LESSON 1

Objective

Relate arrays and repeated addition to multiplication.

Common Core State Standards

- **3.OA.1** Interpret products of whole numbers, e.g., interpret 5 × 7 as the total number of objects in 5 groups of 7 objects each. *For example, describe a context in which a total number of objects can be expressed as 5 × 7.*
- **3.OA.3** Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.

Operations and Algebraic Thinking

Multiplying with Arrays

Arrays are arrangements of equal groups that can be used to show repeated addition and multiplication. Arrays can be made from Color Tiles or units of Base Ten Blocks but are also found in everyday objects, such as the arrangement of cans in a six-pack or eggs in a carton. They can be especially helpful as students learn multiplication facts.

Try It! *Perform the Try It! activity on the next page.*

Talk About It

Discuss the Try It! activity.

- **Ask:** *How did the array help you solve the problem?* Discuss with students how they used the array and repeated addition to solve the problem.
- **Ask:** *If you made 4 rows of 8 and added 8 + 8 + 8 + 8, would you get the same answer?* Have students model 4 × 8 and compare the 2 arrays side by side.
- **Ask:** *If you wanted to find 8 × 3 instead of 8 × 4, how would you change the array you made?*

Solve It

With students, reread the problem. Have students draw a picture of the array of chairs. Then have them write the numerical representation as both repeated addition and multiplication.

More Ideas

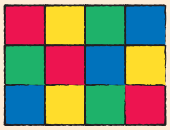
For other ways to teach about relating arrays and repeated addition to multiplication—

- Have students work in pairs. One partner will create an array with Color Tiles. The other partner must then create an equation using repeated addition to represent the array. Both students should count the tiles to check the equation.
- Have students use Color Tiles to create an array using prime numbers. For example, ask students to make an array using 29 tiles. Challenge them to explain why this array can only be made as a straight line rather than a square or rectangle.
- Have students use Color Tiles to explore arrays of perfect squares. Ask students to explain why they can make a square array for 16 but not for 18.

Formative Assessment

Have students try the following problem.

Which number sentence describes the array?



A. 3 × 4 **C.** 4 + 4 + 4 + 4

B. 3 + 3 + 3 **D.** 4 + 3

Try It! 20 minutes | Pairs

Here is a problem about relating arrays and repeated addition to multiplication.

Mr. Booth asked a police officer to speak to his class and another third-grade class about summer safety. To make room for the other students, Mr. Booth arranged the chairs in his classroom into 8 rows and put 4 chairs in each row. How many chairs were there in all?

Introduce the problem. Then have students do the activity to solve the problem. Distribute Color Tiles, paper, and pencils to students.

Materials
- Color Tiles (40 per pair)
- paper (1 sheet per student)
- pencils (1 per student)

1. Tell students that one way to solve the problem is by using an array. **Say:** *Use the tiles to show 8 rows of 4 tiles.* Emphasize rows and columns in the array.

2. Ask: *How could we find the number of tiles in the array?* Point out that students can use the array they made to add 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4.

3. Have students calculate the answer to the problem by adding. **Ask:** *What other ways can we find the answer?* Demonstrate that 8 × 4 is the same as 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4.

⚠ Look Out!

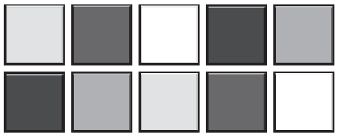
Make sure students are aware of the difference between a row and a column. Additionally, students may not understand that they need to have the same number of tiles in each row. Reinforce that in order to use repeated addition for multiplication, they need the same number in each group. To increase students' understanding of the number sense behind multiplication, encourage them to use skip-counting for repeated addition before they start to memorize multiplication facts. This will give them a deeper understanding of what multiplication is, rather than merely encouraging rote memorization.

Answer Key

Use Color Tiles to build each array. Write the multiplication sentence for each array.

(Check students' work.)

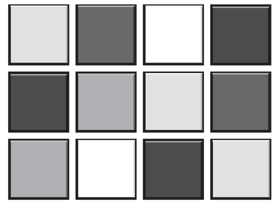
1.



2 rows of 5 tiles

$2 \times 5 = 10$

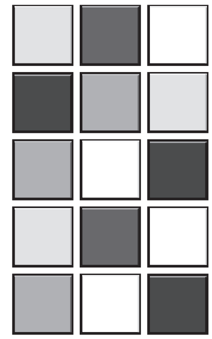
2.



3 rows of 4 tiles

$3 \times 4 = 12$

3.



5 rows of 3 tiles

$5 \times 3 = 15$

Build each array using Color Tiles. Then sketch the model below. Write each multiplication sentence.

(Check students' models.)

4. 2 rows of 9 tiles

$2 \times 9 = 18$

5. 7 rows of 4 tiles

$7 \times 4 = 28$

6. 5 rows of 6 tiles

$5 \times 6 = 30$

Find the answer to each multiplication problem.

7. $8 \times 5 =$ 40

8. $2 \times 7 =$ 14

9. $4 \times 4 =$ 16

10. $6 \times 3 =$ 18

11. $3 \times 5 =$ 15

12. $7 \times 6 =$ 42

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Answer Key

Challenge! Which two problems from the previous page can be used to demonstrate the Commutative Property of Multiplication? Model the arrays that show both multiplication expressions.

Challenge: (Sample) Problems 3 and 11; Both have factors of 3 and 5. In Problem 3, there are 5 rows of 3 tiles for a total of 15 tiles. The multiplication sentence is $5 \times 3 = 15$. In Problem 11, the array is 3 rows of 5 tiles for a total of 15 tiles. The multiplication sentence is $3 \times 5 = 15$. These arrays show that the order of the factors does not change the product.

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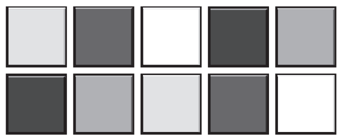
Name ______________________________

Use Color Tiles to build each array.
Write the multiplication sentence for each array.

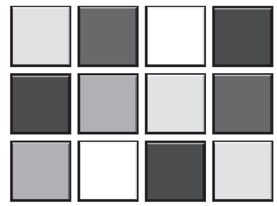
1.



___ rows of ___ tiles

____

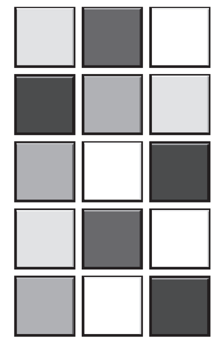
2.



___ rows of ___ tiles

____

3.



___ rows of ___ tiles

____

Build each array using Color Tiles. Then sketch the model below.
Write each multiplication sentence.

4. 2 rows of 9 tiles

____

5. 7 rows of 4 tiles

____

6. 5 rows of 6 tiles

____

Find the answer to each multiplication problem.

7. $8 \times 5 =$ ________

8. $2 \times 7 =$ ________

9. $4 \times 4 =$ ________

10. $6 \times 3 =$ ________

11. $3 \times 5 =$ ________

12. $7 \times 6 =$ ________

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Name ___________________________________

Challenge! Which two problems from the previous page can be used to demonstrate the Commutative Property of Multiplication? Model the arrays that show both multiplication expressions.

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