

## TANGRAM AREAS

### Performance Standard (7A/9B/9C).G

Identify geometric shapes and their areas in a seven-piece tangram and use those pieces to determine the area of a second figure and to construct a third figure accordingly:

- *Mathematical knowledge*: identify relative size relationships of geometric shapes and find their area,
- *Strategic knowledge*: find the area of each shape, determine the fractional area of a tangram that is present in another figure, and construct another figure using pieces of the tangram, and
- *Explanation*: explain completely and clearly what was done and why it was done.

### Procedures

1. Provide students with sufficient learning opportunities to develop the following in order to (7A) measure and compare quantities using appropriate units, instruments and methods, (9B) identify, describe, classify and compare relationships using points, lines, planes, and solids, and (9C) construct convincing arguments and proofs to solve problems:
  - Develop and discuss strategies to find the area of combined shapes,
  - Describe, classify and justify relationships among types of two- and three- dimensional objects using their defining properties,
  - Solve problems using properties of polygons and circles, and
  - Create and critique arguments concerning geometric ideas and relationships.
2. Provide each student a copy of the "Tangram Areas" task sheet and the rubric. Have students review and discuss the task to be completed and how the rubric will be used to evaluate it. (If actual tangram pieces are not available a template has been provided so you can have them cut their own pieces from card stock. Please note the template and drawing in the problem may not be the same scale as commercial tangrams. The figure in part B is drawn to the same scale as the tangram template provided.)
3. Have students work individually to solve the 3 problems. Do not help the students or guide their thinking as they solve the problem.
4. Evaluate each student's work using the rubric and its guide to determine the performance level. Give each student a score in each of the three categories, scoring each part of the problem separately. Minor errors in computation include making errors in actual addition or multiplication, rounding incorrectly. Major errors include using the wrong operation or formulas, or not using the correct relationship between figures (e.g., saying piece D is  $\frac{1}{4}$  of piece A, instead of  $\frac{1}{2}$ ). Evaluate each part as follows:
  - Part A: the students should clearly describe the relationship between the various pieces, using correct numerical relationships and correct terminology for the names of the pieces. Each of the large isosceles right triangles has an area of 2 sq. units, the middle-sized isosceles right triangle has an area of 1 sq. unit, and each of the two small isosceles right triangles has an area of  $\frac{1}{2}$  sq. unit. The parallelogram has an area of 1 sq. unit.
  - Part B: the students should provide a clearly labeled drawing showing which pieces they used to create the new figure, as well as a detailed description of how they know the new shape is  $\frac{7}{8}$  of the original tangram square. A student who says that the area is  $\frac{6}{7}$  because 6 of the 7 original pieces are used should receive no more than a 1.
  - Part C: the students should provide a clearly labeled drawing showing which pieces they used to create the new figure, as well as a detailed description of how they know the fraction of the original square that is represented by the figure. Because the pieces used can vary, the exact area of their shape will vary also.

### Examples of Student Work follow

### Resources

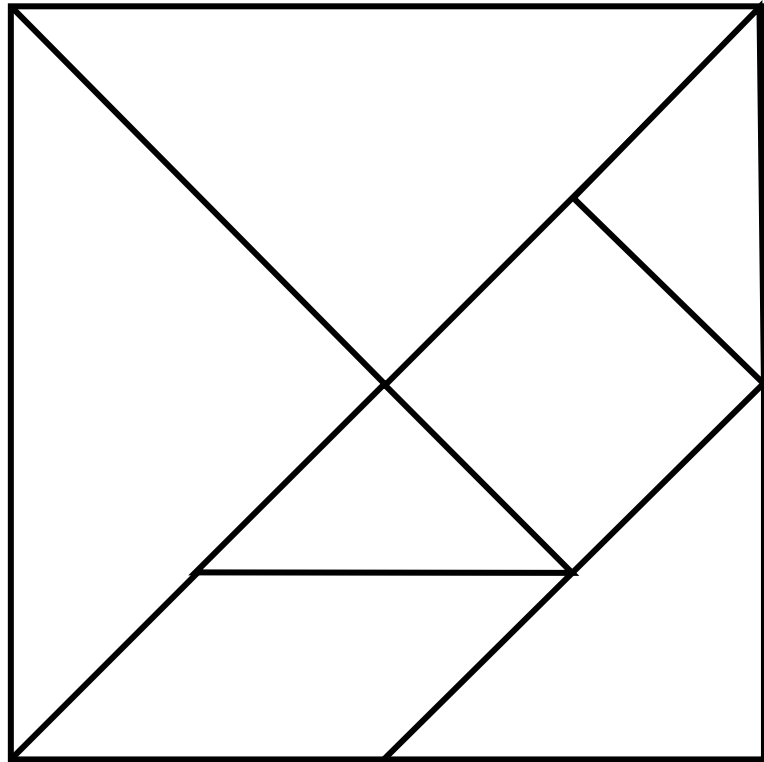
- Copies of "Tangram Areas" task sheet
- Tangram pieces
- Mathematics Rubric

