LESSON 9

Objective

Model and identify the Distributive Property.

Common Core State Standards

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

Operations and Algebraic Thinking

Distributive Property

The Distributive Property may be particularly challenging to students at this age because it involves more than one operation. The Distributive Property shows that, for the whole numbers a, b, and c: $(a \times b) + (a \times c) = a \times (b + c)$. While learning to apply the Distributive Property, students must address the order of operations and explore the consequences of ignoring it.

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

Talk About It

Discuss the Try It! activity.

- **Say:** *First you made two rectangles.* **Ask:** *What part of the problem on the board does each model represent?*
- **Say:** *Both rectangles had one side that was two Color Tiles long. Then you pushed the two rectangles together to make one.* **Ask:** *What number sentence shows the multiplication problem modeled by the tiles?*
- **Say:** *The Distributive Property worked for (2 × 3) + (2 × 5) because the multiplication problems have a* common factor, *or one factor that is the same in both.* Have students identify the common factor (2).

Solve It

With students, reread the problem. Have students draw a picture of the tables and computers in the problem. **Say:** *Now draw a picture that shows the tables pushed together to make one long table.* Have students write a short paragraph telling how many computers there are in all.

More Ideas

For other ways to teach about the Distributive Property—

- Discuss the order of operations with students. Write *3 × 5 + 3 × 4* on the board. Have students use Centimeter Cubes to model each problem twice: once following the proper order of operations and once ignoring it. Have students use pencils or cut out parentheses to group the models. Then have students apply the Distributive Property and solve the problem.
- Make two columns on the board. On the left, write *(5 × 4) + (5 × 2)*, *(3 × 6) + (3 × 5)*, and *(2 × 8) + (2 × 3)*. On the right, write *2 × (8 + 3)*, *5 × (4 + 2)*, and *3 × (6 + 5)*. Have groups of students use Color Tiles to model each problem. Then have students identify the equivalent models and problems.

Formative Assessment

Have students try the following problem.

Circle the choice that shows (3 × 2) + (3 × 4) rewritten using the Distributive Property.

A. 3 × (2 + 4) **B.** 2 × (3 × 4) **C.** 4 × (3 + 2) **D.** 2 × (3 + 4)

Try It! 30 minutes | Pairs

Here is a problem about modeling and identifying the Distributive Property.

The computer lab at Lincoln Elementary School rearranged the computers. One table has 2 rows of 3 computers each, and the other table has 2 rows of 5 computers each. How many computers are there in all?

Introduce the problem. Then have students do the activity to solve the problem. Distribute Color Tiles to students. Write *(2 × 3) + (2 × 5) =* ______ on the board. Remind students that the numbers within the parentheses should be multiplied before their products are added together.

Materials

- Color Tiles (30 of one color and 30 of another color per pair)

1. Tell students to use one color of tiles to model a 2 × 3 rectangle and another color to model a 2 × 5 rectangle. **Ask:** *How many counters are in each rectangle? How many in all?*

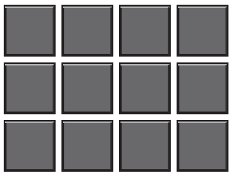
2. Point out that both rectangles have one side that is 2 tiles long, and explain that this means they can push the rectangles together to make one larger one. Have students push their 2 rectangles together to make one larger 2 × 8 rectangle.

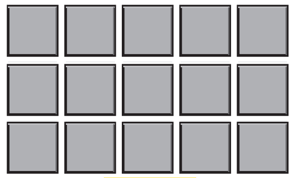
3. Say: *Your model shows one side that is 2 tiles long and another that is 3 + 5, or 8, tiles long.* Write *2 × (3 + 5)* and *2 × 8* on the board. **Ask:** *How many tiles are there altogether?* Explain that their models show an example of the Distributive Property. **Say:** *Making a 2 × 3 array and adding it to a 2 × 5 array is the same as making a 2 × 8—or 2 × (3 + 5)—array.*

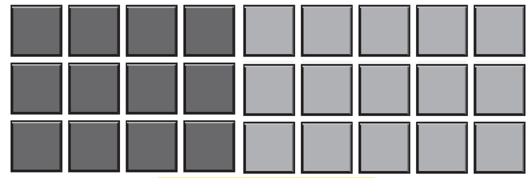
Look Out!

