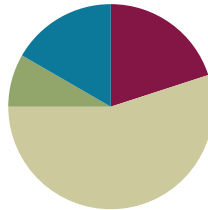


Lesson 10

Objective: Model the distributive property with arrays to decompose units as a strategy to multiply.

Suggested Lesson Structure

■ Fluency Practice	(12 minutes)
■ Application Problem	(5 minutes)
■ Concept Development	(33 minutes)
■ Student Debrief	(10 minutes)
Total Time	(60 minutes)



Fluency Practice (12 minutes)

- Multiply By 2 **3.OA.7** (8 minutes)
- Group Counting **3.OA.1** (4 minutes)

Multiply by 2 (8 minutes)

Materials: (S) Multiply by 2 (6–10) Pattern Sheet

Note: This activity builds fluency with multiplication facts using units of 2. It works toward students knowing from memory all products of two one-digit numbers. See *Directions for Administration of Multiply By Pattern Sheet* in Lesson 9.

T: (Write $2 \times 7 = \underline{\quad}$.) Let's skip-count up by twos. (Count with fingers to 7 as students count.)

S: 2, 4, 6, 8, 10, 12, 14.

T: Let's skip count by twos starting at 10.

S: (Show 5 fingers) 10, 12, 14. (Count with fingers to 7 as students count.)

T: Let's see how we can skip-count down to find the answer, too. (Show 10 fingers) Start at 20. (Count down with your fingers as student say numbers.)

S: 20, 18, 16, 14.

Repeat the process for 2×9 and 2×8 .

T: (Distribute Multiply By 2 pattern sheet.) Let's get some practice multiplying by 2. Be sure to work left to right across the page.

Group Counting (4 minutes)

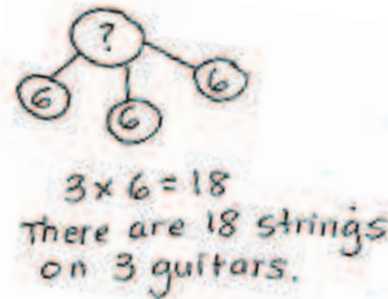
Note: Group counting reviews interpreting multiplication as repeated addition. Counting by threes and fours in this activity supports work with units of 3 in this topic, and anticipates work using units of 4 in Topic E.

- T: Let's count by fours. (Direct students to count forward and backward to 24, emphasizing the 16 to 20 transition.)
- T: Let's count by threes. (Direct students to count forward and backward to 30, emphasizing transition from 18 to 21.)

Application Problem (5 minutes)

A guitar has 6 strings. How many strings are there on 3 guitars? Write a multiplication sentence to solve.

Note: This problem leads into today's concept development. Students will compare their multiplication equation with the new equations presented in the lesson.

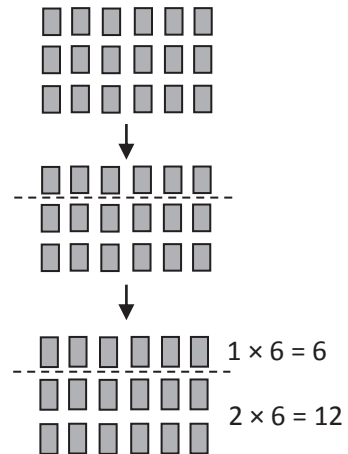


Concept Development (33 minutes)