### Time Requirements

- One class period

### ASSESSMENT (7A/9B/9C).G

# Tangram Template

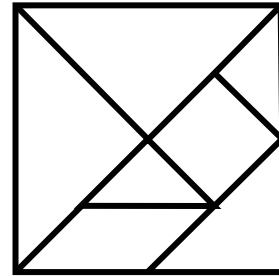


NAME \_\_\_\_\_ DATE \_\_\_\_\_

## TANGRAM AREAS

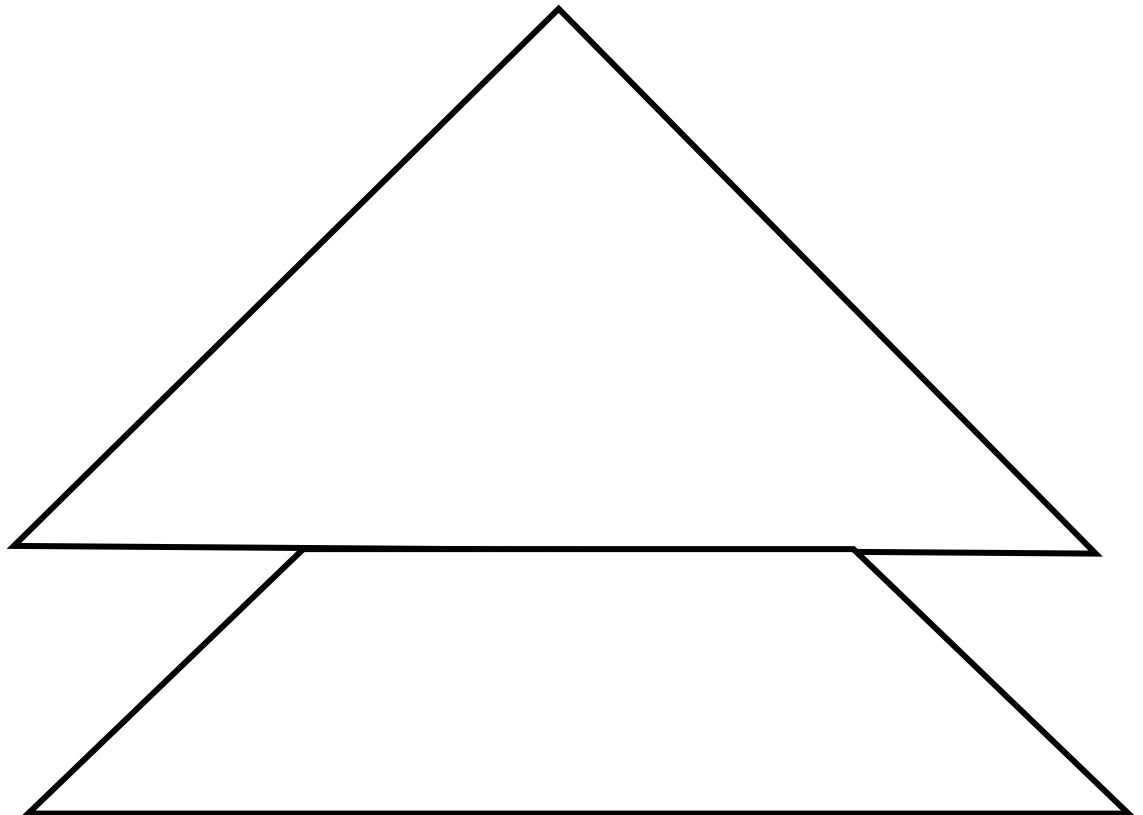
### Student Task Sheet

The seven-piece tangram puzzle has been around for centuries. The sketch here shows all seven pieces put together to form a square. Use your pieces to explore the relationships between the areas of the different-sized pieces then complete parts A through C.



- A. Name the geometric shapes present in the seven pieces and give the area of each if you know that the small square piece has an area of 1 square unit. Explain your reasoning.