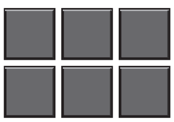
Watch for students who try to push their models together into a shape that is not a rectangle. For example, students might make a shape that has four rows instead of two. Have students start over, then ask them to count to find the side that is the same length in both rectangles. Tell students to make these two sides meet when they push the rectangles together.

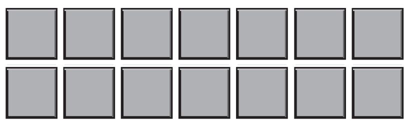
Use Color Tiles to model each array. Write the multiplication expression for each array. Then write the Distributive Property sentence modeled by the arrays. (Check students' work.)

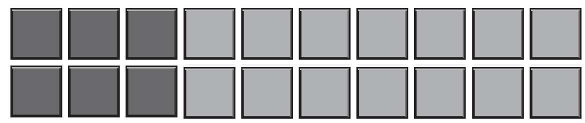
1. 
3 × 4


3 × 5


3 × (4 + 5) = 27

2. 
2 × 3


2 × 7


2 × (3 + 7) = 20

Using Color Tiles, model arrays to show the Distributive Property. Sketch the models. Write the sentence modeled. (Check students' models.)

3. $(3 \times 3) + (3 \times 4)$

3 × (3 + 4) = 21

4. $(5 \times 2) + (5 \times 7)$

5 × (2 + 7) = 45

Write a number sentence for the total using the Distributive Property. Then find the total.

5. $(2 \times 4) + (2 \times 6)$

2 × (4 + 6) = 20

6. $(3 \times 8) + (3 \times 1)$

3 × (8 + 1) = 27

7. $(4 \times 3) + (4 \times 7)$

4 × (3 + 7) = 40

8. $(6 \times 2) + (6 \times 3)$

6 × (2 + 3) = 30

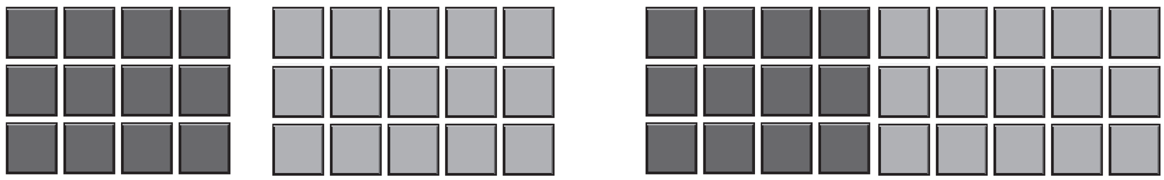
Challenge! Problems 1 and 6 both simplify to 27. Explain how this can be correct even though the problems have different numbers being multiplied. Draw pictures to help.

Challenge: (Sample) Problem 1 simplified to 3 × (4 + 5) and Problem 6 simplified to 3 × (8 + 1). Because they both have sums that are multiplied by 3, the sums have to be the same. The sum of 4 + 5 is 9 and the sum of 8 + 1 is 9.

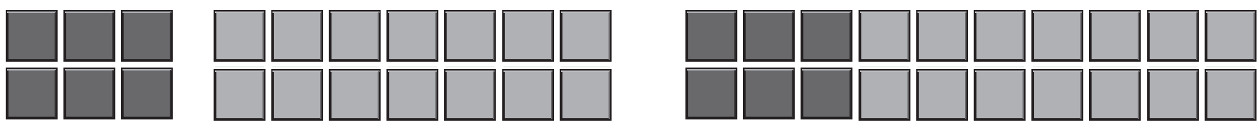
Name ______________________________

Use Color Tiles to model each array. Write the multiplication expression for each array. Then write the Distributive Property sentence modeled by the arrays.

1.



2.



Using Color Tiles, model arrays to show the Distributive Property. Sketch the models. Write the sentence modeled.

3. $(3 \times 3) + (3 \times 4)$

4. $(5 \times 2) + (5 \times 7)$

Write a number sentence for the total using the Distributive Property. Then find the total.

5. $(2 \times 4) + (2 \times 6)$

6. $(3 \times 8) + (3 \times 1)$

7. $(4 \times 3) + (4 \times 7)$

8. $(6 \times 2) + (6 \times 3)$

Name ___________________________________

Challenge! Problems 1 and 6 both simplify to 27. Explain how this can be correct even though the problems have different numbers being multiplied. Draw pictures to help.