

LESSON 8

Objective

Model and identify the Associative Property of Multiplication.

Common Core State Standards

- **3.OA.5** Apply properties of operations as strategies to multiply and divide. *Examples: If $6 \times 4 = 24$ is known, then $4 \times 6 = 24$ is also known. (Commutative property of multiplication.) $3 \times 5 \times 2$ can be found by $3 \times 5 = 15$, then $15 \times 2 = 30$, or by $5 \times 2 = 10$, then $3 \times 10 = 30$. (Associative property of multiplication.) Knowing that $8 \times 5 = 40$ and $8 \times 2 = 16$, one can find 8×7 as $8 \times (5 + 2) = (8 \times 5) + (8 \times 2) = 40 + 16 = 56$. (Distributive property.)*

Operations and Algebraic Thinking

Associative Property of Multiplication

The Associative Property of Multiplication allows you to group and regroup the factors in a multiplication equation without changing the product. For any three values, a , b , and c , $(a \times b) \times c = a \times (b \times c)$. Students need to understand that regrouping numbers will allow them to multiply number pairs. The Associative Property is used in algebraic relations when working with equations.

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

Talk About It

Discuss the Try It! activity.

- **Ask:** When you grouped the factors differently, did you get different products? Emphasize that the Associative Property of Multiplication allows students to use different groups of factors to get the same product.
- **Ask:** Which way was easier to multiply, $2 \times (4 \times 5)$ or $(2 \times 4) \times 5$? Why do you think the Associative Property is useful sometimes? Guide students to understand that some number pairs are easier to multiply than others.
- **Ask:** How is the Associative Property of Multiplication like the Associative Property of Addition? How are the properties different?

Solve It

With students, reread the problem. Have students write to tell what products Jack and Meg calculated and explain why their answers were the same.

More Ideas

For other ways to teach about the Associative Property of Multiplication—

- Ask students to use Color Tiles to group factor arrays in different ways to get the same product. Have students draw large parentheses on paper to put around the tiles to show which factors are being multiplied first.
- Have students work in pairs with Color Tiles. Give students a product and have them work backward to find factors using the Associative Property. For example, if you gave students 50 as a product, they could come up with the number sentences $(25 \times 2) \times 1 = 50$ or $(2 \times 5) \times 5 = 50$.

Formative Assessment

Have students try the following problem.

What is another way to write $(4 \times 9) \times 8 = 288$ using the Associative Property of Multiplication?

- A. $4 + (9 + 8) = 288$
- B. $8 \times 9 \times 4 = 288$
- C. $4 \times (9 \times 288) = 8$
- D. $4 \times (9 \times 8) = 288$

Try It! 25 minutes | Groups of 4

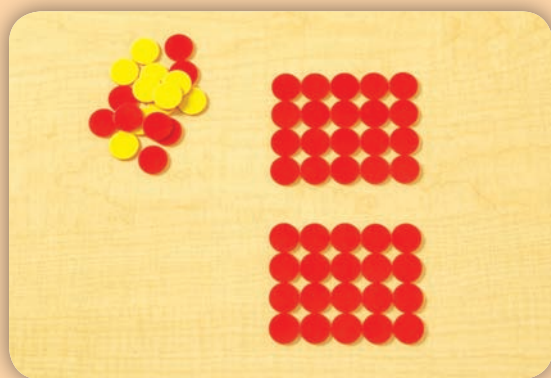
Here is a problem about the Associative Property of Multiplication.

Mrs. Larson's third-grade class is practicing multiplication. Mrs. Larson gives Jack the following problem to solve: $2 \times (4 \times 5) = \underline{\hspace{2cm}}$. She gives Meg another problem: $(2 \times 4) \times 5 = \underline{\hspace{2cm}}$. What answers do the students get?

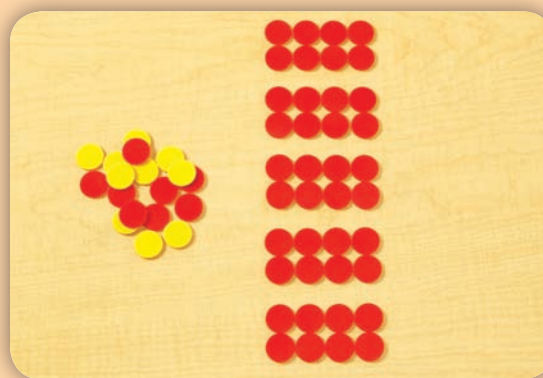
Introduce the problem. Then have students do the activity to solve the problem. Distribute Two-Color Counters to groups of students. Review the terms *factor* and *product* and the use of arrays if necessary. Write the problem $2 \times 4 \times 5 = \underline{\hspace{2cm}}$ on the board.

