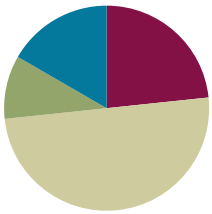
Lesson 31

Objective: Explore and create unconventional representations of one-half.

Suggested Lesson Structure



Fluency Practice	(14 minutes)
Application Problem	(6 minutes)
Concept Development	(30 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**

Fluency Practice (14 minutes)

- Sprint: Multiply or Divide by 9 **3.OA.7** (10 minutes)
- Multiply and Divide **3.OA.7** (4 minutes)

Sprint: Multiply or Divide by 9 (10 minutes)

Materials: (S) Multiply or Divide by 9 Sprint

Note: This Sprint builds fluency with multiplication and division facts using units of 9.

Multiply and Divide (4 minutes)

Materials: (S) Personal white board

Note: This activity focuses on student mastery of all products and quotients within 100.

T: (Write 5 × 4 = ___.) Write the multiplication sentence.
S: (Write 5 × 4 = 20.)

Continue with the following possible sequence: 5 × 8, 7 × 8, 6 × 4, 6 × 8, 9 × 8, and 8 × 9.

T: (Write 6 ÷ 3 = ___.) Write the division sentence.
S: (Write 6 ÷ 3 = 2.)

Continue with the following possible sequence: 15 ÷ 3, 30 ÷ 6, 18 ÷ 3, 36 ÷ 6, 14 ÷ 7, 28 ÷ 7, and 56 ÷ 7.

T: (Write 3, 2.) Write two multiplication sentences and two division sentences using these factors.
S: (Write 3 × 2 = 6, 2 × 3 = 6, 6 ÷ 2 = 3, and 6 ÷ 3 = 2.)

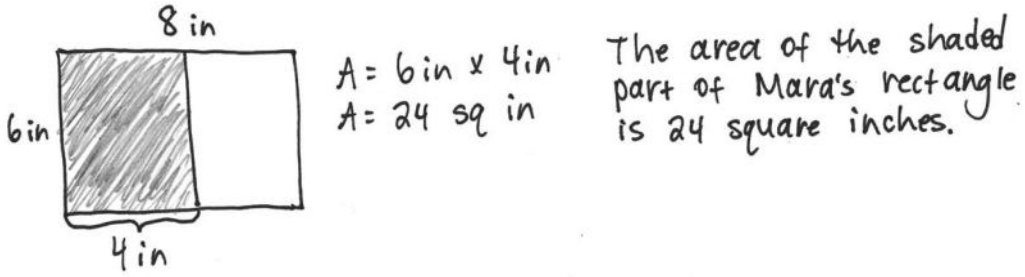
Continue with the following possible sequence: 9 and 5, 6 and 4, and 7 and 8.

NOTES ON MULTIPLE MEANS OF ACTION AND EXPRESSION:

Support students working below grade level during the Multiply and Divide fluency activity by coupling language and number sentences with models such as tape diagrams, number bonds, and arrays. It may be helpful to repeat exercises until students gain ease and confidence.

Application Problem (6 minutes)

Mara draws a 6-inch by 8-inch rectangle. She shades one-half of the rectangle. What is the area of the shaded part of Mara's rectangle?



Note: Students may also divide the rectangle lengthwise and get an 8-inch by 3-inch rectangle or find the area of the whole rectangle and divide it by 2. This problem reviews calculating area from Module 4. Invite students to discuss how this problem could be solved using reasoning skills and mental math.

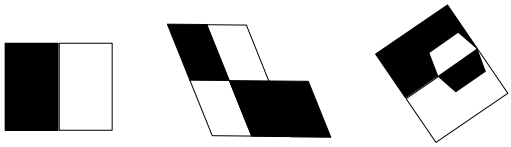
Concept Development (30 minutes)

Materials: (S) Squares (Template), ruler, crayons, Problem Set

Part 1: Explore different representations of one-half.

Project the following images.

T: Study these images. Estimate to decide which shapes have one-half shaded. Discuss your reasoning with a partner.



S: Shape A definitely does because the black and white parts look like they are the same size. → I think Shape C does, too, because that little black trapezoid just got cut out and flipped over. The black and white parts still look equal. → I do not think Shape B shows one-half shaded. That bottom black part looks like it is made of two parallelograms, not one. That means that three are shaded and two are not. Three shaded parallelograms are more than one-half of that shape.

