

## Lesson 6: Distributive Property of Multiplication

### Getting Started

#### ? Big Ideas

- What are some strategies we can use to multiply and divide?
- How do we read and write in mathematical language?



#### Facts and Definitions

- **Distributive property of multiplication:** math law that states that when given a multiplication problem, it's possible to break a factor down into easier numbers, find the products of the other factor with those easier numbers, and then add those products together to find the product of the original problem

#### 🎯 Skills

- Apply properties of operations as strategies to multiply and divide
- Fluently multiply and divide within 100

#### ✂️ Materials

- |                                     |                              |
|-------------------------------------|------------------------------|
| ✓ abacus (kit)                      | ✓ calculator                 |
| ✓ counters (kit)                    | ✓ drinking straw (kit)       |
| ✓ fine point dry-erase marker (kit) | ✓ Interactive Notebook (kit) |
| ✓ one die (kit)                     | ✓ small sticky notes (kit)   |
| ✓ whiteboard (kit)                  |                              |

### Introduction

Give your child one die, and ask her to roll it three times. Each time she rolls a number, she will write it on the whiteboard. When she has three numbers written on the whiteboard, she will use them to write a number sentence that shows the associative property of multiplication by writing the numbers in the same order and drawing parentheses in different places. She will then find the product for each side of the number sentence. For example, if she rolls 2, 3, and 5, she might write  $(2 \times 3) \times 5 = 2 \times (3 \times 5)$  and then find the product of each side. (30) Ask, "Which side was easier for you to find the product for? Why?" Model this process for her as needed, and allow her to use the abacus or a calculator to find products that she doesn't know. The focus here is on modeling the associative property of multiplication.

Ask her to repeat this process three more times using the die and the whiteboard, as well as the abacus or a calculator as needed.

### Activities

#### Activity 1: Arrays and the Distributive Property

Give your child a large handful of counters, and ask her to create a  $6 \times 4$  array using them (6 rows, 4 columns). Tell her to name her array on the whiteboard. She should write " $6 \times 4$ ." Next, give her a drinking straw, and tell her to break her array into two pieces by placing the straw either vertically or horizontally across her array. The pieces don't have to be the same size. Say, "Now, you have two arrays. What are their names?" There are several possibilities, but she may now have a 2 by 4 array and a 4 by 4 array or a 1 by 4 array and a 5 by 4 array (there are other possibilities).

Ask her to name each of the arrays and write them as multiplication sentences next to each other on the whiteboard. Finish her work on the whiteboard by drawing parentheses around each of the multiplication sentences and adding an addition sign between them. For example, it may now read " $(2 \times 4) + (4 \times 4)$ ." Say, "You still have the same number of counters, but you've created different arrays using them. You've just proven that 6 times 4 is the same as adding 2 times 4 and 4 times 4."

Ask your child to repeat this process by following these steps:

1. Create an array of your choosing.
2. Write the name of this array on a sticky note.
3. Break the large array down into two smaller arrays using the straw.
4. Write the names of these arrays on separate sticky notes.
5. Draw an addition sign on a sticky note, and place it between the last two sticky notes.

Now, help your child lay out the sticky notes to show that the first and larger array is equal to adding the smaller arrays together. Add an equal sign on a sticky note, and place it after the sentence for the larger array and before the two sentences for the smaller ones. For example, the sticky notes might show  $5 \times 3 = 2 \times 3 + 3 \times 3$ . Explain to your child that she's just proven an important property about multiplication and that she'll be working with it more during this lesson.

### Activity 2: Exploring the Distributive Property of Multiplication

Explain that, even though it's best to memorize facts for multiplication, sometimes we come across a fact that is more difficult than others to memorize. In this case, we can often use facts that we do know to find the product of the more difficult fact. Say, "When you were breaking a large array down into two smaller arrays, you were turning a more difficult multiplication problem into two easier multiplication problems that you then added together."

