Area of Complex Figures

Standards:
3MG 1.2: Estimate or determine the area and volume of solid figures by covering them with squares or by counting the number of cubes that would fill them.

4MG 1.4: Understand and use formulas to solve problems involving perimeters and areas of rectangles and squares. Use those formulas to find the areas of more complex figures by dividing the figures into basic shapes.

Vocabulary:
Area: The number of *square units* needed to cover the inside of a region or plane figure without any overlap. (Macmillan McGraw-Hill Glossary)

Rectangle: a parallelogram having four right angles.

Parallelogram: a quadrilateral having both pairs of opposite sides parallel to each other.

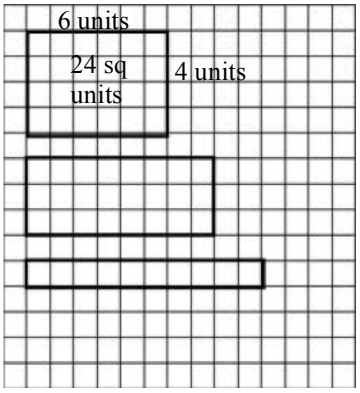
Complex Figure: A shape that is made up of two or more shapes.

Materials:
Large grid paper, scissors, glue sticks, plain white paper or construction paper, pencils.

Warm-Up: see attached

Lesson:
Model to students drawing three (or more) different sized rectangles on a piece of large grid paper.

While drawing a rectangle ask students to tell you what makes up a rectangle. [two parallel opposite sides, four right angles] "What is area and how does it relate to shapes or geometry?" [parallel sides, closed figure, four right angles, counting square units that cover the whole region, etc.]



We can show area by drawing a rectangle and counting the number of square units within the rectangle. Ask students to count with you the number of square units needed to cover the inside of each rectangle. [1,2,3,4,5,6,…..19,20,21,22,23,24] – Write the area inside the rectangle.

"Is there a faster way to figure out the area?" [multiply 6 units (point to the length) by 4 units (point to the width) to get 24 square units] – Label the length and width.

Tap into **prior knowledge** by showing a multiplication chart and how when we multiply two numbers it creates a square or a rectangle.

GO BACK and emphasize that a rectangle is a quadrilateral having both pairs of opposite sides parallel to each other. Label each side of the rectangles (not shown in diagram but important for developing the concept of a complex figure).

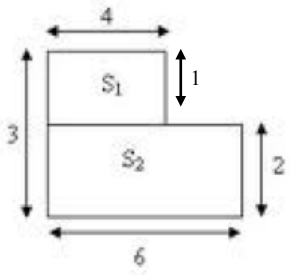
Choral Response: If this side of the rectangle is 6 units (point to it), then what is this side? [6 units]. If this side of the rectangle is 4 units (point to it), then what is this side? [4 units]

Student Talk: (Think, Pair, Share)
Ask students to create 2 different sized rectangles on their grid paper. As they think about what size they will draw on the paper, direct them to determine the area of their rectangle the same way the teacher modeled – either counting the squares or multiplying the length and width. Ask students to label the sides of their rectangles.

On the board: *draw two different sized rectangles (one can be a square)
*determine the area of each rectangle or square and write how you figured it out
* label each side of the shapes
* take turns sharing your shapes with your partner

Bring a student to the front of the class to model "how" to share rectangles; describing the length, width, and area, and "how" they found it (by counting each square or multiplying length by width).

Create Complex Figures:
Model to student groups how to cut out one of their shapes and create a new shape, without overlapping, with their partner's shape. Model example:



Create a new figure on white paper and glue together without overlapping. (The new figure should not create a new rectangle)

Ask students, as you are modeling putting together the two rectangles, "How is finding the area of a complex figure related to finding the area of rectangles?" [a complex figure is just adding together the area of two or more shapes.]

