Lesson Four: Parts and Wholes

Overview and Big Ideas

The lesson is intended to capitalize on structuring the space enclosed by a rectangle with a whole number of units to develop consideration of the meaning of partial units of area measure. This theme revisits that of the second lesson, where partial units were first considered, but in this lesson, the partial units are expressed as products of fractional units. To bridge to fractional units, students first investigate area models of the distributive property. The distributive property becomes a useful resource for the children when they start to find areas of rectangles with fractional length units.

Materials

Rulers

Set of rectangles *(see Supplemental Materials at the end of this lesson)*

Rectangles should measure:

3” x 5”

3” x 5 ½”

3 ½” x 5 ½”

Part 1

Area Model of the Distributive Property

Show, with rectangles and area measurement, why it must be true that:

3 x (5 + 3) – (3 x 5) + (3 x 3)

Is this relationship true for all numbers that are greater than or equal to zero? Why do you think so?

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Teacher Note

This activity allows students to use their understanding of area to make sense of the distributive property. To begin, the equation might be presented with units (such as inches):

3 inches x (5 inches + 3 inches) = (3 inches x 5 inches) + (3 inches x 3 inches)

The area model for this equation is shown in Figure 1. Once the students have experience creating area models for this equation and others, they may be given equations without units.

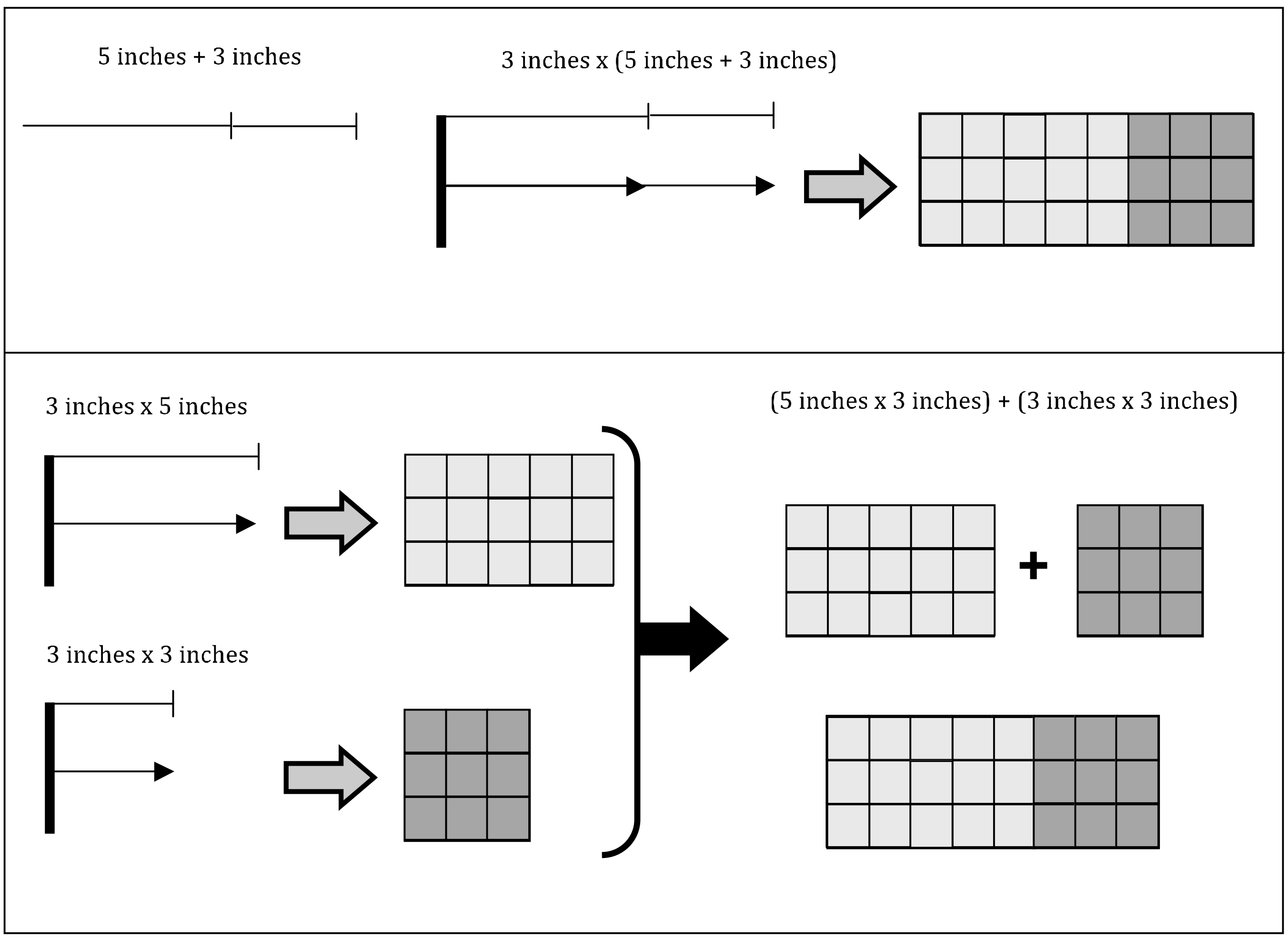

Figure 1. Area model of the distributive property

Part 2

Area with Partial Units

