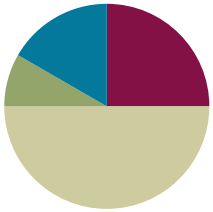
Lesson 2

Objective: Relate multiplication to the array model.

Suggested Lesson Structure

Fluency Practice	(15 minutes)
Application Problem	(5 minutes)
Concept Development	(30 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**



Fluency Practice (15 minutes)

- Sprint: Add or Subtract Using 2 **3.OA.1** (9 minutes)
- Group Counting **3.OA.1** (3 minutes)
- Add Equal Groups **3.OA.1** (3 minutes)

Sprint: Add or Subtract Using 2 (9 minutes)

Materials: (S) Add or Subtract Using 2 Sprint

Note: This Sprint supports group counting skills that are foundational to interpreting multiplication as repeated addition.

Directions for Administration of Sprints

A Sprint has two parts, A and B, with closely related problems on each. Each part is organized into four quadrants that move from simple to complex. This builds a challenge into each Sprint for every learner. Before the lesson, print Sprint A and Sprint B on two separate sheets of paper. Students complete the two parts of the Sprint in quick succession with the goal of improving for the second part, even if only by one more. With practice, the following routine takes about 9 minutes.

Sprint A

Place Sprint A face down on student desks, and instruct students not to look at the problems until a signal is given.

T: You will have 60 seconds to do as many problems as you can. I do not expect you to finish all of them, just as many as you can, trying for your personal best.

T: Take your mark! Get set! THINK!

Students turn papers over and work furiously to finish as many problems as they can in 60 seconds. Time precisely.

T: Stop! Circle the last problem you completed. I will read just the answers. If you got the answer right, call out "Yes!" If you made a mistake, circle it. Ready?

Repeat to the end of Sprint A or until no student has a correct answer.

T: Now, at the top of the page, write the number of problems you got correct. This is your personal goal for Sprint B.

T: How many of you got one right? (All hands should go up.)

T: Keep your hand up until I say a number that is one more than the number you got right. So, if you got 14 right, when I say 15, your hand goes down. Ready?

T: (Continue quickly.) How many got two right? Three? Four? Five? (Continue until all hands are down.)

If the class needs more practice with Sprint A, continue with the optional routine presented below.

T: Take one minute to do more problems on this half of the Sprint.

As students work, the student who scored highest on Sprint A might pass out Sprint B.

T: Stop! I will read just the answers. If you got it right, call out "Yes!" If you made a mistake, circle it. Ready?

Read the answers to the first half again as students stand.

Movement: To keep the energy and fun going, do a stretch or a movement game in between Sprints.

Sprint B

Place Sprint B face down on student desks, and instruct students not to look at the problems until a signal is given. Repeat the procedure for Sprint A up through the show of hands for how many correct answers.

T: Stand up if you got more correct on the second Sprint than on the first.

S: (Stand.)

T: Keep standing until I say the number that tells how many more you got right on Sprint B. If you got three more right on Sprint B than on Sprint A, when I say *three*, you sit down. Ready?

Call out numbers, starting with one. Students sit as the number by which they improved is called. Students may take Sprints home.

Group Counting (3 minutes)

Note: Basic skip-counting skills from Grade 2 shift focus in this Grade 3 activity. Group counting lays a foundation for interpreting multiplication as repeated addition. When students count groups in this activity, they add and subtract groups of three when counting up and down.

T: Let's count to 18 forward and backward. I want you to whisper, whisper, and then speak numbers.

T: Watch my fingers to know whether to count up or down. A closed hand means stop. (Show signals while explaining.)

T: (Rhythmically point up until a change is desired. Show a closed hand then point down.)
S: (Whisper) 1, (whisper) 2, (speak) 3, etc.
T: Let's count to 18 forward and backward again. This time, think every number instead of whispering.
S: (Think), (think), 3, (think), (think), 6, (think), (think), 9, etc.
T: What did we just count by? Turn and talk to your partner.
S: Threes.
T: Let's count by threes. (Direct students to count forward and backward to 18, periodically changing directions. Emphasize the 9 to 12 transition.)

Add Equal Groups (3 minutes)

Materials: (S) Personal white board

Note: This activity reviews Lesson 1. Students directly relate repeated addition to multiplication. They interpret products as the number of equal groups times the number of objects in each group.

T: (Project a picture array with 3 groups of 2 circled.) How many groups are circled?
S: 3.
T: How many are in each group?
S: 2.
T: Write this as an addition sentence.
S: (Write 2 + 2 + 2 = 6.)
T: Write a multiplication sentence for 3 twos equals 6.
S: (Write 3 × 2 = 6.)

