

# Decomposition and Area

## Summary

The students will be able to determine the area of a trapezoid by the composition and decomposition of rectangles, triangles, and parallelograms.

## Materials

Square piece of paper (one per student, app. 4 x 4)

Student-made tangram set

Math journal or notebook

Books:

- *Fractions With Tangrams*  
 , by Larry Ecklund, ISBN:9781583242551
- *Elementary and Middle School Mathematics*  
 , by John A Van De Walle, ISBN: 1402918348

## Background for Teachers

Students will create their own set of tangrams to use in this lesson. Even if you have commercially made sets, it is essential to this lesson that students create their own. This initial activity is laying the groundwork for helping students understand that shapes can be decomposed into other shapes. Decomposing a large square into the tangram shapes is creating awareness of decomposition and composition. Be sure to use and emphasize the proper geometric vocabulary.

This lesson assumes that students are competent in finding the area of rectangles and squares. A review of this knowledge may be helpful before beginning the lesson. This lesson works well with students working independently or as partners or small groups.

## Intended Learning Outcomes

Develop a positive learning attitude toward mathematics.

Become effective problem solvers by selecting appropriate methods, employing a variety of strategies, and exploring alternative approaches to solve problems.

Reason logically, using inductive and deductive strategies and justify conclusions.

Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notation of mathematics.

Connect mathematical ideas within mathematics, to other disciplines, and to everyday experiences.

Represent mathematical ideas in a variety of ways.

## Instructional Procedures

Invitation to Learn:

Students need a square piece of paper (app. 4 in. x 4 in.) and a pair of scissors. Give directions aloud as students create their own set of tangrams from a square piece of paper.

Fold the square piece of paper in half to create two congruent triangles. Cut along the fold.

Set one triangle aside.

Fold one of the triangles in half and cut along the fold. Set the two new pieces aside.

With the triangle from Step 2, gently fold in half without creasing just to find the midpoint of the longest side. Then fold the vertex of the right angle down so it rests on the midpoint of the longest side. Crease and cut. Set the new little triangle aside.

Using the trapezoid you created in Step 4, fold it in half and cut on the crease, creating two new

trapezoids.

Fold one of the new trapezoids into a square and a triangle by folding the two base angles together. Crease and cut.

Using the other trapezoid you made in Step 5, fold the right base angle onto the opposite obtuse angle. Crease and fold.

You now have seven pieces that complete your own set of tangrams.

#### Instructional Procedures:

"We are going to find the area of each of these shapes. Please sort them into two piles. One pile for the shapes you think you know how to find the area of, and one pile for shapes you think will be difficult." (Discuss the sorting results and have students tell you why some look easy and some look hard.)

"I will give you a hint to get started. The square has an area of four square units. Please trace the square in your journal and label its area inside."

"What two shapes will fit together right on top of the square? What is the area of those two triangles together? What would the area of each triangle alone be? What can you tell me about the relationship between those two triangles? Please trace each of the small triangles in your journal and label the area."

"Using what we know about the area of those three shapes, find the area of each of the remaining pieces. Be sure to trace and label each shape in your journal. If you finish early, try to put all the shapes back into the big original square."

"What is the area of the big original square using all seven pieces?"

"Build a small trapezoid using the parallelogram and one small triangle. What is the area?"

"Add one more piece to make a different trapezoid. What is its area? How do you know?"

"Build a trapezoid using four pieces. Find the area. Trace this shape in your journal and record the area. If you finish early, try to build a trapezoid using all seven pieces."

"Discuss how we can find the area of large or unusually shaped objects by decomposing them into smaller or more familiar pieces whose area we can easily find."

#### Lesson and Activity Time Schedule:

Invitation to Learn: 15 minutes

Instructional Procedure: 40 minutes

Each activity is 30 minutes.

Total lesson and activity time is 90 minutes.

#### Activity Connected to Lesson:

Students repeat finding the area of each shape, this time with the square being 9 sq. units.

Students find the area of each shape knowing only that the area of the big square, using all seven pieces, is 64 square units.

Students choose their own value for the little square (can't use a number already used in the lesson). Then find the value of each piece. This will most likely involve fractions and/or decimals for some pieces.

Any students who finish early can trade Step 3 with a neighbor and solve each other's.

Give all these directions at the beginning and post them somewhere easily visible to allow students to work at their own pace. The goal is for all students to get through Steps 1 and 2.

Steps 3 and 4 are for differentiation purposes.

All work must be recorded in a journal or notebook.

#### Extensions

Have students create their own tangram design. Then give a partner the area of one shape and have him or her find the total area of the picture.

#### Family Connections:

Because students made their own tangrams, they should be allowed to take them home and can teach their parents and siblings about the relationships among all the shapes and how you can find the area of each shape just by knowing one of them.

#### Assessment Plan

Observe and take notes throughout activity. Watch for students who cannot follow instructions due to not understanding math vocabulary.

During the independent practice of finding area, make notes about students' number sense (i.e., Can she quickly tell that if two congruent triangles fit on the square then their area must be one square unit each?).

Review student journals for accuracy upon completion of attached activity.

#### Authors

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