21 unit tiles, 21 paper clips
For display: example problems, objects to support problems
Activity Sheet: 1-Centimeter Grid Paper

Math Toolkit 1-inch tiles, 1-centimeter tiles, counters, buttons, cups, 1-centimeter grid paper, 1-inch grid paper, index cards, sticky notes

Digital Math Tools Perimeter and Area Tool, Number Line, Multiplication Models

*We continually update the Interactive Tutorials. Check the Teacher Toolbox for the most up-to-date offerings for this lesson.

Connect to Family, Community, and Language Development

The following activities and instructional supports provide opportunities to foster school, family, and community involvement and partnerships.

Connect to Family

Use the **Family Letter**—which provides background information, math vocabulary, and an activity—to keep families apprised of what their child is learning and to encourage family involvement.

Available in Spanish
Teacher Toolbox

Solve One-Step Word Problems Using Multiplication and Division

LESSON 17

Dear Family,
This week your child is solving one-step word problems using multiplication and division.

For example, he or she might see a problem like this one.

Tom created a patio using square tiles side-by-side with no gaps. He used 24 square tiles and made 6 rows. Tom used the same number of squares in each row. How many squares did he put in each row?

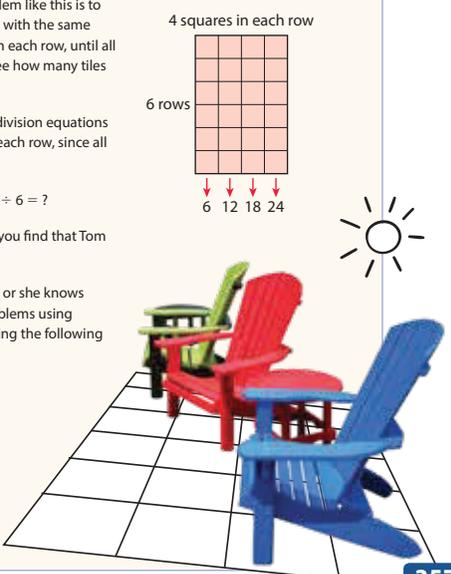
One way to make sense of a problem like this is to make a grid showing rows of tiles with the same number in each row. Draw 1 tile in each row, until all 24 tiles are used. Then count to see how many tiles are in each row.

Or you can use multiplication or division equations to find the number of squares in each row, since all the rows are equal groups.

$6 \times ? = 24$ or $24 \div 6 = ?$

However you solve the problem, you find that Tom put 4 squares in each row.

Invite your child to share what he or she knows about solving one-step word problems using multiplication and division by doing the following activity together.



357

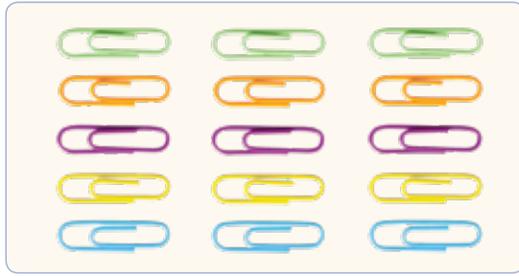
ACTIVITY ONE-STEP WORD PROBLEMS

Do this activity with your child to practice solving one-step word problems with multiplication and division.

Materials 40 small objects (pennies, buttons, paper clips)

- Using some of the objects, ask your child to create an array.
- Take turns making up and solving word problems about the array.
- Each time, have your child say an equation to describe the problem.
- Ask your child to say whether he or she used multiplication or division to solve the problem.

For example, suppose your child makes the following array.



Here are two possible problems about the array. Ask your child to say an equation for each problem.

- Nigel has 15 cookies. He puts them in equal groups onto 5 plates. How many cookies are on each plate?
- Paul pasted 15 stickers in his scrapbook. He put 3 stickers in each row. How many rows of stickers did he make?

Answers: 1. $15 \div 5 = 3$ or $5 \times 3 = 15$; 2. $15 \div 3 = 5$ or $3 \times 5 = 15$

358

Goal

The goal of the Family Letter is to show different ways to solve one-step multiplication and division word problems.

- An array can be used to show the equations that are related in a multiplication and division fact family.

Activity

Look at the *One-Step Word Problems* activity and adjust it if necessary to connect with your students.

Math Talk at Home

Encourage students to talk with their family members about everyday situations in which they use multiplication and division. Emphasize how both concepts involve equal-sized groups, and that the groups can be displayed in the rows and columns of an array.

Conversation Starters Below are additional conversation starters students can write in their Family Letter or math journal to engage family members.

- Do you prefer to use multiplication or division to solve problems? Why?
- When you divide, do you think about the related multiplication fact?
- Did you learn about multiplication or division using arrays? Do you know any other methods?

Connect to Community and Cultural Responsiveness

Use these activities to connect with and leverage the diverse backgrounds and experiences of all students.

Session 1 Use anytime during the session.

- Say: *Items of the same kind are sometimes sold in packages. What kind of stores sell items this way?* [grocery stores, convenience stores, and department stores, for example] Have students turn the pages of Session 1 and name items they see that are bought in packages. Clarify that bananas arrive in boxes but are purchased in bunches. Ask: *Is it possible to buy only one baseball, one banana, or one tangerine?* [Yes.] *What are some reasons you might buy more than one of these items?* [Possible answers: when you are sharing; when you are buying for a team or for a lot of people]

Session 2 Use with Try It.

- Ask students to share any experiences they have had with rivers, lakes, and oceans. Ask students to share the difference between ocean water and the water in most rivers and lakes. Clarify the difference between fresh water and salt water. Explain that different types of fish are able to live in each type of water. Ask: *Does your family have a fish bowl or fish tank? What kind of water is in your fish bowl or fish tank? How do you know?*

Session 3 Use with Try It.

- Ask students to raise their hands if they are wearing jeans. Explain that jeans are a kind of clothing worn all over the world by all different kinds of people, including farmers, movie stars, and students. Have students tell about when they wear jeans. Ask: *Where do you wear jeans? When do you wear them? Do you wear them to special occasions like weddings? Do you wear them to get together with friends?* Ask students to tell whether they like wearing jeans and why or why not.

Session 4 Use with Try It.

- Explain that patterns are used in art in different cultures. Display pictures of tessellations. (Note: A tessellation is a regular pattern of flat shapes repeated and joined together with no gaps or overlaps.) Distribute colored paper cut into squares and triangles, a slip of construction paper, and a glue stick to each student. Have students create a pattern of two rows using a combination of squares and triangles. Remind students that there can be no gaps within the pattern.

Connect to Language Development

For ELLs, use the Differentiated Instruction chart to plan and prepare for specific activities in every session.



English Language Learners:
Differentiated Instruction

Prepare for Session 1
Use with *Try It*.

Levels 1–3

Listening/Speaking Read *Try It* aloud. Pair students. Ask: *How many baseballs are in each row?* Say: *You can solve this problem using the following equation.* Display:

$$5 \times \square = 40; 40 \div 5 = \square$$

Say: *Discuss with your partner another question you can ask about the array.* List responses, and then provide the following questions:

- *How many rows of baseballs are there?*
- *How many baseballs are there in all?*

Say: *With your partner, select a question and write an equation to solve the problem.* Select students to share their equations.

Levels 2–4

Speaking/Writing Read *Try It* aloud. Say: *Dani places 40 baseballs in five rows. How many baseballs are in each row? What equation can be used to solve this problem?* Display responses. Provide the following for guidance:

$$5 \times \square = 40; 40 \div 5 = \square$$

Ask: *What other questions can you ask about the array?* List responses, and then provide the following questions:

- *How many rows of baseballs are there?*
- *How many baseballs are there in all?*

Say: *Choose a question. Write a word problem with the question included. Write an equation to solve the problem.* Call on volunteers to share their problems and equations.

Levels 3–5

Speaking/Writing Have pairs read *Try It*. Say: *Dani places 40 baseballs in five rows. How many baseballs are in each row? Discuss with your partner what equation can be used to solve this problem.* Display responses. Provide the following, if necessary:

$$5 \times \square = 40; 40 \div 5 = \square$$

Display: *baseball, row, column, array, total*
Say: *Discuss with your partner another question you can ask about the array. You might use these words when you write your word problem. Write an equation to solve the problem.* Select students to share and describe their problems and equations.

Purpose In this session students draw on their knowledge of multiplication and division to solve word problems. They write a word problem and equation involving multiplication or division for a given picture. Then they will look ahead to think about writing related multiplication and division equations to model and solve given word problems.

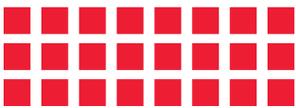
Start

Connect to Prior Knowledge

Why Support students' facility with representing an array with a multiplication equation to prepare them for using models to help solve multiplication and division word problems.

How Have students write a multiplication equation for a 3×8 array.

Write a multiplication equation to represent the array.



Solution

$3 \times 8 = 24$ or
 $8 \times 3 = 24$

TRY IT

Make Sense of the Problem

To support students in making sense of the problem, have them show that they understand that the problem is asking them to write a multiplication or division word problem and equation to represent the given array of baseballs.

DISCUSS IT

Support Partner Discussion

To reinforce the meaning of multiplication and division, encourage students to use the terms *total*, *number of equal groups*, and *number in each group* as they talk to each other.

Look for, and prompt as necessary for, understanding of:

- 40 total baseballs in the array
- 5 rows with 8 baseballs in each row
- one of these numbers must be made the unknown in the problem

Explore Solving One-Step Word Problems Using Multiplication and Division

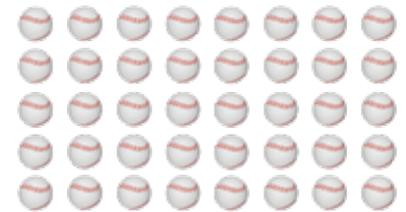
You have learned about different ways to show multiplication and division. In this lesson you will learn how to solve multiplication and division word problems. Use what you know to try to solve the problem below.

Learning Target

- Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities.
- SMP 1, 2, 3, 4, 5, 6, 7



Write a word problem about this array that you could solve with multiplication or division. Then write an equation to represent your problem.



TRY IT

Possible student work:

Sample A

Martin places his baseballs on 5 shelves with 8 on each shelf. How many baseballs are there in all?
 $5 \times 8 = 40$
 40 baseballs in all

Sample B

Julio has 40 baseballs. He stores them in 5 boxes with the same number of baseballs in each box. How many baseballs are in each box?
 $40 \div 5 = 8$
 8 baseballs in each box

Math Toolkit

- counters
- buttons
- cups
- 1-centimeter grid paper
- multiplication models
- number lines

DISCUSS IT

Ask your partner: How did you get started?
Tell your partner: I started by ...



Common Misconception Look for students who have trouble identifying and translating information from the array to a word problem. Such students may want to try to write an equation first. As students present solutions, have them identify the total, number of equal groups, and number in each group.

Select and Sequence Student Solutions

One possible order for whole class discussion:

- writing a multiplication word problem in which the unknown is the product
- writing a multiplication word problem in which the unknown is the number of equal groups or the number in each group
- writing a division word problem in which the unknown is the number of equal groups or the number in each group

Support Whole Class Discussion

Prompt students to note the relationship between the numbers in each word problem and equation and the given array.

Ask Do [student name]'s and [student name]'s word problems and equations ask about the total, number of equal groups, or number in each group? How do you know?

Listen for 40 is the total, with 5 the number of equal groups and 8 the number in each group, or vice versa.

CONNECT IT

1 LOOK BACK

Look for understanding that the array shows 5 equal groups, with 8 in each group, for a total of 40.



