Lesson 13: Rectangles with Fractional Side Lengths

Goals

- Apply dividing by fractions to calculate the side length of a rectangle, given its area and the other side length.
- Coordinate (orally) diagrams and equations that represent the area of a rectangle with fractional side lengths.
- Draw and label a diagram to justify the area of a rectangle with fractional side lengths.

Learning Targets

- I can use division and multiplication to solve problems involving areas of rectangles with fractional side lengths.

Lesson Narrative

This lesson builds on students' work on area and fractions in grade 5. Students solve problems involving the relationship between area and side lengths of rectangles, in cases where these measurements can be fractions. Knowing that the area of a rectangle can be found by multiplying its side lengths, and knowing the relationship between multiplication and division, they use division to find an unknown side length when the other side length and the area are given.

Alignments

Building On

- 5.NF.B.4.b: Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.

Addressing

- 6.NS.A.1: Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. For example, create a story context for $(2/3) \div (3/4)$ and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that $(2/3) \div (3/4) = 8/9$ because $3/4$ of $8/9$ is $2/3$. (In general, $(a/b) \div (c/d) = ad/bc$.) How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi?

Building Towards

- 6.G.A.2: Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = lwh$ and $V = bh$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.

Instructional Routines

- Anticipate, Monitor, Select, Sequence, Connect
- MLR6: Three Reads
- MLR7: Compare and Connect
- Think Pair Share

Required Materials

$\frac{1}{4}$-inch graph paper
Straightedges
A rigid edge that can be used for drawing line segments. Sometimes a ruler is okay to use as a straightedge, but sometimes it is preferable to use an unruled straightedge, like a blank index card.

Required Preparation

Consider having the objects mentioned in the How Many Would it Take? activity available for students to verify their answers. These objects are: $\frac{3}{4}$-inch square stickers, $\frac{5}{8}$-binder clips, and $1\frac{3}{4}$-inch paper clips.

Student Learning Goals

Let's explore rectangles that have fractional measurements.

13.1 Areas of Squares

Warm Up: 5 minutes
In this warm-up, students review how to find and record the area of a square with whole-number and fractional side lengths. The first question is open-ended to encourage students to notice many things about the area of each square, the relationships between them, and other geometric ideas they might remember from earlier grades. The second question prepares students for the work in this lesson. Focus class discussion on this question.

As students discuss the second question, note those who think of the area of a $\frac{1}{3}$-inch square in terms of:

- Tiling, i.e., determining how many squares with $\frac{1}{3}$-inch side length cover a square with 1-inch side length and dividing the area of 1 square inch by that number
- Multiplying $\frac{1}{3} \cdot \frac{1}{3}$

Building On

- 5.NF.B.4.b

Launch

Arrange students in groups of 2. Display the image and the first question for all to see. Give students 1 minute of quiet time to make observations about the squares. Follow with a brief whole-class discussion.

If not mentioned by students, ask students what they notice about the following:

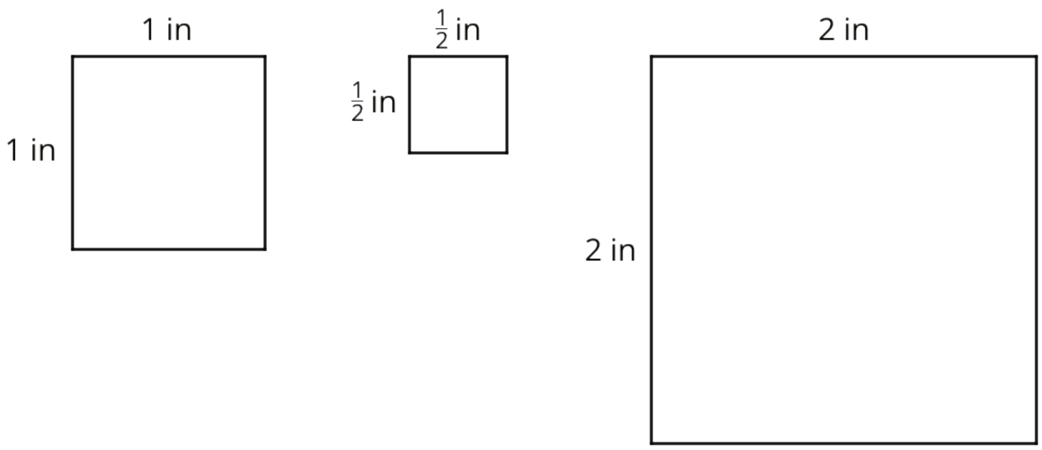
- The area of each square
- How to record the area in square inches
- Whether one square could tile another square completely

Then, give students 1–2 minutes to discuss the second question with their partner.

Anticipated Misconceptions

Some students may struggle in getting started with the second question. Suggest that they try marking up the given 1-inch square to show $\frac{1}{3}$-inch squares.