Write  $8 \times 9$  on the whiteboard, and ask your child to picture it in her head as an array. Say, "That's a pretty big array." Now, say, "I'm going to show you how we can make this multiplication problem a little bit easier. I know that I can add 4 and 5 together to make 9. I'm going to use that to make this problem easier for me, and it will be the same as working with two smaller arrays." Below  $8 \times 9$ , write the following, making sure to line the numbers up in the columns as shown:

$$\begin{array}{r} 8 \times 4 = 32 \\ 8 \times 5 = 40 \\ 8 \times 9 = ?? \\ 8 \times 9 = 72 \end{array}$$

Ask the following questions, and discuss the answers with your child, leading her to them as needed by pointing to the numbers on the whiteboard:

- What did I do with these products to get the product of  $8 \times 9$ ? (added them together)
- Does 8 times 9 equal 72? (yes)
- How might you prove that? (allow your child to choose a way to prove it, for example, using the abacus or drawing a picture)

Explain that we call this approach the **distributive property of multiplication**.

Now, provide time for your child to watch the video at the following web link. Tell her to look for how the distributive property of multiplication can make math easier.

<b>Distributive Property of Multiplication</b>
<a href="http://www.movingbeyondthepage.com/link/7061">www.movingbeyondthepage.com/link/7061</a>
<a href="https://youtu.be/APWCe2KtpjQ">https://youtu.be/APWCe2KtpjQ</a>

### Activity 3: Using the Distributive Property of Multiplication

Write  $12 \times 5$  on the whiteboard, and review the steps of the distributive property of multiplication with your child by saying and writing the following:

1. "First, I'm going to break 12 down into two easier factors: 5 and 7. Picture breaking a 12 by 5 array down into two smaller arrays."
2. "Second, I'm going to multiply each of these easier factors by the other factor in  $12 \times 5$ ." (Write  $5 \times 5 =$  and  $7 \times 5 =$ )
3. "Now, I need to find the products of each of these multiplication problems." (Write 25 and 35 with their corresponding problems)
4. "Next, I will find the sum of 25 and 35." (Write a vertical addition sentence for  $25 + 35 = 60$ )
5. "Finally, I'm going to check my answer using a calculator. Is  $12 \times 5$  equal to 60?" (YES!)

Next, repeat this process, breaking 12 down into two other factors: 10 and 2. Say, "When you break a large factor down, you have options about how you do that." With  $12 \times 5$  still on the whiteboard, say and write the following:

1. "First, I'm going to break 12 down into two easier factors: 10 and 2. Again, picture a large array becoming two smaller ones."
2. "Second, I'm going to multiply each of these smaller factors by the other factor in  $12 \times 5$ ." (Write  $10 \times 5 =$  and  $2 \times 5 =$ )
3. "Now, I need to find the products of each of these multiplication problems." (Write 50 and 10 with their corresponding problems)
4. "Next, I will find the sum of 50 and 10." (Write a vertical addition sentence for  $50 + 10 = 60$ )
5. "Once again, I have a product of 60. So, I've broken  $12 \times 5$  down using the Distributive Property in two different ways and have found the same product both times."

Now, say, "Remember that we use parentheses to tell us what to do first in math problems. I'm going to show you how we use parentheses when applying the distributive property." Write the following on the whiteboard:

Tell your child to talk about the steps in the distributive property as she points to the numbers on the board. Ask the following questions as needed:

- Which number sentence represents a large array? ( $6 \times 9$ )
- Which number sentence represents two smaller arrays? [ $(6 \times 4) + (6 \times 5)$ ]
- What did I do at each step?

Say, "While you may already know  $6 \times 9$  easily, you're definitely going to come across multiplication problems that are harder for you, and using the distributive property can help you find the answers."

Leaving the previous numbers on the whiteboard so that your child can refer to them and the steps they represent, write the following multiplication problems on a sheet of paper, and ask your child to follow the steps to find their products. Encourage her to use multiplication facts that she knows as she works. For example, if she knows her 10 facts well, then she can break the larger number down into 10 and another number (for example, 10 and 4 for the first problem) and then work from there. Also, remind your child that she can use the commutative property of multiplication to first switch the order of the factors so that she can break down the second factor in each sentence.