Students receive the first rectangle (3” x 5” — *see Supplemental Materials*). They should be asked to find the area, the perimeter and draw the units of area measure. The students should share their solutions as a class. The class should then proceed to the second rectangle and then the third, following the same activity structure each time. Students should be encouraged to use the formula for area they created in Lesson 3. The students should be additionally encouraged to use the distributive property to when multiplying fractions *(see the Teacher Note below)*.

Problems and Corresponding Questions

Problem 1: 3” x 5” rectangle

Questions for Individual Work:

What is the area of this figure?
What is the perimeter?
Draw the units of measure.

Problem 2: 3” x 5 ½” rectangle

Questions for Individual Work:

What is the area of this figure?
What is the perimeter?
Draw the units of measure.

Problem 3: 3 ½” x 5 ½” rectangle

Questions for Individual Work:

What is the area of this figure?
What is the perimeter?
Draw the units of measure.

Teacher Note

Students should be encouraged to use the distributive property when solving the fractional problems. Often students find it easier to multiply fractional quantities when using the distributive property. Additionally, as an extension activity, the students may be asked to explain with a drawing what the distributive property means. The strategies to solve problem 2 and problem 3 using the distributive property are shown below.

Problem 2

3 in. x 5 ½ in. = 3 in. x (5 in. + ½ in.)

= (3 in. x 5 in.) + (3 in. x ½ in.)

= 15 in.^{2} + 1 ½ in.^{2}

= 16 ½ in.^{2}

Problem 3

3 ½ in. x 5 ½ in. = (3 in. + ½ in.) x (5 in. + ½ in.)

= (3 in. x 5 in.) + (3 in. x ½ in.) + (½ in. x 5 in.) + (½ in. x ½ in.)

= 15 in.^{2} + 1 ½ in.^{2} + 2 ½ in.^{2} + ¼ in.^{2}

= 19 ¼ in.^{2}

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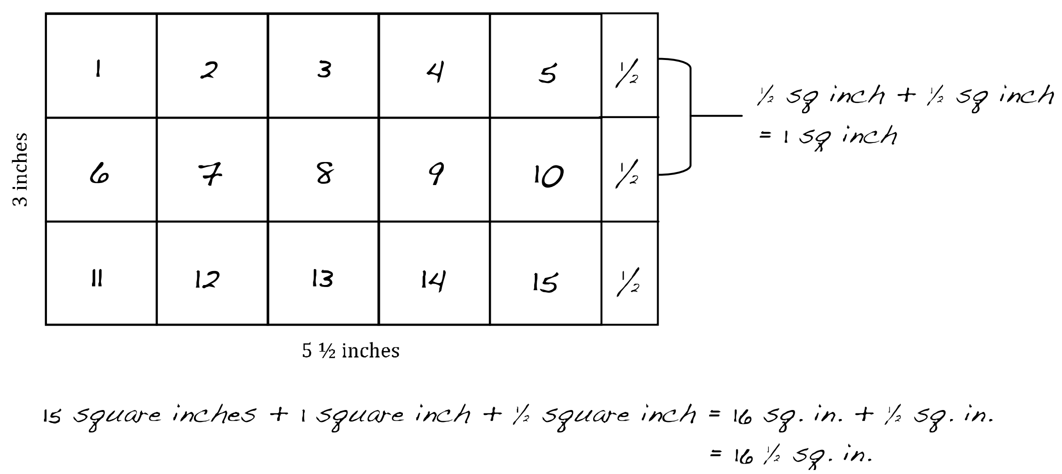
Students' Partitions of the Rectangles

When students find the solutions for the 3" by 5 ½" rectangle and the 3 ½" by 5 ½" rectangle, they may partition the rectangle into 1 inch squares or ¼ inch squares. In discussion, these different solutions should be compared, and it is important to push the students to consider what the unit of measure is.