Materials: (S) Personal white boards, 1 sheet of blank paper per student

- T: Draw an array to represent the total number of guitar strings. Let the number of strings on 1 guitar be 1 row.
- S: (Draw a 3 by 6 array, shown to the right.)
- T: Make a dotted line below the first row to show just 1 guitar.
- T: Write and solve a multiplication sentence to describe each part of your array.
- S: (Write $1 \times 6 = 6$ and $2 \times 6 = 12$, as shown to the right.)
- T: (Write $6 + 12 = 3$ sixes.) Why is this true?
- S: 1 six is 6, 2 sixes are 12. When I add 6 and 12, I get 18, which is 3 sixes.
- T: (Write $(1 \times 6) + (2 \times 6) = 3$ sixes on the board as shown to the right.) How do you know the 2 number sentences on the board are equal?
- S: 1×6 is the same as 6, and 2×6 is the same as 12. You just rewrote 6 and 12 as multiplication facts.
- T: (Write $(1 \times 6) + (2 \times 6) = 6 + \underline{\quad}$.) With your partner discuss what number completes the equation.
- S: 1×6 equals 6. That's how the teacher got 6. \rightarrow To get the other number we do 2×6 . That's 12. \rightarrow I know its 12

Sequence of Student Work on Personal White Board



Sample Teacher Board

$6 + 12 = 3 \text{ sixes}$
$(1 \times 6) + (2 \times 6) = 3 \text{ sixes}$
$(1 \times 6) + (2 \times 6) = 6 + \underline{12}$

because you need the same amount on each side of the equal sign. On the left the value is $6 + 12$ if you solve the multiplication. That’s what it should be on the right too.

T: (Write 12 to complete the equation.)

T: Notice the symbols around my multiplication expressions. They are called **parentheses**. Let’s say that word together.

S: Parentheses.

T: (Write $(1 \times 6) + (2 \times 6) = \underline{\quad}$ and $(1 + 2) \times 6 = \underline{\quad}$ below it as shown to the right.) My parentheses show how I make groups. How did I rearrange the groups?

S: You added the number of rows. Then you multiplied by 6.

T: Look back at the array you drew. Do the 1 and 2 represent the number of groups or the size of groups?

S: The number of groups.

T: What does the 6 represent?

S: The size of the groups.

T: Use that language—the number of groups and the size of groups—to tell your partner about my second equation.

S: The teacher added the number of groups first. That’s 1 + 2. Then she multiplied the number of groups times the size of the groups, which is 6.

T: $1 + 2$ equals?

S: 3.

T: (Write $3 \times 6 = \underline{\quad}$ under the second equation.) Look back at the work you did on today’s application problem. How does this equation compare with what you did?

S: It’s the same! → It’s the number of groups times the size of groups, just like we did.

T: Rewrite each equation on your board and solve them. What is the answer to all 3 equations?

S: 18.

T: (Complete the equations on the board.) Think back to the problem we’re solving. 18 what?

S: 18 strings.

T: (Write $(1 \times 6) + (2 \times 6) = 3 \times 6$ on the board.) True or false?

S: True.

T: In your own words, tell your partner how we got 3×6 and why it’s equal to $(1 \times 6) + (2 \times 6)$. Use the 3 equations you just solved to help you explain.

S: (Students retell the steps using the 3 equations and solutions to guide them.)

Sample Teacher Board

$(1 \times 6) + (2 \times 6) = \underline{\quad 18 \quad}$

$(1 + 2) \times 6 = \underline{\quad 18 \quad}$

↓

$3 \times 6 = \underline{\quad 18 \quad}$

$(1 \times 6) + (2 \times 6) = 3 \times 6$

MP.4



**NOTES ON
MULTIPLE MEANS FOR
ENGAGEMENT:**

Support students to work at their individual levels of comfort by inviting them to choose to work independently or with a partner to solve the equations.

Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students solve these problems using the RDW approach used for Application Problems.

Student Debrief (10 minutes)

Lesson Objective: Model the distributive property with arrays to decompose units as a strategy to multiply.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson. You may choose to use any combination of the ideas below to lead the discussion.

- In Problems 1 and 2, why might breaking an array into 2 parts to multiply, add, then solve be easier than just multiplying the total number of groups times their size?
- Check Problem 3(a) by drawing and writing on the board as students give you verbal directions for how to create the page in Ruby’s photo album. Then invite several students to share their work on 3(b).
- Understand that 5×3 is the result of the number of groups added together and then multiplied by the size of groups in $(2 \times 3) + (3 \times 3)$.
- Understand that 6 and 9 are the products of each multiplication expression.
- Relate the factors in 5×3 to the number of groups and size of groups in the array.
- Recognize that both sides of the equation $5 \times 3 = 6 + 9$ have a value of 15.

NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 10 3•1

Name Gina Date 9/10

1. $7 \times 3 = (5 \times 3) + (2 \times 3) = 21$

$(5 \times 3) = 15$
 $(2 \times 3) = 6$

$(5 \times 3) + (2 \times 3) = 15 + 6$
 $15 + 6 = 21$

2. $8 \times 3 = (4 \times 3) + (4 \times 3) = 24$

$(4 \times 3) = 12$
 $(4 \times 3) = 12$

$(4 \times 3) + (4 \times 3) = 12 + 12$
 $8 \times 3 = 24$

COMMON CORE Lesson #: Lesson Name EXACTLY GS-M3-TC-103
Date: 3/14/13 engage^{ny} X.X.7

NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 10 3•1

3. Ruby is making a photo album. She puts 3 pictures in each row.

a) Use the multiplication sentences on the left. Draw arrays to show the photos on the upper and lower parts of Ruby’s album page.

$2 \times 3 = 6$
 $3 \times 3 = 9$

b) Ruby calculates the total number of pictures as shown below. Use the array you drew to help explain her calculation.

$5 \times 3 = 6 + 9 = 15$

The whole array shows 5 rows times 3 columns, so 5×3 . Then maybe Ruby didn’t know the answer to 5×3 so she broke it into 2 smaller facts, 2×3 , which is 6, and 3×3 , which is 9. So she did $6 + 9$. Because $5 \times 3 = 6 + 9$. Then if you do 5×3 it’s 15. And $6 + 9$ is 15. So $5 \times 3 = 6 + 9 = 15$.

COMMON CORE Lesson #: Lesson Name EXACTLY GS-M3-TC-103
Date: 3/14/13 engage^{ny} X.X.8

- Review the vocabulary **parentheses**.

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students.



NOTES ON VOCABULARY:

In this lesson students are not responsible for the vocabulary *distributive property*. Students revisit the distributive property as a strategy for multiplication and division in Topics E and F. In those lessons they name the strategy with precise vocabulary as they use it.

Multiply.

$2 \times 1 = \underline{\quad}$ $2 \times 2 = \underline{\quad}$ $2 \times 3 = \underline{\quad}$ $2 \times 4 = \underline{\quad}$

$2 \times 5 = \underline{\quad}$ $2 \times 6 = \underline{\quad}$ $2 \times 7 = \underline{\quad}$ $2 \times 8 = \underline{\quad}$

$2 \times 9 = \underline{\quad}$ $2 \times 10 = \underline{\quad}$ $2 \times 5 = \underline{\quad}$ $2 \times 6 = \underline{\quad}$

$2 \times 5 = \underline{\quad}$ $2 \times 7 = \underline{\quad}$ $2 \times 5 = \underline{\quad}$ $2 \times 8 = \underline{\quad}$

$2 \times 5 = \underline{\quad}$ $2 \times 9 = \underline{\quad}$ $2 \times 5 = \underline{\quad}$ $2 \times 10 = \underline{\quad}$

$2 \times 6 = \underline{\quad}$ $2 \times 5 = \underline{\quad}$ $2 \times 6 = \underline{\quad}$ $2 \times 7 = \underline{\quad}$

$2 \times 6 = \underline{\quad}$ $2 \times 8 = \underline{\quad}$ $2 \times 6 = \underline{\quad}$ $2 \times 9 = \underline{\quad}$

$2 \times 6 = \underline{\quad}$ $2 \times 7 = \underline{\quad}$ $2 \times 6 = \underline{\quad}$ $2 \times 7 = \underline{\quad}$

$2 \times 8 = \underline{\quad}$ $2 \times 7 = \underline{\quad}$ $2 \times 9 = \underline{\quad}$ $2 \times 7 = \underline{\quad}$

