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ISBN 978-0-8454-8766-2

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LESSON **5** Understanding Multiplication CC.2.2.3.A.1


**1 Introduction**

**Multiply** to put together groups of the same size.

Bethany spills the pennies from her piggy bank. How can she use multiplication to count them?



Bethany can arrange the pennies in an **array**. An array has rows with the same number of objects. Bethany has 3 rows of 5 pennies.



Bethany can add 5 pennies 3 times to find the total. This is called **repeated addition**.

$$5 + 5 + 5 = 15$$

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## Objective

To understand multiplication and basic multiplication facts

## 1 Introduction

Review the concept of multiplication as repeated addition. Students should recognize that an array is an arrangement of objects or symbols, in which each row has the same number of objects. They should see that an array of 15 can represent both  $5 + 5 + 5$  and  $3 \times 5$ , and so these expressions are equal. Students should use the terms *factor* and *product* comfortably, recognizing that one factor represents the number of objects in the group and the other the number of groups.

## Think About It

Students should identify that they can find the total number of rolls made by finding the number of rolls per pan. They should be able to determine that each pan has 24 rolls:  $6 \times 4 = 24$  or  $4 + 4 + 4 + 4 + 4 + 4 = 24$ .

Bethany can also multiply.

$$\begin{array}{c} 3 \times 5 = 15 \\ \uparrow \quad \uparrow \\ \text{Number of groups} \quad \text{Number in each group} \end{array}$$

**Factors** are the numbers being multiplied. The answer is the **product**.

**Think About It**

Eduardo baked rolls for a family party. Each pan had 6 rows of rolls. There were 4 rolls in each row. Explain how the rolls are like an array. How can Eduardo find how many rolls he made?

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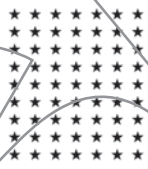
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**2 Focused Instruction**

Multiplication problems can be described using an array. The number of rows is one factor. The number of shapes in each row is another factor. The total number of shapes is the product.



Think of each row as a group.

How many groups are there?   7  

How many stars are in each group?   9  

What number do you add repeatedly?   7  

How many times do you add it?   9  

Write the multiplication sentence:    $9 \times 7 = 63$   

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## PA Core Standard

**CC.2.2.3.A.1** Represent and solve problems involving multiplication and division.

## Eligible Content

**M03.B-O.1.1.1** Interpret and/or describe products of whole numbers (up to and including  $10 \times 10$ ).

## Vocabulary

**array:** a model using rows and columns of symbols or shapes

**factors:** whole numbers that multiply to form a product

**multiply:** to combine groups of the same size

**product:** the answer in a multiplication problem

**repeated addition:** a way of showing multiplication by adding the same number multiple times ( $3 \times 4 = 4 + 4 + 4$ )

**2 Focused Instruction**

Students describe an array of 63 stars arranged in 9 rows. The questions help students focus on the number of stars per row, the number of rows, and relationship of these numbers to repeated addition and to multiplication. Guide them to translate the 9 groups of 7 stars into the multiplication sentence  $9 \times 7 = 63$ .

Students then interpret a real-life situation in terms of factors and products and then solve the problem with a multiplication sentence. If necessary, guide students in describing the factors.

Conclude the Focused Instruction section by having students write and solve multiplication sentences to represent three real-life situations.

**3 Guided Practice**

Students should complete the Guided Practice section on their own. Offer assistance as needed, pointing out the reminder and hint boxes along the right side of the page.

**2 Focused Instruction** Lesson 5

Think about what the numbers in a word problem mean. Solve this problem using a multiplication sentence.

▶ Carla picked peaches and put them in a basket. She carried 4 peaches at a time. She stopped when the basket was full. It took her 8 trips to fill the basket. How many peaches did Carla pick?

What are the parts of a multiplication sentence?  
factors and products

How many factors are in the multiplication sentence that solves this problem?  
2

Describe one of the factors.  
the number of peaches she can carry (4)

Describe the other factor. the number of trips to fill the basket (8)

Solve the problem using a multiplication sentence.  $8 \times 4 = 32$

**Use what you know about multiplication to write multiplication sentences to answer these questions.**

- 1 A group of friends went to a picnic in 4 cars. Each car had 5 people in it. How many people went to the picnic?  
 $4 \times 5 = 20$
- 2 Tricycles have 3 wheels. How many wheels do 7 tricycles have?  
 $7 \times 3 = 21$
- 3 A room has 6 rows of chairs. Each row has 9 chairs. How many chairs are in the room?  
 $6 \times 9 = 54$


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**3 Guided Practice** Lesson 5

Solve the following problems.


- 1 Write a multiplication sentence that goes with the array below.
 




One factor is the number of rows. The other factor is the number of objects in each row.

Answer  $5 \times 8 = 40$
- 2 Draw an array that models the multiplication sentence:
 

$2 \times 5 = 10$



In a multiplication sentence, the number of groups is written first. In an array, each row is a group.
- 3 Write an addition sentence and related multiplication sentence that represent the drawing below.
 



Remember how addition sentences are related to multiplication sentences.

Addition  $6 + 6 + 6 = 18$

Multiplication  $3 \times 6 = 18$

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**Connections to Standards for Mathematical Practice**


- Model with mathematics.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.


