BRIDGES IN MATHEMATICS 3

GRADE 3 SUPPLEMENT

Set D5 Measurement: Area in U.S. Customary Units

Includes

Skills & Concepts

- ★ determine area by finding the total number of same-sized units of area that cover a shape without gaps or overlaps
- ★ select appropriate units, strategies, and tools for solving problems that involve estimating or measuring area
- ★ solve problems involving areas of rectangles and squares
- ★ find the areas of complex shapes by dividing those figures into basic shapes (e.g., rectangles, squares)
- ★ measure necessary attributes of shapes to use area formulas to solve problems

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Bridges in Mathematics Grade 3 Supplement
Set D5 Measurement: Area In U.S. Customary Units

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Bridges in Mathematics is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

The Math Learning Center is a nonprofit organization serving the education community. Our mission is to inspire and enable individuals to discover and develop their mathematical confidence and ability. We offer innovative and standards-based professional development, curriculum, materials, and resources to support learning and teaching. To find out more, visit us at www.mathlearningcenter.org.

Set D5 ★ Activity 1

ACTIVITY

Measuring Area: U.S. Customary Units

Overview

Students work together to list some things that might be best measured in square inches, square feet, and square yards. Then they measure their math journals in square inches.

Skills & Concepts

- ★ determine area by finding the total number of same-sized units of area that cover a shape without gaps or overlaps
- ★ select appropriate units, strategies, and tools for solving problems that involve estimating or measuring area
- ★ solve problems involving areas of rectangles and squares
- ★ find the areas of complex shapes by dividing those figures into basic shapes (e.g., rectangles, squares)
- ★ measure necessary attributes of shapes to use area formulas to solve problems

You'll need

- ★ Area: U.S. Customary Units (page D5.3, run 1 copy on a transparency)
- ★ Measuring My Math Journal (page D5.4, run a class set)
- ★ 1" Grid Paper (page D5.5, run 10–15 copies)
- ★ yard stick
- ★ rulers (class set)
- ★ color tile (class set)
- ★ Word Resource Card (area)
- ★ Student Math Journals

Instructions for Measuring Area: U.S. Customary Units

1. Post the area card on the whiteboard and take a minute to review this term with the class. Be sure students understand that when people measure area, they find the total number of square units needed to cover a 2-dimensional surface.

2. Now display the Area: U.S. Customary Units overhead. Ask the class to study the words and pictures shown on the transparency and think quietly about different surfaces that could be measured using these units.

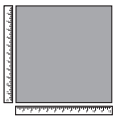
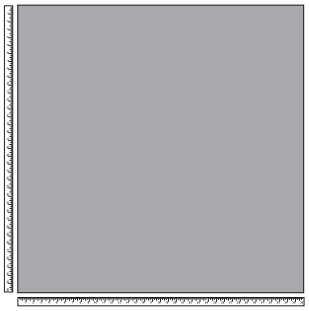
3. Have them write the phrases *square inches*, *square feet*, and *square yards* in their math journals and then record at least one area they would measure with each unit. Encourage them to look at their rulers, as well as the class yardstick, for reference as they think about how big each unit would be.

4. When they have finished writing, ask students to share their ideas and record them on the overhead. Encourage students to add to the lists in their journals as others share their suggestions.

Activity 1 Measuring Area (cont.)

Set D5 Measurement: Area in U.S. Customary Units B ack ine Run 1 copy on a transparency