$2 \times 8 = \underline{\quad}$ $2 \times 6 = \underline{\quad}$ $2 \times 8 = \underline{\quad}$ $2 \times 7 = \underline{\quad}$

$2 \times 8 = \underline{\quad}$ $2 \times 9 = \underline{\quad}$ $2 \times 9 = \underline{\quad}$ $2 \times 6 = \underline{\quad}$

$2 \times 9 = \underline{\quad}$ $2 \times 7 = \underline{\quad}$ $2 \times 9 = \underline{\quad}$ $2 \times 8 = \underline{\quad}$

$2 \times 9 = \underline{\quad}$ $2 \times 8 = \underline{\quad}$ $2 \times 6 = \underline{\quad}$ $2 \times 9 = \underline{\quad}$

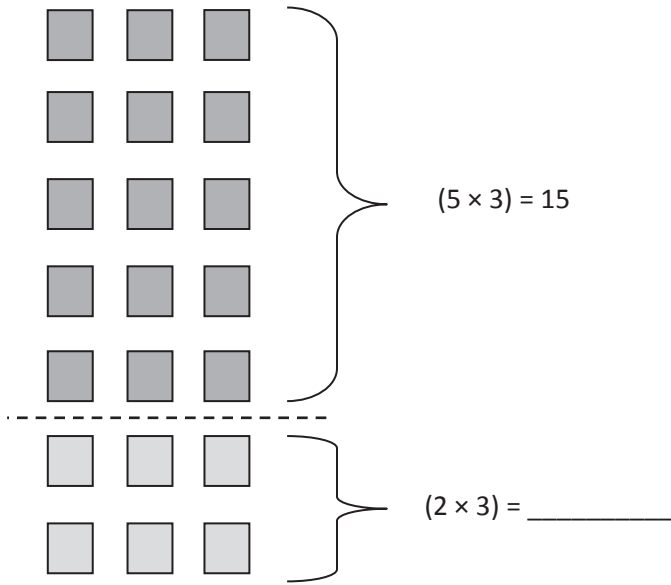
$2 \times 7 = \underline{\quad}$ $2 \times 9 = \underline{\quad}$ $2 \times 6 = \underline{\quad}$ $2 \times 8 = \underline{\quad}$

$2 \times 9 = \underline{\quad}$ $2 \times 7 = \underline{\quad}$ $2 \times 6 = \underline{\quad}$ $2 \times 8 = \underline{\quad}$

Name _____

Date _____

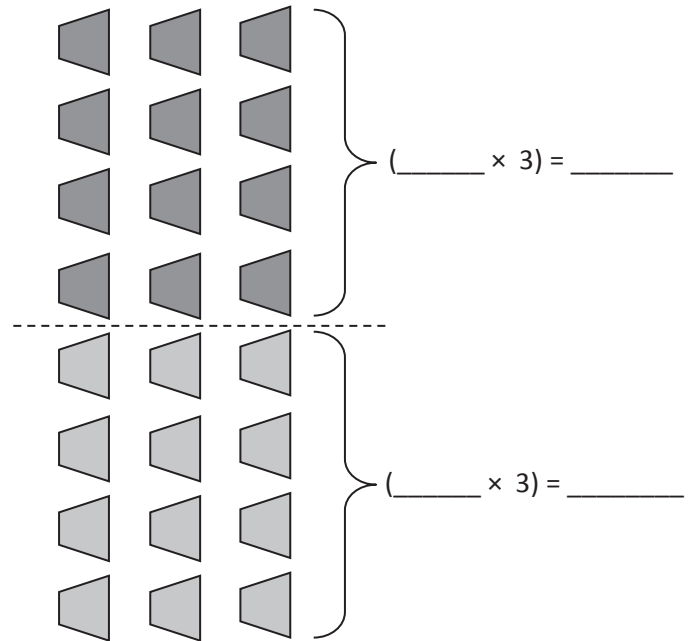
1. $7 \times 3 = (5 \times 3) + (2 \times 3) =$ _____



