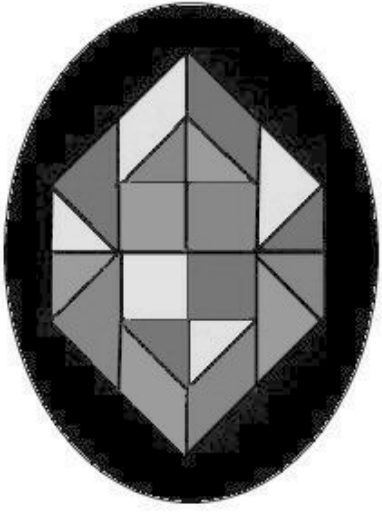
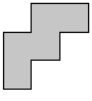
**Ages 6 to adult**

# Twenty-Tans™



**Small and large**
**Symmetries**
**Maximums**
**Patterns**



*A product of*
*Kadon Enterprises, Inc.*

**Twenty-Tans**™ is a trademark of Kadon Enterprises, Inc., for its puzzle set of 20 tiles made of 32 isosceles right triangles (half-squares), including squares, parallelograms, and triangles. Invented by Hans Weidig IV, and developed further by Kate Jones. Made by Kadon under exclusive license.

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*Twenty-Tans* is crafted in lasercut acrylic by
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# The Twenty-Tans set

We like to pronounce it "Twhen-tea Tans," not "Twon-ee Tans".

One of the oldest dissection puzzles in the world is a set of seven pieces known as *tangrams,* originating centuries ago in China. The word *tans* is generally believed to mean *shape*. The basic building block of this puzzle is an "isosceles right triangle" made by cutting a square in half diagonally. This triangle has a square (90◦) corner (the right angle) and two equal-length sides. The third and longer side is opposite the right angle and is called the hypotenuse. Please note: a hypotenuse must join only another hypotenuse, never a side, when assembling figures with the set.

Fitting two triangles together in pairs reproduces the original square, and makes a larger triangle of the same shape and a parallelogram that looks like a tilted rectangle. The number of ways these further shapes can be combined to form different figures is beyond counting. Solve the material in this booklet, and use your own imagination to create other artistic designs.

Eight triangles make up the five pieces of any one-color subset of Twenty-Tans. There are 4 different "hands," each a different color. One hand can model each of the five tetromino shapes (4 squares each) shown at the bottom of page 5 and a very large number of octotans—shapes made of 8 isosceles triangles joined on their matching lengths of sides. There are 1116 octotans altogether, though not all are solvable with the Twenty-Tans tiles. Of those 1116 shapes. 88 are also symmetrical. Of those, only 64 are solvable, and that number includes the tetrominoes. We show all 64 in this booklet, starting on page 6.

Any shape you can form with one "hand," you can also form by combining two hands and tilting the figure by 45 degrees. And you can form that shape doubled with all 20 tiles. See page 5.

Kadon makes several other original puzzles with *tan*-type pieces:

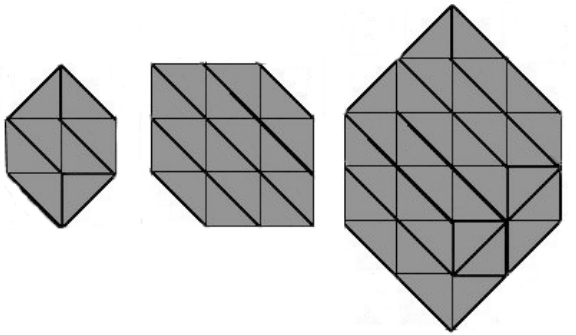
*Triangoes*
*Tiny Tans*
*Trio in a Tray*
*Chasing Squares*

Although related geometrically, each set has its own unique and special features and activities. You can see them on our website,