Materials

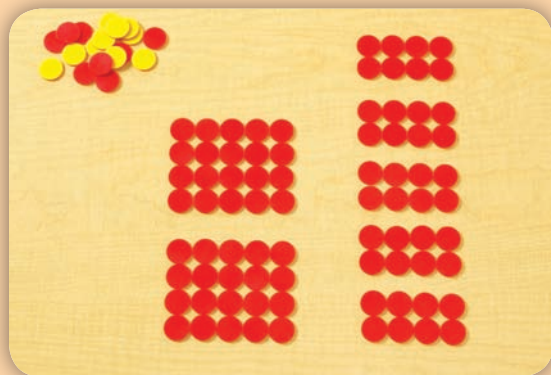
- Two-Color Counters (80 per group)
- paper (1 sheet per group)
- pencils (1 per group)



1. Have students model the number sentence $2 \times (4 \times 5) = \underline{\hspace{2cm}}$ by showing 2 groups of 4×5 arrays. Then have them find the product.



2. Have students model the number sentence $(2 \times 4) \times 5 = \underline{\hspace{2cm}}$ by showing 5 groups of 2×4 arrays. Then have them find the product.



3. Have students compare the two sets of arrays they made out of counters. Ask them to write two number sentences to represent their models using parentheses to group the numbers that are multiplied first.

Look Out!

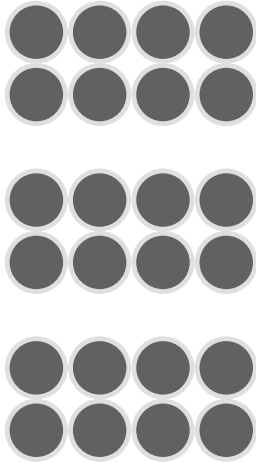
Students may confuse the Associative Property of Multiplication with the Commutative Property of Multiplication. Remind students that the Associative Property allows you to group numbers in different ways. The Commutative Property allows you to shift the factors' places in the number sentence. Also, watch for students who try to use the Associative Property when there is more than one operation present. For example, students may think that $(6 + 4) \times 3$ is the same as $6 + (4 \times 3)$. Model for students on the board that number sentences like this will have two different answers. It may be helpful to allow students to represent their products on grid paper.



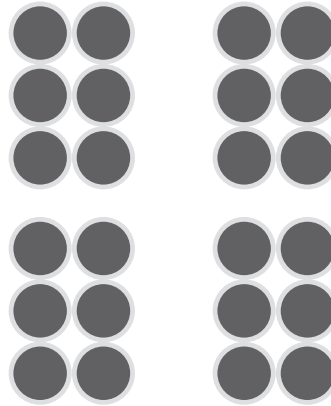
Use Two-Color Counters to build each model. Write two number sentences that show the Associative Property of Multiplication.

(Check students' work.)

1.



$$3 \times (2 \times 4) = 24$$



$$(3 \times 2) \times 4 = 24$$

Using Two-Color Counters, model the Associative Property of Multiplication for each set of factors. Sketch the models. Write number sentences for both models.

(Check students' models.)

2. 3, 5, 6

$$3 \times (5 \times 6) = 90$$

$$(3 \times 5) \times 6 = 90$$

Write two number sentences for each set of factors that show the Associative Property of Multiplication.

3. 2, 3, 5

$$2 \times (3 \times 5) = 30$$

$$(2 \times 3) \times 5 = 30$$

4. 2, 4, 5

$$2 \times (4 \times 5) = 40$$

$$(2 \times 4) \times 5 = 40$$

5. 3, 6, 8

$$3 \times (6 \times 8) = 144$$

$$(3 \times 6) \times 8 = 144$$

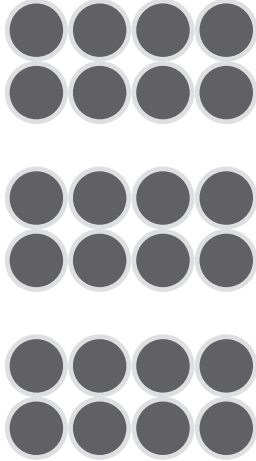
Answer Key

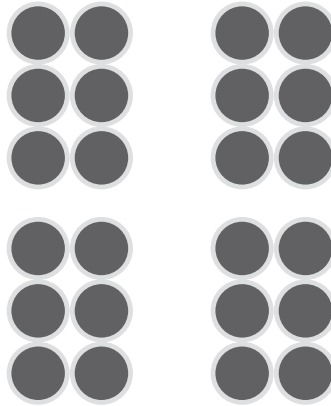
Challenge! In Problem 4, one way that you can associate the numbers makes the problem simpler because you get a multiple of 10 multiplied by a single-digit number. In what other problem on the previous page can you use the Associative Property to get a multiple of 10 times a single-digit number? Write the number sentence showing the association.

Challenge: (Sample) Problem 2 when you use the association $3 \times (5 \times 6) = 90$, because you have 3×30 to find the answer of 90.

Use Two-Color Counters to build each model. Write two number sentences that show the Associative Property of Multiplication.

1.





Using Two-Color Counters, model the Associative Property of Multiplication for each set of factors. Sketch the models. Write number sentences for both models.

2. 3, 5, 6

Write two number sentences for each set of factors that show the Associative Property of Multiplication.

3. 2, 3, 5

4. 2, 4, 5

5. 3, 6, 8

Name _____

Challenge! In Problem 4, one way that you can associate the numbers makes the problem simpler because you get a multiple of 10 multiplied by a single-digit number. In what other problem on the previous page can you use the Associative Property to get a multiple of 10 times a single-digit number? Write the number sentence showing the association.

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