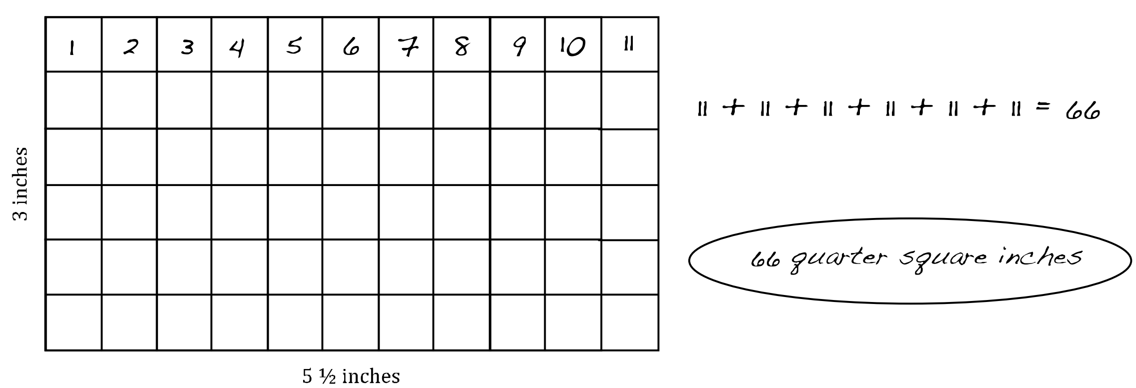
- **What are your units of measure? (If a student measured in ¼ inch squares)**
- **What would the area of the rectangle be in square inches?**

Students also often call ¼ inch squares "½ inch squares" because the side lengths are ½ inch. If students do so, they should be asked to consider how much of a square inch the unit takes up. How much space does it cover? **Types of student solutions for the 3" by 5 ½" rectangle are shown below:**