Hands-On Activity

Build arrays and relate them to multiplication and division.

If . . . students are unsure how an array can be represented by related multiplication and division facts,

Then . . . use this activity to have them practice with concrete objects.

Materials For each pair: 50 small objects

- Call out a number between 1 and 50 that is a product of a basic fact, for example, 42. Tell students that this is the total number of objects in the array they will build.
- Have partners count out the total number of objects in the array.
- Then call out another number that is a factor of the number of objects in the array, for example, 6. Tell students that this is the number of rows in the array.
- Ask students to build the array. Have them write the fact family the array represents.
- Repeat with different numbers.

2 LOOK AHEAD

Point out that related multiplication and division equations can often be written for the same word problem.

Students should be able to recognize the four equations as part of the same multiplication and division fact family.

Ask *What can you say about the four equations you wrote in 2a and 2b? Why is this true?*

Listen for All use the numbers 2, 6, and 12 and so are part of the same fact family. This is because the equations all relate to the same 12 bananas, in 2 groups of 6 bananas. You can write four different equations for one fact family, two multiplication and two division equations, that all use the same three numbers.

CONNECT IT

1 LOOK BACK

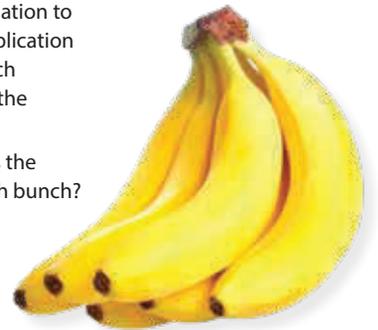
Explain how you decided what word problem to write to match the array of baseballs.

Possible answer: I thought about the number of rows of baseballs and number of baseballs in each row. I used that to write a multiplication word problem for $5 \times 8 = 40$.

2 LOOK AHEAD

Often you can write either a multiplication or a division equation to solve a problem. Look at the problems below. Write a multiplication equation and a division equation you could use to solve each problem about bananas. Use a ? in your equations to show the unknown number.

- Two bunches have a total of 12 bananas. Each bunch has the same number of bananas. How many bananas are in each bunch?
 $2 \times ? = 12$; $12 \div 2 = ?$
- Each bunch has 6 bananas. If there are 12 bananas, how many bunches are there?
 $? \times 6 = 12$; $12 \div 6 = ?$



3 REFLECT

How are the multiplication and division equations alike in problem 2b?

Possible answer: Both equations show the total, 12, and the number of bananas in each bunch, 6. Both have the number of bunches as the unknown number, or ?.

360

Close: Exit Ticket

3 REFLECT

Look for understanding that a multiplication equation and a division equation can both describe an equal-groups word problem.

Common Misconception If students have trouble explaining what each number means in each equation, **then** use counters or paper clips to model 2 groups with 6 in each group. Have students use the words *total*, *equal groups*, and *number in each group* as they explain their models in relation to each multiplication and division equation.



Real-World Connection

Encourage students to think about everyday places or situations where they have seen examples of arrays. Have volunteers share ideas. Examples: muffin pan, egg carton, a package of cookies, glass partitions of a window, or the buttons on a remote control, calculator, or phone.

Solutions

Support Vocabulary Development

1 Ask students to focus on the term *equation*. Ask: *What symbol does an equation need in order to be an equation?* [equal sign] *What pictures can you draw to illustrate an equation?* Display students' suggestions as a scaffold. Say: *Equations are used to represent solutions to word problems. The words are translated into numbers to represent the situation and answer a question. Think about a word problem you solved recently as you complete the graphic organizer.*

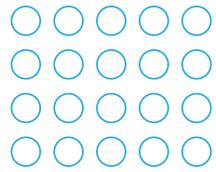
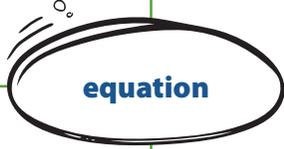
2 Have students listen as you read the directions. Ask: *What do you know about the two equations you will write?* [They are in the same fact family. They have the same numbers.] Have student pairs read the problem and underline the question. Ask: *What are you trying to find?* [the number of tangerines in each box] *What is pictured on the page?* [a tangerine] Say: *Work with your partner to write two equations that can be used to find the number of tangerines in each box.*

Supplemental Math Vocabulary

- array
- division
- division equation
- multiplication
- multiplication equation

Prepare for Solving One-Step Word Problems

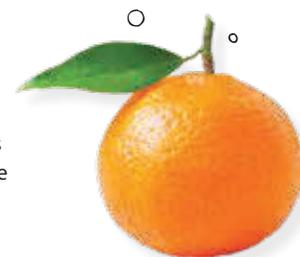
1 Think about what you know about solving word problems. Fill in each box. Use words, numbers, and pictures. Show as many ideas as you can. **Possible answers:**

| | |
|---|---|
| <p>In My Own Words</p> <p>When I write an equation, I use an equal sign (=) to show that two expressions have the same value.</p> | <p>My Illustrations</p>  <p>$4 \times 5 = 20$ $20 \div 5 = 4$</p> |
|  <p>equation</p> | |
| <p>Examples</p> <p>$6 \times 5 = 30$ $4 \times ? = 24$ $18 \div ? = 9$ $32 \div 8 = ?$</p> | <p>Non-Examples</p> <p>$24 \div 8$ 7×6 17 $12 > 8$</p> |

2 Write a multiplication equation and a division equation you could use to solve the following problem. Use a ? in your equations to show the unknown number.

There are a total of 24 tangerines in 3 boxes. Each box has the same number of tangerines. How many tangerines are in each box?

$3 \times ? = 24$ or $? \times 3 = 24$, and $24 \div 3 = ?$ or $24 \div ? = 3$.



3 Assign problem 3 to provide another look at writing a word problem about an array.

This problem is very similar to the problem about writing a word problem and an equation for an array of baseballs. In both problems, students are asked to write a word problem and an equation for a given array. The question asks students to write a word problem for a 4 by 6 array of flowers and then write an equation to represent their word problem.

Students may want to use counters or 1-centimeter grid paper.

Suggest that students read the problem three times, asking themselves one of the following questions each time:

- What is this problem about?
- What is the question I am trying to answer?
- What information is important?

Solution: Student word problems will vary. The possible equations for the array are $4 \times 6 = 24$, $6 \times 4 = 24$, $24 \div 6 = 4$, or $24 \div 4 = 6$.

Challenge

4 Have students solve the problem another way to check their answer.

3 Solve the problem. Show your work.

Write a word problem about this array that you could solve with multiplication or division. Then write an equation to represent your problem.



Possible student work:

Luke plants 4 rows of flowers. Each row has 6 flowers. How many flowers did Luke plant in all?

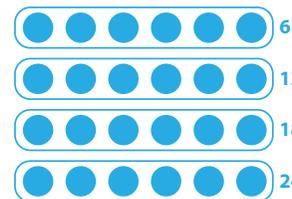
$4 \times 6 = 24$

Solution Luke planted 24 flowers in all.

4 Check your answer. Show your work.

Possible student work:

Luke plants 4 rows of flowers. Each row has 6 flowers. How many flowers did Luke plant in all?



Luke planted 24 flowers in all.



ELL English Language Learners: Differentiated Instruction Prepare for Session 2 Use with *Apply It*.

Levels 1–3

Listening/Speaking Read *Apply It* problem 7 aloud. Have students underline the question. Ask: *What are you trying to find?* [the number of pages Jenna uses] Say: *If you make equal groups to solve this problem, the groups are the pages. What will be in each group or on each page?* [6 photos] *How will you know when you have enough groups?* [All 30 photos are used.] Say: *When you make groups, you are dividing.* Display the following equation: $30 \div 6 = ?$
Review the meaning of each part of the equation. Pair students. Say: *Work together to find a multiplication equation you can use to solve this problem.* Validate students' suggestions. Display: $? \times 6 = 30$.

Levels 2–4

Listening/Speaking Read *Apply It* problem 7 aloud. Have students underline the question. Ask: *What are you trying to find?* [the number of pages Jenna uses] Ask: *If you make equal groups to solve the problem, what do the pages represent?* [the groups] *What is in each group or on each page?* [6 photos] *How will you know when you have enough groups?* [All 30 photos are used.] Pair students. Ask: *What division equation can you write to represent this problem?* [$30 \div 6 = ?$]
Review the meaning of each part of the equation. Say: *With your partner, write a multiplication equation you can use to solve this problem.* Validate suggestions. Display: $? \times 6 = 30$.

Levels 3–5

Listening/Speaking Have students read *Apply It* problem 7 and underline the question. Ask: *What are you trying to find?* [the number of pages Jenna uses] Ask: *If you make equal groups to solve the problem, what do the pages represent?* [the groups] *What is in each group or on each page?* [6 photos] *How will you know when you have enough groups?* [All 30 photos are used.] Pair students. Ask: *What division equation can you write to represent this problem?* [$30 \div 6 = ?$]
Review the meaning of each part of the equation. Say: *With your partner, write the fact family that includes $30 \div 6 = ?$.* Select students to share and explain each equation.

Purpose In this session students solve a word problem about equal groups. Students model the problem either on paper or with manipulatives and then solve the problem using an equation with an unknown number. This helps them develop strategies for solving one-step multiplication and division word problems involving equal groups.

Start

Connect to Prior Knowledge

Why Support students' facility with writing an equation with an unknown to represent a division or multiplication word problem.

How Have students write an equation with an unknown number to represent a word problem about how to find how many of 21 players will be on 3 equal-sized teams.

Jeremy wants 3 equal-sized teams. He has 21 players. How many will be on each team?

Write an equation you could use to solve this problem. Use a ? for the unknown number.

Possible Solutions

$21 \div 3 = ?$ or
 $3 \times ? = 21$

Develop Language

Why Clarify the meaning of the term *stand for* used in mathematical contexts.

How Point out the term *stand for* in **Connect It** problem 1. Explain that, when used in mathematical contexts, the term *stand for* means to represent, or to be a sign, symbol, or number for something else. Ask students what the number 24 stands for in the problem. [the total number of fish]. Next, have students read problem 3. Ask: *What does the f stand for in the problem?* [the unknown number of fish in each tank]

TRY IT

Make Sense of the Problem

To support students in making sense of the problem, have them show that they understand that the problem is asking them to find how many of 24 fish are in each of 4 tanks if each tank has the same number of fish.

Develop Solving Problems About Equal Groups

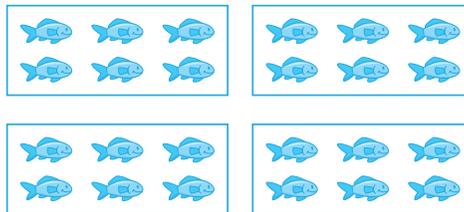
Read and try to solve the problem below.

A store has 24 saltwater fish. The store has 4 tanks for the fish. Each tank has an equal number of fish. How many fish are in each tank?

TRY IT

Possible student work:

Sample A



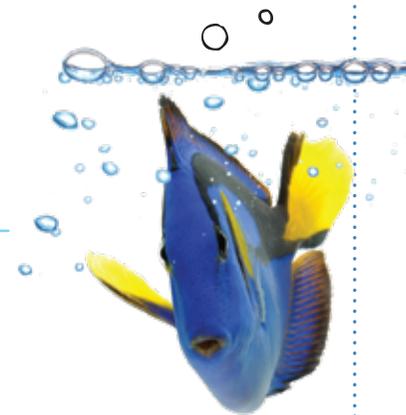
6 fish in each tank

Sample B

$4 \times ? = 24$
 $4 \times 6 = 24$
6 fish

Math Toolkit

- counters and buttons
- cups
- index cards
- multiplication models
- number lines



DISCUSS IT

Ask your partner: Can you explain that again?