Student Task Statement



1. What do you notice about the areas of the squares?
2. Kiran says "A square with side lengths of $\frac{1}{3}$ inch has an area of $\frac{1}{3}$ square inches." Do you agree? Explain or show your reasoning.

Student Response

1. Answers vary.

2. No, there are 9 squares with side lengths of $\frac{1}{3}$ inch in a square with side lengths of 1 inch, so the area of a square with side length of $\frac{1}{3}$ inch is $\frac{1}{9}\text{ in}^2$.

Activity Synthesis

Consider telling students that we can call a square with 1-inch side length "a 1-inch square."

Ask previously identified students to share their response to the second question. Illustrate their reasoning for all to see. After each person shares, poll the class on whether they agree with the answer and the explanation. If not mentioned in students' explanations, highlight the following ideas:

- A square with a side length of 1 inch (a 1-inch square) has an area of 1 in^2.
- A 2-inch square has an area of 4 in^2, because 4 squares with 1-inch side length are needed to cover it.
- A $\frac{1}{2}$-inch square has an area of $\frac{1}{4}$ in^2 because 4 of them are needed to completely cover a 1-inch square.
- A $\frac{1}{3}$-inch square has a side length of $\frac{1}{3}$ inch, so it would take 9 squares to cover a 1-inch square. Its area is therefore $\frac{1}{9}$ square inch.

13.2 Areas of Squares and Rectangles

20 minutes

This activity serves two purposes:

- To review and illustrate the idea from grade 5 that the area of a rectangle with fractional side lengths can be found by multiplying the two fractions, just as in the case of whole numbers.
- To prepare students to reason about a prism with fractional edge lengths. Students connect the area of a square with fractional side length with that of a unit square. Later, they transfer this idea to find the volume of prisms with fractional edge lengths. They will then compare whole cubic units and fractional cubic units.

As students work, monitor the ways students represent and reason about the area of the rectangle with fractional side lengths in the last question. A few possibilities are shown in the Possible Responses. Select students who use different strategies to share later.

Building On

- 5.NF.B.4.b

Building Towards

- 6.G.A.2

Instructional Routines

- Anticipate, Monitor, Select, Sequence, Connect
- MLR7: Compare and Connect
- Think Pair Share

Launch

Keep students in groups of 2. Give students 7–8 minutes of quiet work time and 2–3 minutes to share their responses and drawings with their partner. Provide each student with $\frac{1}{4}$-inch graph paper and a straightedge.

Access for Students with Disabilities

Action and Expression: Internalize Executive Functions. Chunk this task into more manageable parts to support students who benefit from support with organizational skills in problem solving. For example, pause to check for understanding after 3–5 minutes of work time. *Supports accessibility for: Organization; Attention*

Anticipated Misconceptions

Some students may have trouble counting grid squares or using a ruler on graph paper and struggle to measure the lengths of the rectangle. Consider preparing pre-drawn copies of the rectangle for students who may benefit from them.

Student Task Statement

Your teacher will give you graph paper and a ruler.

1. On the graph paper, draw a square with side lengths of 1 inch. Inside this square, draw another square with side lengths of $\frac{1}{4}$ inch.

   Use your drawing to answer the questions.

   a. How many squares with side lengths of $\frac{1}{4}$ inch can fit in a square with side lengths of 1 inch?

   b. What is the area of a square with side lengths of $\frac{1}{4}$ inch? Explain or show your reasoning.

2. On the graph paper, draw a rectangle that is $3\frac{1}{2}$ inches by $2\frac{1}{4}$ inches.

   For each question, write a division expression and then find the answer.

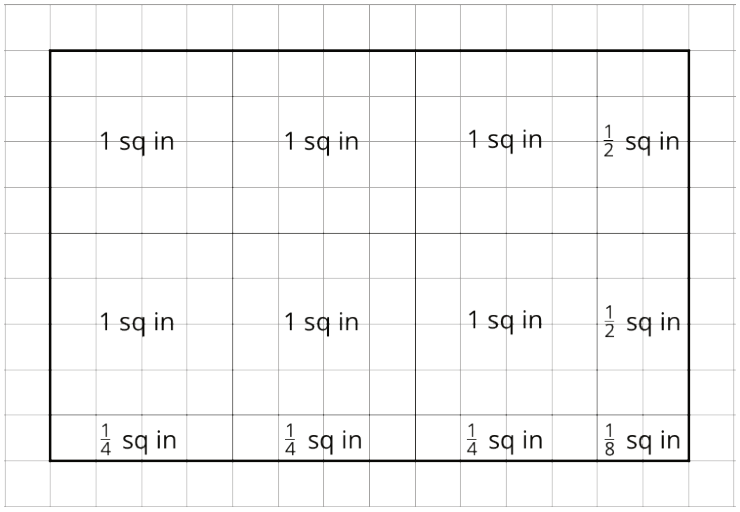
   a. How many $\frac{1}{4}$-inch segments are in a length of $3\frac{1}{2}$ inches?

b. How many $\frac{1}{4}$-inch segments are in a length of $2\frac{1}{4}$ inches?

