NJIT New Jersey Institute of Technology

Center for Pre-College Programs
Campbell Hall, 4th & 5th Floors

University Heights
Newark, New Jersey 07102-1982
Phone: 973-596-3550
njit.edu/precollege

**Helping Kids Learn – Post #8   4/20/20**

STEM: Mathematics – Geometry

Puzzles are exercises for your brain. Visual ones, like jigsaw puzzles, help you become more flexible at *seeing* or picturing the world. The puzzle we're exploring today has been doing just that for people all over the world for hundreds of years. The activity is readily adaptable for different ages and stages of learning. See **Lift the Level** below.

Be a Geometer – Tangrams

A tangram is a 7-piece puzzle. The seven pieces are regular shapes that fit together to make a square. Each piece is called a *tan.* Tangrams were invented in ancient China.

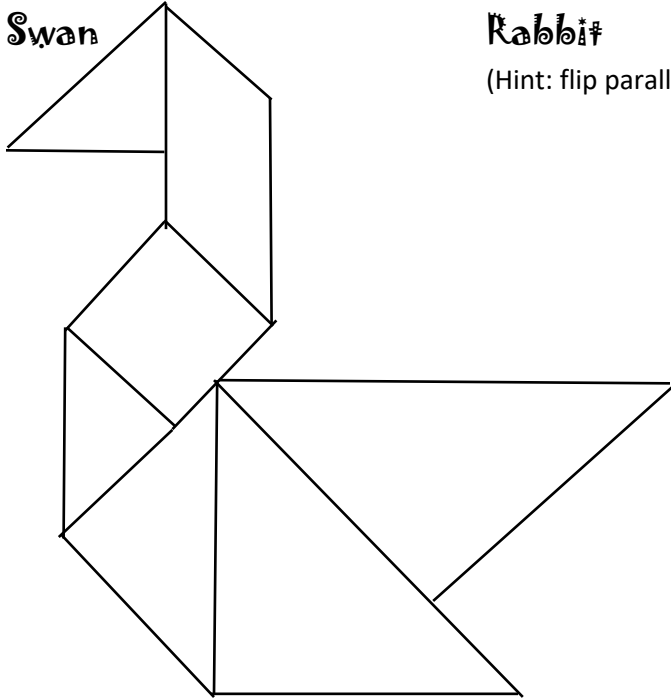Cut out the tangram. **Cutting needs to be exact. Adults may need to help.**
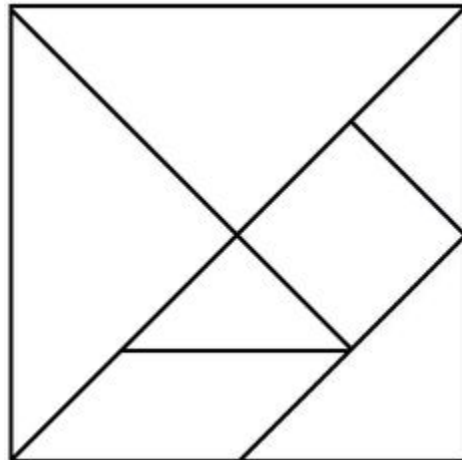
Explore your Tangram: You have 7 pieces; each piece is a *tan.*

1. How many square tans?

2. How many parallelograms that aren't squares?

3. How many triangles?

4. How many different sizes of triangles?

5. Lay down the square tan. Find other pieces that fit exactly on top of the square.

6. Can you make any other tan out of tangram pieces? (See Solutions.)

NJIT
New Jersey Institute of Technology

Center for Pre-College Programs
Campbell Hall, 4th & 5th Floors

University Heights
Newark, New Jersey 07102-1982
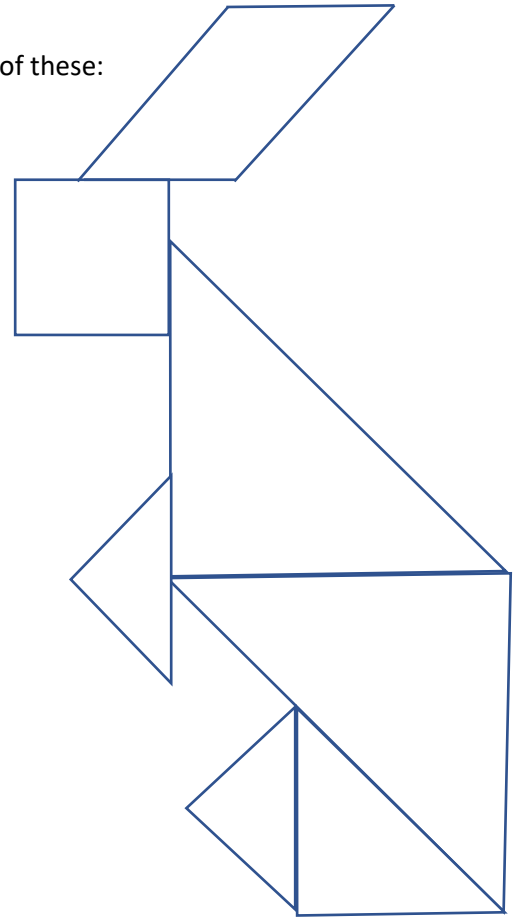Phone: 973-596-3550
njit.edu/precollege