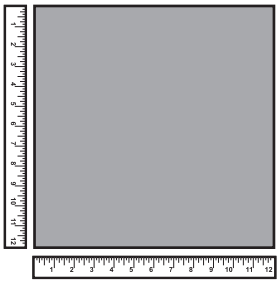
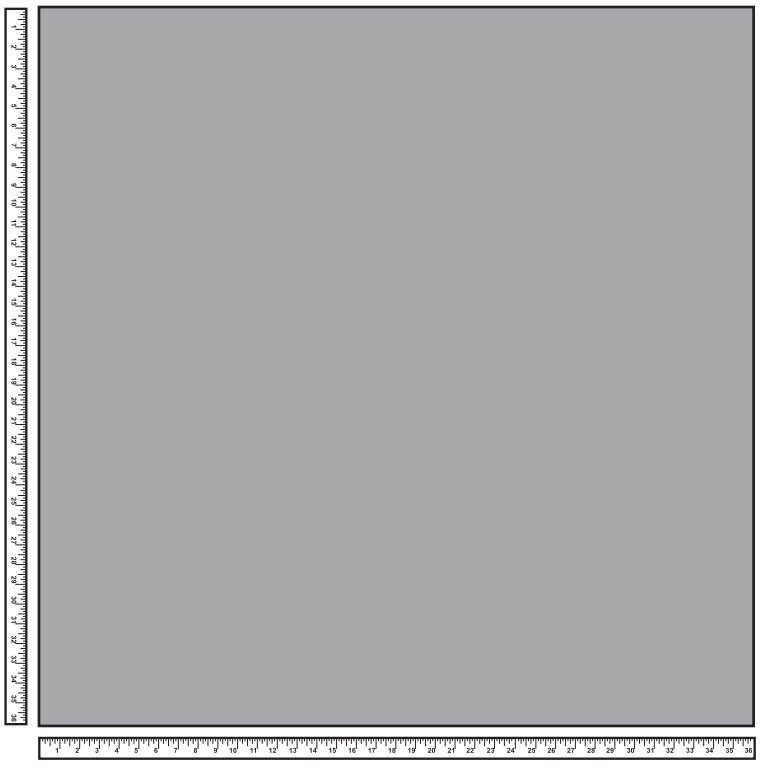
Area: U.S. Customary Units

Square unit	Things we would measure with this square unit
Square Inch	book CD case envelope magazine piece of paper
Square Foot 	door window fabric for making a dress curtains the rug in my room
Square yard 	our classroom floor the hallway gym floor ceiling the playground the soccer field

5. Give each student a copy of Measuring My Math Journal. Review the sheet together, and discuss the measuring tools available to them. Which might be most efficient?

6. Once students understand what to do, have them get started. Circulate as they work, and encourage them to devise methods that are more efficient than covering their math journals with tiles and then counting the tiles one by one.

Area: U.S. Customary Units

Square unit	Things we would measure with this square unit
Square Inch 	
Square Foot 	
Square yard 	

NAME _____ **DATE** _____

Measuring My Math Journal

1 Estimate the area of the front cover of your math journal in square inches.

Estimate: _____

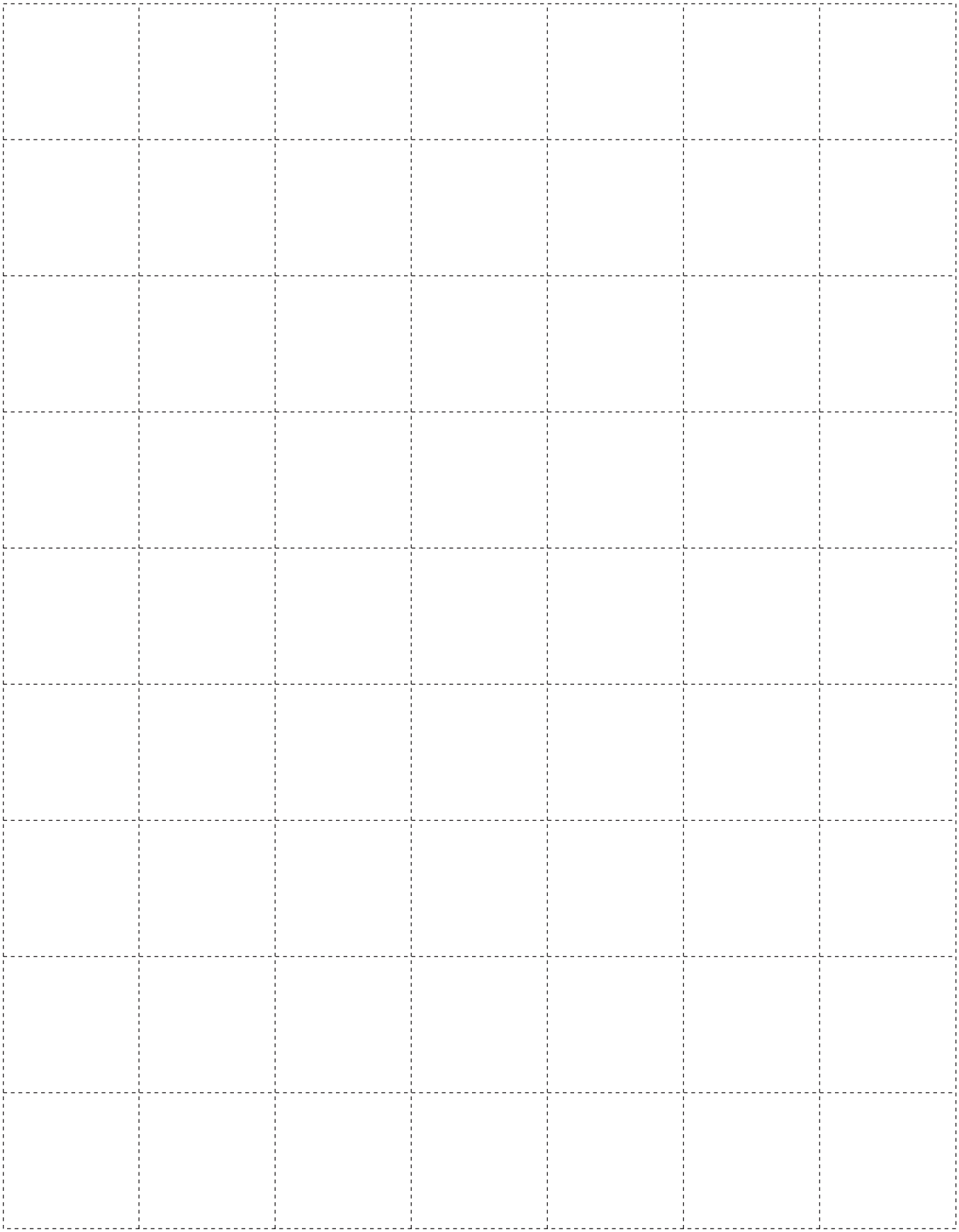
2 Using measurement tools from your classroom (ruler, tile, grid paper, etc.), determine the area of the front cover of your math journal in square inches. Use words, pictures, and numbers to explain how you got your answer.

Area of my math journal:

CHALLENGE

3 If you were to make a book cover for your entire math journal, front and back, approximately how many square inches of paper would you need? Explain your answer below.

1-Inch Grid Paper



Set D5 ★ Activity 2

ACTIVITY

Rainbow Rectangles

Overview

Students estimate and measure the area of paper rectangles, working toward increasingly efficient methods, including the use of the area formula.

Skills & Concepts

- ★ determine area by finding the total number of same-sized units of area that cover a shape without gaps or overlaps
- ★ select appropriate units, strategies, and tools for solving problems that involve estimating or measuring area
- ★ solve problems involving areas of rectangles and squares
- ★ measure necessary attributes of shapes to use area formulas to solve problems

You'll need

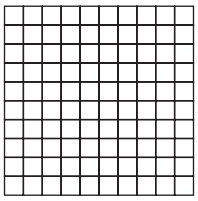
- ★ Rainbow Rectangles (page D5.10, run a class set)
- ★ construction paper rectangles (see Advance Preparation)
- ★ rulers (class set)
- ★ color tile (class set)
- ★ tape

Advance Preparation You will need a set of 6 construction paper rectangles in the following colors and sizes for each group of 4 students: 6" × 9" (blue), 7" × 8" (green), 9" × 9" (yellow), 8" × 10" (red), 10" × 12" (purple), 12" × 12" (orange)

Instructions for Rainbow Rectangles

1. Explain that you're going to do some more work with area today. Hold up a single tile and ask students to tell you what they think its area is in square inches. If necessary, have a volunteer measure the dimensions of the tile and work with students to establish the fact that each of the color tile has an area of exactly 1 square inch.

2. Distribute sets of tile. Ask students to work in groups of 4 to build a square with an area of exactly 100 square inches. After they've had a few minutes to work, have students share and compare their results.



