Tangrams and Convex Polygons

TANGRAM FURY™

What is a Tangram?

A tangram is an ancient Chinese puzzle. There's something highly unusual about it. The original puzzle forms a square, but for some reason, those same pieces can be rearranged to make thousands of other shapes. The shapes seem to be limited only by a person's imagination.

What Makes a Tangram?

A traditional tangram puzzle is made up of 7 pieces, called "tans." These include 2 large triangles, 2 small triangles, 1 medium-sized triangle, 1 square, and 1 parallelogram (also known as a rhomboid). When solving a puzzle, all 7 pieces must be used and they must not overlap.

What is a Polygon?

A polygon is an enclosed, two-dimensional shape with more than two straight sides. The sides must not be curved or rounded. Triangles, squares, and rectangles are polygons. Because they have rounded edges, circles, ovals and ellipses are not polygons. Polygons can have many sides.

Are All Tangrams Polygons?

Because proper tangrams should consist of all seven tans of the tangram puzzle touching and not overlapping, then, yes, all tangram shapes are polygons. It may seem odd that a "house," or a "bunny," or a "person running" could be considered a polygon, but keep in mind we're not literally referring to "houses," "bunnies," or "people." Tangrams are only shapes that suggest those things. Try as they might, nobody has ever managed to get a stomach as flat as those represented by tangram images.

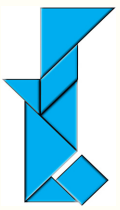
Simple or Complex?

Some are simple polygons, while others are complex polygons. Simple polygons have sides or edges that do not cross over each other, such as is the case with triangles and squares. Complex polygons have edges that do cross over each other, such as a star.

Tangrams as Art

Some consider the tangram puzzles to be a form of art. If so, then tangram art is a form of abstract art, as it merely hints at, or implies an idea or image, such as a person or object, without being an exact depiction of it. Part of the limitation of tangram art is there are no rounded or curved shapes with which to work. Every image must be made of flat lines and exact angles. Some people have trouble picturing what tangram images are trying to show, while others see the images quickly. When making or viewing tangram art, it's best to have an open mind and a broad imagination.


Charging Ape


Penguin with Egg


Bullet Bike

What is a "Convex Tangram"?

A convex tangram is a tangram that is in the shape of a convex polygon. A convex polygon is polygon without indents. See below for more info on convex vs. concave polygons.

Tangrams as Polygons

Tangram puzzles form polygons and can include the following types of polygons.

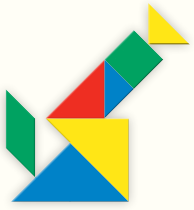
- A **simple polygon** has no edges that cross over any other. The sides of a polygon can dip inward, as long as they don't cross. Examples include outlines of a stop sign or crown.
- A **complex polygon** has at least two edges that cross over each other. A traditional, hand-drawn star is in the shape of a complex polygon.
- A **concave polygon** has one or more inside angles greater than 180 degrees, so that there appears to be a dent in at least one side. Most tangrams are concave polygons.
- A **convex polygon** has no inside angle greater than 180 degrees. In other words, there are no "dents" in any of its sides.


"Fan" card


"Expert" card

Tangrams and Science

Hobbyists aren't the only ones to study tangrams. Mathematicians have studied the 7-piece puzzle for decades. In 1942, two mathematicians, Fu Traing Wang and Chuan-Chih Hsiung, published a proof that the 7-piece tangram could only be rearranged into 13 unique convex ("undented") polygons. While some of the polygons could be formed via varying arrangements of the tans, only 13 unique silhouettes can be formed. The other side of this sheet shows those 13 convex polygons. It also shows that there are many ways to build those shapes.


Microscope

Today, school teachers use tangrams to help teach mathematics and geometry.

Tangram Website

If you're interested in tangrams, there's a great website at **www.TangramFury.com** with lots of interesting information about tangrams. On it, you'll find:

- Free videos showing images that can be built with tangram puzzles.
- A library of other tangram puzzles.
- Free downloadable handouts with information about tangrams.
- Information about tangrams in general.
- Information about the fun, multi-player, competitive tangram game called Tangram Fury.