Continue with this possible sequence: 3 groups of 5, 5 groups of 10, and 3 groups of 4.

Application Problem (5 minutes)

Jordan uses 3 lemons to make 1 pitcher of lemonade. He makes 4 pitchers. How many lemons does he use altogether? Use the RDW process to show your solution.

4 x 3 = 12

Jordan uses 12 lemons altogether.

Note: Present the image of 4 groups of 3 lemons with the word problem as a scaffold. This problem reviews multiplying equal groups from Lesson 1. It also leads into today's Concept Development in which students relate multiplication to the array model.

Concept Development (30 minutes)

Materials: (S) Personal white board with threes array (Template) inserted (pictured below), lemons image from Application Problem, 1 sheet of blank paper

Problem 1: Relate equal groups to arrays.

Note: Students' templates should be vertical rather than horizontal, as shown below.

T: Look back at Jordan's lemons. Compare the way his lemons are organized with the groups of 3 circles on your template.

S: The lemons are touching each other, but the circles have space between them. → Each line on the template shows three, like each group of lemons. → The template is organized with everything in straight lines.

T: Many students are noticing straight lines on the template. Let's call a straight line going across a **row**. Use your blank paper to cover all but the top row.

S: (Cover all but the top row.)

T: Uncover 1 row at a time in the picture. As you uncover each row, write the new total number of circles to the right of it.

S: (Skip-count by three using the threes array template.)

T: At the signal, say the total number of circles you counted. (Signal.)

S: 30 circles!

T: Take 10 seconds to find how many rows of 3 you counted. At the signal say how many. (Signal.)

S: 10 rows!

T: True or false: 10 rows of 3 circles equals 30 circles?

S: True!

T: (Write 10 × 3 = 30 on the board.) Use the picture on your template to talk with your partner about why this equation is true.

S: Yesterday, we learned that we can multiply equal groups. → We skip-counted 10 rows of 3 circles each and the total is 30. → It means 10 groups of 3. When you add 10 threes, you get 30. → Yeah, but writing 10 × 3 is a lot easier than writing out 3 + 3 + 3 + 3 +…

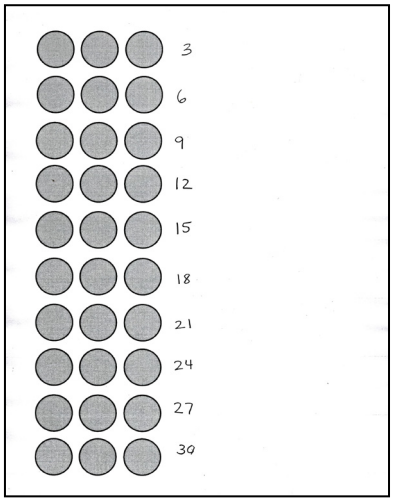
T: We call this type of organized picture an **array**.

NOTES ON MULTIPLE MEANS OF REPRESENTATION:

The words *array* and *row* were introduced in Grade 2, Module 6 but are treated as new vocabulary in this lesson.

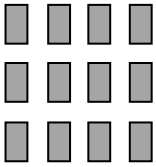
When reviewing the concept, have students trace a row on the array with a finger while saying the word *row*. Provide a real-world example by having students count the rows on various cupcake pans (miniature and regular size) before using the template.

Threes array template (with student work)



NOTES ON MULTIPLE MEANS OF REPRESENTATION:

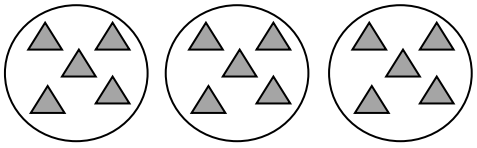
When presenting the concept of *array*, it may be beneficial to ask students to turn and talk, describing or defining an array for their partner.



T: (Project or draw the image on the right.) Take a look at this array. At the signal, tell how many rectangles are in the top row. (Signal.)
S: 4 rectangles.
T: The size of 1 row is 4 rectangles. Each row of 4 can also be called a group of 4. At the signal, tell how many groups of four are in the array. (Signal.)
S: 3 groups of four.
T: To write this as an equation, we first write the **number of groups**. How many groups?
S: 3 groups!
T: (Write 3 × ____ = ____.) Next, we write the **size of the group**. How many rectangles are in each group?
S: 4 rectangles!
T: (Fill in the equation to read 3 × 4 = ____.) Skip-count to find the total number of rectangles in the array.
S: 4, 8, 12.
T: (Fill in the equation to read 3 × 4 = 12.) We just found the answer to the multiplication equation that represents the array. In multiplication, the answer, or total, is called the **product**.