$(5 \times 3) + (2 \times 3) = 15 +$ _____

$15 +$ _____ $=$ _____

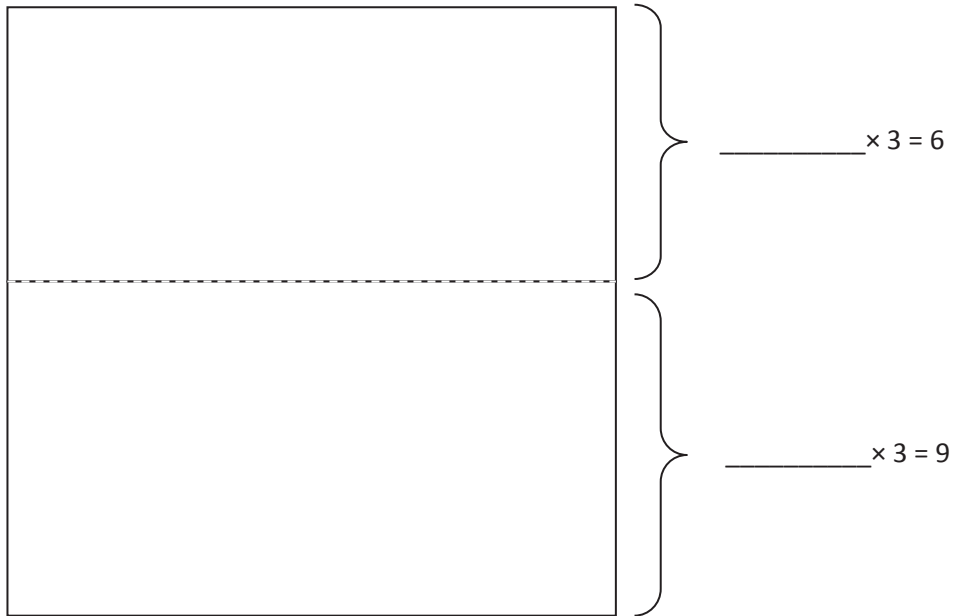
2. $8 \times 3 = (4 \times 3) + (4 \times 3) =$ _____



$(4 \times 3) + (4 \times 3) =$ _____ $+$ _____

_____ $\times 3 =$ _____

3. Ruby is making a photo album. She puts 3 pictures in each row.
- a. Use the multiplication sentences on the left. Draw arrays to show the photos on the upper and lower parts of Ruby’s album page.



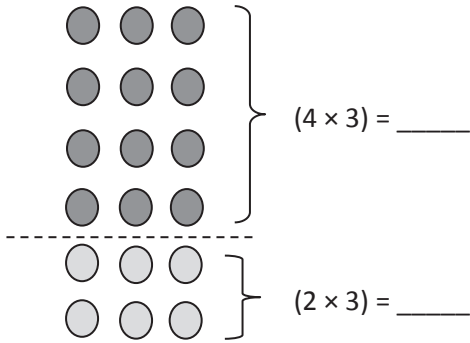
- b. Ruby calculates the total number of pictures as shown below. Use the array you drew to help explain her calculation.