T: I heard many students mention same-sized, or equal, parts. Tell your partner why equal parts are important when we are talking about one-half.

S: If the parts are the same size and the same number of parts are shaded and unshaded, then we know we have one-half. If the parts are not equal, we cannot really tell. → You can compare the number of shaded and unshaded parts when shapes are divided up into equal parts. Like my friend did when she was talking about Shape B. Three out of 5 parts are shaded.

T: When I asked you to study the shapes, I said you should *estimate* to decide which represent one-half. Why did I use the word *estimate*?

S: Because you wanted us to look at them and take a guess. → We do not really know for sure if the parts are equal just by looking at them. It seems like it, but they could be a little different. → To be sure, we would have to measure or maybe make the shapes ourselves out of unit squares or something.

MP.6

T: Let's do that now. I'll pass out squares with grids in them that will help you be precise in showing one-half. Instead of making my shapes, make your own representations. Be as creative as you can!

Part 2: Create different representations of one-half of a 6 by 6 square.

Give each student a copy of the squares Template. Students shade each square to show different ways to represent one-half of a 36-square-unit square (in pencil). Students then trade squares with a partner to analyze each other's work. The Problem Set is a tool for students to use to record their analyses of their partners' work. After the analyses, students can make adjustments to their work, if necessary.

Prepare students by doing the following:

- Students should create between 4 and 10 different representations of one-half using the squares Template.
- Students should label each square with a letter so partners can refer to squares by the letter name.
- If necessary, review strategies that students can use to shade in one-half of a unit square.
- After representations are made, students analyze each other's work to confirm that squares are, in fact, one-half shaded.
- Show a completed Problem Set (analyzing tool) to establish your expectation for student analysis.

Once every student has made at least four representations, guide an analysis of the representations to confirm that they accurately represent one-half. Students may work in pairs to do this or participate in a gallery walk. Students can use the Problem Set as a tool to record their analyses.

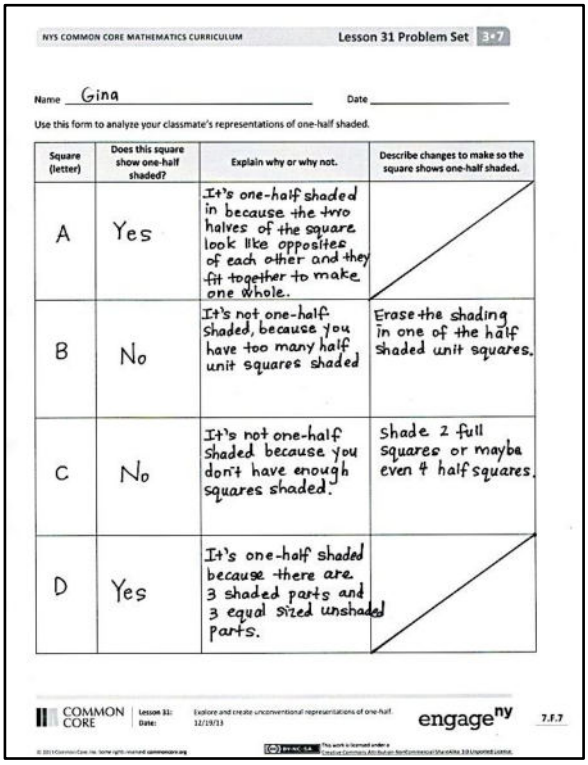
NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

As students make unconventional representations of one-half, offer autonomy and choice to those working above grade level and others. Encourage student creativity by making the exploration as open-ended as possible. For example, students might cut or combine their 36 unit squares to extend the variety of designs and increase the challenge of partner analysis.

NOTES ON MULTIPLE MEANS OF ACTION AND EXPRESSION:

If the 36-square-unit square is too small or otherwise challenging for some learners, magnify it, and present it on an interactive board or a computer.

When the analysis is complete and mistakes are corrected, students can use crayons to color over their pencil shadings. Combine all the finished squares to form a class quilt to display the various representations of one-half.



NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 31 Problem Set 3•7

Name Gina Date

Use this form to analyze your classmate's representations of one-half shaded.