Tell your partner: I knew... so I...

DISCUSS IT

Encourage students to explain the model or strategy they used as they discuss their solutions.

Support as needed with questions such as:

- *Why did you use that strategy?*
- *How could writing down what you know help you to solve the problem?*

Common Misconception Look for students who try to find 24×4 instead of dividing or making the other factor the unknown number. As students present solutions, be sure to have them explain how they know this was not a "find the total" situation.

Select and Sequence Student Solutions

One possible order for whole class discussion:

- placing a counter in each of 4 cups/equal groups until all 24 counters are used
- drawing 4 equal groups and counting the number that goes in each group until you reach 24
- writing a multiplication and/or division equation

Support Whole Class Discussion

Compare and connect the different representations and have students identify how they relate.

Ask *How is the total number of fish represented? The number of tanks?*

Listen for Students should recognize that all representations should show 4 equal groups of 6 that make a total of 24. A division equation could show 24 divided by 4 equals an unknown number, and a multiplication equation could show 4 multiplied by an unknown number equals 24.

PICTURE IT & MODEL IT

If no student presented these models, connect them to the student models by pointing out the ways they each represent:

- the total number of fish
- the number of equal groups
- the number in each group

Ask *How many equal groups are there? How many total fish are there? What information is unknown? How does each representation show this?*

Listen for There are 4 equal groups of fish for a total of 24. The number of fish in each group is unknown. In the picture, 24 fish are separated into 4 equal groups to represent the 4 tanks. In the multiplication equation, 4 is one factor and 24 is the product. In the division equation, 24 is divided by 4. All representations show the unknown number with a “?”.

For a picture, prompt students to explain the drawing.

- *What do the red boxes represent?*
- *What do the fish in each box represent?*

For words and equations, prompt students to identify the key information in the word problem.

- *What information is given in the problem? What is missing?*
- *How does each equation show the given information? The missing information?*

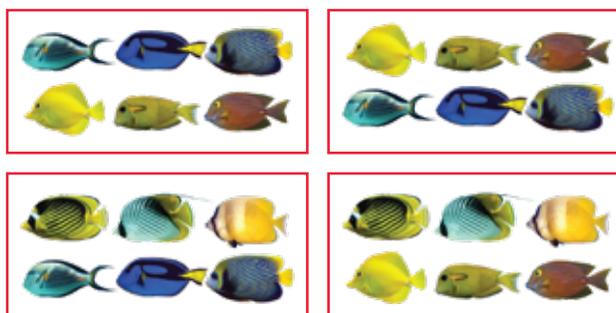
Explore different ways to understand solving word problems about equal groups.

A store has 24 saltwater fish. The store has 4 tanks for the fish. Each tank has an equal number of fish. How many fish are in each tank?

PICTURE IT

You can use a drawing to show and solve problems about equal groups.

Make 4 groups of 1 fish each. Add 1 fish at a time to each group until there are 24 fish.



There are 4 tanks with ? fish in each tank.

MODEL IT

You can also use words to show and solve problems about equal groups.

Make notes about the problem.

24 fish in all. 4 groups, or tanks.

? fish in each group.

Use multiplication or division to find the number of fish in each group.

$$4 \times ? = 24 \text{ or}$$

$$24 \div 4 = ?$$

364

Deepen Understanding

Division

SMP 2 Reason quantitatively.

To support discussion of using words and writing equations to solve a word problem involving division, encourage reasoning about the quantities in relation to the given context.

Ask *Suppose a student answered that there are 96 fish in each tank. How do you know that the student did something incorrectly? What do you suppose that student did?*

Listen for There are only 24 fish in all, so having 96 fish in each tank is impossible. The fish are separated into 4 equal groups, so the number of fish in each group must be less than 24. The student must have multiplied 24×4 to get 96.

Generalize *When working with whole numbers, why can't the quotient in a division problem be greater than the total?* The quotient in a division problem must be less than or equal to the total because in division you separate the total into equal groups.

CONNECT IT

- Remind students that one thing that is alike about all the representations is the numbers.
- Explain that on this page they will use those representations to write and solve an equation with an unknown number.

Monitor and Confirm

1 – 4 Check for understanding that:

- 24 is the total number of fish
- 4 is the number of tanks, or equal groups
- the number of fish in each tank is unknown
- 24, 4, and f (for the unknown number of fish) are used to write the related equations within the same fact family
- $f = 6$

Deepen Understanding Division as an Unknown-Factor Problem

SMP 7 Use structure.

When discussing problems 3 and 4, prompt students to remember that division facts can be represented as unknown-factor problems. For example, $24 \div 4 = ?$ can be written as $4 \times ? = 24$.

Ask How are $4 \times ? = 24$ and $4 \times f = 24$ alike? How are they different?

Listen for The numbers and operations are the same. The only difference is the symbol used to represent the unknown number.

Help students realize that using a letter for an unknown number is no different than using a ? or a box. Using a letter can actually help you remember what the unknown number represents, e.g., using f for number of fish.

Support Whole Class Discussion

5 Look for the idea that word problems about equal groups can be solved using a division equation or a related multiplication equation.

6 **REFLECT** Have all students focus on the strategies used to solve this problem. If time allows, have students share their preferences with a partner.

CONNECT IT

Now you will use the problem from the previous page to help you understand how to solve word problems about equal groups.

- 1 What does 24 in the problem stand for? **the total number of fish**
What does 4 stand for? **the number of tanks or equal groups**
- 2 What is the unknown number in the problem? **the number of fish in each tank**
- 3 Use the letter f to stand for the unknown number. Write a division equation that can be used to solve the problem. Then write a related multiplication equation.

$24 \div 4 = f$ and $4 \times f = 24$

- 4 What is the solution? Explain how you found your answer.
 $4 \times 6 = 24$; Possible explanation: I know that 4 groups of 6 is 24, so there are 6 in each group. There are 6 fish in each tank.

- 5 Suppose the problem is changed to the one below.
There are 24 fish. The store manager wants to put 6 fish in each tank.
How many tanks will there be?

Write both a multiplication and division equation. Then solve the problem.

$24 \div 6 = t$ or $6 \times t = 24$; $t = 4$; There will be 4 tanks.

- 6 **REFLECT**
Look back at your **Try It**, strategies by classmates, and **Picture It** and **Model It**. Which models or strategies do you like best for solving problems about equal groups? Explain.

Students may mention a preference for using multiplication over division (or vice versa) to find the solution to a problem. Visual students may explain that drawing equal groups allows them to see the solution to the problem.

Visual Model

Organize quantities in a table.

If . . . students are unsure about what each number in a problem represents,

Then . . . use this activity to practice organizing the information.

Materials For each student: 1 index card

- Tell students that tables can be used to sort and organize the quantities in multiplication and division problems.
- Have students draw and label a three-column table as shown below and fill it in with the information from the fish problem on the previous page.

| Number of Groups | Number of Fish in Each Group | Total Number of Fish |
|------------------|------------------------------|----------------------|
| 4 | ? | 24 |

- Point out that a table can help in writing an equation that represents a problem, such as $4 \times ? = 24$ or $24 \div ? = 4$.
- Have students add another row to their table and fill in the information from problem 5 above. [?; 6; 24]

APPLY IT

For all problems, encourage students to draw equal-group models to support their thinking.

- 7 5 pages; See Student Worktext page for possible student work. Students may also write an equation.
- 8 36 pencils; See Student Worktext page for possible student work.

Close: Exit Ticket

- 9 7 apples in each basket; See Student Worktext page for possible student work. Students may also draw equal groups.

Students' solutions should indicate understanding of:

- 21 total apples, 3 baskets (or groups), and an unknown number of apples in each basket
- using a division equation or related multiplication equation to solve

Error Alert If students subtract instead of dividing and answer 18, **then** have them read the problem aloud and explain what each number represents. Have them model the problem using counters in cups or quick drawings to give more concrete practice.

APPLY IT

Use what you just learned to solve these problems. Use a drawing of equal groups or an equation with a letter for the unknown number to show your work.

- 7 Jenna has 30 photos of her friends. She puts 6 photos on each page in her album. How many pages does Jenna use? Show your work.

Possible student work:



Solution Jenna uses 5 pages.

- 8 There are 9 drawing kits on a table in the art room. Each kit has 4 pencils. How many pencils are there in all? Show your work.

Possible student work:

$$4 \times 9 = p \text{ or } 9 \times 4 = p$$

$$p = 36$$

Solution There are 36 pencils.

- 9 Tom has 21 apples and 3 baskets. If Tom puts the same number of apples in each basket, how many apples will be in each basket? Show your work.

Possible student work:

$$21 \div 3 = a$$

$$a = 7$$

Solution There will be 7 apples in each basket.



Solutions

1 Drawings must show 3 groups of 6; See Student Worktext page for a sample drawing.

Basic

2 $18 \div 6 = n$

$n \times 6 = 18$

$n = 3$

Basic

3 3

Medium

Practice Solving Problems About Equal Groups

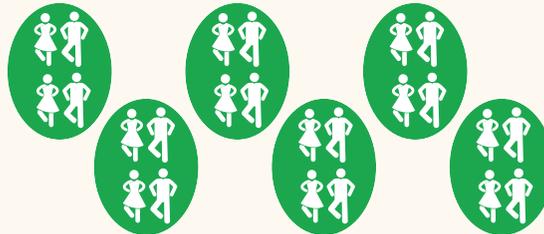
Study the Example that shows how a drawing can help you understand problems about equal groups. Then solve problems 1–8.

EXAMPLE

24 students sign up for an Irish folk dancing class. There are 4 students in each group. How many groups are there?

Draw a picture.

24 students
4 in each group
 n groups



Write an equation.

$24 \div 4 = n$

$n = 6$

There are 6 groups of students.

18 students take hula dance classes. There are 6 students in each class. How many classes are there?

1 Make a drawing for this problem. Use ☺ for each student. Make groups to show the classes.



2 Complete the multiplication and division equations for this problem. Write the value of n .

$18 \div 6 = n$ $n \times 6 = 18$ $n = 3$

3 How many hula dance classes are there? 3

Fluency & Skills Practice

Teacher Toolbox

Assign Solving Problems About Equal Groups

In this activity students solve word problems about equal groups. Students may experience similar real-world situations. For example, students may want to determine how many photos they need to fill each page of a photo album, how to split a restaurant bill equally among a group of friends, or how many minutes are in a certain number of hours.

Fluency and Skills Practice

Solving Problems About Equal Groups Name: _____

Read and solve each problem. Show your work.

| | |
|--|--|
| 1 Heather has 18 photographs of rockets. She wants to hang them on 3 different walls in her room. Each wall will have the same number of photographs. How many photographs will hang on each wall? | 2 There are 24 people who want to play volleyball. The coach divides the players into teams of 6. How many teams can she make? |
| There will be _____ photographs on each wall. | The coach can make _____ teams. |
| 3 At an art show, there are 7 groups of paintings with 6 paintings in each group. How many paintings are there in all? | 4 Jasmine reads for 10 minutes each night. If she reads for 5 nights, how many minutes will she read in all? |
| There are _____ paintings. | Jasmine will read for _____ minutes. |
| 5 Rhonda plants 28 tomato plants in her garden. She plants 7 tomato plants in each row. How many rows does she plant? | 6 Mr. Jones buys 6 packages of pencils. There are 8 pencils in each package. How many pencils does Mr. Jones buy? |
| Rhonda plants _____ rows. | Mr. Jones buys _____ pencils. |

7 Choose one problem. Describe the strategy you used to solve it.

©Curriculum Associates, LLC. Copying is permitted for classroom use.