Show an array of 2 rows of 6 and repeat the process.

Problem 2: Redraw equal groups as arrays.



T: (Project or draw the image on the right.) The drawing shows 3 equal groups of 5. On your personal white board, re-draw the picture as an array with 3 rows of 5.
S: (Draw 3 rows of 5.)
T: Write a multiplication expression to describe your array. Remember, an expression is different from an equation because it doesn't have an equal sign.
S: (Write 3 × 5.)
T: Skip-count to find the product.
S: 5, 10, 15.
T: With your partner, compare my drawing with your array. Which is easier to count? Why?
S: (Discuss.)

Show 6 groups of 2 and repeat the process.

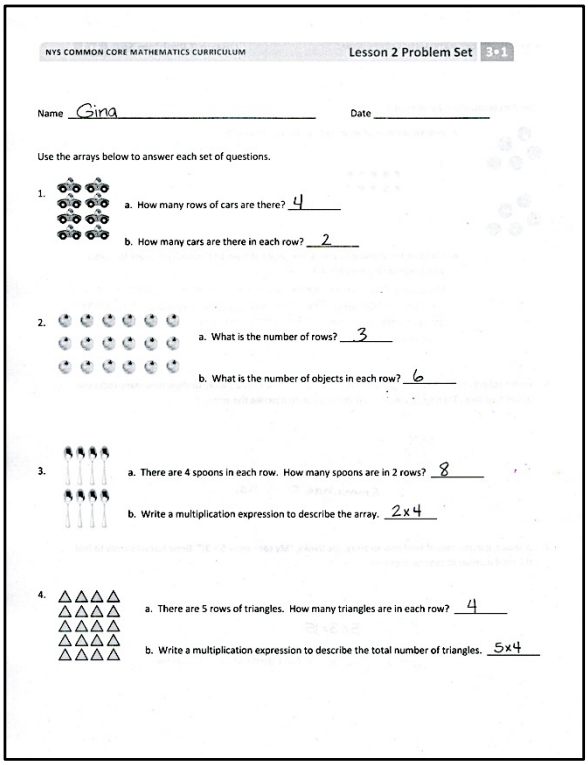
NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

Provide a challenge in this part of the lesson by giving an equation (e.g., 5 × 4 = _____) and no picture. Have students draw both the equal groups and the array to represent the equation. Then, they skip-count to find the total.

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 should solve these problems using the RDW approach used for Application Problems.

Directions on this Problem Set include the words *expression* and *equation*. Remind students that while an answer is not required with an expression, it should be included with an equation.

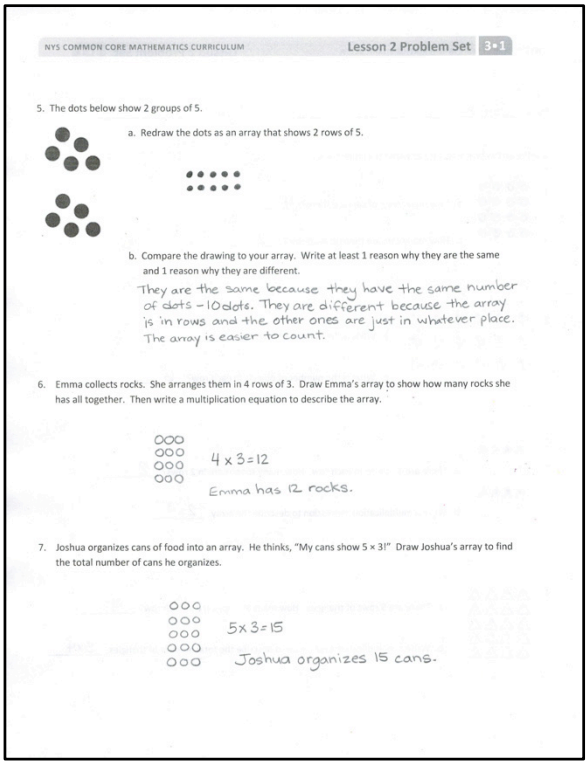


NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 2 Problem Set 3•1

Name Gina Date

Use the arrays below to answer each set of questions.

