

Tantalizing Tangrams

Connections to the mathematics TEKS

- (4.8) Geometry and spatial reasoning. The student identifies and describes lines, shapes, and solids using formal geometric language.

The student is expected to:

- (A) identify right, acute, and obtuse angles
- (B) identify models of parallel and perpendicular lines
- (C) describe shapes and solids in terms of vertices, edges, and faces

- (4.9) Geometry and spatial reasoning. The student connects transformations to congruence and symmetry.

The student is expected to:

- (A) demonstrate translations, reflections, and rotations using concrete models
- (B) use translations, reflections, and rotations to verify that two shapes are congruent
- (C) use reflections to verify that a shape has symmetry

- (4.15) Underlying processes and mathematical tools. The student communicates about Grade 4 mathematics using informal language.

The student is expected to:

- (A) explain and record observations using objects, words, pictures, numbers, and technology

- (4.16) Underlying processes and mathematical tools. The student uses logical reasoning to make sense of his or her world.

The student is expected to:

- (A) make generalizations from patterns or sets of examples and non examples



Mathematics overview

Students identify attributes of polygons and practice geometric vocabulary.

Lesson Overview

Students explore polygons by manipulating tangram pieces.

Materials

9" x 9" construction paper squares

scissors

Tangram Grid (a blackline master appears at the end of this lesson)

Lesson resources

Ann Tompert, *Grandfather Tang's Story*, Dragonfly, 1997.

Marilyn Burns, *About Teaching Mathematics: A K-8 Resource*, Pearson Learning, 2000.

Related resources

Jean Kerr Stenmark, Virginia Thompson, and Ruth Cossey, *Family Math*, Lawrence Hall of Science, 1986.

Online Tangram Puzzle at enchantedmind.com/tangram/tangram.htm

Clarifying discussions

Online Tangram Tutorial at www.uconnect.net/~advreason/tantutor.htm

Set-up (to set the stage and motivate the students to participate)

1. Tell the legend of the tangram as a flannel-board story, using *Grandfather Tang's Story* by Ann Tombert.
2. Demonstrate how to make the tangrams and have students follow along with you. Use appropriate terminology as the tangram pieces are created (e.g., isosceles right triangle, congruent, similar, etc.). (4.8A)
3. Have students compare the attributes of various pieces. (4.8A, B, C; 4.9B, C)



4. Have students learn a specific name or description (such as medium right triangle) for each tangram piece to aid in communication within and between groups. (4.8A, 4.15A)
5. Discuss the definitions and characteristics of the shapes listed on the Tangram Grid. For example, How many pairs of parallel sides does a trapezoid have? Why is it important for us to decide on one particular definition of trapezoid? (4.8A, B, C; 4.9C)
6. Have students work in small groups to find the given shapes with the given number of pieces to complete the Tangram Grid. (4.9A, B, C)

Teacher notes *(to personalize the lesson for your classroom)*

Guiding Questions

(to engage students in mathematical thinking during the lesson)

- Could you reflect, rotate, or replace pieces to make a new shape? (4.9A, B)
- Could you make that shape another way? (4.9B)
- What strategies are you using? (4.16A)
- Could you replace one piece in a shape with two pieces? Two pieces with one piece? (4.9B)
- Which piece seems to be the easiest to use? The hardest? Why? (4.9A, B, C; 4.15A)
- Which pieces do you seem to use most often? Least often? Why? (4.9A, B, C; 4.15A)
- How do you know that what you have made is a square (trapezoid, etc.)? (4.8A, B, C; 4.15A)



Teacher notes (to personalize the lesson for your classroom)

Summary Questions

(to direct students' attention to the key mathematics in the lesson)

To determine students' abilities to identify shapes' characteristics and use appropriate geometric vocabulary, ask questions such as:

- What kinds of triangles did you make? (4.8A)
- How did you decide if your shape was a square, a trapezoid, etc.? (4.8A, B, C; 4.15A)
- How did the definitions of the shapes help you? (4.8A, B, C; 4.15A)

To encourage students to reflect on their problem-solving processes, ask questions such as:

- Which pieces did you tend to use more than others? Why? (4.9A, B, C; 4.15A)
- What are some other ways to construct each of the shapes? (4.9A, B; 4.15A, 4.16A)
- What strategies did your group use for finding shapes? (4.16A)

Teacher notes (to personalize the lesson for your classroom)



Assessment Tasks

(to identify the mathematics students have learned in the lesson)

- Have students compile a class glossary.
- Have students make a class poster display.
- Have students write summary statements or a paragraph about what they learned about polygons.

Teacher notes (to personalize the lesson for your classroom)

Extensions *(to lead students to connect the mathematics*

learned to other situations, both within and outside the classroom)

- Students can find all the ways to make each shape with a given number of pieces.
- Students can develop an argument for why there is no six-piece square.
- Students can design a display where all the solutions could be posted (perhaps one poster for each shape).

Teacher notes (to personalize the lesson for your classroom)



Tangram Grid

use this number of pieces to form a 	SQUARE	RECTANGLE (that is not a square)	TRIANGLE	TRAPEZOID	PARALLELOGRAM (that is not a rectangle)
1					
2					
3					
4					
5					
6					
7					