Students *We thought it was going to be really big, but it's not so big after all.*
We knew it was going to be a 10" × 10" square because 10 × 10 is 100.
We each made 2 rows of 10 and put them together. Then we each made a little row of 5 and hooked them onto the big square. It went pretty fast for us.

Units Activity 2 Rainbow Rectangles (cont.)

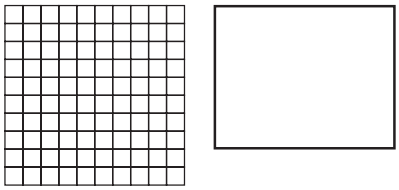
3. Ask each group to measure the dimensions of the square they've just built with the inch side of their ruler. What can they tell you about the square now? As volunteers share with the class, press them to explain their thinking.

Corey *It's 10 inches on both sides.*

Teacher *What is the area of your square, and how do you know?*

Students *It's 100 square inches because that's what you told us to do.*
It's 100 square inches because we used 100 tiles, and each tile is 1 square inch.
There are 10 in each row, right? If you count by 10s, you get 100 in all.
If you just multiply 10 × 10, it makes 100.

4. Now hold up one of the red construction paper rectangles you've prepared. Ask students to estimate the area in square inches, using their tile square as a visual benchmark.



Students *That paper rectangle is a little smaller than our square.*
I think it's just smaller along one side. Can we hold it up against our square?

Teacher *Sure, here it is. If you want to stand up where you are so you can see what Vanesa is doing, go ahead. Raise your hand if you have an estimate. What do you think the area of the red paper rectangle is in square inches?*

Students *Less than 100. Maybe about 60.*
I think it's 10 along the top and maybe 7 or 8 inches along the side. I'd say 70 or 80 square inches.
I agree with 70.

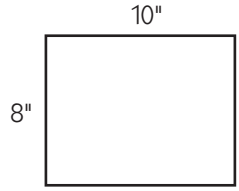
5. Now ask students to pair-share ideas for finding the actual area of the red paper rectangle. Challenge them to think of a method that's more efficient than covering the paper with individual tile. Some may propose laying the rectangle on top of the tile square they just built. Others may suggest laying tile across the top to see how wide the paper is, and then laying tile down the side to see how many rows would be required without actually laying out every single tile.

6. Try some of the suggestions students have made to determine the area of the red paper rectangle. If it doesn't come from the class, propose measuring the side and top of the rectangle and multiplying the two numbers. Ask students to evaluate your suggestion. Will it work? Will it yield the same answer as the other methods? Why or why not?

Michael *I think it'll work. We already know from holding it right on top of our tiles that it's 10 inches across the top and 8 inches along the side. 8 × 10 is 80, and we already found out that it's 80 square inches.*

Activity 2 Rainbow Rectangles (cont.)

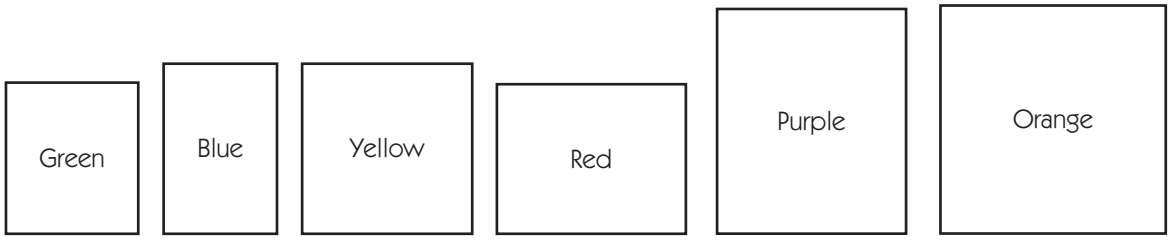
7. Tape the red rectangle to the board. Ask a volunteer to measure and label the dimensions as the others watch. Record the numbers on the board and then have students multiply them. Ask them to comment on the results. Does the method work? Why?



8" × 10" = 80 square inches

Students *The 10 tells you how many tiles fit across the top. The 8 tells you how many rows of tiles you'd need.*
You can just multiply them together to get the answer.
This is cool! It's way faster than covering the paper with tiles.