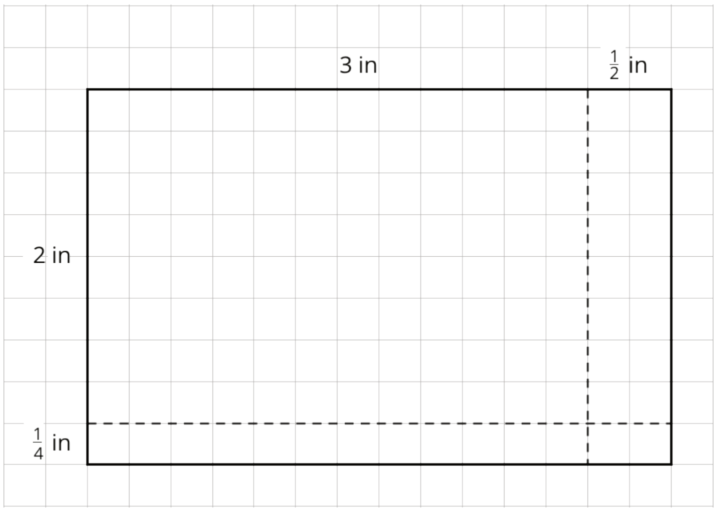
3. Use your drawing to show that a rectangle that is $3\frac{1}{2}$ inches by $2\frac{1}{4}$ inches has an area of $7\frac{7}{8}$ square inches.

Student Response

1. Drawing on graph paper should show a square that is 4 units by 4 units. (Each unit is $\frac{1}{4}$ inch.)
   a. 16 squares
   b. $\frac{1}{16}$ square inches
2. Drawing on graph paper should show a rectangle that is 14 units by 9 units. (Each unit is $\frac{1}{4}$ inch.)
   a. $3\frac{1}{2} \div \frac{1}{4} = ?$. Fourteen $\frac{1}{4}$-inch segments.
   b. $2\frac{1}{4} \div \frac{1}{4} = ?$. Nine $\frac{1}{4}$-inch segments.
3. Reasoning varies. Sample reasoning:
   - Multiplying the number of $\frac{1}{4}$-inch segments in the length and width (from the second question) to find the number of $\frac{1}{4}$-inch squares, then multiplying by $\frac{1}{16}$ to find the area in square inches. $14 \cdot 9 = 126$ and $126 \cdot \frac{1}{16} = 7\frac{7}{8}$
   - Filling the rectangle with squares with side lengths of 1 inch and with side lengths of $\frac{1}{4}$ inch and adding their areas. $(6 \cdot 1) + (2 \cdot \frac{1}{2}) + (3 \cdot \frac{1}{4}) + (1 \cdot \frac{1}{8}) = 6 + 1 + \frac{3}{4} + \frac{1}{8} = 7\frac{7}{8}$



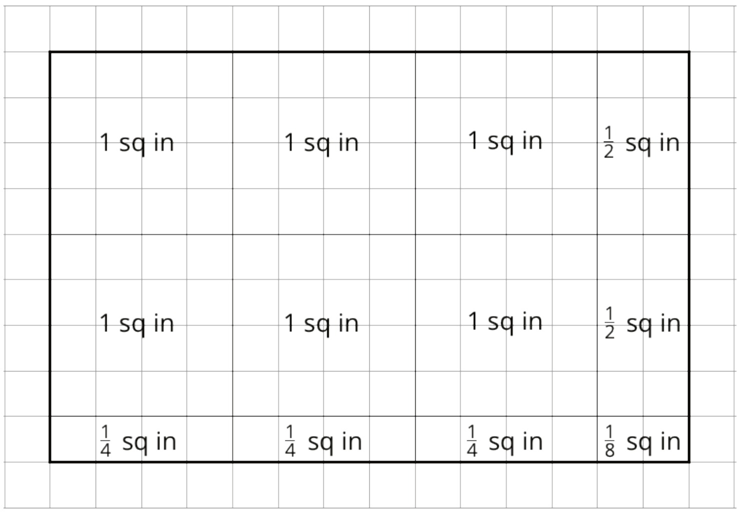
   - Using partial products and the distributive property. $(3 \cdot 2) + (3 \cdot \frac{1}{4}) + (\frac{1}{2} \cdot 2) + (\frac{1}{2} \cdot \frac{1}{4}) = 6 + \frac{3}{4} + 1 + \frac{1}{8} = 7\frac{7}{8}$