**4 Independent Practice** Lesson 5


Solve the following problems.

1 Which array models  $3 \times 2 = 6$ ? **DOK 2**  
**M03.B-O.1.1.1**

A 

**B** 

C 

D 

2 Each of the 4 wheels of a car is held on by 5 bolts. Which multiplication sentence shows the total number of wheel bolts on a car? **DOK 2**  
**M03.B-O.1.1.1**

A  $4 \times 4 = 20$

B  $5 \times 5 = 20$

**C**  $4 \times 5 = 20$

D  $4 \times 4 \times 4 \times 4 \times 4 = 20$

3 Can you write  $6 + 6 + 6 + 4 = 22$  as a multiplication sentence? Explain. **DOK 2**  
**M03.B-O.1.1.1**

No, the groups are not all the same size.

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**4 Independent Practice Answer Rationales**

- 1 An array to show  $3 \times 2 = 6$  must show 3 rows of 2 circles or 2 rows of 3 circles. Choice B shows 3 rows of 2 circles, so it is correct. Choice A shows  $2 \times 2 = 4$ . Choice C shows  $2 \times 4 = 8$ . Choice D shows  $3 \times 3 = 9$ .
- 2 There are 4 groups because there are 4 wheels, so the first factor is 4. There are 5 bolts on each wheel so the second factor is 5. Choices A and B each have one incorrect factor. Choice D shows 4 multiplied by itself 5 times, which is  $4^5$ , not  $4 \times 5$ . Choice C is correct.
- 3 There are 3 groups of 6 and 1 group of 4. To multiply, all groups must be the same size. So this number sentence cannot be rewritten as a multiplication sentence.

**4 Independent Practice** Lesson 5

4 Emilio planted 4 rows of tomato plants. Each row had 6 plants.


**Part A** Write the multiplication sentence that shows how many tomato plants Emilio planted. Solve the problem. **DOK 3**  
**M03.B-O.1.1.1**

Answer  $4 \times 6 = 24$

**Part B** Draw the array that shows the multiplication sentence.  
*Students should have drawn a 4-by-6 array.*

**Part C** Draw an array to show another way that Emilio could have arranged the same number of tomato plants other than in a single row.  
*Accept any of the following arrays: 6-by-4, 3-by-8, 8-by-3, 12-by-2, or 2-by-12.*

5 Look at the drawing at the right. Rama wrote the addition sentence and the multiplication sentence below to put together the equal groups. Is she correct? Explain. **DOK 3**  
**M03.B-O.1.1.1**



$5 + 5 + 5 + 5 + 5 = 25$

$5 \times 5 = 25$

She is not correct. The number of groups is correct, but the number of triangles in each group should be 7, not 5.

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- 4 **PART A** The first number is the number of rows (groups), and the second number is the number of objects in each row. Multiply the number of rows and the number of plants in each row for the total number of plants:  $4 \times 6 = 24$ .
- PART B** An array shows the factors as rows and columns. To show this situation, show 4 rows with 6 objects in each row.
- PART C** Emilio planted 24 plants. He could have planted these as 3 rows of 8, 8 rows of 3, 2 rows of 12, 12 rows of 2, or 6 rows of 4. These are all pairs of factors for 24.
- 5 The drawing shows 5 groups of 7 triangles. Rama correctly found one factor as 5. However, she did not find the correct second factor, which should be 7. She should have written  $5 + 5 + 5 + 5 + 5 + 5 + 5 = 35$  and  $5 \times 7 = 35$ .

**6 PART A** The arrays should show that George made 3 rows with 4 cookies in each row and Elsa made 4 rows with 3 cookies in each row.

**PART B** Both people made the same number of cookies. Students should recognize that  $3 \times 4 = 12$  and  $4 \times 3 = 12$ . Both arrays represent multiplication with the same factors, 3 and 4, and will have the same product, 12.


4 Independent Practice

Lesson 5


**6** George and Elsa put trays of cookies in the oven to bake. George made 3 rows of cookies with 4 cookies in each row. Elsa made 4 rows of cookies with 3 cookies in each row. DOK 3  
M03.B-O.1.1.1

**Part A** In the space below, draw an array to show how George placed the cookies. Then draw an array to show how Elsa placed the cookies.

George



Elsa



**Part B** Write a multiplication sentence for each array. Then select an option to complete the sentence below.

George's Array 3 × 4 = 12

Elsa's Array 4 × 3 = 12

The number of cookies George made was  less than,  the same as,  more than, the number of cookies Elsa made.

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### Extension Activity

Assemble a collection of small items in packages from a school supply or office supply store; you will need packages of 1 through 9 items, such as a pack of 2 erasers, a box of 5 pencils, and so on. Leave the objects in their packaging and place them in a box labeled "Shopping Cart." Then write the factors 0 through 9 on small cards and place them in a pile, face down. Distribute individual dry-erase boards and markers to small groups of students. Have students take turns selecting a card from the pile; this will be one factor. Ask one student to select a package from the shopping cart and announce the number of items in the package. Direct students to draw an array to represent the product of these factors and to label their array with the correct number sentence. Review the completed drawings. Have students return their factors cards and choose another. Then repeat with another object pulled from the box.