8. Ask students to take their tile squares apart and put them back in their bags for now. Give each table a set of 6 construction paper rectangles. Ask them to use their estimation skills to place the 6 in order, from least to most area. Let them know that the red rectangle in the set is the same size as the one you just measured together. Have them discuss their thinking as they sequence the rectangles, and then choose a few volunteers to share their ideas with the class.



Mirabel *You can definitely see that the orange one is the biggest, and then the purple. It's a little harder to tell with the green and blue, and the yellow and red.*

Andre *We put them on top of each other. We think blue is the smallest, and then green. We're not sure about the yellow and red, but we agree that purple and orange are the biggest.*

9. Ask students to get out their rulers (if they haven't done so already), and give each student a copy of the Rainbow Rectangles worksheet. Encourage them to work together in their groups, even though each student needs to complete his or her own sheet. Circulate as they work and continue to challenge them to find methods more efficient than covering each of the paper rectangles with tile and then counting the tile one by one. If they are using the area formula comfortably, press them to explain how and why it works.

INDEPENDENT WORKSHEET

See Set D5 Independent Worksheet 1 for more practice estimating and measuring area in customary units.

NAME _____ **DATE** _____

Rainbow Rectangles

1 Work with the students in your group to put the rectangles in order, from least to most area.

2 After you've agreed on the order, write the colors of the rectangles where you think they belong in the boxes below.

Least Area					Most Area

3 Estimate the area of each rectangle and then measure it in square inches. Remember to label your work with the correct units (square inches). Record your work on the chart below. (Hint: Use the red rectangle as a benchmark to help make your estimates.)

Color Rectangle	Your Estimate in Square Inches (sq. in.)	Actual Area in Square Inches (sq. in.)

NAME _____ **DATE** _____

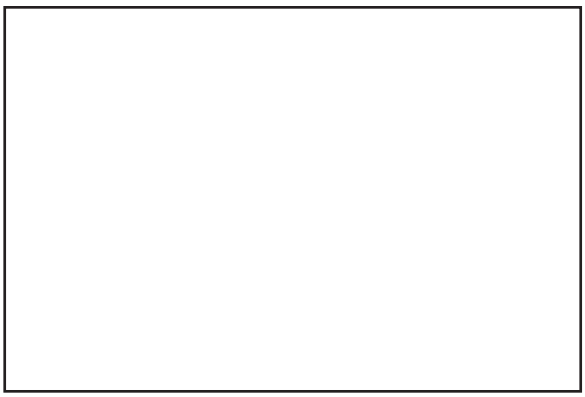
Set D5 ★ Independent Worksheet 1

INDEPENDENT WORKSHEET

Estimating & Measuring Area in Square Inches

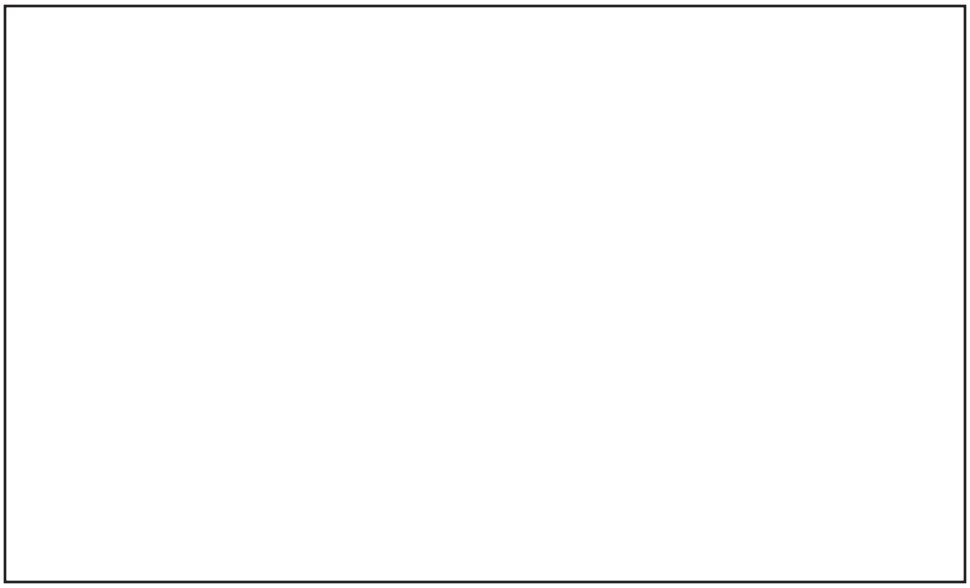
1 Estimate the area of each rectangle. Then use tile or a ruler to find the area in square inches.