1. a. How many rows of cars are there? 4
   b. How many cars are there in each row? 2
2. a. What is the number of rows? 3
   b. What is the number of objects in each row? 6
3. a. There are 4 spoons in each row. How many spoons are in 2 rows? 8
   b. Write a multiplication expression to describe the array. 2x4
4. a. There are 5 rows of triangles. How many triangles are in each row? 4
   b. Write a multiplication expression to describe the total number of triangles. 5x4



NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 2 Problem Set 3•1

5. The dots below show 2 groups of 5.
   a. Redraw the dots as an array that shows 2 rows of 5.
   b. Compare the drawing to your array. Write at least 1 reason why they are the same and 1 reason why they are different.
   They are the same because they have the same number of dots – 10 dots. They are different because the array is in rows and the other ones are just in whatever place. The array is easier to count.
6. Emma collects rocks. She arranges them in 4 rows of 3. Draw Emma's array to show how many rocks she has all together. Then write a multiplication equation to describe the array.
   4 x 3 = 12
   Emma has 12 rocks.
7. Joshua organizes cans of food into an array. He thinks, "My cans show 5 × 3!" Draw Joshua's array to find the total number of cans he organizes.
   5 x 3 = 15
   Joshua organizes 15 cans.

Student Debrief (10 minutes)

Lesson Objective: Relate multiplication to the array model.

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.

Any combination of the questions below may be used to lead the discussion.

- In Problems 5 and 6, how do the arrays represent equal groups?
- Compare Problems 6 and 7. (Arrays have the same number in each group but a different number of groups.)
- Compare equal groups in scattered configurations and arrays.
- Review new vocabulary: **row**, **array**, **number of groups**, **size of groups**, and **product**.
- Prompt students to notice arrays around the room and possibly think of arrays in real-world situations.

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help with assessing students' understanding of the concepts that were presented in today's lesson and planning more effectively for future lessons. The questions may be read aloud to the students.

Number Correct: _____

A

Add or Subtract Using 2

1.	0 + 2 =	
2.	2 + 2 =	
3.	4 + 2 =	
4.	6 + 2 =	
5.	8 + 2 =	
6.	10 + 2 =	
7.	12 + 2 =	
8.	14 + 2 =	
9.	16 + 2 =	
10.	18 + 2 =	
11.	20 – 2 =	
12.	18 – 2 =	
13.	16 – 2 =	
14.	14 – 2 =	
15.	12 – 2 =	
16.	10 – 2 =	
17.	8 – 2 =	
18.	6 – 2 =	
19.	4 – 2 =	
20.	2 – 2 =	
21.	2 + 0 =	
22.	2 + 2 =	

23.	2 + 4 =	
24.	2 + 6 =	
25.	2 + 8 =	
26.	2 + 10 =	
27.	2 + 12 =	
28.	2 + 14 =	
29.	2 + 16 =	
30.	2 + 18 =	
31.	0 + 22 =	
32.	22 + 22 =	
33.	44 + 22 =	
34.	66 + 22 =	
35.	88 – 22 =	
36.	66 – 22 =	
37.	44 – 22 =	
38.	22 – 22 =	
39.	22 + 0 =	
40.	22 + 22 =	
41.	22 + 44 =	
42.	66 + 22 =	
43.	888 – 222 =	
44.	666 – 222 =	

B

Number Correct: _____

Improvement: _____

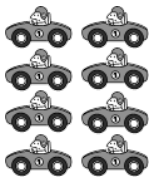
Add or Subtract Using 2

1.	2 + 0 =	
2.	2 + 2 =	
3.	2 + 4 =	
4.	2 + 6 =	
5.	2 + 8 =	
6.	2 + 10 =	
7.	2 + 12 =	
8.	2 + 14 =	
9.	2 + 16 =	
10.	2 + 18 =	
11.	20 − 2 =	
12.	18 − 2 =	
13.	16 − 2 =	
14.	14 − 2 =	
15.	12 − 2 =	
16.	10 − 2 =	
17.	8 − 2 =	
18.	6 − 2 =	
19.	4 − 2 =	
20.	2 − 2 =	
21.	0 + 2 =	
22.	2 + 2 =	

23.	4 + 2 =	
24.	6 + 2 =	
25.	8 + 2 =	
26.	10 + 2 =	
27.	12 + 2 =	
28.	14 + 2 =	
29.	16 + 2 =	
30.	18 + 2 =	
31.	0 + 22 =	
32.	22 + 22 =	
33.	22 + 44 =	
34.	66 + 22 =	
35.	88 − 22 =	
36.	66 − 22 =	
37.	44 − 22 =	
38.	22 − 22 =	
39.	22 + 0 =	
40.	22 + 22 =	
41.	22 + 44 =	
42.	66 + 22 =	
43.	666 − 222 =	
44.	888 − 222 =	

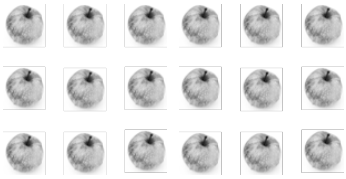
Name _____ Date _____

Use the arrays below to answer each set of questions.

