

Tangram Puzzle

3rd/4th Grade

Standard 3: Students will describe and analyze attributes of two-dimensional shapes.

3rd Objective 2: Demonstrate the meaning of congruence through applying transformations.

4th Objective 3: Visualize and identify geometric shapes after applying transformations.

Intended Learning Outcomes:

1. Develop a positive learning attitude toward mathematics.
2. Become effective problem solvers by selecting appropriate methods, employing a variety of strategies, and exploring alternative approaches to solve problems.
3. Reason logically, using inductive and deductive strategies and justify conclusions.
4. Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notation of mathematics.
5. Connect mathematical ideas within mathematics to other disciplines and to everyday experiences.
6. Represent mathematical ideas in a variety of ways.

Background Information

Geometry not only provides a means for describing, analyzing, and understanding structures in the world around us but also introduces an experience of mathematics that complements and supports the study of other aspects of mathematics such as number and measurement. Geometry offers powerful tools for representing and solving problems in all areas of mathematics (Navigating through Geometry, NCTM, 2002).

Learning with understanding is essential to mathematical literacy. Mathematical literacy is having procedural and computational skills as well as conceptual understanding. Mathematical proficiency has five interwoven and interdependent strands: understanding, computing, applying, reasoning, and engaging (National Research Council, 2002). This activity is intended to promote mathematical literacy geometric proficiency within your students.

Materials

4" x 4" piece of construction paper for every student plus a few extras for errors
an envelope for every child
a pair of scissors for every student

Invitation to Learn

A long time ago in China, there lived a man called Tan. Tan's greatest possession was a fine ceramic tile. One day Tan was carrying his tile to show the emperor. He tripped and the tile fell and broke into seven geometric shapes: two large triangles, a medium size triangle, a square, and a parallelogram. Tan spent the rest of his life trying to put the tile back together again. He was not successful, but he did succeed in creating many different geometric designs.

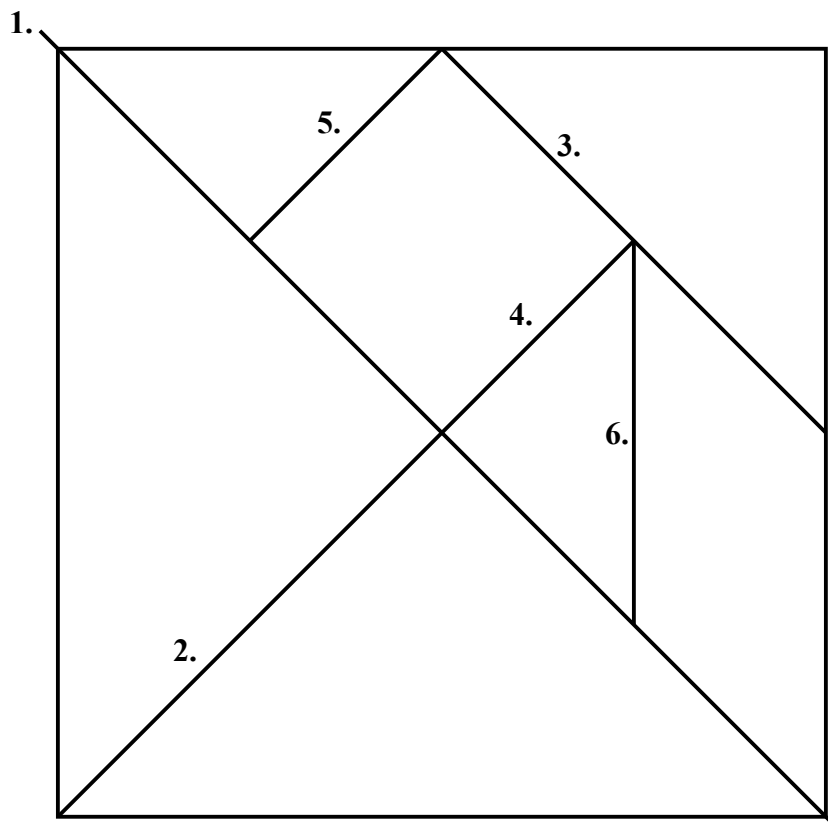
Tan enjoyed creating the designs. His friends also enjoyed trying to recreate his designs. Tan's puzzles, later called tangrams, were passed on through generations and from country to country.

Instructional Procedures

Activity 1

When working with Tangrams, students are often asked to form a square by putting the pieces together. This often results in frustration. This task allows students to cut the pieces to form a square convincing them that a square can be made. Give each child a 4" x 4" piece of construction paper. Read the following directions to your students as you demonstrate the process while they follow along.

1. Fold the square in half along a diagonal. Unfold and cut on the crease.
2. Take one of the halves and fold it in half forming two smaller congruent triangles. Unfold and cut on the crease. Set those two pieces aside.
3. Take the remaining large triangle and touch the top point of the triangle so that it touches the middle of the bottom edge. You should now have a small triangle and a trapezoid. Unfold and cut on the crease. Put the small triangle in the pile with the other two triangles.
4. Take the trapezoid and fold it in half so you have two congruent trapezoids with each side looking something like a shoe.
5. Take one of the shoes with the longest part at the bottom and fold it in half so you have a square on one side and a triangle on the other. Unfold and cut on the crease. Put the pieces in the pile with all your other shapes.
6. Take the other shoe with the longest part at the bottom. Do you see where the laces would tie if it were really a shoe? Fold it so the heel touches where the shoelaces would tie. You should have a small triangle on one side and a parallelogram on the other. Unfold and cut on the crease.
7. You should have seven pieces altogether.



Now have the students attempt to reassemble the square.

Challenges for those who finish early:

- Create a triangle using all seven tangram pieces.

When students have completed the activity, pull them back together for a whole group discussion. Ask the following questions:

- Do you have any advice for someone who was not able to solve the puzzle?
- Did you have to use any slides (translations), flips (reflections), or turns (rotations) to solve the puzzle?

Have them put all seven pieces in their envelope and put it in their desk for the next day's activity.

Activity 2

Construct a parallelogram using all seven pieces. Sketch your solution. Was there anything you did yesterday when you formed the square that helped you form a parallelogram today?

Students must explain their thinking in words and pictures by:

1. Producing a visual representation of possible combinations.
2. Writing a description of the reasoning and justification of the process they used as well as their solution.