

## Mathematics Lesson Plan (for Grade 5)

For the lesson on Monday August 6, 2001  
At Turnbull School, San Mateo, CA  
Instructors: Nobuaki Hattori & Aki Murata

### 1. Title of the lesson: Area of Complex Figures

### 2. Goal

- Using the formulas for calculating the areas of squares and rectangles, be able to find the area of a complex figure.
- By comparing their own ideas with their classmates' ideas, notice that there are multiple methods for finding the area of a complex figure

### 3. Relationship between the Lesson and the Mathematics Content Standards for California Public Schools K-Grade12.

#### Grade One

Identify, describe, and compare triangles, rectangles, squares, and circles, including the faces of three-dimensional objects.(2.1)

#### Grade Two

Put shapes together and take them apart to form other shapes (e.g., two congruent right triangles can be arranged to form a rectangle).(2.2)

#### Grade Three

Students describe and compare the attributes of plane and solid geometric figures and use their understanding to show relationships and solve problems.(2.0)

#### Grade Four

Students understand perimeter and area.(1.0)

Measure the area of rectangular shapes by using appropriate units, such as square centimeter ( $\text{cm}^2$ ), square meter ( $\text{m}^2$ ), square kilometer ( $\text{km}^2$ ), square inch ( $\text{in}^2$ ), square yard ( $\text{yd}^2$ ), or square mile ( $\text{mi}^2$ ).(1.1)

Recognize that rectangles that have the same area can have different perimeters.(1.2)

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.(1.4)

#### Grade Five

Students understand and compute the volumes and areas of simple objects.(1.0)

Although the content covered in this lesson is originally for grade four, we have chosen it as a bridge to the very beginning of grade five.

### 4. Instruction of the lesson

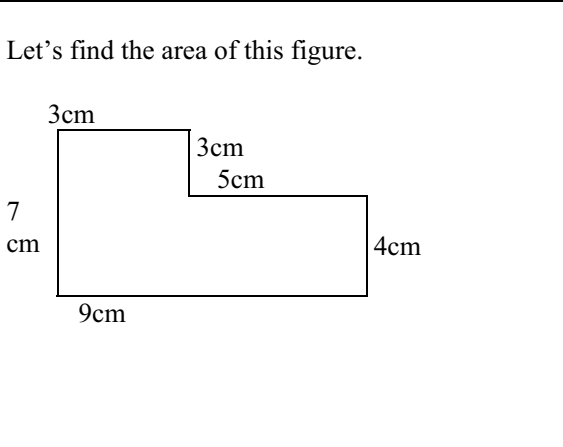
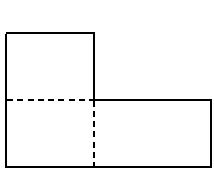
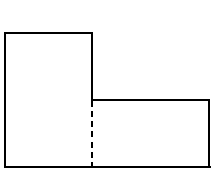
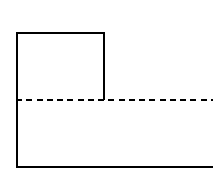
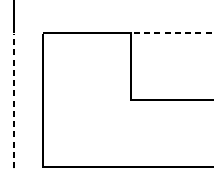
The students have had experience composing various figures using geo boards and pattern blocks in prior years. Therefore, they can understand that one figure can be composed of several figures. In addition, they have studied the basic concept of area and how to calculate it for the square and rectangle.

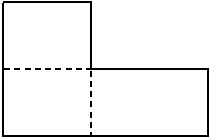
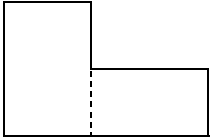
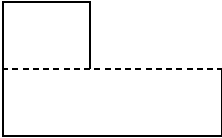
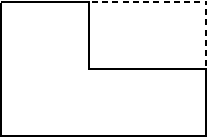
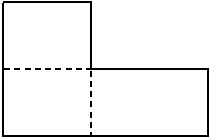
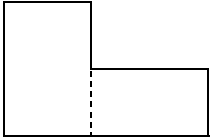
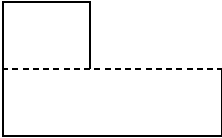
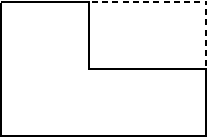
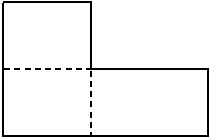
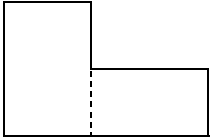
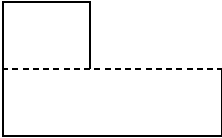
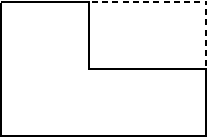
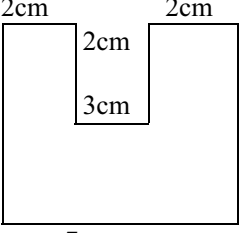
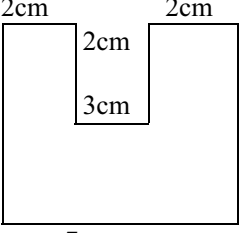
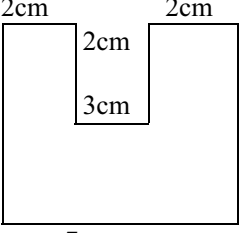
In this lesson, students will use their prior knowledge to measure a complex figure. It is necessary that students (a) see the figure as a combination of several figures or (b) see the figure as a rectangle with one part missing. These two perspectives are both important and it is the purpose of this lesson to help the students recognize these two perspectives and use them to find the area of the complex figure.