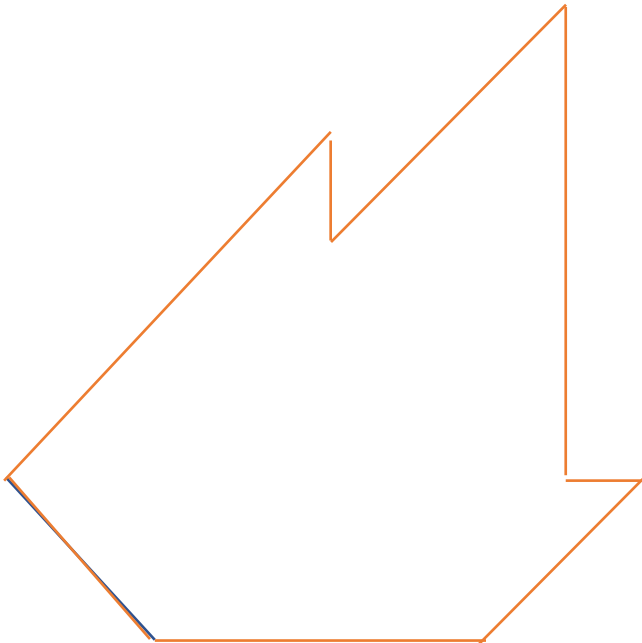You can use the tans to make shapes – try putting your pieces on top of these:
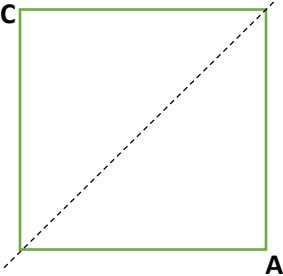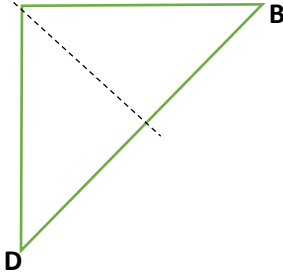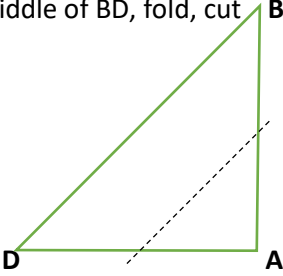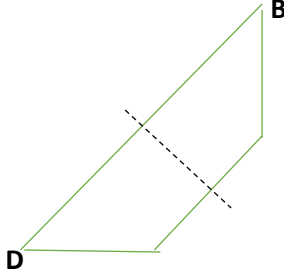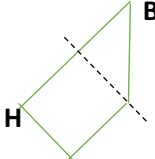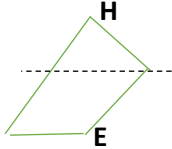
Swan

Rabbit

(Hint: flip parallelogram)

Boat Working from only an outline is considerably more difficult. (See Solutions.)

Lift the Level You can make this lesson deeper and/or suitable for older students by any of the following:

1. Young children will need a printed pattern; copying from a screen (far point) is challenging.
2. Making a tangram puzzle from scratch is fun but more challenging! To make a tangram, start with a square of paper 6 or 7 inches on a side – any kind of paper is OK but paper stiff paper works best. To start with a square, measure 6 inches on a straight edge; fold it across to another straight edge and crease to make two triangles. Cut off the extra paper. Your triangles are the same ones shown in Step 1. Have a go:

Step 1 - Touch A to C, fold, cut (If you made a square above, you just need to cut) You have two triangles. C ⬚ A	**Step 2** – For ONE triangle: Touch B to D, fold, cut B D
Step 3 – For the OTHER triangle: Touch A to middle of BD, fold, cut B D A	**Step 4** - Touch B to D, fold, cut. Now you have 2 *parallelograms.* B D
Step 5 – For 1 parallelogram: Touch B to H, fold, cut B H	Step 6 – For the OTHER parallelogram, Touch H to E, fold, cut. Done! H E

Now, mix the pieces around and reassemble without looking at a finished square!