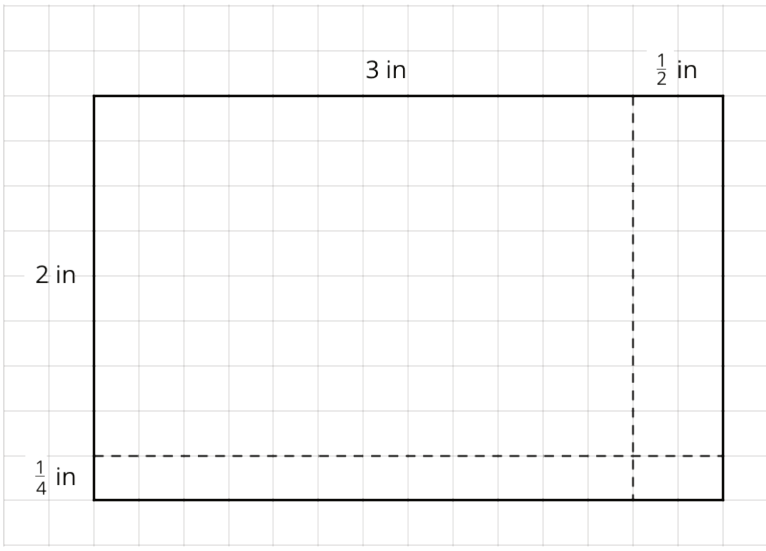


Activity Synthesis

Focus the whole-class discussion on the last question. Invite previously selected students to share their answers and diagrams in the sequence shown in the Possible Responses. Ask students to explain how they found that $3\frac{1}{2} \cdot 2\frac{1}{4}$ equals $7\frac{7}{8}\text{ in}^2$. Record their reasoning for all to see.

Consider displaying the following images and highlighting the areas of the sub-rectangles with fractional side lengths.





Compare and contrast the different strategies. Then, ask students how the area they found would compare to the product $3\frac{1}{2} \cdot 2\frac{1}{4}$. Ask them to calculate the product. Make sure students see that the product of the two numbers is equal to the area of the rectangle.

$$3\frac{1}{2} \cdot 2\frac{1}{4} = \frac{7}{2} \cdot \frac{9}{4} = \frac{63}{8} = 7\frac{7}{8}$$

Access for English Language Learners

Representing: MLR7 Compare and Connect. Use this routine after share their answers and diagrams for the last question. Ask students, "What is the same and what is different?" about the different strategies. Help students make connections by asking, "How was multiplication used in each strategy?". This will help strengthen students' mathematical language use and reasoning about the connection between the area of rectangles and multiplication of fractions. *Design Principle(s): Support sense-making; Maximize meta-awareness*

13.3 Areas of Rectangles

Optional: 10 minutes

This activity also revisits grade 5 work on finding the area of a rectangle with fractional side lengths. Students interpret and match numerical expressions and diagrams. Because the diagrams are unlabeled, students need to use the structure in the expressions and in the diagrams to make a match (MP7). This work reinforces their understanding of the area of rectangles and of multiplication. Specifically, it helps them see how the product of two mixed numbers (or two fractions that are greater than 1) can be found using partial products.

Building On

- 5.NF.B.4.b

Building Towards

- 6.G.A.2

Launch

Give students 2–3 minutes of quiet work time. Emphasize the direction that states, "All regions shaded in light blue have the same area" before students begin working.

Anticipated Misconceptions

In answering the second question (showing that $2\frac{1}{2} \cdot 4\frac{3}{4} = 11\frac{7}{8}$), some students may neglect to use the diagram and simply multiply the whole numbers in the side lengths (the 2 and 4), multiply the fractions (the $\frac{1}{2}$ and $\frac{3}{4}$), and then add them. Allow them to pursue this path of reasoning, but later, when they recognize their answer is less than $11\frac{7}{8}$, refer them to the diagram. Ask them to identify the rectangles whose areas they have calculated and those they have not accounted for, and to think about how they could find the area of the entire rectangle.

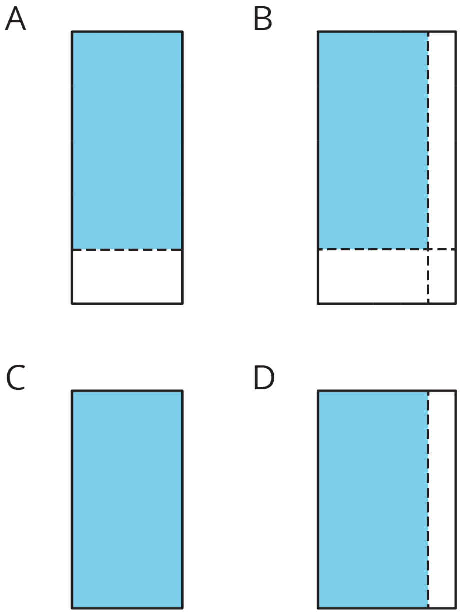
When adding partial products with fractions in different denominators, some students may simply add the numerators and denominators. Remind them to attend to the size of the fractional parts when adding or subtracting fractions.

Student Task Statement

Each of these multiplication expressions represents the area of a rectangle.

$2 \cdot 4$ $\qquad$ $2\frac{1}{2} \cdot 4$ $\qquad$ $2 \cdot 4\frac{3}{4}$ $\qquad$ $2\frac{1}{2} \cdot 4\frac{3}{4}$

1. All regions shaded in light blue have the same area. Match each diagram to the expression that you think represents its area. Be prepared to explain your reasoning.