Finding the area with 1 inch squares

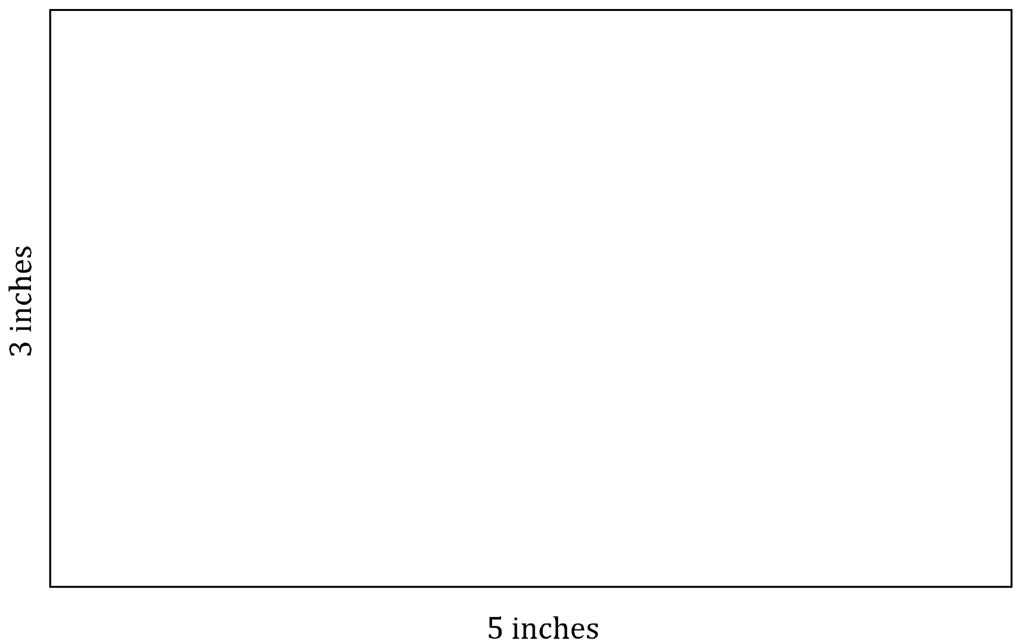


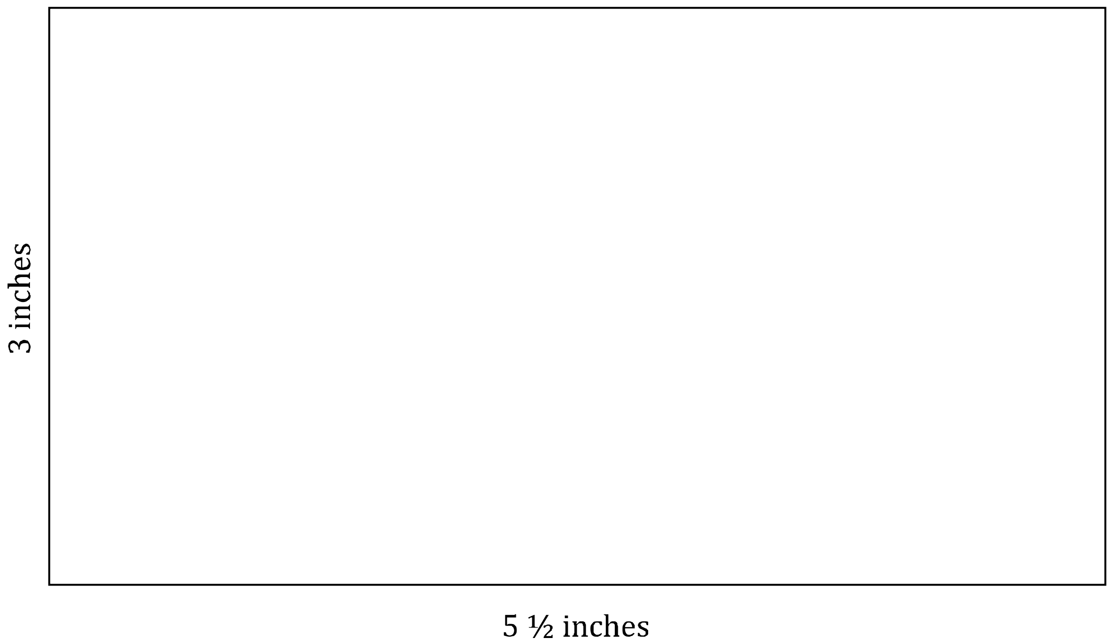
Finding the area with ¼ inch squares

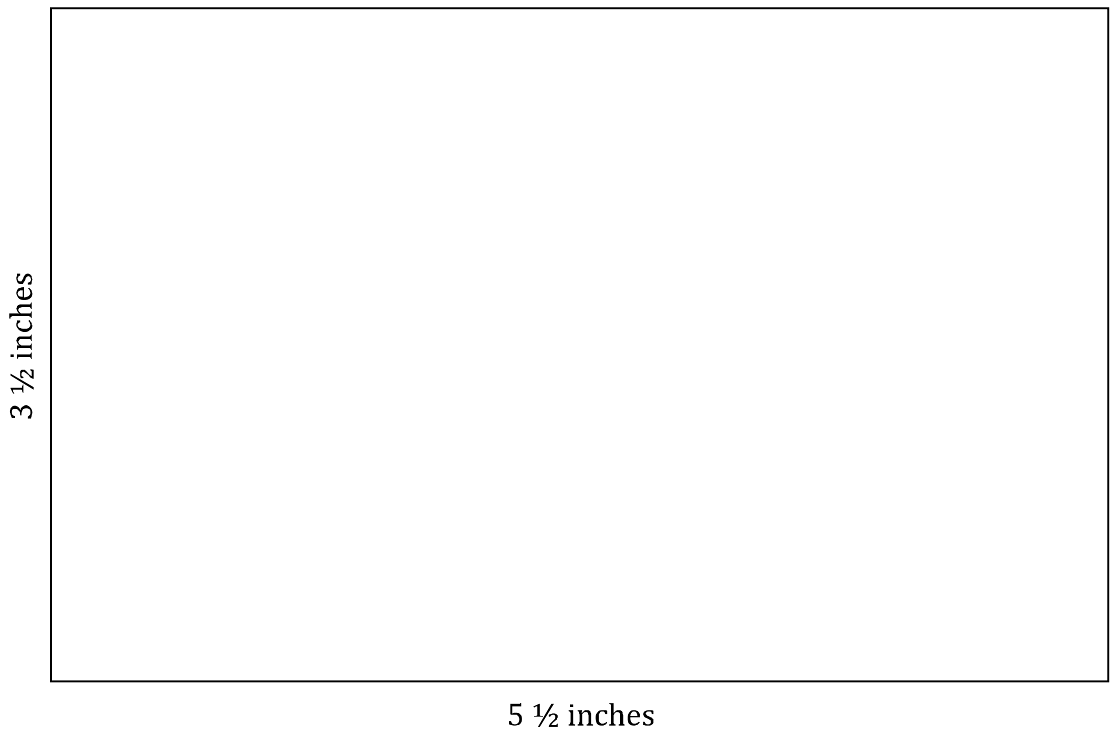


****Note:** Students who find the solution this way may say the answer is 66 half square inches.*

Supplemental Materials




3 inches
5 ½ inches


3 ½ inches
5 ½ inches