- 4 The total number of students who take Mexican folk dance.

Basic

- 5 $2 \times 8 = n$, $8 \times 2 = n$, $n = 2 \times 8$, or $n = 8 \times 2$
16

Medium

- 6 $15 \div 3 = n$, $n = 15 \div 3$, $3 \times n = 15$,
or $15 = 3 \times n$
5

Challenge

- 7 $30 \div 3 = n$, $n = 30 \div 3$, $3 \times n = 30$,
or $30 = 3 \times n$
10

Challenge

- 8 See Student Worktext page for possible answer.
Challenge

There are 2 classes for Mexican folk dance. There are 8 students in each class. How many students take Mexican folk dance class?

- 4 What is the unknown that you need to find out?

how many students take the class

- 5 Write an equation for the problem. Use n to stand for the number you need to find out. Solve the problem.

Equation $2 \times 8 = n$ or $n = 8 \times 2$

16 students take Mexican folk dance class.

15 students take modern dance lessons. There are 3 students in each group. How many groups of students are there?

- 6 Write an equation for the problem. Then solve.

Equation $15 \div 3 = n$ or $3 \times n = 15$

There are **5** groups of students.

- 7 If 15 more students sign up for modern dance, how many groups would there be?

Equation $30 \div 3 = n$ or $3 \times n = 30$

There would be **10** groups of students.

- 8 How can you use the answer to problem 6 to find the answer to problem 7?

Possible answer: Since there are twice as many students, there will be twice as many groups, or 10 groups.

368



English Language Learners:
Differentiated Instruction

Prepare for Session 3
Use with *Connect It*.

Levels 1–3

Listening/Speaking Read *Connect It* problem 1. Pair students. Say: *Word problems can be solved with arrays.* Give partners cards labeled: *rows, columns, and total.* Also provide cards with the symbols: \times , \div , and $=$. Say: *Build a multiplication equation using these cards.* Display:

$$\text{rows} \times \text{columns} = \text{total}$$

Say: *Now display a division equation.* Display:

$$\text{total} \div \text{rows} = \text{columns}$$

$$\text{total} \div \text{columns} = \text{rows}$$

Say: *Think about Try It. What did you need to find? [the number of rows] Which of your division equations represents $42 \div 6 = 7$? [total \div columns = rows] Have students use their cards and display.*

Levels 2–4

Listening/Speaking Read *Connect It* problem 1. Pair students. Give pairs cards labeled: *total, rows, columns, \times , \div , and $=$.* Say: *Arrays can represent word problems. Use the cards. Represent an array with a multiplication equation.* Display:

$$\text{rows} \times \text{columns} = \text{total}$$

Say: *Now display a division equation.* Display:

$$\text{total} \div \text{rows} = \text{columns}$$

$$\text{total} \div \text{columns} = \text{rows}$$

Say: *Use your cards and build a division equation that represents Try It.* Select pairs to share and explain their card equations referring to the context. Read problem 5 aloud. Repeat the building and sharing process. Ask: *What is the same about both problems? [You had to find the number of rows in both.]*

Levels 3–5

Listening/Speaking Have pairs read *Connect It* problem 1. Display: *total, rows, columns, \times , \div , and $=$.* Say: *Arrays can represent word problems. Represent an array with a multiplication equation.* Display:

$$\text{rows} \times \text{columns} = \text{total}$$

Say: *Think about Try It. With your partner, use these same words and symbols and represent the problem with a division equation.* Select pairs to share and explain their equation referring to the context. Have students read problem 5 and represent the problem. Repeat the process of sharing and explaining. Ask: *What is the same about these two problems? [You have to find the number of rows in both.]*

Purpose In this session students solve a word problem about arrays. Students model the problem either on paper or with manipulatives and solve it using an equation with an unknown number. This helps them develop strategies for solving one-step multiplication and division word problems involving arrays.

Start

Connect to Prior Knowledge

Materials For each student: 12 sticky notes

Why Support students' facility with using arrays to represent a division fact.

How Have students make an array to represent and complete $12 \div 6 = \underline{\quad}$.

Use sticky notes to make an array to represent and complete this division fact.

$12 \div 6 = \dots\dots\dots$

Solution
2
Look for a 6×2 array or a 2×6 array

Develop Language

Why Review the difference between *rows* and *columns*.

How Say: *You know arrays are formed by making rows and columns. Display three stacks of four books. Say: These books make an array. Do rows go up and down or across? [across] Use your fingers. How many rows of books are there? [4] Do columns go up and down or across? [up and down] How many columns are in this array? [3] Display: There are 3 stacks of 4 books. Say: What do the stacks represent in this sentence, rows or columns? [columns]*

TRY IT

Make Sense of the Problem

To support students in making sense of the problem, have them describe what a crate looks like.

Ask *What information are you given? What are you trying to find?*

Develop Solving Problems About Arrays

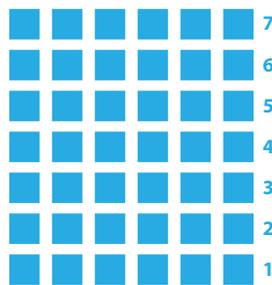
Read and try to solve the problem below.

A clothing store uses stacking crates for storing jeans. The manager orders 42 crates. Six crates will fit in one row along the wall. How many rows of crates will there be?

TRY IT

Possible student work:

Sample A



7 rows

Sample B

42 crates and 6 crates in one row
 $6 \times ? = 42$
7 rows of crates

Math Toolkit

- counters
- square tiles
- grid paper
- sticky notes
- multiplication models
- number lines

DISCUSS IT

Ask your partner: Do you agree with me? Why or why not?

Tell your partner: I do not understand how ...

DISCUSS IT

Support Partner Discussion

Encourage students to use the terms *total*, *number of equal groups*, and *number in each group* as they discuss their solutions.

Support as needed with questions such as:

- *What did you notice about your partner's strategy that is different from yours?*
- *Did you draw a picture or model to solve the problem? Why or why not?*

Common Misconception Look for students who give the number of rows as 6, possibly confusing the number of crates with the number of rows. Have students explain what each number represents as they present their solutions.

Select and Sequence Student Solutions

One possible order for whole class discussion:

- modeling an array with counters or sticky notes
- drawing an array
- using a chart or notes to organize information
- writing a multiplication and/or division equation

Support Whole Class Discussion

Compare and connect the different representations and have students identify how they relate.

Ask *Where does each model show the total number of crates? The number of crates in each row? The number of rows of crates?*

Listen for Students should point out the 42 when showing the total crates, the 6 when showing the number of crates in each row, and the 7 when showing the number of rows of crates.

PICTURE IT & MODEL IT

If no student presented these models, connect them to the student models by pointing out the ways they each represent:

- the total number of crates
- the number of crates in each row
- the number of rows of crates

Ask *What operation can you use to represent this situation? How does each model show this?*

Listen for Division or multiplication. The array shows 42 divided into equal rows of 6, which can also be said as finding how many rows of 6 equals 42. The equations show 42 divided by 6 or have the factor 6 multiplied by an unknown factor to get 42.

For an array, prompt students to identify how the array represents the crates.

- *What do the rows in the array represent? The columns?*
- *What do the numbers to the right of each row mean?*
- *Why does it make sense to use an array as a strategy for solving this problem?*

For words and equations, prompt students to identify the known and unknown information.

- *Why might you want to collect information in notes or a chart before solving a word problem?*
- *How does each equation show the given information? The unknown information?*

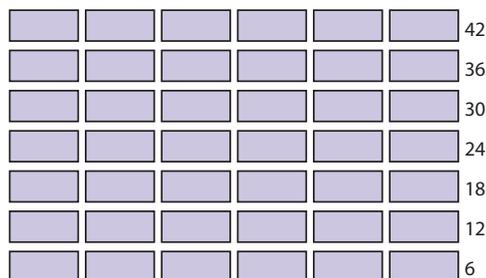
Explore different ways to understand solving word problems about arrays.

A clothing store uses stacking crates for storing jeans. The manager orders 42 crates. Six crates will fit in one row along the wall. How many rows of crates will there be?

PICTURE IT

You can use a drawing to show and solve problems about arrays.

Use an array. Show a row of 6. Add rows of 6 until you get to 42.



MODEL IT

You can also use words to show and solve problems about arrays.

Make notes about the problem.

42 crates in all.

6 crates in each row.

? rows

Use multiplication or division to find the number of rows.

$$? \times 6 = 42$$

or

$$42 \div 6 = ?$$

370



Deepen Understanding Arrays

SMP 7 Use structure.

To support discussion of the array, have students create an equal-group problem that uses the same numbers (6, 7, 42) to expose students to the structure of different types of multiplication and division word problems.

Materials For each pair: 42 counters

Ask each student to write an equal-group word problem that uses the same numbers as the array: 6, 7, 42. Have partners swap problems and solve, using counters to model the problem and explain their solution to their partner.

Ask *How is the array model of the crates problem similar to your equal-group model? How is it different?*

Listen for Both models use the same three numbers. The number of rows in the array is the same as the number of equal groups and the number in each row is the same as the number in each group. The structure of the array makes it look more organized but the equal-group model shows the separate groups more clearly.

CONNECT IT

- Remind students that one thing that is alike about all the representations is the numbers.
- Explain that on this page they will use those numbers to write different equations to represent the problem and choose one to solve.

Monitor and Confirm

① – ④ Check for understanding that:

- 6 crates in each row; 42 total crates
- the number of rows is unknown
- related multiplication and division equations can be written to represent the problem
- there are 7 rows of crates

Deepen Understanding Real-World Multiplication and Division

SMP 4 Model with mathematics.

Point out to students that the crate problem is one a manager of a clothing store might need to solve.

Ask *How could workers in other jobs use multiplication or division to solve problems?*

Listen for Examples: a truck driver who calculates gas mileage, a chef who doubles a recipe, a doctor or nurse who calculates medicine dosage amounts.

Support Whole Class Discussion

⑤ Look for the idea that problems in which you are finding the number of rows, the number in each row, or the total of a certain number of rows and columns can be solved by using an array.

Ask *How do you know how many columns and rows your array should have?*

Listen for I need to build an array with 8 crayons in each row until I have a total of 24 crayons. Then I can count the number of rows, which is the unknown number.

⑥ **REFLECT** Have all students focus on the strategies used to solve this problem. If time allows, have students share their preferences with a partner.

CONNECT IT

Now you will use the problem from the previous page to help you understand how to solve word problems about arrays.

① What do the numbers in the problem stand for?

42 is the total number of crates ordered, and 6 is the number of crates that will fit in each row.

② What is the unknown number in the problem? **the number of rows of crates**

③ Use the letter r to stand for the unknown number. Write a division equation that can be used to solve the problem. Then write a related multiplication equation.

$42 \div 6 = r$ and $r \times 6 = 42$

④ Show and explain how to solve the problem.

Possible answer: I used the multiplication equation since I know multiplication facts. $7 \times 6 = 42$. There will be 7 rows of crates.

⑤ Explain how you can use an array to solve this problem.

There are 24 crayons in a box. There are 8 crayons in each row. How many rows of crayons are there?

Possible answer: Draw one row of 8. Then add more rows of 8 until you get to 24. There are 3 rows of crayons.

⑥ **REFLECT**

Look back at your **Try It**, strategies by classmates, and **Picture It** and **Model It**. Which models or strategies do you like best for solving problems about arrays? Explain.