"If we take my shape (S1) with an area of 4 square units (label the length of 4 and width of 1), and add that to my partner's shape (S2) with an area of 12 square units (label the length of 6 and width of 2), how many total square units is the complex figure?" [16 square units]

Next to the complex figure on the white paper write out the new area:

$S_1 + S_2 =$ Area of Complex Figure

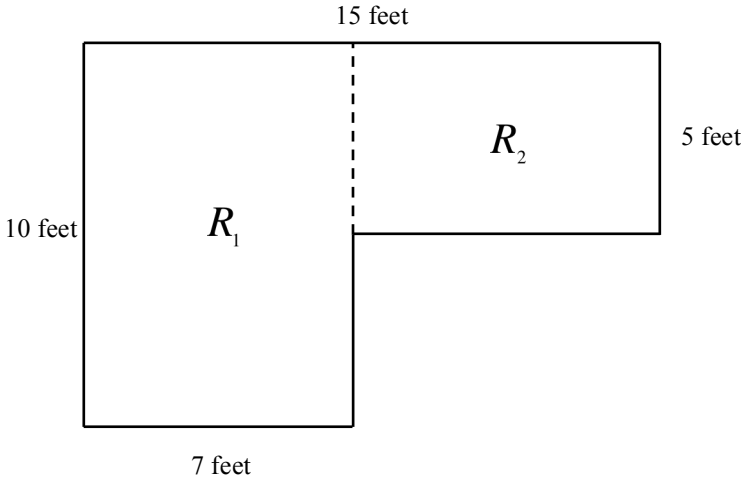
4 sq units + 12 sq units = 16 sq units

Note: Those groups that finish before others may create a second complex figure with their remaining shapes.

Post completed papers around the classroom as others continue to work. It will encourage other groups to finish their work and lower the fear of asking what to do "next". Students will feel more confident if they see correct completed work.

Find the Area of a Complex Figure ("garden") with missing lengths:

In student notebooks, ask students to draw the complex figure (garden) below. Label the sides with them one at a time. [15 feet, 10 feet, etc]



"To find the area of this complex figure, can we break the figure into smaller parts?" [two rectangles]

Use a dotted line to show how to break apart the complex figure. (one way is shown)

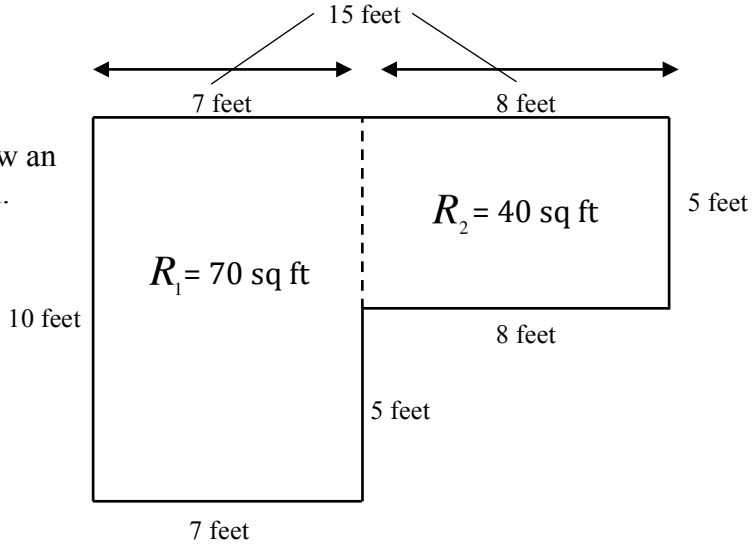
Label rectangles R_1 and R_2

"What were the two ways we found the area of a rectangle?" [counting the squares or multiplying the length by width of the rectangle]

"Since we don't have squares to count, we will have to use the formula of length X width to find the area."

"How do we find the area of our first rectangle (R_1)?" [$7\,feet \times 10\,feet = 70\ square\ feet$]
"If this is 7 feet (point to the bottom length of R1), then what is the length of the opposite side?" [7 feet] – draw an arrow to show the length and label.

Pointing from the end of R1 to the dotted line, "If this is 7 feet and the total length is 15 feet, then what is the missing feet?" [8 feet] (**Think, Pair, Share**)– draw an arrow to show remaining length and label.