a



Estimate: _____ sq. in. Area: _____ sq. in.

b

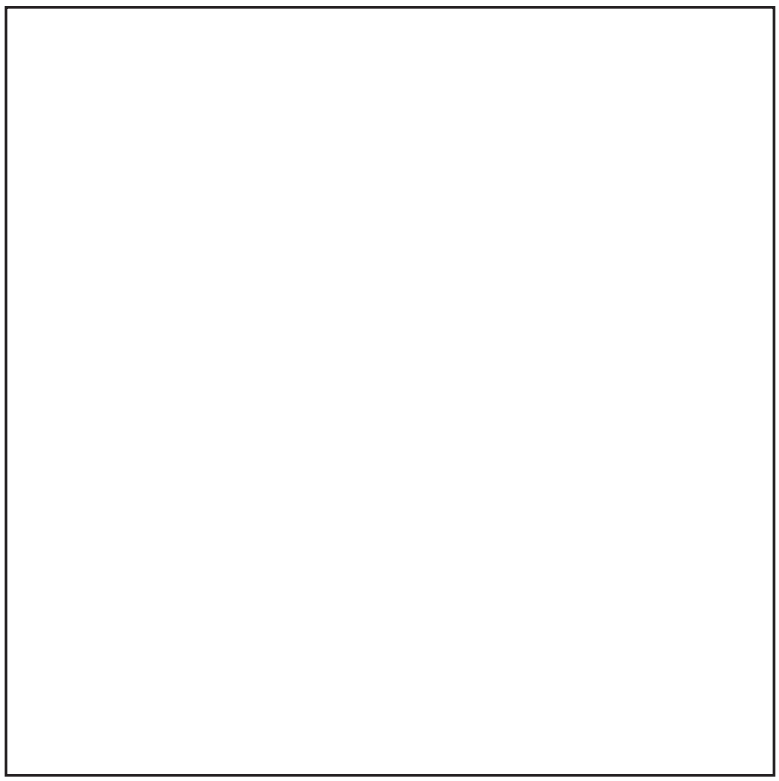


Estimate: _____ sq. in. Area: _____ sq. in.

(Continued on back.)

Independent Worksheet 1 Estimating & Measuring Area in Square Inches (cont.)

c



Estimate: _____ sq. in. Area: _____ sq. in.

2 In the space below, draw a 2" × 4" rectangle Label the dimensions and the area of the rectangle.

(Continued on next page.)

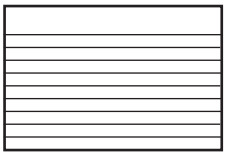
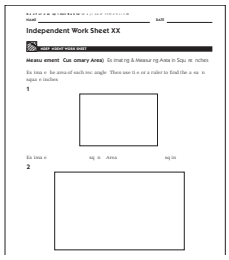
NAME _____ **DATE** _____

Independent Worksheet 1 Estimating & Measuring Area in Square Inches (cont.)

3 James says all you have to do to find the area of a 4" × 5" rectangle is multiply 4 × 5 Do you agree? Why or why not?

4 Estimate the area of the first object on the chart below in square inches. Record your estimate in square inches. Find the area of the object using 1-inch tile or a ruler and record the measurement. Find the difference between your estimate and the actual measurement. Record the difference in the last column.

Continue estimating, finding the area, and finding the difference for the other objects below and on the next page. Use what you know about the area of the first object to estimate the others.

Object	Your Estimate (in square inches)	Actual Area (in sq. in.)	The Difference (in sq. in.)
a A Notecard 			
b This Worksheet 			
c Cover of a Chapter Book from your classroom 			

Independent Worksheet 1 Estimating & Measuring Area in Square Inches (cont.)

Object	Your Estimate (in square inches)	Actual Area (in sq. in.)	The Difference (in sq. in.)
d Top of Your Calculator 			
e Your Classroom Door