Students who are visual may like to draw an array to organize the information and find the solution. Other students may prefer the option of using a multiplication or a division equation because they can get the answer more quickly.

371

**Visual Model**

Skip-count to solve the problem.

If . . . students are unsure about their multiplication facts,

Then . . . use this activity to remind students about this skip-counting strategy.

Materials For each student: Activity Sheet 1-Centimeter Grid Paper

- Have students draw the crates array on grid paper. Explain that skip-counting is another way to solve this problem.
- Direct students to start at 0 and skip-count by 6 until they get to the total number of crates, 42. Have them write the number of each skip to the right of each row of their array as they count. [6, 12, 18, 24, 30, 36, 42]
- Have them count the number of times they skip-counted. [7] Have them note that this matches the number of rows in the array.
- Ask students what the number of times they skip-counted represents in the problem. [the unknown number; the number of rows of crates]

APPLY IT

For all problems, encourage students to draw array models to support their thinking.

- 7 32 plants; See Student Worktext page for possible student work. Students may also write an equation.
- 8 5 children in each row; See Student Worktext page for possible student work. Students may also draw an array.

Close: Exit Ticket

- 9 6 rows of flowers; See Student Worktext page for possible student work. Students may also draw an array.

Students' solutions should indicate understanding of:

- 54 total flowers
- 9 flowers in each row
- the number of rows of flowers is unknown

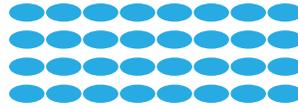
Error Alert If students try to multiply 54×9 instead of dividing, **then** have them use counters or a quick drawing on grid paper to model the problem. Ask if they think the number of rows should be greater than or less than 54.

APPLY IT

Use what you just learned to solve these problems. Use an array or an equation with a letter for the unknown number to show your work.

- 7 Grace's garden has 4 rows of tomatoes with 8 plants in each row. How many tomato plants are in Grace's garden? Show your work.

Possible student work:



Solution There are 32 plants.

- 8 There are 20 children in gym class. The teacher lines up the children in 4 equal rows for a game. How many children are in each row? Show your work.

Possible student work:

$$4 \times c = 20 \text{ or } 20 \div 4 = c$$

$$c = 5$$

Solution There are 5 children in each row.

- 9 There are 54 flowers in the garden. There are 9 flowers in each row. How many rows of flowers are there? Show your work.

Possible student work:

$$54 \div 9 = f$$

$$f = 6$$

Solution There are 6 rows of flowers.



Solutions

1 Students should draw an array with 4 rows of 5; See Student Worktext for sample drawing.

Basic

2 $20 \div 4 = n; n = 5$

Medium

3 5

Medium

Practice Solving Problems About Arrays

Study the Example that shows how an array can help you solve multiplication and division problems. Then solve problems 1–6.

EXAMPLE

The art teacher wants to hang 18 drawings on the hall wall. She hangs 6 drawings in each row. How many rows of drawings are there?

18 drawings
6 in each row
 n rows



$18 \div 6 = n$ and $n \times 6 = 18$

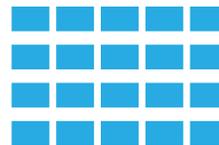
$18 \div 6 = 3$ and $3 \times 6 = 18$

There are 3 rows of drawings.

In the art room, there are 20 easels. The easels are arranged in 4 equal rows. How many easels are in each row?

1 Draw an array to show the 20 easels in 4 rows. Put the same number in each row.

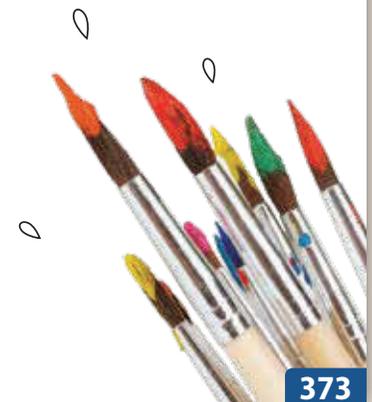
Students' arrays should show 4 rows with 5 easels in each row.



2 Complete the division equation to solve the problem. n stands for the unknown.

$20 \div 4 = n$, so $n = 5$.

3 How many easels are in each row? 5



Fluency & Skills Practice

Teacher Toolbox

Assign Solving Problems About Arrays

In this activity students solve word problems about arrays. Students may experience similar real-world situations. For example, students may want to arrange books so the same number of books are on each shelf, determine the number of seats in a movie theater, or figure out how many muffins a muffin pan will hold.

Fluency and Skills Practice

Solving Problems About Arrays Name: _____

Read and solve each problem. Show your work.

1 A parking lot has 6 rows of parking spaces. There are 5 spaces in each row. How many parking spaces are in the lot?
There are _____ parking spaces.

2 Jack has 36 toy robots. He wants to display 9 on each shelf in his room. How many shelves will Jack need to display all of the robots?
Jack will need _____ shelves.

3 There are 24 dancers. The teacher has them stand in 3 equal rows. How many dancers are in each row?
There are _____ dancers in each row.

4 Emily is putting away plates. She puts 6 plates each in 3 stacks. How many plates does she put away?
Emily puts away _____ plates.

5 A farmer picks 54 pumpkins. She places an equal number of pumpkins in 9 wagons. How many pumpkins are in each wagon?
There are _____ pumpkins in each wagon.

6 The school band marches in rows at the parade. There are 24 band members and they form rows with 4 members in each row. How many rows are there?
There are _____ rows.

7 Choose one problem. Describe and use a strategy to check your answer.

©Curriculum Associates, LLC. Copying is permitted for classroom use.

Students might draw arrays and/or write different equations to help solve the problems.

- 4 45 paint jars; See Student Worktext page for possible student work.

Medium

- 5 9 frames in each row; See Student Worktext page for possible student work.

Medium

- 6 10 drawing pads on each shelf; See Student Worktext page for possible student work.

Challenge

- 4 The art room has 5 shelves of paint jars. There are 9 paint jars on each shelf. How many paint jars are in the art room? Show your work.

Possible student work:

5 shelves \times 9 jars on each shelf

$$5 \times 9 = n$$

$$n = 45$$

Solution There are 45 paint jars in the art room.

- 5 There are 54 frames on the wall in an art store. The frames are in 6 equal rows. How many frames are in each row? Show your work.

Possible student work:

6 rows of frames, 54 frames in all

$$6 \times n = 54$$

$$n = 9$$

Solution There are 9 frames in each row.

- 6 A store has 3 shelves with the same number of drawing pads on each shelf. There are 30 drawing pads in all. How many drawing pads are on each shelf? Show your work.

Possible student work:

$$30 \div 3 = n$$

$$n = 10$$

Solution There are 10 pads on each shelf.



374

ELL

English Language Learners:
Differentiated Instruction

Prepare for Session 4
Use with *Apply It*.

Levels 1–3

Listening/Speaking Read *Apply It* problem 8 aloud. Have students underline the question. Ask: *What do you want to find out?* [the number of rows of tiles] *How many tiles are in each row?* [5] *How many tiles did Michael use?* [35] Pair students. Say: *Discuss with your partner a strategy you can use to solve the problem.* List students' suggestions. Focus on drawing, using tiles, and writing equations. Ask: *What equations can you use to solve this problem?* [(Display) $35 \div 5 = ?$; $? \times 5 = 35$] Say: *You can use a letter to represent the unknown number in an equation.* [Display: $35 \div 5 = r$; $r \times 5 = 35$] Explain that the r is used to represent the rows of tiles.

Levels 2–4

Listening/Speaking Read *Apply It* problem 8 aloud. Have students underline the question. Ask: *What do you want to find out?* [the number of rows of tiles] *How many tiles are in each row?* [5] *How many tiles did Michael use?* [35] Pair students. Say: *Discuss with your partner a strategy you can use to solve the problem.* List students' suggestions. Focus on drawing, using tiles, and writing equations. Ask: *What equations can you use to solve this problem?* [(Display) $35 \div 5 = ?$; $? \times 5 = 35$] Say: *You can use a letter to represent the unknown number in an equation.* *What are you trying to find out?* [the number of rows] *What letter can you use for rows?* [r] *Write these equations again using an "r" for rows in place of the question mark.* Select students to share and describe their equations.

Levels 3–5

Listening/Speaking Have pairs read *Apply It* problem 8. Ask: *What do you want to find out?* [the number of rows of tiles] *How many tiles are in each row?* [5] *How many tiles did Michael use?* [35] Pair students. Say: *Discuss with your partner a strategy you can use to solve the problem.* List students' suggestions. Focus on drawing, using tiles, and writing equations. Say: *You can use a letter instead of a question mark to represent the unknown number in an equation.* *What are you trying to find out?* [the number of rows] *What letter can you use for rows?* [r] *With your partner, write two equations you can use to solve this problem.* *In place of a question mark, use an "r" for rows of tiles.* Select students to share and describe their equations.

Purpose In this session students solve a word problem about area. Students model the numbers in the word problem either on paper or with manipulatives and solve it using an equation with an unknown number. This helps them develop strategies for solving one-step multiplication and division word problems involving area.

Start

Connect to Prior Knowledge

Materials For each student: 15 unit tiles

Why Support students' facility with using tiling models to represent a multiplication fact.

How Have students make a tiling model to represent and complete $3 \times \underline{\quad} = 15$.

Use square tiles to make a tiling model to represent and complete this multiplication fact.

$3 \times \underline{\quad} = 15$

Solution
5
Look for tiling with 3 rows of 5 or 5 rows of 3

Develop Language

Why Clarify the meaning of the term *tiling*.

How Give a sheet of construction paper to each student. Lay a sheet of paper on the floor. Explain each student must lay their sheet of paper in such a way that the papers do not overlap or form a gap. Demonstrate placing two sheets. Call on students one-by-one to place his/her sheet of paper. Say: *The pieces altogether are called a tiling. A tiling can be created using any shape. A tiling cannot have overlaps or gaps. You can use a tiling of square units to find area.* Repeat the activity if time permits.

TRY IT

Make Sense of the Problem

To support students in making sense of the problem, have them identify that the problem is asking them to find the length of the rectangle.

Ask *What does each number given in the problem represent?*

Develop Solving Problems About Area

Read and try to solve the problem below.

For an art project, Sean uses colored squares of paper to tile a rectangle that has an area of 48 square inches. Each piece of paper is 1 square inch. He makes 6 rows. How long is the rectangle?



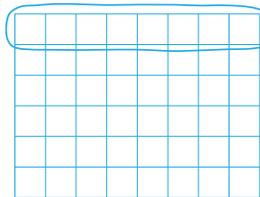
TRY IT

Possible student work:

Sample A

$48 \div 6 = 8$
8 inches

Sample B



Area = 48 square inches
There are 6 rows with 8 squares in each row.
The rectangle is 8 inches long.



Math Toolkit

- 1-inch tiles
- 1-inch grid paper
- sticky notes
- multiplication models
- perimeter and area tool



DISCUSS IT

Ask your partner: Why did you choose that strategy?
Tell your partner: The strategy I used to find the answer was ...

DISCUSS IT

Support Partner Discussion

Encourage students to share what did not work for them as well as what did as they talk to each other.

Support as needed with questions such as:

- *How did you start?*
- *Why did you choose the strategy you used?*

Common Misconception Look for students who write 7 inches or 9 inches as the solution, as they may not know their multiplication and division facts for 6. Have students use a number line and skip-counting to model $48 \div 6 = 8$ and $6 \times 8 = 48$.