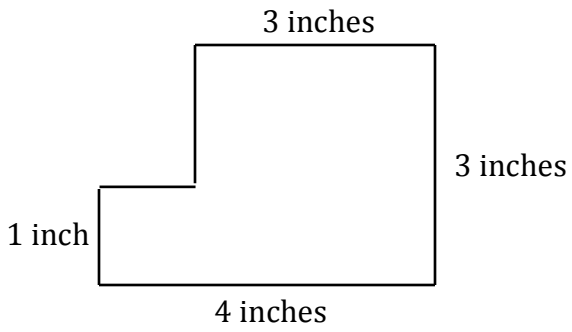
"Can we now find the area of our second rectangle?" **(TPS)**
[$8\,feet \times 5\,feet = 40\ square\ feet$]

Reinforce the definition of a rectangle – opposite sides have same length. Label remaining sides to show this concept.

Add the areas together: 70 sq ft + 40 sq ft = 110 sq ft
The garden is 110 square feet.

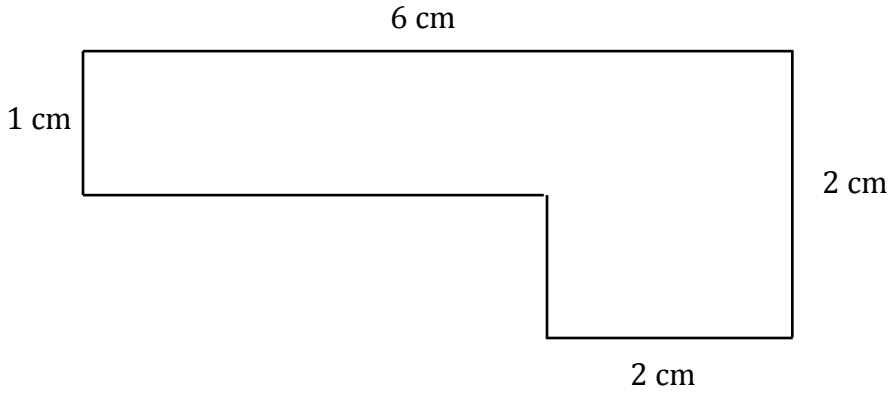
You-Try 1: (work in pairs)

Find the area of the complex figure:



You-Try 2: (individual work)

Find the area of the complex figure:



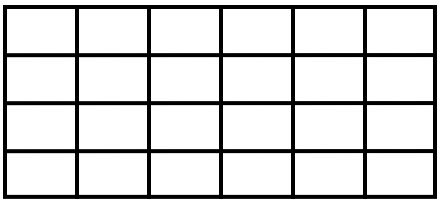
Closure: "Where do we see complex figures in our real world?" [house, gardens, schools, park] We have to find the area of so many things in our daily lives, which is why it is so important to be able to find the area of a complex figure.

Homework:

Warm-Up

CST: Grade 3 MG 1.2

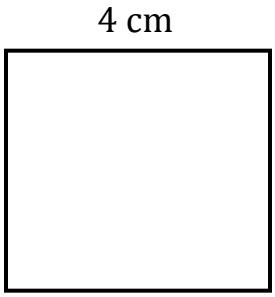
A rectangle is 6 inches long and 4 inches wide. What is the area of the rectangle?



A 24 square inches
B 30 square inches
C 74 square inches
D 120 square inches

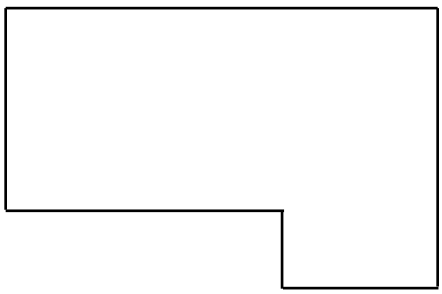
Review: Grade 3 and 4

Find the perimeter of the square.



Current: Grade 4

A complex figure is made up of two or more shapes. Draw dotted lines to break up the complex figure into smaller parts.



Other: Grade 4

Martin is mowing a lawn that is rectangular in shape. The lawn is 25 feet wide and 10 feet long. What is the area of the lawn?

Draw a picture and find the area.