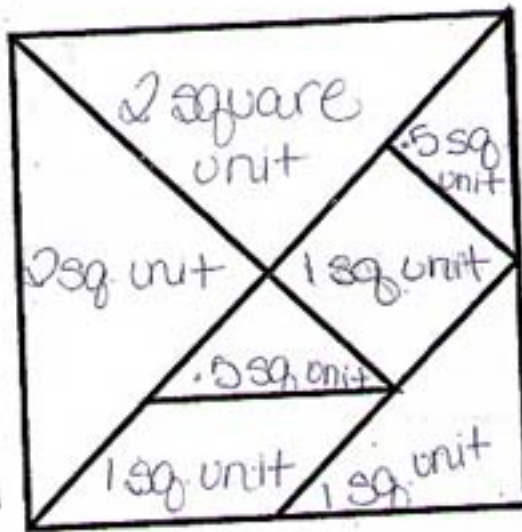
- B. Using some of the tangram pieces (you may not need them all) to build the shape shown here. What fraction of the area of the original seven-piece square is present in this figure? How do you know?



- C. Construct your own figure using between 3 and 5 of the tangram pieces. Draw and label the shape you made, so others can build it easily. What fraction of the area of the original seven-piece square is your new shape? Justify your reasoning.

Tangram Areas

The seven-piece tangram puzzle has been around for centuries. The sketch here shows all seven pieces put together to form a square. Use your pieces to explore the relationships between the areas of the different-sized pieces then complete parts A through C.

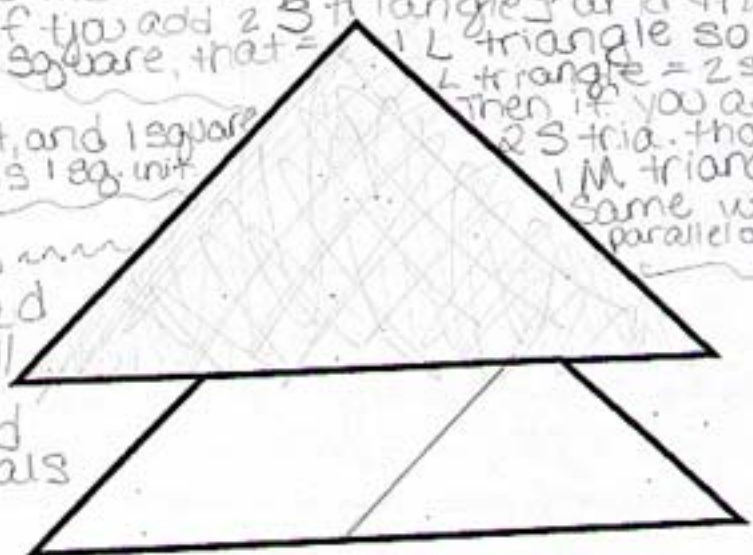


- A. Name the geometric shapes present in the seven pieces and give the area of each if you know that the small square piece has an area of 1 square unit. Explain your reasoning.

There are 2 large triangles, 2 small triangles, and 1 medium triangle, and 1 parallelogram and 1 square.

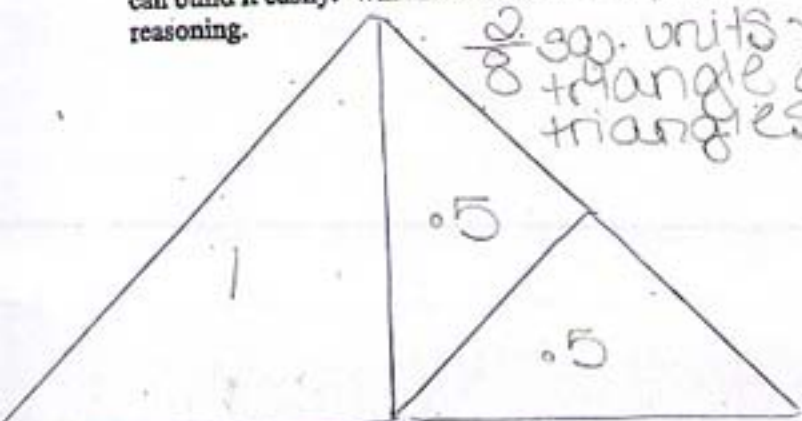
I know this because I already know that the square is 1 sq. unit. And if you add 2 small triangles that = a square so the 2 triangles are .5 each. Then if you add 2 S triangles and the square, that = 1 L triangle so 1 L triangle = 2 sq units. Then if you add 2 S tria. that = 1 M triangle same w/ the parallelogram.

- B. Using some of the tangram pieces (you may not need them all) to build the shape shown here. What fraction of the area of the original seven-piece square is present in this figure? How do you know?



I know this because I used the parallelogram, the small triangle, and the large triangle and then I added up the areas and it equals  $\frac{3.5}{8}$  square units.

- C. Construct your own figure using between 3 and 5 of the tangram pieces. Draw and label the shape you made, so others can build it easily. What fraction of the area of the original seven-piece square is your new shape? Justify your reasoning.



$\frac{2}{8}$  sq. units ~ I used the medium triangle and the two small triangles to make this triangle.