Lesson 9
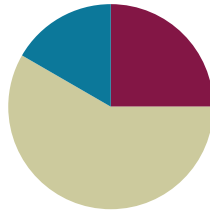
Objective: Find related multiplication facts by adding and subtracting equal groups in array models.

Suggested Lesson Structure

■ Fluency Practice	(15 minutes)
■ Concept Development	(35 minutes)
■ Student Debrief	(10 minutes)
Total Time	**(60 minutes)**

Fluency Practice (15 minutes)

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

Multiply by 2 (7 minutes)

Materials: (S) Multiply by 2 (1–5) 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.

T: (Write 2 × 5 = _____.) Let's skip-count by twos to find the answer. (Count with fingers to 5 as students count.)

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

T: (Circle 10 and write 2 × 5 = 10 above it. Write 2 × 3 = _____.) Let's skip-count up by twos again. (Count with fingers to 3 as students count.)

S: 2, 4, 6.

T: Let's see how we can skip-count down to find the answer, too. Start at 10 with 5 fingers, 1 for each two. (Count down with your fingers as students say numbers.)

S: 10 (five fingers), 8 (4 fingers), 6 (3 fingers).

Repeat the process for 2 × 4.

T: Let's practice multiplying by 2.

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Directions for Administration of *Multiply By* Pattern Sheet

- Distribute *Multiply By* pattern sheet.
- Allow a maximum of 2 minutes for students to complete as many problems as possible.
- Direct students to work left to right across the page.
- Encourage skip-counting strategies to solve unknown facts.

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.)

Forms of Multiplication (4 minutes)

Materials: (S) Personal white boards

Note: Students directly relate repeated addition to multiplication in preparation for using the distributive property in this Lesson.

 T: (Project a 3 by 5 picture array.) Represent this array as a repeated addition sentence using 5 as the size of the groups.

 S: (Write 5 + 5 + 5 = 15.)

 T: (Project a 3 by 4 array. Write ____ fours = ____.) Complete the expression on your personal board.

 S: (Write 3 fours = 12.)

 T: (Project a 7 by 2 array.) Write 2 multiplication sentences for 7 groups of 2.

 S: (Write $7 \times 2 = 14$ and $2 \times 7 = 14$.)

 T: (Project a 6 by 3 array.) Write 18 = 6 × ____.) Complete the expression on your personal board.

 S: (Write $18 = 6 \times 3$.)

 T: (Project a 5 by 3 array. Write 5 threes = ___.) Complete the expression on your personal board.

 S: (Write 5 threes = 15.)

 T: (Add one more group of 3 to the array. Write 5 threes + 1 three = ____ threes = ____ ones.)

 S: (Write 5 threes + 1 three = 6 threes = 18 ones.)

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Threes Array No Fill Template

Concept Development (35 minutes)

Materials: (S) Personal white board, Threes Array No Fill
             Template (pictured at right), blank paper
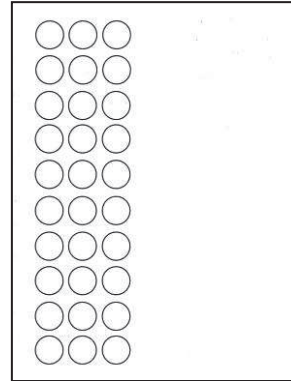
Problem 1: Add 2 known smaller facts to solve an unknown larger fact.

T: Slip the template into your board. Cover part of the array with blank paper to show 5 rows of 3. Draw a box around the uncovered array. Write and solve a multiplication sentence to describe it.

S: (Cover, then box array and write 5 × 3 = 15.)

T: Move the paper so the array shows 7 × 3. Shade the rows you added.

S: (Shade 2 rows.)

T: Write and solve a multiplication sentence to describe the shaded part of your array.

S: (Write 2 × 3 = 6.)

T: How many threes are in 5 × 3?

S: 5 threes.

T: How many threes did you add to 5 × 3 to make the array show 7 × 3?