Square (letter)	Does this square show one-half shaded?	Explain why or why not.	Describe changes to make so the square shows one-half shaded.
A	Yes	It's one-half shaded in because the two halves of the square look like opposites of each other and they fit together to make one whole.	
B	No	It's not one-half shaded, because you have too many half unit squares shaded	Erase the shading in one of the half shaded unit squares.
C	No	It's not one-half shaded because you don't have enough squares shaded.	Shade 2 full squares or maybe even 4 half squares.
D	Yes	It's one-half shaded because there are 3 shaded parts and 3 equal sized unshaded parts.	

COMMON CORE Lesson 31: Explore and create unconventional representations of one-half. Date: 12/19/13 engage^ny 7.F.7

Student Debrief (10 minutes)

Lesson Objective: Explore and create unconventional representations of one-half.

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.

- Look at our class quilt. How is it possible to have so many different ways to show one-half of the same square?
- What is the area in square units of the shaded part of each of your squares? How do you know?
- What fraction of our class quilt is shaded in? How do you know?
- Did anyone shade in one-half of a unit square? How? Are there other ways to shade in one-half of a unit square?
- How did the Application Problem connect to today's lesson?

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.

A

Number Correct: _____

Multiply or Divide by 9

1.	2 × 9 =	
2.	3 × 9 =	
3.	4 × 9 =	
4.	5 × 9 =	
5.	1 × 9 =	
6.	18 ÷ 9 =	
7.	27 ÷ 9 =	
8.	45 ÷ 9 =	
9.	9 ÷ 9 =	
10.	36 ÷ 9 =	
11.	6 × 9 =	
12.	7 × 9 =	
13.	8 × 9 =	
14.	9 × 9 =	
15.	10 × 9 =	
16.	72 ÷ 9 =	
17.	63 ÷ 9 =	
18.	81 ÷ 9 =	
19.	54 ÷ 9 =	
20.	90 ÷ 9 =	
21.	___ × 9 = 45	
22.	___ × 9 = 9	
23.	___ × 9 = 90	
24.	___ × 9 = 18	
25.	___ × 9 = 27	
26.	90 ÷ 9 =	
27.	45 ÷ 9 =	
28.	9 ÷ 9 =	
29.	18 ÷ 9 =	
30.	27 ÷ 9 =	
31.	___ × 9 = 54	
32.	___ × 9 = 63	
33.	___ × 9 = 81	
34.	___ × 9 = 72	
35.	63 ÷ 9 =	
36.	81 ÷ 9 =	
37.	54 ÷ 9 =	
38.	72 ÷ 9 =	
39.	11 × 9 =	
40.	99 ÷ 9 =	
41.	12 × 9 =	
42.	108 ÷ 9 =	
43.	14 × 9 =	
44.	126 ÷ 9 =	

B

Number Correct: _____

Improvement: _____

Multiply or Divide by 9

1.	1 × 9 =	
2.	2 × 9 =	
3.	3 × 9 =	
4.	4 × 9 =	
5.	5 × 9 =	
6.	27 ÷ 9 =	
7.	18 ÷ 9 =	
8.	36 ÷ 9 =	
9.	9 ÷ 9 =	
10.	45 ÷ 9 =	
11.	10 × 9 =	
12.	6 × 9 =	
13.	7 × 9 =	
14.	8 × 9 =	
15.	9 × 9 =	
16.	63 ÷ 9 =	
17.	54 ÷ 9 =	
18.	72 ÷ 9 =	
19.	90 ÷ 9 =	
20.	81 ÷ 9 =	
21.	___ × 9 = 9	
22.	___ × 9 = 45	
23.	___ × 9 = 18	
24.	___ × 9 = 90	
25.	___ × 9 = 27	
26.	18 ÷ 9 =	
27.	9 ÷ 9 =	
28.	90 ÷ 9 =	
29.	45 ÷ 9 =	
30.	27 ÷ 9 =	
31.	___ × 9 = 27	
32.	___ × 9 = 36	
33.	___ × 9 = 81	
34.	___ × 9 = 63	
35.	72 ÷ 9 =	
36.	81 ÷ 9 =	
37.	54 ÷ 9 =	
38.	63 ÷ 9 =	
39.	11 × 9 =	
40.	99 ÷ 9 =	
41.	12 × 9 =	
42.	108 ÷ 9 =	
43.	13 × 9 =	
44.	117 ÷ 9 =	

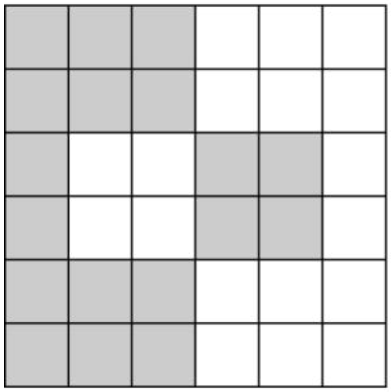
Name _____ Date _____

Use this form to analyze your classmate's representations of one-half shaded.

Square (letter)	Does this square show one-half shaded?	Explain why or why not.	Describe changes to make so the square shows one-half shaded.

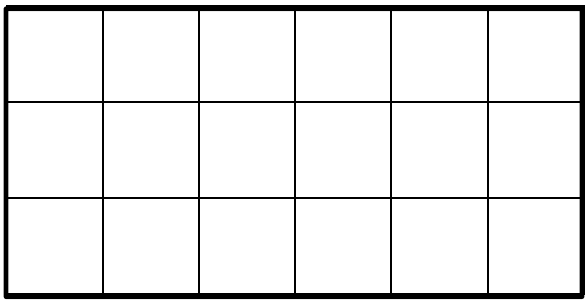
Name _____ Date _____

Marty shades the square as shown below and says one-half of the big square is shaded. Do you agree? Why or why not?



Name _____ Date _____

1. Use the rectangle below to answer Problem 1(a–d).



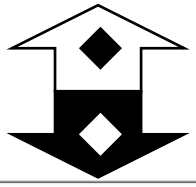
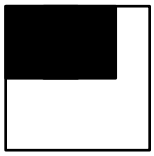
a. What is the area of the rectangle in square units?

b. What is the area of half of the rectangle in square units?

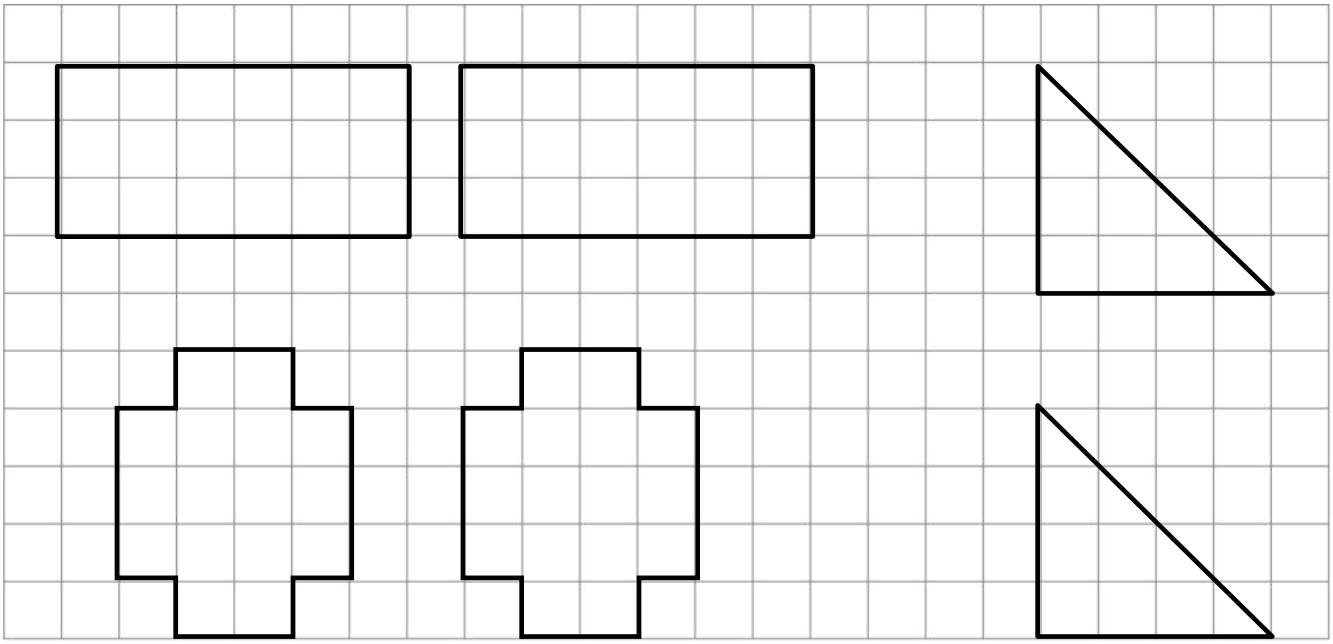
c. Shade in half of the rectangle above. Be creative with your shading!