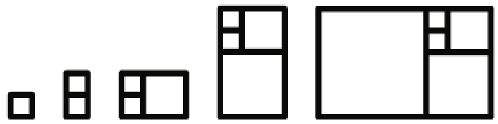
2. Use the diagram that matches $2\frac{1}{2} \cdot 4\frac{3}{4}$ to show that the value of $2\frac{1}{2} \cdot 4\frac{3}{4}$ is $11\frac{7}{8}$.

Student Response

1. $2 \cdot 4$ is Figure C, $2\frac{1}{2} \cdot 4$ is Figure D, $2 \cdot 4\frac{3}{4}$ is Figure A, $2\frac{1}{2} \cdot 4\frac{3}{4}$ is Figure B.
2. $(2 \cdot 4) + \left(\frac{1}{2} \cdot 4\right) + \left(\frac{3}{4} \cdot 2\right) + \left(\frac{3}{4} \cdot \frac{1}{2}\right) = 8 + 2 + \frac{3}{2} + \frac{3}{8} = 11\frac{7}{8}$

Are You Ready for More?

The following rectangles are composed of squares, and each rectangle is constructed using the previous rectangle. The side length of the first square is 1 unit.



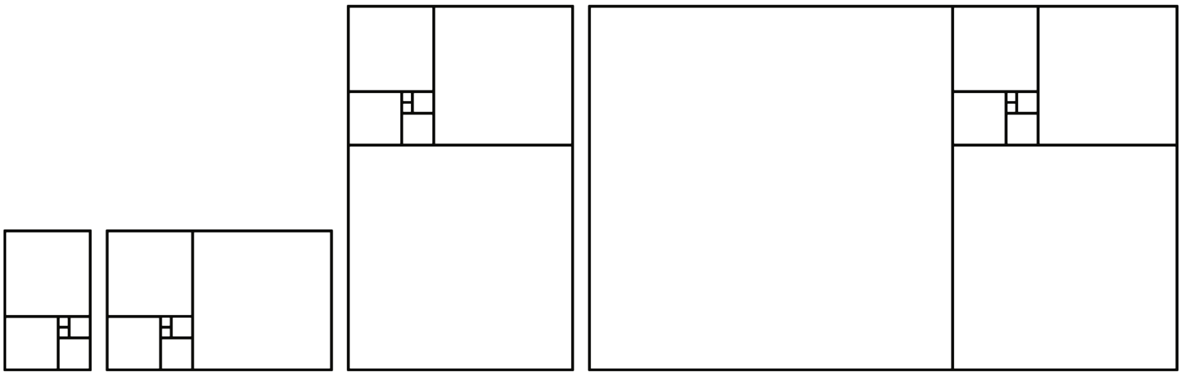
1. Draw the next four rectangles that are constructed in the same way. Then complete the table with the side lengths of the rectangle and the fraction of the longer side over the shorter side.

short side	long side	$\frac{\text{long side}}{\text{short side}}$
1		
1		
2		
3		

2. Describe the values of the fraction of the longer side over the shorter side. What happens to the fraction as the pattern continues?

Student Response

1.



short side	long side	$\frac{\text{long side}}{\text{short side}}$
1	1	1
1	2	2
2	3	$1\frac{1}{2}$
3	5	$1\frac{2}{3}$
5	8	$1\frac{3}{5}$
8	13	$1\frac{5}{8}$
13	21	$1\frac{8}{13}$
21	34	$1\frac{13}{21}$
34	55	$1\frac{21}{34}$

2. Answers vary. The fractions go up and down around a value that is near $1\frac{2}{3}$.

Activity Synthesis

For each diagram, ask one or more students to share which expression they think matches. Ask students to share their reasoning for how they matched the figure to the expression. Consider displaying the four figures for all to see and recording students' reasoning or explanations on the figures. To involve more students in the conversation, consider asking:

- "Who can restate ___'s reasoning in a different way?"
- "Does anyone want to add on to _____'s reasoning?"
- "Do you agree or disagree? Why?"

For the second question, ask students for the area of each section in Figure B. Label each section with its side lengths and its area and display for all to see. If not already articulated by students, highlight that combining all the partial areas gives us a sum of $11\frac{7}{8}$, which is the area of the entire rectangle.

13.4 How Many Would it Take? (Part 2)

15 minutes

This activity consolidates prior work on the area of rectangles and the current work on division of fractions. Students determine how many tiles with fractional side lengths are needed to completely cover another rectangular region that also has fractional side lengths. Besides dividing fractions, students also need to plan their approach, think about how the orientation of the tiles affects their calculation and solution, and attend carefully to the different measurements and steps in their calculation. The experience here prepares students to work with lengths and volumes in the culminating lesson (in which students determine how many small boxes with fractional edge lengths will fit into larger boxes that also have fractional edge lengths).