Naturally, some students will probably imagine only one method. We will understand this from their individual activities and we will let students present their ideas in a whole-class discussion. By listening to each other's ideas, students will be able to recognize the multiplicity of solutions and the similarities among them. This is how student learning will be deepened.

Today's key topic of composition and decomposition of figures to find area will be essential for finding the area of parallelograms and triangles, content covered later in 5<sup>th</sup> grade.

### 5. Lesson procedure

Activities	Teacher support	Evaluation
<p>1. Review how to find the area of rectangles and squares.</p> <ul style="list-style-type: none"> <li>• Area of rectangle = base X height</li> <li>• Area of square = one side X one side</li> </ul>	<p>Provide an opportunity for students to recall the formulas for finding the areas of rectangles and squares. The teacher writes them on the board.</p>	
<p>2. Introduction to the problem.</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p>Let's find the area of this figure.</p>  </div>	<p>Show the enlarged complex figure on a white board. Distribute worksheets (without the specified length for each side.)</p> <p>In order to find the area of the shape, for which sides of the shape do we need to know their lengths?</p> <p>Let's find a method with which we can find the area using the least number of known lengths of the sides.</p> <p>After finding one method, try to see if there is any other way to find the area.</p> <p>Tell the students to write in as much detail as they can how to solve the problem (a formula).</p>	
<p>3. Finding the area (individually.)</p> <div style="display: flex; justify-content: space-around; border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; padding: 5px; text-align: center;">  <p>Draw lines vertically and horizontally, and find the areas of the three rectangles.</p> </div> <div style="border: 1px solid black; padding: 5px; text-align: center;">  <p>Draw a vertical line and find the areas of the two rectangles.</p> </div> <div style="border: 1px solid black; padding: 5px; text-align: center;">  <p>Draw a horizontal line and find the areas of the two rectangles.</p> </div> <div style="border: 1px solid black; padding: 5px; text-align: center;">  <p>Draw a line to create a large rectangle and subtract the area of the small rectangle.</p> </div> </div>	<p>Assess students' individual understanding. Give hints to the students who are having difficulty finding a solution method.</p>	<p>Did each student think of his/her own solution? (Check their worksheets)</p>

<p>4. Discuss the solutions (whole-class learning).</p>	<p>Let students explain various solutions in front of the class. Prepare enlarged figures to illustrate them.</p>										
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<p>(a)  <math>12+16+20=48</math>  A. <math>48\text{cm}^2</math>  Number of sides used---4</p>	<p>(b)  <math>28+20=48</math>  A. <math>48\text{cm}^2</math>  Number of sides used---4</p>	<p>(c)  <math>12+36=48</math>  A. <math>48\text{cm}^2</math>  Number of sides used--4</p>	<p>(d)  <math>63-15=48</math>  A. <math>48\text{cm}^2</math>  Number of sides used---4</p>								
<p>The solutions (a) (b) (c) are quite similar. The solution (a) is a bit complicated. We can use the solution (d) to find the area too. We could find the area by using the lengths of four sides only. We can find the area of a complex figure by dividing it into rectangles or squares or by subtracting a missing part from a large rectangle!</p>											
<p>5. Summary and Extension  Write down what you learned in this lesson on the worksheet and present to the class.</p>	<p>Let students who completed the worksheet present what they learned in this lesson.</p>										
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center; width: 30%;">  </td> <td style="vertical-align: top; width: 70%;"> <p>How can you find the area of this figure?  Let's try!  5cm</p> </td> </tr> </table>			<p>How can you find the area of this figure?  Let's try!  5cm</p>	<p>Give the worksheet to the students who want to try a challenge.</p>							
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**6. Evaluation**

- a. Did the students try to find the area using not just one but a variety of methods?
- b. During discussion, were the students able to present their own method and compare it with classmates' methods?
- c. Did the students summarize what they learned in this lesson using their own words?