- $14 \times 3$  (42)
- $15 \times 6$  (90)

Your child will complete the "Distributive Property of Multiplication" sheet. There are two options for this sheet. The first option is more concrete, while the second is slightly more abstract. Both provide support for your child, so you may want to ask your child to complete both, starting with Option 1 and then moving to Option 2 if you feel that your child needs additional work with this property. She can use the "Understanding the Distributive Property of Multiplication" sheet for reference as needed and then place the page in her Interactive Notebook.

### Option 1

On the Option 1 sheet, the first row provides a model for completing the other rows. The missing answers for the other rows are as follows:

- 2nd row:  $15+30$ , 45
- 3rd row:  $(4\times 3)+(4\times 5)$ ,  $12+20$ , 32
- 4th row:  $(7\times 4)+(7\times 5)$ ,  $28+35$ , 63
- 5th row:  $(4\times 5)+(4\times 10)$ ,  $20+40$ , 60
- 6th row: approaches will vary, but the product is 39
- 7th row: approaches will vary, but the product is 108

### Option 2

On the Option 2 sheet, your child should work with the factors 10 and 2 in the first box:  $(4\times 10)+(4\times 2)$ ,  $40+8$ , 48. The approaches will vary in the other three boxes, but the products are as follows:

- $4\times 12=\underline{48}$
- $14\times 5=\underline{70}$
- $3\times 15=\underline{45}$
- $6\times 12=\underline{72}$

### **Activity 4: Basic Skills Review**

Your child will complete the "Basic Skills Review #9" sheet. Give her scratch paper to use, and allow her to refer to her Interactive Notebook as needed.

### Answer Key:

1. Katarina started cleaning her room at 3:05 and stopped at 4:15. How long did she clean her room? (1 hour and 10 minutes)
2. Cliff starts looking for tadpoles at 8:20. If he continues looking for 45 minutes, what time will he be finished? (9:05)
3. Mrs. Moneybags had \$4.25 in her purse. Her friend borrowed 2 quarters. How much does she have in her purse now? (\$3.75)
4. Mrs. Moneybags has 11 coins in her purse that total \$1.36. Which coins does she have in her purse? (3 quarters, 5 dimes, 2 nickels, 1 penny OR 4 quarters, 1 dime, 5 nickels, and 1 penny)
5. Round 5871 to the nearest 10 and 100. (5870, 5900)
6.  $2277+3109=\underline{5386}$
7.  $8793-2888=\underline{5905}$
8. Robert needs to fill a two-gallon tank with water. How many cups of water will he need? Circle one: 16 cups or 32 cups (32 cups)

**Wrapping Up**

Write  $5 \times 12 = (5 \times 10) + (5 \times 2)$  on the whiteboard, and ask your child to explain whether or not it's true. She should note that 10 and 2 add up to 12 and that this number sentence represents the distributive property of multiplication.

Now, allow your child to practice more with creating a large array using counters and then breaking it down into two smaller ones using a drinking straw. Give her small sticky notes so that she can write the corresponding number sentences as she works, and tell her to be sure to include addition and equal signs on separate sticky notes to show how all of the number sentences are related. Remind her that adding the two smaller numbers sentences (the ones for the smaller arrays) together should equal the larger number sentence (the one for the large array).

# Understanding the Distributive Property of Multiplication

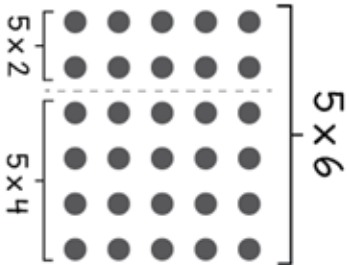
## The Distributive Property

The distributive property of multiplication says that in a multiplication problem,

$$2 \times 8$$

- 1. you can use addition to break a factor down to smaller numbers,  
8 can be broken down into  $4 + 4$
- 2. find the products of the other factor with those smaller numbers,  
 $(2 \times 4) + (2 \times 4)$
- 3. and then add those products together to find the product of the original problem.  
 $8 + 8 = 16$   $(2 \times 8 = 16)$

## Arrays



$5 \times 6 = 30$   
 $5 \times 2 = 10$  and  $5 \times 4 = 20$  and  $10 + 20 = 30$