S: 2 threes.

T: (Write 7 threes = 5 threes + 2 threes.) So 7 threes equals 5 threes plus 2 threes. (Write 7 × 3 = 5 × 3 + 2 × 3 as shown to the right.) Do you agree or disagree?

S: I agree. That's just adding the 2 parts of the array together. → 7 rows of three is the same as 5 rows of three plus 2 rows of three.

T: We already wrote totals for the 2 parts of our array. Let's add those to find the total for the whole array. What is the total of 5 × 3?

S: 15.

T: (Write 15 + on the board.) What is the total of 2 × 3?

S: 6.

T: (Add to the board so the equation reads _____ = 15 + 6.) Say the total at the signal. (Signal.)

S: 21.

Provide students with another example. Have them use the template to add the totals of 4 × 3 and 4 × 3 to find the answer to 8 × 3. Teach them to double the total for 4 × 3.

> **NOTES ON MULTIPLE MEANS FOR REPRESENTATION:**
>
> Decomposing this way naturally relates to the part-whole relationship that students studied in grades K-2. The vignette implies the relationship, but you may want to make a more formal connection to prior knowledge.

Sample teacher board

7 threes = 5 threes + 2 threes
7 x 3 = 5 x 3   +   2 x 3
21 =   15   +   6

> **NOTES ON MULTIPLE MEANS FOR ENGAGEMENT:**
>
> The second example for subtraction (8 x 3) is intentionally the same as the second example for addition. Solving the same problem in 2 ways provides an opportunity for students to compare the strategies. Ask students who benefit from a challenge to analyze the strategies independently or in pairs, then present their thinking to others during the debrief.

COMMON CORE

Lesson 9:   Find related multiplication facts by adding and subtracting equal groups in array models.
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T: Explain how we added to find 7 × 3 = 21 and 8 × 3 = 24.

S: We added the totals of smaller facts together to find the whole. → We used 2 facts we already knew to find one we didn't know.

Problem 2: Subtract 2 known smaller facts to solve an unknown larger fact.

T: Draw a box around an array that shows 9 × 3. Notice that 9 × 3 is very close to 10 × 3. 10 × 3 is easier to solve because we can count by tens to get the total. Let's do that now.

S: 10, 20, 30.

T: Let's use 10 × 3 = 30 to help us solve 9 × 3.

T: Use your finger to trace 10 threes.

T: What should we subtract to show 9 threes instead?

S: 1 three!

T: (Write 10 threes – 1 three = _____ on the board.) 10 threes equals?

S: 30.

T: 30 – 3 equals?

S: 27.

Provide another example. Have students subtract to find the answer to 8 × 3. 10 × 3 is the basic fact, so the subtraction to find 8 × 3 is 30 – 6.

T: Tell your partner how we used 10 × 3 to help us find the answer to 9 × 3 and 8 × 3.

S: (Discuss.)

NOTES TO TEACHER ON VOCABULARY:

Introduce the word *distribute* into your everyday, classroom language. This will help with students' understanding of the distributive property, which is formally introduced in Lesson 16.

For example: "Paper monitors, please distribute the papers to the class."

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.

COMMON CORE

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Student Debrief (10 minutes)

Lesson Objective: Find related multiplication facts by adding and subtracting equal groups in array models.

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.

- Review the strategy of adding and subtracting the totals of known "easy" facts for solving unknown facts
- Differentiate between when to apply addition or subtraction through analysis of the example 8 × 3 from concept lesson. (Students solved 8 × 3 using both addition and subtraction.) You may then ask students to apply the strategy to solve 8 × 4.

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.

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Multiply.