3. Read *Grandfather Tang's Story* by Ann Tompert. It is available online (see below).
4. Make up your own animals or other shapes by laying the pieces on a sheet of paper. You must use all 7 tans, they must touch and the can't overlap. Take a picture or make a sketch to remember the solution. Draw around the outside of your shape and give to someone else to solve.

5. Color each tan a different color. Assemble into a 3-dimensional figure or hang from strings to make a mobile.
6. Create and share your own tangram story.
7. A quilt can be made of blocks in different patterns. Design a quilt that uses tangram pieces.

STEM Online

Grandfather Tang's Story on YouTube https://www.youtube.com/watch?v=x74l1ZM-zP0 You can use the speaker's audio or mute it and read/pause as you wish. We recommend reading through once and then pausing to make each animal with the second reading. Consider why each fox fairy chose the animal he transformed into. There's also a great moral at the end.

Virtual tangrams (and many other manipulatives) http://nlvm.usu.edu/en/nav/vlibrary.html

NJ Student Learning Standards Mathematics

K.G.A. Identify and describe shapes (squares, circles, triangles, rectangles, hexagons, cubes, cones, cylinders, and spheres).

K.G.B. Analyze, compare, create, and compose shapes.

1., 2. & 3.G.A. Reason with shapes and their attributes.

4.G.A. Draw and identify lines and angles, and classify shapes by properties of their lines and angles.

5.G.B. Classify two-dimensional figures into categories based on their properties.

6.G.A. Solve real-world and mathematical problems involving area, surface area, and volume.

7.G.A. Draw, construct, and describe geometrical figures and describe the relationships between them.

8.G.A. Understand congruence and similarity using physical models, transparencies, or geometry software.

HS-G-CO.A. Experiment with transformations in the plane.

Solutions

1. 1 square
2. 1 parallelogram that isn't a square
3. 5 triangles
4. 3 sizes of triangles
5. The 2 small triangles fit on the square

NJIT
New Jersey Institute of Technology

Center for Pre-College
Programs
Campbell Hall, 4th & 5th Floors

University Heights
Newark, New Jersey 07102-1982
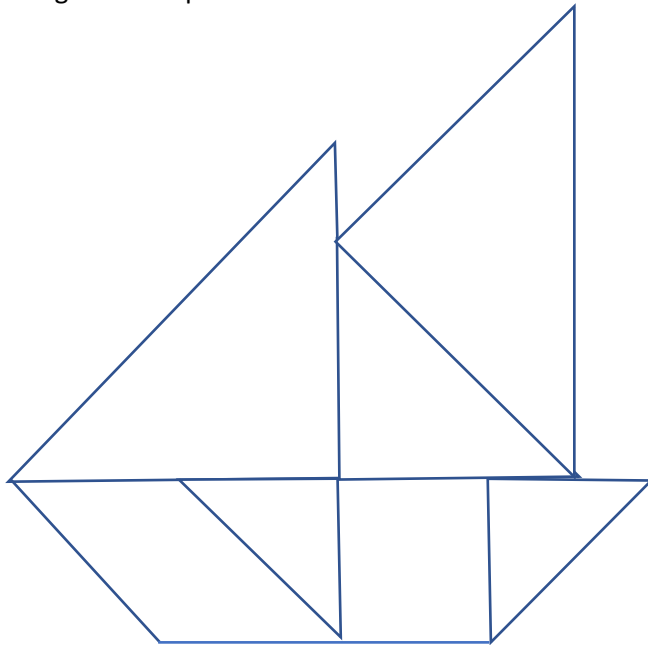Phone: 973-596-3550
njit.edu/precollege

6. Yes. The two small triangles and the parallelogram fit on a large triangle.

The two small triangles fit on the medium triangle.
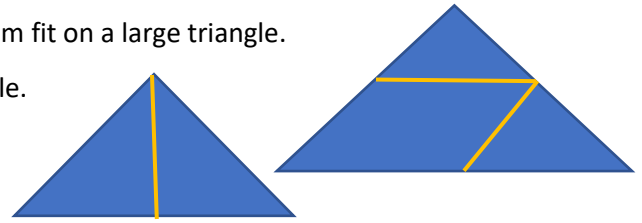
Tangram Boat p. 2

Here are extra tangrams, just in case: