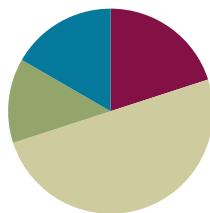


Lesson 21

Objective: Solve division problems with remainders using the area model.

Suggested Lesson Structure

■ Fluency Practice	(12 minutes)
■ Application Problem	(8 minutes)
■ Concept Development	(30 minutes)
■ Student Debrief	(10 minutes)
Total Time	(60 minutes)



Fluency Practice (12 minutes)

- Sprint: Division with Remainders **4.NBT.6** (8 minutes)
- Find the Unknown Factor **4.OA.4** (4 minutes)

Sprint: Division with Remainders (8 minutes)

Materials: (S) Division with Remainders Sprint

Note: This Sprint reviews content from Topic E, including division with basic one- and two-digit facts with and without remainders.

Find the Unknown Factor (4 minutes)

Materials: (S) Personal white boards

Note: This prepares students for G4–M3–Lesson 22’s Concept Development

T: (Write $6 \times \underline{\quad} = 18$.) Say the unknown factor.

S: 3.

T: (Write $18 \div 6$.) On your boards, complete the division sentence.

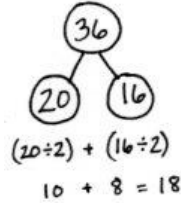
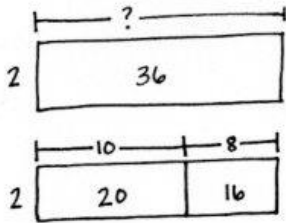
S: (Write $18 \div 6 = 3$.)

Continue with the following possible suggestions: $3 \times \underline{\quad} = 21$, $4 \times \underline{\quad} = 20$, $5 \times \underline{\quad} = 25$, $6 \times \underline{\quad} = 42$, $7 \times \underline{\quad} = 56$, $9 \times \underline{\quad} = 72$, $6 \times \underline{\quad} = 54$, $7 \times \underline{\quad} = 63$, and $9 \times \underline{\quad} = 63$.

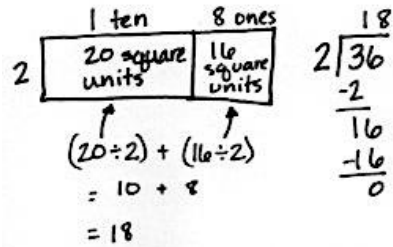
Application Problem (8 minutes)

A rectangle has an area of 36 square units and a width of 2 units. What is the unknown side length?

Method 1:



Method 2:



The unknown side length is 18 units.

Note: This Application Problem serves as an introduction to Problem 1 in the Concept Development, in which the students find the total unknown lengths of a rectangle with an area of 37 and a side length of 2. In this Concept Development, students move on to the complexity of using the area model when there is a remainder.

Concept Development (30 minutes)

Materials: (S) Problem Set

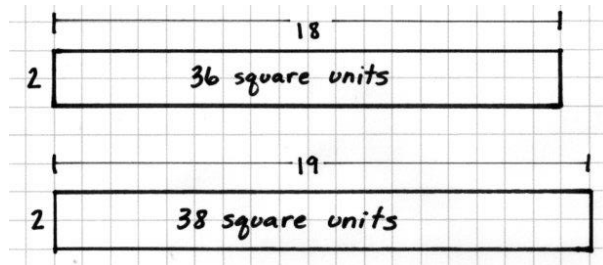
Note: Use the Problem Set for Lesson 21 to record work for Problems 1 and 2 of this Concept Development. Use the remaining problems on the Problem Set for class instruction or independent practice.

Problem 1: 37 ÷ 2

T: (Display the Application Problem with an area of 36 square units on graph paper.) This rectangle has a side length of 18. What would be the area of a rectangle with a width of 2 units and a length of 19 units? (Draw on graph paper.)

S: 38 square units.

T: So we cannot represent a rectangle with an area of 37 square units with whole number side lengths. Let's build a rectangle part to whole as we did yesterday.



Problem 2: $76 \div 3$

T: (Write $76 \div 3$.) I'm going to represent this with an area model moving from part to whole by place value just as we did with $37 \div 2$. What should the total area be?

S: 76 square units.

T: (Draw a rectangle.) What is the width or the known side length?

S: 3 length units.

T: (Label a width of 3.) 3 times how many tens gets us as close as possible to an area of 7 tens? (Point to the 7 tens of the dividend.)

S: 2 tens.

T: Let's give 2 tens to the length. (Write the length on the area model.) Let's record 2 tens in the tens place.

T: What is 2 tens times 3?

S: 6 tens. (Record 6 tens below the 7 tens.)

T: How many square units of area is that?

S: 60 square units. (Record in the rectangle.)

T: How many tens remain?

S: 1 ten. (Record 1 ten below the 6 tens.)

T: Let's add the remaining ten to the 6 ones. What is 1 ten + 6 ones? (Record the 6 ones to the right of the 1 ten.)

S: 16 ones.

T: We have an area of 16 square units remaining with a width of 3. (Point to the 16 in the algorithm.) 3 times how many ones gets us as close as possible to an area of 16?

S: 5 ones.

T: Let's give 5 ones to the length. (Label the length.)

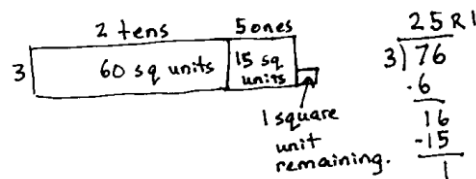
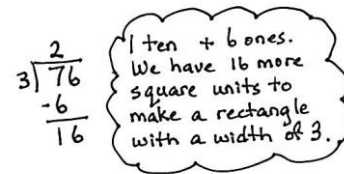
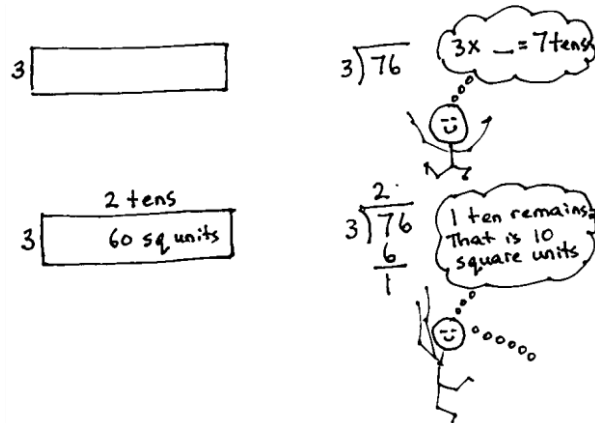
T: This rectangle has an area of?

S: 15 square units.

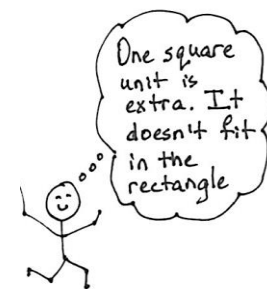
T: How many square units remaining?

S: 1 square unit.

T: What is the unknown length and how many square units remain?



The length of the unknown side is 25 units. One square unit was left over.



- S: The unknown length is 25 with a remainder of 1 square unit.
- T: 60 square units divided by a side length of 3 (record with the distributive property as shown to the right) gave us a side length of?
- S: 20.
- T: Let's say "length units."
- S: 20 length units.
- T: 15 square units divided by a side length of 3 (record) gave us a side length of?
- S: 5 length units.
- T: The total length was?
- S: 25 length units.
- T: With 1 square unit we did not add on to the length.
- T: We built the area one rectangle at a time by place value. Each time after we divide, we have some area remaining. After dividing the tens, we had 16 square units remaining. (Point to the model and long division.) After dividing the ones, we had 1 square unit remaining. (Point to the model and long division.) Later when we study fractions more, we will be able to make a little more length from that area, but for now, we are just going to leave it as 1 square unit of area remaining. (Optional: See the Debrief for a way of understanding the remainder as length.)
- T: Review with your partner how we solved this problem step by step.

$$\begin{aligned} & (60 \div 3) + (15 \div 3) \\ & = 20 + 5 \\ & = 25 \\ & (25 \times 3) + 1 = 76 \end{aligned}$$



**NOTES ON
MULTIPLE MEANS
OF REPRESENTATION:**

You might give students the option of using graph paper, which gives the concreteness of the squares that make up the area, to draw the area models.

Have students proceed through the balance of the Problem Set supported as you see best.

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.

NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 21 Problem Set 4•3

Name Jack Date _____

1. Solve $37 \div 2$ using an area model. Use long division and the distributive property to record your work.

2. Solve $76 \div 3$ using an area model. Use long division and the distributive property to record your work.

3. Carolina solved the following division problem by drawing an area model.

a. What division problem did she solve? $53 \div 4$

b. Show how Carolina's model can be represented using the distributive property.

$$\begin{aligned} & (40 \div 4) + (12 \div 4) \\ & = 10 + 3 \\ & = 13 \\ & (13 \times 4) + 1 = 53 \end{aligned}$$

COMMON CORE Lesson 21: Solve division problems with remainders using the area model. 4•72/1.3 engage^{ny} 3.E.93

Student Debrief (10 minutes)

Lesson Objective: Solve division problems with remainders using the area 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.

You may choose to use any combination of the questions below to lead the discussion.

- In Problem 3, explain to your partner the connection between the distributive property and the area model.
- Because we often have remainders when we divide, we have to use the area model by building up from part to whole. What did the first rectangle you drew in Problem 1 represent? The next chunk of the rectangle?
- Each time we divide, what happens to the amount of area we still have left to divide?
- Why don't we have this complication of leftovers or remainders with multiplication?
- In Problem 4, we didn't know if we were going to have a remainder in the ones place, so instead we built up to the area working with one place value unit at a time. How might the problems with remainders been challenging if you started with the whole area, like in Lesson 20?
- (Optional.) Let's look back at Problem 2, $76 \div 3$. What if we cut this remaining square unit into 3 equal parts with vertical lines? What is the length of one of these units? What if we stack them to add more area? What is the total length of the new rectangle including this tiny piece?

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.

A

Correct _____

1	$8 \div 2$	Q = _____ R = _____	23	$6 \div 2$	Q = _____ R = _____
2	$9 \div 2$	Q = _____ R = _____	24	$7 \div 2$	Q = _____ R = _____
3	$4 \div 4$	Q = _____ R = _____	25	$3 \div 3$	Q = _____ R = _____
4	$5 \div 4$	Q = _____ R = _____	26	$4 \div 3$	Q = _____ R = _____
5	$7 \div 5$	Q = _____ R = _____	27	$6 \div 4$	Q = _____ R = _____
6	$8 \div 5$	Q = _____ R = _____	28	$7 \div 4$	Q = _____ R = _____
7	$5 \div 3$	Q = _____ R = _____	29	$6 \div 6$	Q = _____ R = _____
8	$6 \div 3$	Q = _____ R = _____	30	$7 \div 6$	Q = _____ R = _____
9	$8 \div 4$	Q = _____ R = _____	31	$4 \div 2$	Q = _____ R = _____
10	$9 \div 4$	Q = _____ R = _____	32	$5 \div 2$	Q = _____ R = _____
11	$2 \div 2$	Q = _____ R = _____	33	$9 \div 3$	Q = _____ R = _____
12	$3 \div 2$	Q = _____ R = _____	34	$9 \div 5$	Q = _____ R = _____
13	$7 \div 3$	Q = _____ R = _____	35	$7 \div 7$	Q = _____ R = _____
14	$8 \div 3$	Q = _____ R = _____	36	$9 \div 9$	Q = _____ R = _____
15	$9 \div 3$	Q = _____ R = _____	37	$13 \div 4$	Q = _____ R = _____
16	$8 \div 6$	Q = _____ R = _____	38	$18 \div 5$	Q = _____ R = _____
17	$9 \div 6$	Q = _____ R = _____	39	$21 \div 6$	Q = _____ R = _____
18	$5 \div 5$	Q = _____ R = _____	40	$24 \div 7$	Q = _____ R = _____
19	$6 \div 5$	Q = _____ R = _____	41	$29 \div 8$	Q = _____ R = _____
20	$8 \div 8$	Q = _____ R = _____	42	$43 \div 6$	Q = _____ R = _____
21	$9 \div 8$	Q = _____ R = _____	43	$53 \div 6$	Q = _____ R = _____
22	$9 \div 9$	Q = _____ R = _____	44	$82 \div 9$	Q = _____ R = _____