## Steps to Success!

Follow these steps to distributive property success!

$$5 \times 15$$

- Step 1:** Break one of the factors down:  $5 \times (10 + 5)$
- Step 2:** Multiply these new factors by the original one:  
 $(5 \times 10) + (5 \times 5)$
- Step 3:** Find the products:  $50 + 25$
- Step 4:** Add the products:  $75$
- Step 5:** Use a calculator to check your answer.  
 $5 \times 15 = 75$



# Distributive Property of Multiplication

Problem	Step 1	Step 2	Step 3	Product
$4 \times 6$	$4 \times (3 + 3)$	$(4 \times 3) + (4 \times 3)$	$12 + 12$	24
$5 \times 9$	$5 \times (3 + 6)$	$(5 \times 3) + (5 \times 6)$	_____ + _____	_____
$8 \times 4$	$4 \times (3 + 5)$	$(4 \times \underline{\quad}) + (4 \times \underline{\quad})$	_____ + _____	_____
$7 \times 9$	$7 \times (4 + 5)$	$(\underline{\quad} \times \underline{\quad}) + (\underline{\quad} \times \underline{\quad})$	_____ + _____	_____
$4 \times 15$	$4 \times (5 + 10)$	$(\underline{\quad} \times \underline{\quad}) + (\underline{\quad} \times \underline{\quad})$	_____ + _____	_____
$3 \times 13$	$\underline{\quad} \times (\underline{\quad} \times \underline{\quad})$	$(\underline{\quad} \times \underline{\quad}) + (\underline{\quad} \times \underline{\quad})$	_____ + _____	_____
$9 \times 12$	$\underline{\quad} \times (\underline{\quad} \times \underline{\quad})$	$(\underline{\quad} \times \underline{\quad}) + (\underline{\quad} \times \underline{\quad})$	_____ + _____	_____

# Distributive Property of Multiplication

Follow these steps to distributive property success!

$$7 \times 9$$

**Step 1:** Break one of the factors down:  $7 \times (5 + 4)$

**Step 2:** Multiply these new factors by the original one:  $(7 \times 5) + (7 \times 4)$

**Step 3:** Find the products:  $35 + 28$

**Step 4:** Add the products: 63

**Step 5:** Use a calculator to check your answer.

Fill in the blanks. Check your answer using a calculator.

<b>4 x 12</b>	<b>14 x 5</b>
$4 \times (10 + 2)$ $(4 \times \underline{\quad}) + (4 \times \underline{\quad})$ $\underline{\quad} + \underline{\quad}$ $\underline{\quad}$	<p>Hint: We can always use the Commutative Property of Multiplication, too.</p> $5 \times (\underline{\quad} + \underline{\quad})$ $(5 \times \underline{\quad}) + (5 \times \underline{\quad})$ $\underline{\quad} + \underline{\quad}$ $\underline{\quad}$
<b>3 x 15</b>	<b>6 x 12</b>
<p>Hint: What do you know about multiples of 5 and 10?</p> $\underline{\quad} \times (\underline{\quad} + \underline{\quad})$ $(\underline{\quad} \times \underline{\quad}) + (\underline{\quad} \times \underline{\quad})$ $\underline{\quad} + \underline{\quad}$ $\underline{\quad}$	<p>Try this one on your own!</p>





# Basic Skills Review #9




1. Katarina started cleaning her room at 3:05 and stopped at 4:15. How long did she clean her room?

2. Cliff starts looking for tadpoles at 8:20. If he continues looking for 45 minutes, what time will he be finished?

3. Mrs. Moneybags had \$4.25 in her purse. Her friend borrowed 2 quarters. How much does she have in her purse now?

4. Mrs. Moneybags has 11 coins in her purse that total \$1.36. Which coins does she have in her purse?

5. Round 5871 to the nearest 10 and 100.

6.

$$2277 + 3109 = \underline{\hspace{2cm}}$$

7.

$$8793 - 2888 = \underline{\hspace{2cm}}$$

8. Robert needs to fill a two-gallon tank with water. How many cups of water will he need?

Circle one:

16 cups or 32 cups