2 x 1 = _____   2 x 2 = _____   2 x 3 = _____   2 x 4 = _____

2 x 5 = _____   2 x 1 = _____   2 x 2 = _____   2 x 1 = _____

2 x 3 = _____   2 x 1 = _____   2 x 4 = _____   2 x 1 = _____

2 x 5 = _____   2 x 1 = _____   2 x 2 = _____   2 x 3 = _____

2 x 2 = _____   2 x 4 = _____   2 x 2 = _____   2 x 5 = _____

2 x 2 = _____   2 x 1 = _____   2 x 2 = _____   2 x 3 = _____

2 x 1 = _____   2 x 3 = _____   2 x 2 = _____   2 x 3 = _____

2 x 4 = _____   2 x 3 = _____   2 x 5 = _____   2 x 3 = _____

2 x 4 = _____   2 x 1 = _____   2 x 4 = _____   2 x 2 = _____

2 x 4 = _____   2 x 3 = _____   2 x 4 = _____   2 x 5 = _____

2 x 4 = _____   2 x 5 = _____   2 x 1 = _____   2 x 5 = _____

2 x 2 = _____   2 x 5 = _____   2 x 3 = _____   2 x 5 = _____

2 x 4 = _____   2 x 2 = _____   2 x 4 = _____   2 x 3 = _____

2 x 5 = _____   2 x 3 = _____   2 x 2 = _____   2 x 4 = _____

2 x 3 = _____   2 x 5 = _____   2 x 2 = _____   2 x 4 = _____

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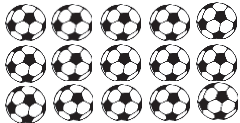**Date:** 6/26/13

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Name _____   Date _____

1. The team organizes soccer balls into 2 rows of 5. The coach adds 3 rows of 5 soccer balls. Complete the number sentences to describe the total array.
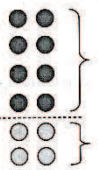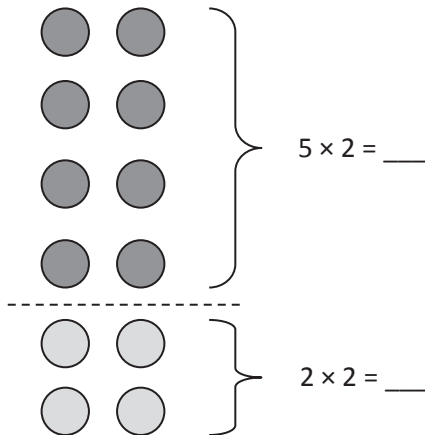
   a. $(5 + 5) + (5 + 5 + 5) =$ _____
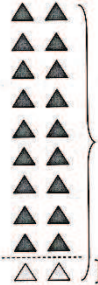
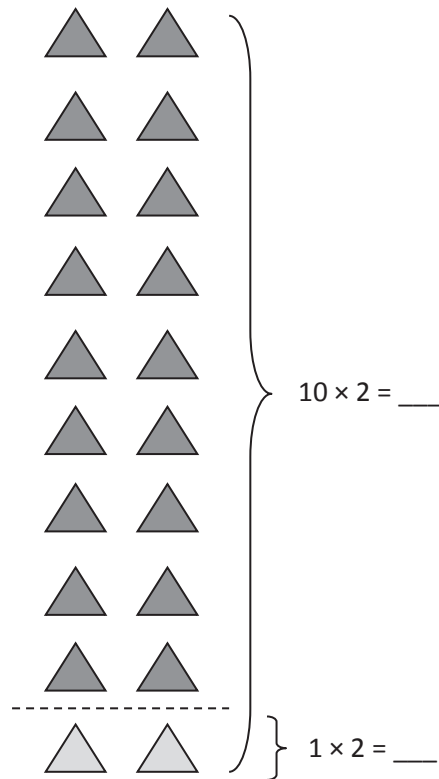   b. 2 fives + _____ fives = _____ fives

   c. _____ × 5 = _____

2. 7 × 2 = _____

   5 × 2 = ___

   2 × 2 = ___

   10 + 4 = _____

   _____ × 2 = 14

3. 9 × 2 = _____

   10 × 2 = ___

   1 × 2 = ___

   20 − _____ = 18

   9 × 2 = _____

4. Matthew organizes his baseball cards in 4 rows of 3.

    a. Draw an array that represents Matthew's cards using an x to show each card.

    b. Solve the multiplication sentence to find Matthew's total number of cards.   4 × 3 = _____

5. Matthew adds 2 more rows. Use circles to show his new cards on the array in part 4a.

    a. Write and solve a multiplication sentence to represent the circles you added to the array.