1. 

a. How many rows of cars are there? _____

b. How many cars are there in each row? _____

2. 

a. What is the number of rows? _____

b. What is the number of objects in each row? _____

3. 

a. There are 4 spoons in each row. How many spoons are in 2 rows? _____

b. Write a multiplication expression to describe the array. _____

4. 

a. There are 5 rows of triangles. How many triangles are in each row? _____

b. Write a multiplication expression to describe the total number of triangles.

_____

5. The dots below show 2 groups of 5.

a. Redraw the dots as an array that shows 2 rows of 5.

b. Compare the drawing to your array. Write at least 1 reason why they are the same and 1 reason why they are different.

6. Emma collects rocks. She arranges them in 4 rows of 3. Draw Emma's array to show how many rocks she has altogether. Then, write a multiplication equation to describe the array.

7. Joshua organizes cans of food into an array. He thinks, "My cans show 5 × 3!" Draw Joshua's array to find the total number of cans he organizes.

Name _____ Date _____

1. 

a. There are 4 rows of stars. How many stars are in each row? _____

b. Write a multiplication equation to describe the array. _____

2. Judy collects seashells. She arranges them in 3 rows of 6. Draw Judy's array to show how many seashells she has altogether. Then, write a multiplication equation to describe the array.

Name _____ Date _____

Use the arrays below to answer each set of questions.

1. 

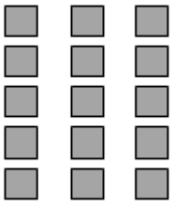
a. How many rows of erasers are there? _____

b. How many erasers are there in each row? _____

2. 

a. What is the number of rows? _____

b. What is the number of objects in each row? _____

3. 

a. There are 3 squares in each row. How many squares are in 5 rows? _____

b. Write a multiplication expression to describe the array. _____

4. 

a. There are 6 rows of stars. How many stars are in each row? _____

b. Write a multiplication expression to describe the array. _____

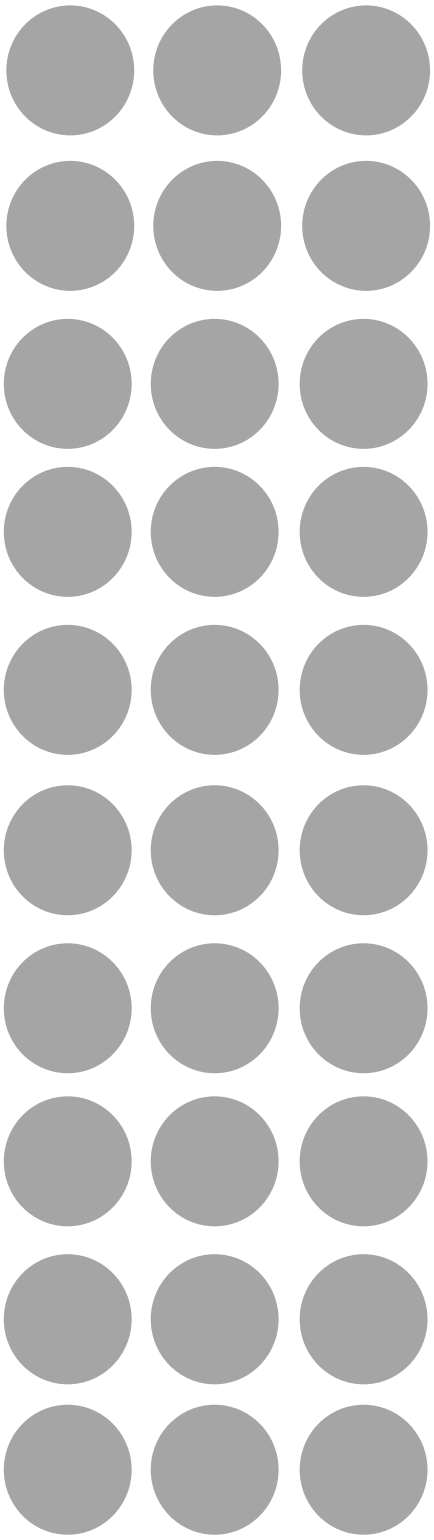
5. The triangles below show 3 groups of four.

a. Redraw the triangles as an array that shows 3 rows of four.

b. Compare the drawing to your array. How are they the same? How are they different?

6. Roger has a collection of stamps. He arranges the stamps into 5 rows of four. Draw an array to represent Roger's stamps. Then, write a multiplication equation to describe the array.

7. Kimberly arranges her 18 markers as an array. Draw an array that Kimberly might make. Then, write a multiplication equation to describe your array.



threes array