Select and Sequence Student Solutions

One possible order for whole class discussion:

- modeling with unit tiles
- drawing a tiling
- skip-counting by sixes or repeated addition of 6
- writing and solving a multiplication and/or division equation

Support Whole Class Discussion

Compare and connect the different representations and have students identify how they relate.

Ask *Where does each model show the area, the width, and the length?*

Listen for In a tiling, the area is the total number of squares, the width is the number of rows, and the unknown length is the number of squares in each row. In an equation, the area is the total or product, and the width and length are factors.

PICTURE IT & MODEL IT

If no student presented these models, connect them to the student models by pointing out the ways they each represent:

- the area or total number of squares
- the width or number of rows
- the length or number in each row

Ask *How is the area represented in the tiling? In the equations?*

Listen for The area is 48 square inches. In the tiling, 48 is the total number of squares. In the multiplication equation, 48 is the product, while in the division equation, it is the number right before the division symbol.

For a tiling, prompt students to identify what the parts of the tiling represent.

- *How does the tiling show the different parts of a rectangle so you can find its area?*
- *How could you use the tiling to find the unknown length without writing an equation?*

For notes and equations, prompt students to identify the given information and what is unknown.

- *What information is given in the word problem?*
- *How do you know what the unknown amount represents?*
- *How can you tell if this is a division or multiplication situation?*

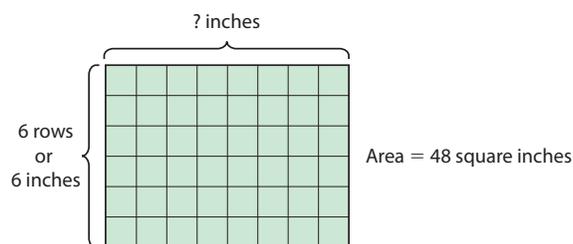
Explore different ways to understand solving word problems about area.

For an art project, Sean uses colored squares of paper to tile a rectangle that has an area of 48 square inches. Each piece of paper is 1 square inch. He makes 6 rows. How long is the rectangle?

PICTURE IT

You can use a drawing to show and solve problems about area.

Draw a picture.



MODEL IT

You can also use an equation to solve problems about area.

Make notes about the problem.

The rectangle has an area of 48 square inches.

6 rows means the rectangle is 6 inches wide.

The rectangle is ? inches long.

Use multiplication or division to find how long the rectangle is.

$$6 \times ? = 48$$

or

$$48 \div 6 = ?$$



376

Deepen Understanding

Relate Multiplication and Division

SMP 2 Reason abstractly and quantitatively.

After discussing the equation in *Model It*, return to *Picture It*. Prompt students to describe how this picture could be used to represent any problem from the same fact family.

Ask *How does this tiling show each number, including the unknown number, in the equation $6 \times ? = 48$?*

Listen for The 6 is the 6 rows, also the width. The ? is how many in each row, also the length. The 48 is how many altogether, also the area.

Ask *What other multiplication or division problems could we solve with this picture?*

Listen for You could find the width or how many rows if you knew the length or how many columns, or you could find how many squares altogether (or the area) if you knew how many rows and how many columns (or the width and the length).

CONNECT IT

- Remind students that one thing that is alike about all the representations is the numbers.
- Explain that on this page they will use those numbers to write different equations to represent the problem, choose an equation to solve, and then use what they have learned to solve a similar problem.

Monitor and Confirm

- 1–3 Check for understanding that:
- the length, the number of squares in each row, is unknown
 - you can write a related multiplication or division equation to represent the problem
 - students may use any strategy to solve

Support Whole Class Discussion

- 4 Be sure students understand that the problem is asking them to use a fact that is not in the fact family of the equations used above.

Students should recognize that one of the multiplication facts in the problem's fact family is $6 \times 8 = 48$ which is 6 (or one row) more than $6 \times 7 = 42$.

- 5 Look for the idea that 7 rows means the width is 7 inches, so you can use a multiplication or division equation to find the length, or the number in each row. Strategy and explanation are student's choice.

- 6 **REFLECT** Have all students focus on the strategies used to solve this problem. If time allows, have students share their preferences with a partner.

CONNECT IT

Now you will use the problem from the previous page to help you understand how to solve word problems about area.

- 1 What is the unknown in this problem? **how long the rectangle is**
- 2 Write a division equation using the letter ℓ to stand for the unknown number. Then write a related multiplication equation.
 $48 \div 6 = \ell$ and $6 \times \ell = 48$
- 3 Show and explain how to solve the problem.
Possible answer: I used the multiplication equation and thought about what number times 6 equals 48; 8.
- 4 How could you use the multiplication fact $6 \times 7 = 42$ to find the solution to this problem?
Answers will vary. Look for answers that recognize that both problems include the factor 6. If you add one more row of 6 to an array showing 7 rows of 6 ($6 \times 7 = 42$), you get 48.
- 5 Suppose Sean's rectangle has an area of 56 square inches and he makes 7 rows. Explain how you could use multiplication and division to find the length of this rectangle.
Possible answer: You can write $7 \times ? = 56$ or $56 \div 7 = ?$ The rectangle is 8 inches long.

6 REFLECT

Look back at your **Try It**, strategies by classmates, and **Picture It** and **Model It**. Which models or strategies do you like best for solving multiplication and division problems about area? Explain.

Some students may like tiling a rectangle because it provides a visual model, much like an array. Others may prefer to solve problems with equations and appreciate that they have two options, multiplication or division, to show their work.

377

**Hands-On Activity**

Model using equal groups, arrays, and tiling.

If . . . students are unsure about which modeling strategy they prefer

Then . . . use this activity to compare and contrast equal groups, arrays, and tiling.

Materials For each group: 21 counters, 21 unit tiles, 21 paper clips

- Write this problem on the board: *Kris has 21 squares of paper. She needs to put them into 7 equal groups. How many squares will be in each group?*
- Have students get into groups of 3. Ask each student in a group to pick one of the sets of materials: paper clips, counters, or unit tiles. Ask each student to model the word problem a different way. The student with paper clips will make equal groups. The student with the counters will make an array. The student with the unit tiles will make a tiling.
- Have students explain their models to the other members of their group and then present to the class. Have the class compare similarities and differences among the three models. Prompt students to describe when each model might be useful. For example, use tiling for an area model when you cannot have gaps, otherwise use an array where you do not need to be so precise.

APPLY IT

For all problems, encourage students to draw a tiling or area model to support their thinking.

- 7 18 square meters; See Student Worktext page for possible student work. Students may also write an equation.
- 8 7 rows; See Student Worktext page for possible student work. Students may also draw a tiling model.

Close: Exit Ticket

- 9 **A**; This fact family involves 5, s , and 30, where s is the length. This can be written as a missing-factor problem.
- C**; This fact family involves 5, s , and 30, where s is the length. This can be written as a missing-factor problem, with the product on either side of the equation, and the factors in either order.
- E**; This fact family involves 5, s , and 30, where s is the length. This can be written as a division problem.

Error Alert If students choose B or D, then have them use a quick drawing to model the problem. Have them use the model to help them write all 4 equations in the fact family. [$5 \times 6 = 30$; $6 \times 5 = 30$; $30 \div 5 = 6$; $30 \div 6 = 5$]

APPLY IT

Use what you just learned to solve these problems. Use a drawing of square tiles or an equation with a letter for the unknown number to show your work.

- 7 A walkway is made of square patio blocks. Each block is 1 square meter. There are 2 rows of blocks with 9 blocks in each row. What is the area of the walkway? Show your work.

Possible student work:



Solution The area of the walkway is 18 square meters.

- 8 Michael uses tiles with an area of 1 square foot each to build a rectangular patio with an area of 35 square feet. He uses 5 tiles in each row. How many rows of tiles are there? Show your work.

Possible student work:

$$35 \div 5 = t$$

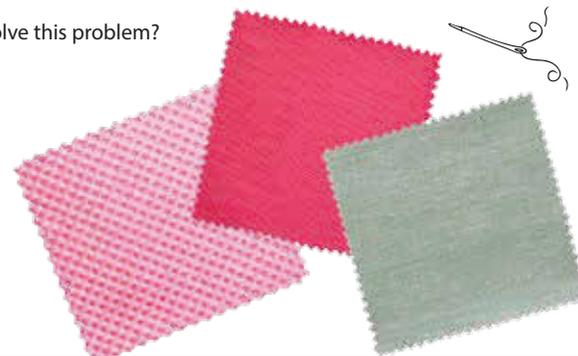
$$t = 7$$

Solution There are 7 rows.

- 9 Ayla uses 30 square pieces of fabric to make a quilt. Each square is 1 square foot. Her finished quilt has 5 rows, and she used the same number of squares in each row. How long is her quilt?

Which equations could be used to solve this problem?

- A $5 \times s = 30$
- B $30 \times 5 = s$
- C $30 = s \times 5$
- D $5 \times 30 = s$
- E $30 \div 5 = s$



Solutions

1 Tiling with 6 rows and 7 columns; See Student Worktext page for sample drawing.
Basic

2 $42 \div 7 = n; n = 6$
Medium

3 6
Medium

Practice Solving Problems About Area

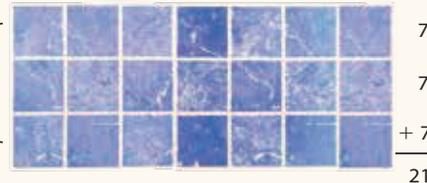
Study the Example that shows how to use drawings and equations to help you solve multiplication and division problems about area. Then solve problems 1–6.

EXAMPLE

Mrs. Milton tiles her patio floor with 1-square-foot tiles. The floor has an area of 21 square feet. She makes 3 equal rows of tiles. How many tiles are in each row?

21 square feet = 21 tiles
3 equal rows
 n tiles in each row

3 rows



$21 \div 3 = n$ and $3 \times n = 21$
 $21 \div 3 = 7$ and $3 \times 7 = 21$

There are 7 tiles in each row.

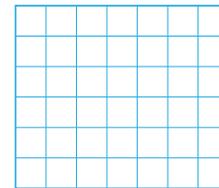
Mr. Salton paves the entrance to his house with 1-square-foot stone tiles. The area of the entrance is 42 square feet. He puts 7 tiles in each row. How many rows of tiles are there?

1 Make a drawing at the right to show the rows of tiles.

2 Complete the division equation to solve the problem. Use n to stand for the unknown number.

$42 \div \underline{7} = n$, so $n = \underline{6}$.

3 How many rows of stone tiles are there? 6



Fluency & Skills Practice **Teacher Toolbox**

Assign Solving Problems About Area

In this activity students practice solving word problems that involve tiling an area. Students may apply similar methods to find area in their everyday life. For example, students may use 1-square-inch tiles to determine the area of the cover of a math book, 1-square-foot tiles to determine the area of a closet, or 1-square-yard tiles to determine the area of a classroom.

Fluency and Skills Practice
Solving Problems About Area Name: _____

Read and solve each problem. Show your work.

1 Nya covers a rectangular tray with 1-square-inch tiles. She uses 42 tiles, arranged in 7 rows. How many tiles are in each row?
There are _____ tiles in each row.

2 Jacob uses tiles to cover a rectangular hallway. Each tile has an area of 1 square foot. He uses 3 rows of tiles, with 8 tiles in each row. What is the area of the hallway?
The area of the hallway is _____ square feet.

3 Sara covers the top of a box with squares of paper that are 1 square centimeter. She uses 48 squares, with 6 squares in each row. How many rows did she make?
Sara made _____ rows.