    _____ × 3 = _____

    b. Add the totals from the multiplication facts in 4b and 5a to find Matthew's total cards.
    _____ + _____ = 18

    c. Write the multiplication sentence that shows Matthew's total number of cards.

    _____ × _____ = 18

Name _____   Date _____

1. Mrs. Stern roasts cloves of garlic. She places 10 rows of two cloves on a baking sheet.

   Write a multiplication sentence to describe the number of cloves Mrs. Stern bakes.

   _____ × _____ = _____

2. When the garlic is roasted, Mrs. Stern uses some for a recipe, leaving 2 rows of two garlic cloves on the pan.

   a. Complete the number sentence below to show how many garlic cloves she uses.

      _____ twos − _____ twos = _____ twos

   b. 20 − _____ = 16

   c. Write a multiplication sentence to describe the number of garlic cloves she uses.

      _____ × 2 = _____

Lesson 9:   Find related multiplication facts by adding and subtracting equal
             groups in array models.
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Name _____   Date _____

1. Dan organizes his star stickers into 3 rows of 4. Irene adds 2 more rows of stickers. Complete the number sentences to describe the total number of stickers in the array.
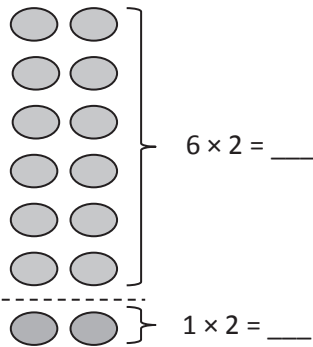
a. $(4 + 4 + 4) + (4 + 4) = $ _____

b. 3 fours + _____ fours = _____ fours

c. _____ × 5 = _____

2. $7 × 2 = $ _____

$6 × 2 = $ ___

$1 × 2 = $ ___

$12 + 2 = $ _____

_____ × 2 = 14

3. $9 × 3 = $ _____

$10 × 3 = $ ___

$1 × 3 = $ ___

$30 - $ _____ $= 27$

_____ × 3 = 27

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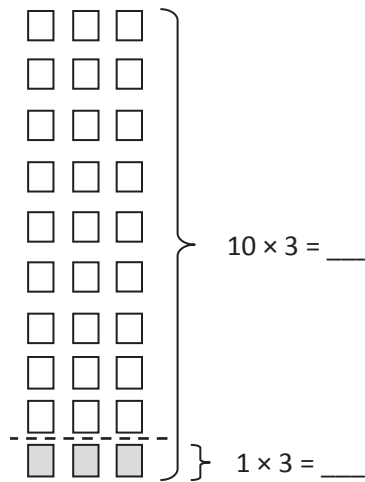
4. Franklin collects stickers. He organizes his stickers in 5 rows of 4 on his table.

   Draw an array that represents Franklin's stickers using an x to show each sticker.

$$5 \times 4 = \underline{\hspace{2cm}}$$

5. Franklin adds 2 more rows. Use circles to show his new stickers on the array in part 3a.

   a. Write and solve a multiplication sentence to represent the circles you added to the array.

$$\underline{\hspace{1.5cm}} \times 4 = \underline{\hspace{1.5cm}}$$

   b. Complete the addition sentence to show how you added the totals of 2 multiplication facts to find Franklin's total number of stickers.

$$\underline{\hspace{1.5cm}} + \underline{\hspace{1.5cm}} = 28$$

   c. Complete the unknown to show Franklin's total number of stickers.

$$\underline{\hspace{1.5cm}} \times 4 = 28$$

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