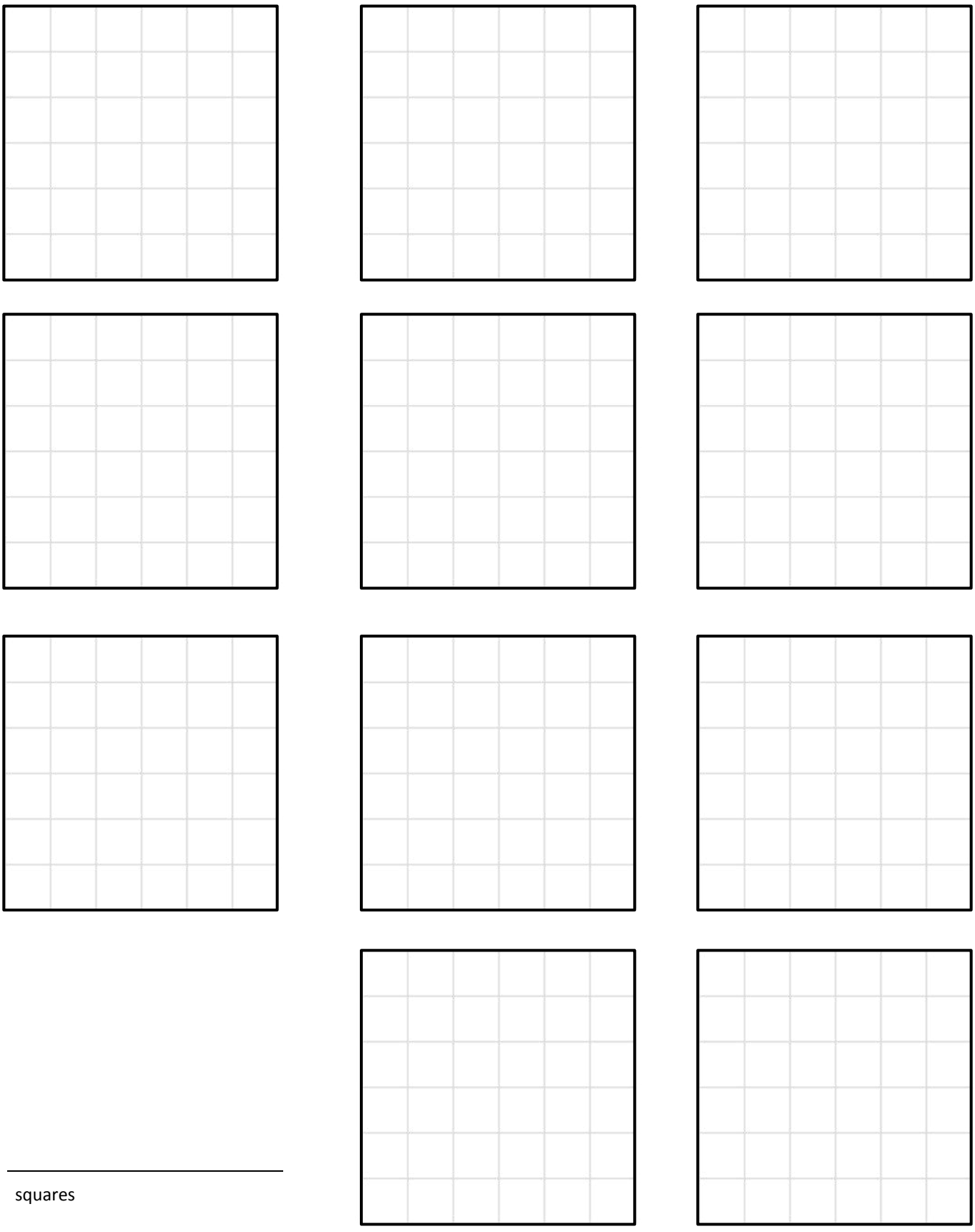
d. Explain how you know you shaded in half of the rectangle.

2. During math class, Arthur, Emily, and Gia draw a shape and then shade one-half of it. Analyze each student's work. Determine if each student was correct or not, and explain your thinking.

Student	Drawing	Your Analysis
Arthur		
Emily		
Gia		

3. Shade the grid below to show two different ways of shading half of each shape.





squares