4 There are 64 squares on Rasha's chessboard. Each square is 1 square inch. There are 8 rows of squares on her chessboard. How many squares are in each row?
There are _____ squares in each row.

5 A rectangular patio at an outdoor restaurant is made of 35 tiles. Each tile is 1 square yard. If there are 5 tiles in each row, how many rows are there?
There are _____ rows of tiles.

6 Mr. Reilly uses square pieces of fabric that are each 1 square inch for a rectangular wall hanging. He uses 81 squares. If he makes 9 rows of squares, how many squares will be in each row?
There will be _____ squares in each row.

7 Choose one problem. Describe the strategy you used to solve it.

8 Explain why you chose that strategy to solve the problem.

©Curriculum Associates, LLC. Copying is permitted for classroom use.

Students might draw diagrams and/or write different equations to help solve the problems.

- 4 4 feet long; See Student Worktext page for possible student work.

Medium

- 5 63 squares; See Student Worktext page for possible student work.

Medium

- 6 14; 18; See Student Worktext page for possible student work.

Challenge

- 4 A rectangular quilt is made from 36 squares that each have an area of 1 square foot. One side of the quilt is 9 feet long. How long is the other side? Show your work.

Possible student work:

$$36 \div 9 = n$$

$$n = 4$$

Solution The other side of the quilt is 4 feet long.

- 5 There are 7 rows of squares on a game board. There are 9 squares in each row. How many squares are on the game board? Show your work.

Possible student work:

$$7 \times 9 = 63 \text{ or } 9 \times 7 = 63$$

Solution There are 63 squares on the game board.

- 6 Each square on the game board in problem 5 has sides that are 2 inches long. How long is the side with 7 squares? How long is the side with 9 squares? Show your work.

Possible student work:

$$2 \text{ inches} \times 7 = 14 \text{ inches}$$

$$2 \text{ inches} \times 9 = 18 \text{ inches}$$

The side with 7 squares is 14 inches long.

The side with 9 squares is 18 inches long.



380

ELL

English Language Learners:
Differentiated Instruction

Prepare for Session 5
Use with *Apply It*.

Levels 1–3

Listening/Speaking Read *Apply It* problem 7 aloud. Give 12 counters to pairs of students. Display the equation. Ask: *How many items are being shared?* [12] *The four means to put four items in a group or to make four groups.* Read scenario A aloud. Ask: *What do you want to find out?* [the cookies each friend gets] *How many cookies are there?* [12] *Are the four friends the groups or the number in the groups?* [the groups] *Use your counters to solve the problem.* Ask: *Can you solve the problem by using $12 \div 4 = ?$* Guide students in forming a consensus. Repeat the process for each scenario.

Levels 2–4

Listening/Speaking Read *Apply It* problem 7 aloud. Give 12 counters to pairs of students. Display the equation. Ask: *How many items are being shared?* [12] *What does the four represent?* [number of groups or number of items in each group] Read scenario A aloud. Say: *Solve the problem. Use the counters or another strategy.* Select pairs to share their strategy. Ask: *Can you solve the problem by using $12 \div 4 = ?$* Form a consensus by relating each number to the context. Repeat the process with the next two scenarios. Say: *With your partner, read the remaining problems and decide if each problem can be solved using $12 \div 4 = ?$.* Select pairs to share their reasoning for each of the remaining scenarios.

Levels 3–5

Listening/Speaking Have pairs read *Apply It* problem 7. Give 12 counters to each pair. Display the equation. Ask: *How many items are being shared?* [12] *What does the four represent?* [number of groups or number of items in each group] Have students read scenario A. Say: *Solve the problem. Use the counters or another strategy.* Select pairs to share their strategy. Ask: *Can you solve the problem by using $12 \div 4 = ?$* Form a consensus by relating each number to the context. Have pairs read and evaluate each scenario. Facilitate a discussion around each. Encourage pairs to share their strategy and reasoning for each scenario.

Purpose In this session students solve multiplication and division word problems involving equal groups, arrays, and area, then discuss and confirm their answers with a partner.

Before students begin work, use their responses to the *Check for Understanding* to determine those who will benefit from additional support.

As students complete the Example and problems 1–3, observe and monitor their reasoning to identify groupings for differentiated instruction.

Start

Check for Understanding

Why Confirm understanding of solving one-step word problems with multiplication and division.

How Have students use any strategy to find the number of desks in each row if there are 20 desks arranged in 4 equal rows.

There are 20 desks arranged in 4 equal rows. How many desks are in each row?



Solution
5 desks

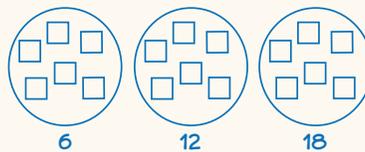
Refine Solving One-Step Word Problems Using Multiplication and Division

Complete the Example below. Then solve problems 1–9.

EXAMPLE

Troy has 18 homework problems to do. He has 3 days to finish the homework. If he does the same number of problems each day, how many problems will he do in a day?

Look at how you could show your work using a drawing.



Solution 6 problems each day

This problem can be solved using $3 \times ? = 18$ or $18 \div 3 = ?$.



PAIR/SHARE

Which equation did you use and why?

APPLY IT

1 Mr. Rivera is posting 28 student papers on the bulletin board. He posts the papers in 4 rows, with an equal number of papers in each row. How many papers does Mr. Rivera put in each row? Show your work.

Possible student work using an array:



Solution 7 in each row

What does 28 stand for in the problem?

PAIR/SHARE

Did you multiply or divide to solve the problem?

Error Alert

| If the error is ... | Students may ... | To support understanding ... |
|---------------------|---|---|
| 16 | have subtracted. | Have students draw an array using the information from the problem, marking one desk in each of four rows, one at a time, until they reach 20. Have them use the array to find the number of desks in each row. |
| 24 | have added. | Remediate the same as for a subtracting error. |
| 80 | have multiplied. | Have students make notes about the problem. Students should realize 20 is the total number of desks, so the answer cannot be greater than 20. |
| other answers | be struggling with multiplication and division word problems. | If students struggle with solving multiplication and division word problems, encourage them to use a table with the headings <i>Number of Groups</i> , <i>Number of Items Per Group</i> , and <i>Total Number of Items</i> to organize problem information. |

EXAMPLE

6 problems each day; The equal groups drawing of 3 groups of 6 shown is one way to solve the problem. Students could also solve the problem with a 3×6 array or the equation $18 \div 3 = 6$.

Look for The problem can be written as a multiplication or division equation with an unknown number.

APPLY IT

- 1 7 papers in each row; Students could solve the problem using a 4×7 array. Students could also use an equation.

DOK 2

Look for 28 is the total, 4 is the number of equal groups, and the unknown number is the number in each group.

- 2 6 teams; Students could solve the problem using a 6×9 array or tiling. Students could also use an equation.

DOK 2

Look for The facts $t \times 9 = 54$ and $54 \div 9 = t$ are two equations that could be used to help solve the word problem.

- 3 C; Students could solve the problem by multiplying $7 \times 3 = ?$ because they are given the number of groups, 7, and the number in each group, 3. They need to find the total number of servings.

Explain why the other two answer choices are not correct:

B is not correct because 18 is equal to 6×3 , not 7×3 .

D is not correct because 24 is equal to 8×3 , not 7×3 .

DOK 3

- 2 There are 54 players at a baseball clinic. The coach puts them into teams of 9 players. How many teams are there? Show your work.

Possible student work using an array:

| | | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|----|
| | | | | | | | | | | 54 |
| | | | | | | | | | | 45 |
| | | | | | | | | | | 36 |
| | | | | | | | | | | 27 |
| | | | | | | | | | | 18 |
| | | | | | | | | | | 9 |

What fact do you know that includes both numbers in the problem?



Solution 6 teams

- 3 Mai eats 3 servings of fruit each day. How many servings of fruit does she eat in a week? [1 week = 7 days]
- A 10 servings
 - B 18 servings
 - C 21 servings
 - D 24 servings

Harry chose A as the correct answer. How did he get that answer?

Possible answer: Harry added 3 and 7 instead of multiplying.

PAIR/SHARE

How can you check that your answer is correct?

Should you multiply or divide to solve the problem?

PAIR/SHARE

How did you figure out how Harry got his answer?

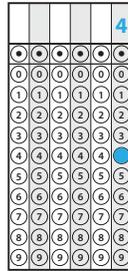
4 4; Each pair uses 2 socks, so $8 \div 2 = 4$.
DOK 1

5 **A**; The total and number in each row are given, so the unknown is the number of rows:
 $15 \div 5 = n$; $n = 3$ rows.
DOK 2

6 **B (No);**
C (Yes);
F (No);
G (Yes)
DOK 1

Error Alert Students who choose A and/or E may not understand that 42 is the total, and so it is the product in a multiplication problem and is the number right before the division symbol in a division problem.

4 There are 8 socks in the dryer.
How many pairs of socks is this?



5 Dana forms a rectangle with 15 square sticky notes.
She puts 5 notes in each row.
How many rows does she make?

- A 3
- B 5
- C 10
- D 20

6 Jasmine has 42 balloons. She gives an equal number of balloons to 6 children.
Can each equation be used to find the number of balloons Jasmine gives each child?

| | Yes | No |
|-------------------------|------------------------------------|------------------------------------|
| $42 \times 6 = \square$ | <input type="radio"/> A | <input checked="" type="radio"/> B |
| $6 \times \square = 42$ | <input checked="" type="radio"/> C | <input type="radio"/> D |
| $6 \div \square = 42$ | <input type="radio"/> E | <input checked="" type="radio"/> F |
| $42 \div 6 = \square$ | <input checked="" type="radio"/> G | <input type="radio"/> H |

Differentiated Instruction

RETEACH

Hands-On Activity
Use an “act-it-out strategy” to solve one-step word problems.

Students struggling with solving one-step word problems

Will benefit from additional work with concrete objects.

Materials For display: example problems, objects to support problems

- Make several “stores” such as *School Supplies*, *Snacks*, *Groceries*, etc. and have 1 or 2 related problems to solve at each store.
- Have groups of 3 or 4 visit each store to solve a problem. Stores should be equipped with objects required to solve the problem. For example, *School Supplies* may have this problem: *Each box contains 8 pencils. There are 32 pencils. How many boxes are there?* This store would have pencils for the students to use as manipulatives.
- Students act out the problem and then model it with an equation and solve it. So, for the pencil problem: $32 \div 8 = b$ or $b \times 8 = 32$; $b = 4$.

EXTEND

Challenge Activity
Solve more complex problems.

Students who have achieved proficiency

Will benefit from deepening understanding of more complex problems.

Have students work in pairs to solve these problems.

- Greater number: *Pat buys hair ribbons for 12 friends. The ribbons cost \$8 each. How much did she spend?* [\$96]
- Remainder: *Mrs. Ro buys a box of 35 pencils to give to 15 students. How many pencils can Mrs. Ro give each student? Will she have any left over? If so, how many?* [2; 5]
- Multi-step: *Jake needs \$150 to buy a bike. He has \$40. He mows 3 lawns, earning \$25 for each. Does he have enough money to buy the bike? If not, how much more is needed?* [No; \$35]

7 **A**; Brandon is dividing 12 cookies evenly among 4 friends, which can be solved with the equation $12 \div 4 = \square$.

C; 12 miles divided into equal groups of 4 can be solved with the equation $12 \div 4 = \square$.

D; Lilah is dividing 12 tomatoes into equal groups of 4, which can be solved with the equation $12 \div 4 = \square$.

DOK 2

8 5 feet; Students may draw a tiling with 5 rows of 5 tiles in each row; A square has sides that are the same length, so the number of rows and the number of tiles in each row must be the same.
 $5 \times 5 = 25$.