As students work, identify those whose diagrams or solutions show different tile orientations. Also notice students who consider both ways of laying the tiles before finding the solutions.

Addressing

- 6.NS.A.1

Instructional Routines

- MLR6: Three Reads

Launch

Keep students in groups of 2. Give students 7–8 minutes of quiet work time and 2–3 minutes to share their responses with their partner, or give 10 minutes for them to complete the activity in groups.

Access for English Language Learners

Reading: MLR6 Three Reads. Use this routine to support reading comprehension. Ask students to keep their books or devices closed and display only the task statement without revealing the questions that follow. Use the first read to orient students to the situation. After a shared reading, ask students “what is this situation about?” (Noah is covering a tray with tiles). Consider using photos of these items to ensure that all students understand the words tray, tile, gaps, and overlaps. After the second read, students list any quantities that can be counted or measured, without focusing on specific values (length of tray, in inches; width of tray, in inches; area of tray, in square inches; length of each tile, in inches; width of each tile, in inches; area of each tile, in square inches). During the third read, the question or prompt is revealed. Invite students to discuss possible strategies, referencing the relevant quantities named after the second read.
Design Principle(s): Support sense-making

Anticipated Misconceptions

Students might only determine the amount of tiles needed to line the four sides of the tray. If this happens, suggest that they look at their drawing of the tray and check whether their tiles cover the entire area of the tray.

Student Task Statement

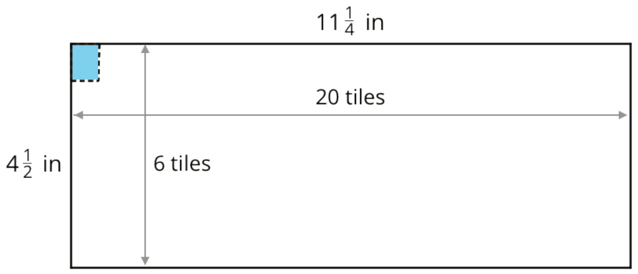
Noah would like to cover a rectangular tray with rectangular tiles. The tray has a width of $11\frac{1}{4}$ inches and an area of $50\frac{5}{8}$ square inches.

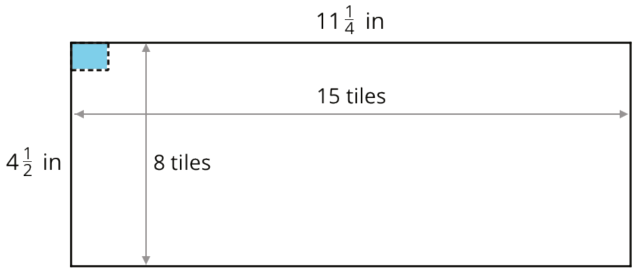
1. Find the length of the tray in inches.
2. If the tiles are $\frac{3}{4}$ inch by $\frac{9}{16}$ inch, how many would Noah need to cover the tray completely, without gaps or overlaps? Explain or show your reasoning.
3. Draw a diagram to show how Noah could lay the tiles. Your diagram should show how many tiles would be needed to cover the length and width of the tray, but does not need to show every tile.

Student Response

1. $50\frac{5}{8} \div 11\frac{1}{4} = \frac{405}{8} \div \frac{45}{4}$, so the length of the tray is $4\frac{1}{2}$ in.
2. If we lay the $\frac{3}{4}$-inch side of the tiles along the $4\frac{1}{2}$-inch side of the tray, we need 6 tiles, because $\left(4\frac{1}{2}\right) \div \frac{3}{4} = 6$, and we'll need 20 tiles along the other side, because $\left(11\frac{1}{4}\right) \div \frac{9}{16} = 20$. So the total number of tiles needed is $6 \cdot 20 = 120$. If we orient the tiles in the other direction, we will need the same number of tiles, but we'll have 8 along the short side and 15 along the long side.

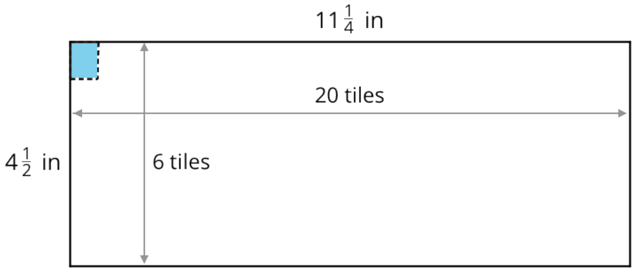
3.

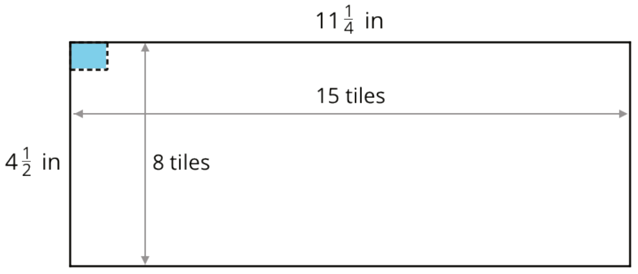




Activity Synthesis

Invite students who chose different tile orientations to show their diagrams and explain their reasoning. Display these two diagrams, if needed.





Point out how in this problem, the two different tile orientations do not matter, as the length and the width of the tiles are factors of both the length and the width of the tray. This means we can fit a whole number of tiles in either direction, and can fit the same number of tiles to cover the tray regardless of orientation.

But if the side lengths of the tiles do not both fit into $11\frac{1}{4}$ and $4\frac{1}{2}$ evenly, then the orientation of the tiles does matter (i.e., we may need more or fewer tiles, or we may not be able to tile the entire tray without gaps if the tiles are oriented a certain way).

Use the opportunity to point out that a diagram does not have to show all the details (i.e., every single tile) to be useful.

Lesson Synthesis

Review the different ways of reasoning about the area of a rectangle with fractional side lengths. If time permits, consider asking students to illustrate each reasoning strategy mentioned.

- "What are some ways that we can find the area of a rectangle that is $5\frac{1}{2}$ cm by $3\frac{1}{2}$ cm?" We can:
    - See how many $\frac{1}{2}$-cm squares cover the rectangle completely and multiply it by the area of each square, which is $\frac{1}{4}$ sq cm
    - Decompose the rectangle into whole centimeter squares (with 1-cm side length) and other rectangles with fractional side lengths, find their areas, and add them
    - Decompose the rectangle into sub-rectangles with whole-number side lengths and fractional side lengths, find their areas, and add them by multiplying the side lengths of the rectangle.

Emphasize that because we can multiply the side lengths of a rectangle (even if they are not whole numbers) to find its area, if we know the area of a rectangle and one side length, we can find the length of the other side by dividing.

- "Suppose we know that the width of a rectangle is $4\frac{3}{5}$ cm and the area is $16\frac{1}{10}$ sq cm. How can we find its length?" (We can find $16\frac{1}{10} \div 4\frac{3}{5} = ?$)
- "How do we check our quotient?" (We can multiply it by the width $4\frac{3}{5}$ and see if we get the given area.)

13.5 Two Frames

Cool Down: 5 minutes

Addressing

- 6.NS.A.1

Student Task Statement

Two rectangular picture frames have the same area of 45 square inches but have different side lengths. Frame A has a length of $6\frac{3}{4}$ inches, and Frame B has a length of $7\frac{1}{2}$ inches.

1. Without calculating, predict which frame has the shorter width. Explain your reasoning.

2. Find the width that you predicted to be shorter. Show your reasoning.

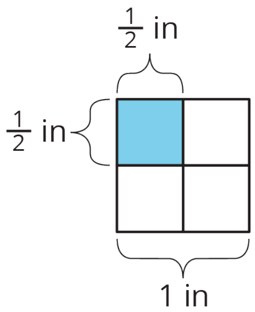
Student Response

1. Frame B has a longer length, so its width is shorter if the two pairs of side lengths produce the same product of 45.

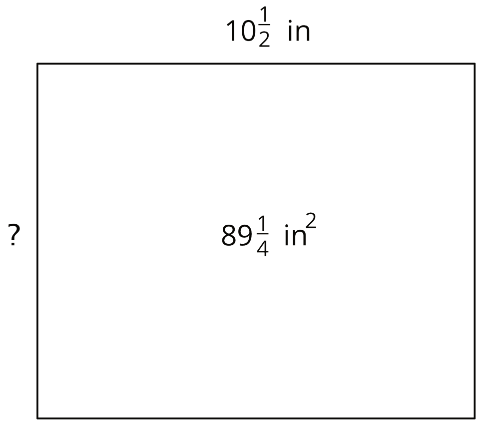
2. 6 inches. Sample reasoning: $45 \div 7\frac{1}{2} = 45 \div \frac{15}{2} = 45 \cdot \frac{2}{15} = 6$

Student Lesson Summary

If a rectangle has side lengths a units and b units, the area is $a \cdot b$ square units. For example, if we have a rectangle with $\frac{1}{2}$-inch side lengths, its area is $\frac{1}{2} \cdot \frac{1}{2}$ or $\frac{1}{4}$ square inches.



This means that if we know the *area* and *one side length* of a rectangle, we can divide to find the *other* side length.



If one side length of a rectangle is $10\frac{1}{2}$ in and its area is $89\frac{1}{4}$ in^2, we can write this equation to show their relationship:

$$10\frac{1}{2} \cdot ? = 89\frac{1}{4}$$

Then, we can find the other side length, in inches, using division:

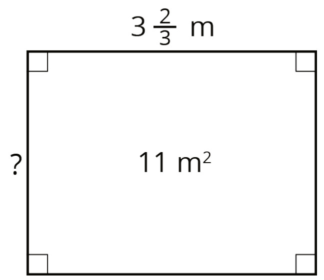
$$89\frac{1}{4} \div 10\frac{1}{2} = ?$$

Lesson 13 Practice Problems

Problem 1

Statement

a. Find the unknown side length of the rectangle if its area is 11 m^2. Show your reasoning.



b. Check your answer by multiplying it by the given side length ($3\frac{2}{3}$). Is the resulting product 11? If not, revise your previous work.

Solution

a. 3 m, because $11 \div \left(3\frac{2}{3}\right) = 3$

b. $3\frac{2}{3} \cdot 3 = 11$

Problem 2

Statement

A worker is tiling the floor of a rectangular room that is 12 feet by 15 feet. The tiles are square with side lengths $1\frac{1}{3}$ feet. How many tiles are needed to cover the entire floor? Show your reasoning.

Solution

$101\frac{1}{4}$ or 102 tiles. Reasoning varies. Sample reasoning: $12 \div \frac{4}{3} = 9$, so 9 tiles are needed to cover the 12 feet of length. $15 \div \frac{4}{3} = \frac{45}{4}$, so $11\frac{1}{4}$ tiles are needed to cover the 15 feet of length. To find the number of tiles, we multiply: $9 \cdot \frac{45}{4} = \frac{405}{4}$ or $101\frac{1}{4}$ tiles, which can be rounded to 102 tiles.

Problem 3

Statement

A television screen has length $16\frac{1}{2}$ inches, width w inches, and area 462 square inches. Select **all** the equations that represent the relationship of the side lengths and area of the television.

A. $w \cdot 462 = 16\frac{1}{2}$

B. $16\frac{1}{2} \cdot w = 462$

C. $462 \div 16\frac{1}{2} = w$

D. $462 \div w = 16\frac{1}{2}$

E. $16\frac{1}{2} \cdot 462 = w$

Solution

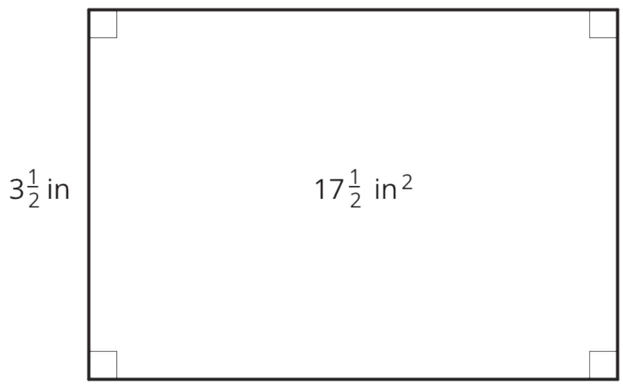
["B", "C", "D"]

Problem 4

Statement

The area of a rectangle is $17\frac{1}{2}$ in^2 and its shorter side is $3\frac{1}{2}$ in. Draw a diagram that shows this information. What is the length of the longer side?

Solution



5 in. (The sides perpendicular to the $3\frac{1}{2}$-inch side each have length in inches of $\left(17\frac{1}{2}\right) \div \left(3\frac{1}{2}\right) = \frac{35}{2} \cdot \frac{2}{7} = 5$.)

Problem 5

Statement

A bookshelf is 42 inches long.

a. How many books of length $1\frac{1}{2}$ inches will fit on the bookshelf? Explain your reasoning.

b. A bookcase has 5 of these bookshelves. How many feet of shelf space is there? Explain your reasoning.

Solution

a. 28 books. $42 \div 1\frac{1}{2} = 42 \div \frac{3}{2} = \frac{84}{3} = 28$

b. $17\frac{1}{2}$ feet. $5 \cdot 42 = 210$. 210 inches is $17\frac{1}{2}$ feet, since $210 \div 12 = 17\frac{1}{2}$.

(From Unit 4, Lesson 12.)

Problem 6

Statement

Find the value of $\frac{5}{32} \div \frac{25}{4}$. Show your reasoning.

Solution

$\frac{1}{40}$ ($\frac{5}{32} \div \frac{25}{4} = \frac{5}{32} \cdot \frac{4}{25}$, which is equal to $\frac{1}{40}$)

(From Unit 4, Lesson 11.)

Problem 7

Statement

How many groups of $1\frac{2}{3}$ are in each of these quantities?

a. $1\frac{5}{6}$

b. $4\frac{1}{3}$

c. $\frac{5}{6}$

Solution

a. $1\frac{1}{10}$

b. $2\frac{3}{5}$

c. $\frac{1}{2}$

(From Unit 4, Lesson 6.)

Problem 8

Statement

It takes $1\frac{1}{4}$ minutes to fill a 3-gallon bucket of water with a hose. At this rate, how long does it take to fill a 50-gallon tub? If you get stuck, consider using a table.

Solution

$\frac{125}{6}$ minutes (or equivalent). Possible strategy:

gallons of water	time in minutes
3	$\frac{5}{4}$
300	125 (or equivalent)
50	$\frac{125}{6}$ (or equivalent)

(From Unit 2, Lesson 14.)