$$5 \times 3 = 6 + 9 = 15$$

Name _____

Date _____

1. $6 \times 3 =$ _____

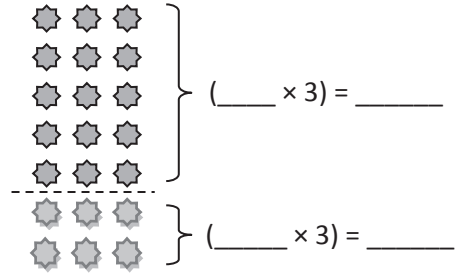


$(4 \times 3) + (2 \times 3) =$ _____ + _____

$6 \times 3 =$ _____ + _____

_____ $\times 3 =$ _____

2. $7 \times 3 =$ _____



$(5 \times 3) + (2 \times 3) =$ _____ + _____

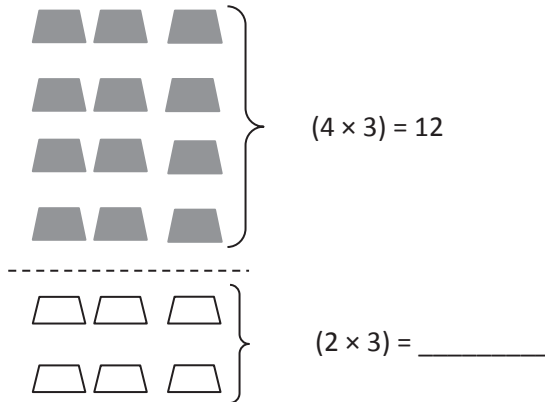
$7 \times 3 =$ _____ + _____

_____ $\times 3 =$ _____

Name _____

Date _____

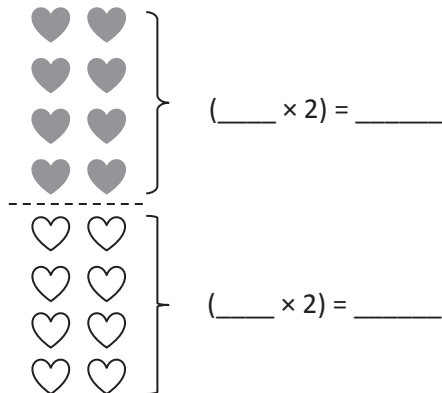
1. $6 \times 3 =$ _____



$12 +$ _____ $=$ _____

$6 \times 3 =$ _____

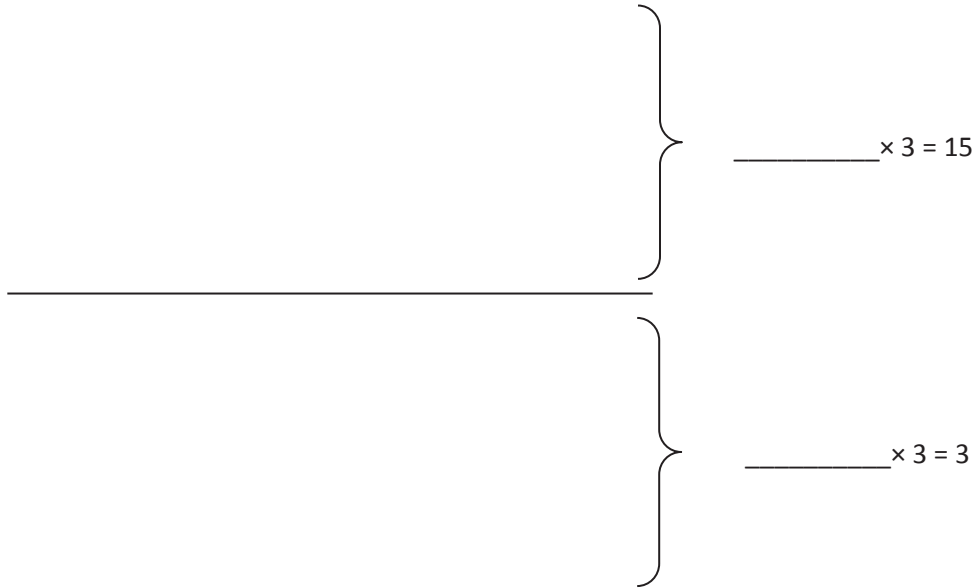
2. $8 \times 2 =$ _____



$(4 \times 2) + (4 \times 2) =$ _____ $+$ _____

_____ $\times 2 =$ _____

3. Adriana is organizing her books on shelves. She puts 3 books in each row.
- a. Use the multiplication sentences on the right to draw arrays to show the books on Adriana’s top and bottom shelves.



- b. Adriana calculates the total number of books as shown below. Use the array you drew to help explain her calculation.

$6 \times 3 = 15 + 3 = 18$