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B

Improvement _____

Correct _____

1	$9 \div 8$	Q = _____ R = _____	23	$4 \div 2$	Q = _____ R = _____
2	$8 \div 8$	Q = _____ R = _____	24	$5 \div 2$	Q = _____ R = _____
3	$9 \div 6$	Q = _____ R = _____	25	$8 \div 4$	Q = _____ R = _____
4	$8 \div 6$	Q = _____ R = _____	26	$9 \div 4$	Q = _____ R = _____
5	$5 \div 5$	Q = _____ R = _____	27	$9 \div 3$	Q = _____ R = _____
6	$6 \div 5$	Q = _____ R = _____	28	$8 \div 3$	Q = _____ R = _____
7	$7 \div 4$	Q = _____ R = _____	29	$9 \div 5$	Q = _____ R = _____
8	$6 \div 4$	Q = _____ R = _____	30	$6 \div 6$	Q = _____ R = _____
9	$5 \div 3$	Q = _____ R = _____	31	$7 \div 6$	Q = _____ R = _____
10	$6 \div 3$	Q = _____ R = _____	32	$9 \div 9$	Q = _____ R = _____
11	$2 \div 2$	Q = _____ R = _____	33	$7 \div 7$	Q = _____ R = _____
12	$3 \div 2$	Q = _____ R = _____	34	$9 \div 2$	Q = _____ R = _____
13	$3 \div 3$	Q = _____ R = _____	35	$8 \div 2$	Q = _____ R = _____
14	$4 \div 3$	Q = _____ R = _____	36	$37 \div 8$	Q = _____ R = _____
15	$8 \div 7$	Q = _____ R = _____	37	$50 \div 9$	Q = _____ R = _____
16	$9 \div 7$	Q = _____ R = _____	38	$17 \div 6$	Q = _____ R = _____
17	$4 \div 4$	Q = _____ R = _____	39	$48 \div 7$	Q = _____ R = _____
18	$5 \div 4$	Q = _____ R = _____	40	$51 \div 8$	Q = _____ R = _____
19	$6 \div 2$	Q = _____ R = _____	41	$68 \div 9$	Q = _____ R = _____
20	$7 \div 2$	Q = _____ R = _____	42	$53 \div 6$	Q = _____ R = _____
21	$8 \div 5$	Q = _____ R = _____	43	$61 \div 8$	Q = _____ R = _____
22	$7 \div 5$	Q = _____ R = _____	44	$70 \div 9$	Q = _____ R = _____

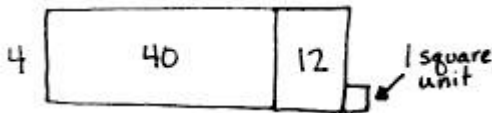
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Name _____ Date _____

1. Solve $37 \div 2$ using an area model. Use long division and the distributive property to record your work.

2. Solve $76 \div 3$ using an area model. Use long division and the distributive property to record your work.

3. Carolina solved the following division problem by drawing an area model.



- a. What division problem did she solve?
- b. Show how Carolina’s model can be represented using the distributive property.

Solve the following problems using the area model. Support the area model with long division or the distributive property.

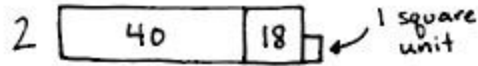
4. $48 \div 3$	5. $49 \div 3$
6. $56 \div 4$	7. $58 \div 4$
8. $66 \div 5$	9. $79 \div 3$

10. Seventy-three students are divided into groups of 6 students each. How many groups of 6 students are there? How many students will not be in a group of 6?

Name _____

Date _____

1. Kyle drew the following area model to find an unknown length. What division equation did he model?



2. Solve $93 \div 4$ using the area model, long division, and the distributive property.

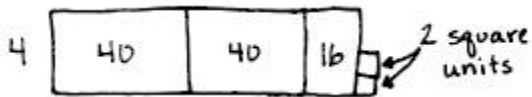
Name _____

Date _____

1. Solve $35 \div 2$ using an area model. Use long division and the distributive property to record your work.

2. Solve $79 \div 3$ using an area model. Use long division and the distributive property to record your work.

3. Paulina solved the following division problem by drawing an area model.



- a. What division problem did she solve?
b. Show how Paulina's model can be represented using the distributive property.

Solve the following problems using the area model. Support the area model with long division or the distributive property.

4. $42 \div 3$	5. $43 \div 3$
6. $52 \div 4$	7. $54 \div 4$
8. $61 \div 5$	9. $73 \div 3$

10. Ninety-seven lunch trays were placed equally in 4 stacks. How many lunch trays were in each stack? How many lunch trays will be leftover?