DOK 2

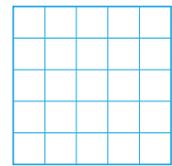
7 Which problems can be solved using $12 \div 4 = \square$?

- A** Brandon has 12 cookies. He gives the same number of cookies to each of his 4 friends. How many cookies does each friend get?
- B** Zoe has 12 folders. She wants to put 4 papers in each folder. How many papers does she need?
- C** Michael rides his bike 4 miles a day. How many days will it take him to ride 12 miles?
- D** Lilah has 12 tomatoes. She always uses 4 tomatoes to make a salad. How many salads can she make?
- E** Jacob has 12 flowers. He gives 4 flowers to his friends. How many flowers does Jacob have left?



8 Catrina uses green tiles to make a square on her kitchen floor that has an area of 25 square feet. How long is each side of the green square? Show your work.

Possible student drawing:



Each side of the green square is5..... feet long.

9 **MATH JOURNAL**

Missy wants to hang 12 pictures on her bedroom wall. She hangs 3 pictures in each row. How many rows of pictures are there? Explain two ways to find the answer.

Possible answer: I can draw an array to model Missy's pictures. Each row has 3 pictures, so there are 4 rows. I can also write a division equation to find the answer. $12 \div 3 = 4$. So, there are 4 rows of pictures.

SELF CHECK Go back to the Unit 3 Opener and see what you can check off.

384

REINFORCE

Problems 4–9

Solve one-step word problems using multiplication and division.

All students will benefit from additional work with using multiplication and division to solve one-step word problems by solving problems in a variety of formats.

- Have students work on their own or with a partner to solve the problems.
- Encourage students to show their work.

PERSONALIZE



Provide students with opportunities to work on their personalized instruction path with *i-Ready* Online Instruction to:

- fill prerequisite gaps
- build up grade-level skills

Close: Exit Ticket

9 **MATH JOURNAL**

Student responses should indicate understanding of two different strategies for solving a one-step multiplication or division word problem.

Error Alert If students add or multiply 12 and 3 [and get 15 or 36], **then** use sticky notes or a quick drawing on grid paper to model the problem. Remind students that Missy is hanging 12 pictures in all, so 12 is the total.

SELF CHECK Have students consider whether they feel they are ready to check off any new skills on the Unit 3 Opener.

Lesson 17 Quiz

Tested Skills

Assesses 3.OA.A.3

Problems on this assessment form require students to be able to use equations to represent and solve multiplication or division word problems. Students will also need to be familiar with the relationship between multiplication and division.

Alternately, teachers may assign the **Digital Comprehension Check** online to assess student understanding of this material.

Error Alert Students may:

- use the wrong operation.
- multiply or divide incorrectly.
- not recognize the product in a multiplication equation as the total number of items.

Solutions

1 $48 \div 8 = 6$

2 points

3.OA.A.3, DOK 1

2 D; Students may solve this problem by using multiplication to find the product of 4 and 8.

A is not correct because 8 is divided by 4 instead of 8 being multiplied by 4.

B is not correct because 8 is added to 4 instead of 8 being multiplied by 4.

C is not correct because the product of 4 and 8 is 32, not 24, so a multiplication error was made.

1 point

3.OA.A.3, DOK 2

Solve the problems.

- 1** There are 48 students on the playground. The teacher puts the students into 8 equal groups. What division equation can be used to find the number of students in each group? Write your answers in the blanks. **(2 points)**

$48 \div 8 = 6$

- 2** Loren has 4 vases of flowers. Each vase contains 8 flowers. How many flowers are there in all? **(1 point)**

- A 2
- B 12
- C 24
- D 32

- 3** Brandie has 28 toy cars. She puts the same number of cars on each of 7 shelves. Which equations can be used to find C, the number of cars on each shelf?

Choose all the correct answers. **(2 points)**

- A $7 \div C = 28$
- B $28 \times 7 = C$
- C $7 \times C = 28$
- D $28 \div C = 7$
- E $C \div 28 = 7$

Multiple Select Scoring Rubric

| 2 points | 1 point | 0 points |
|-------------------------|--------------------|-----------------------------|
| All answers are correct | 1 incorrect answer | 2 or more incorrect answers |

Equation Fill-in-the-Blank Scoring Rubric

| 2 points | 1 point | 0 points |
|---|--|---|
| <ul style="list-style-type: none"> • The dividend and divisor are correct. • The answer is correct. | One of the following is incorrect: <ul style="list-style-type: none"> • The dividend or divisor. • The answer. | More than one of the following are incorrect: <ul style="list-style-type: none"> • The dividend or divisor. • The answer. |

Extended Response Scoring Rubric

| Points | Expectations |
|--------|---|
| 4 | <ul style="list-style-type: none"> • Correct computations, solutions, and/or calculations. (2 points) • Well-organized and concise work that demonstrates thorough understanding of math concepts. (2 points) |
| 3 | <ul style="list-style-type: none"> • Mostly correct solution(s). (1 point) • Shows strong understanding of math concepts. (2 points) |
| 2 | <ul style="list-style-type: none"> • Shows partial to limited understanding of mathematical concepts and/or procedures. |
| 1 | <ul style="list-style-type: none"> • Incorrect solution(s) and poorly organized. • Incomplete work and explanations. • Limited understanding of mathematical concepts. |
| 0 | <ul style="list-style-type: none"> • No attempt to find a solution. • No effort to demonstrate an understanding of mathematical concepts and/or procedures. |

Lesson 17 Quiz continued

- 3 C;** Students may solve the problem by recognizing that the number of shelves multiplied by the number of cars on each shelf is equal to the number of cars.
D; Students may solve the problem by recognizing that the number of cars divided by the number of cars are on each shelf is equal to the number of shelves.
A is not correct because the number of shelves must be multiplied by the number of cars on each shelf, not divided.
B is not correct because the number of cars must be divided by the number of shelves, not multiplied, to find the number of cars on each shelf.

E is not correct because the dividend and divisor are in the incorrect order.

2 points
3.OA.A.3, DOK 2

- 4 A (Yes); D (No); E (Yes); G (Yes)**
 2 points
3.OA.A.3, DOK 2

- 5** The width of the garden is 4 yards; See possible equations on the student page. Students' responses may also include $28 \div w = 7$ and $w \times 7 = 28$.
 2 points
3.OA.A.3, DOK 1

- 4** Decide if $24 \div 6 = \square$ can be used to solve each problem. Choose Yes or No for each problem. (2 points)

| | Yes | No |
|---|-----|-----|
| Aiden's classroom has 24 desks in 6 equal rows. How many desks are in each row? | (A) | (B) |
| Chan has 24 strawberries. She puts 6 strawberries in a smoothie. How many strawberries does she have left? | (C) | (D) |
| Omar practices piano scales for 6 minutes each day. How many days will it take him to practice piano scales for 24 minutes? | (E) | (F) |
| Kona fills a basket with 6 mangoes. She has 24 mangoes. How many baskets can she fill? | (G) | (H) |

- 5** The area of a rectangular garden is 28 square yards. The length of the garden is 7 yards. Write related multiplication and division equations to find the width of the garden. Use w for the unknown. (2 points)

Possible equations: $28 \div 7 = w$, $7 \times w = 28$

The width of the garden is 4 yards.

Choice Matrix Scoring Rubric

| 2 points | 1 point | 0 points |
|-------------------------|--------------------|-----------------------------|
| All answers are correct | 1 incorrect answer | 2 or more incorrect answers |

Differentiated Instruction

Teacher Toolbox

RETEACH: Tools for Instruction

Tools for Instruction
Multiply and Divide to Solve One-Step Word Problems

Objective: Use multiplication and division to solve one-step word problems.

Materials: Counters

Students: Have previously learned about different ways to show multiplication and division. In this lesson, they learn how to solve multiplication and division word problems. This activity groups students to think mathematically about contextual situations. Students identify whether multiplication or division can be used to represent problem situations and apply their mathematical knowledge to the problem at hand. The skills students practice here will prepare them to write and analyze equations to solve word problems.

Step by Step

- 1. Introduce a division problem.**
 - There are 24 flowers and 6 vases. If the same number of flowers in each vase, how many flowers will be in each vase?
- 2. Solve the problem.**
 - Ask questions to elicit information about the problem. Ask: How many flowers does the vase hold? How many vases? What operation do you use to find how many flowers can go in each vase? ($24 \div 6 = 4$)
 - Guide the student to see that since this is a grouping or distribution situation, division is used to make equal groups.
 - Have the student solve the problem. If the student struggles with the division, give him or her counters to model the problem. Ask: What do the counters represent?
- 3. Introduce and solve a multiplication problem.**
 - There are 5 boxes of erasers on a table. Each box has 3 erasers. How many erasers are there in all?
 - Ask the student to identify the given information.
 - Ask: How is this problem different from the first problem? (Sample answer: I need to find how many in all. In the first problem, I had to find how many in each group.)
 - Guide the student to solve the problem by multiplying 5 and 3 to get an answer of 15 erasers, using counters if necessary.

Support English Learners: English learners may need additional practice identifying whether to multiply or divide when solving a word problem. Encourage students to work together to act out scenarios and discuss why multiplication (combining equal groups) or division (separating groups equal) is appropriate.

Present additional multiplication and division problems.

- Show the following problems. Have the student discuss whether each situation calls for multiplication or division and then solve the problems.
- 12 students sign up for an after-school program. There are 8 students in each group. How many groups are there? (Division, 4)

REINFORCE: Math Center Activities

Center Activity 2.5

Solve Word Problems

What You Need

- number cube (1–6)
- 12 game markers in one color
- 12 game markers in a different color
- Game Board

What You Do

1. Take turns. Roll the number cube. Read the word problem next to the number that you rolled.
2. Find one equation on the **Game Board** that can be used to solve the word problem. If all matching equations are covered, your turn ends.
3. Your partner checks your answer. If you are correct, solve and cover that equation with your game marker. If you are incorrect, your turn ends.
4. Repeat until all the equations are covered. The player with the most markers on the **Game Board** wins.
5. Play again!

Check Understanding
 There are 45 children. There are 5 children in each row. How many rows are there? Write an equation and explain how you solved it.

Game Board

| Roll | Word Problem |
|------|---|
| 1 | Andre read 70 pages in all. The first 30 pages each day. How many days did it take her? |
| 2 | Keaton has 7 balloons at each table. He uses 63 balloons. How many tables does he have? |
| 3 | There are 40 flowers in 7 vases. Each vase has an equal number of flowers. How many flowers are in each vase? |
| 4 | Ava takes for 42 minutes in a row. How many weeks does she take? |
| 5 | There are 7 muffins in each package. There are 56 muffins in all. How many packages are there? |
| 6 | Your turn ends. |

Go Further!
 Choose two equations on the **Game Board**. Write a word problem that can be solved using each equation. Trade problems with your partner to solve.

EXTEND: Enrichment Activities

Enrichment Activity

Race Training

Your Challenge

1. You want to run between 12 miles and 30 miles each week to prepare for a marathon. You must run the same distance each day. When you run a total of more than 12 miles, you must take the next day off to rest. On the **Recording Sheet**, make a plan for your training schedule for the next two weeks with each week having a different schedule.
2. You want to ride your bike between 50 and 70 miles each week to train for a bike race. You must bike the same distance each day. You cannot ride more than half the total distance for the week without taking a day off to rest. Make a plan for your training schedule on the **Recording Sheet**.

Can you write a multiplication equation to represent the total distance?