**www.gamepuzzles.com**

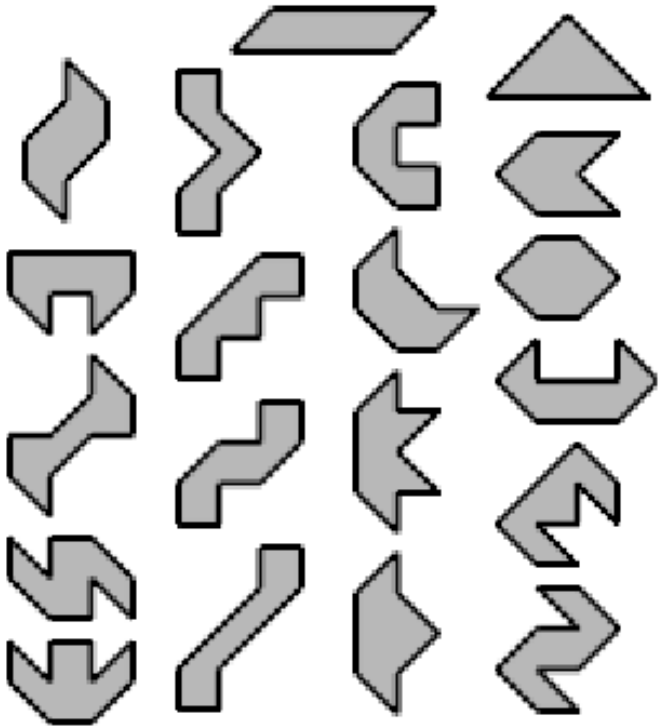
# Forming symmetries

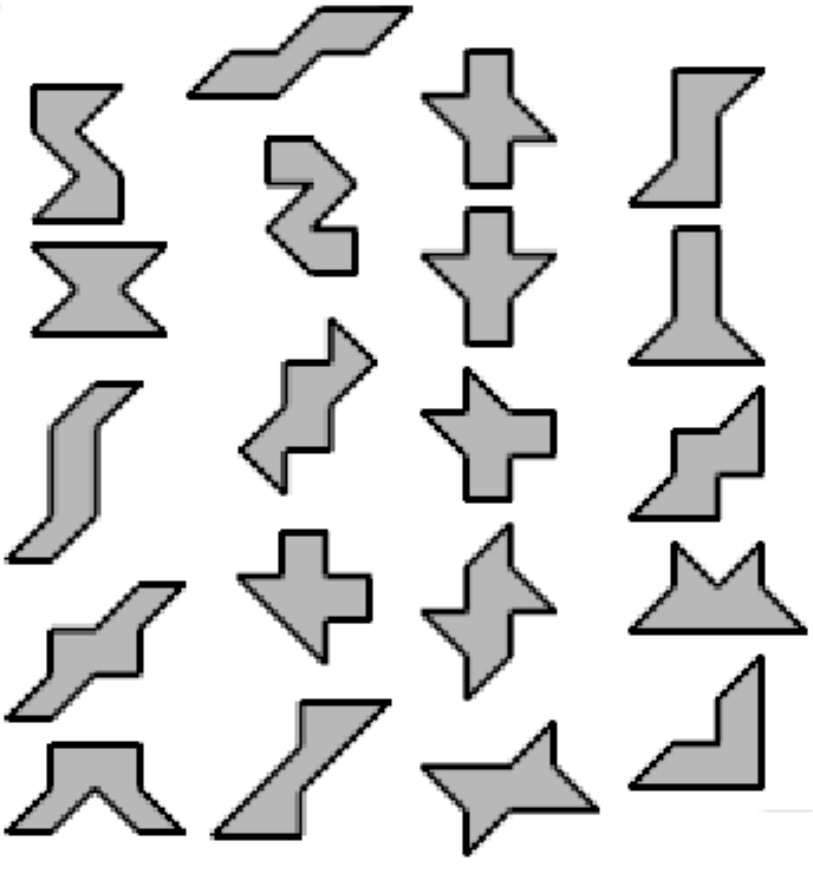
Each of the figures shown on this and the following pages can be formed with just one 5-piece "hand" of the Twenty-Tans set. They can also be formed by combining two hands, though you'll need to turn the figure by 45 degrees. And they can all be solved in doubled size using the entire 20-tile set. Like this:



Start by solving these 5 tetromino shapes in 3 sizes. Only the last tetromino, the L, is not a symmetrical shape. We include it as a member of the family:

Here are all the symmetrical octotans. For extra challenge, build a one-hand and a two-hand copy simultaneously.





# How many sides?

Joining tiles to form polygons can produce both convex and concave shapes. Convex means there are no indented angles—the figure is like an egg. Concave means at least one angle goes inward from the outside edge, like a cave or star.

The fewest number of sides that a convex figure can have is 3, a triangle, followed by 4, as with the square, the parallelogram or trapezoid. Another convex shape is a "stretched" hexagon with 6 sides. Can you find others?

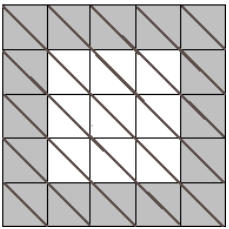
Most of the shapes formed of Twenty-Tans tiles are concave. We can now ask how many different sides they can have, counting each stretch of a straight line as a separate edge. The most we can make with one hand of 5 tiles is 10. For example, this twisted star has 10. There are many others.

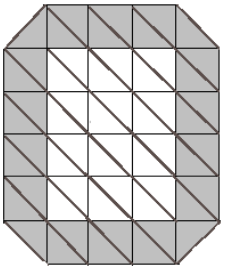
Using all 20 tiles, what are the most numbers of sides possible? Our best result is 34, and it's symmetrical. Can you do better?

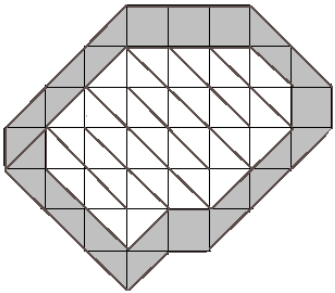
# How large a space? How long a fence?

Building with all 20 tiles, how large a space can you enclose and how long a border (perimeter) can you build? Here are a few examples. Shaded areas hold tiles. *Left to right:*

- Four sides, 20 units of border, 18 enclosed triangles.
- Eight sides, 18 units of border, 24 enclosed triangles.
- Nine sides, 18 units of border, 40 enclosed triangles.

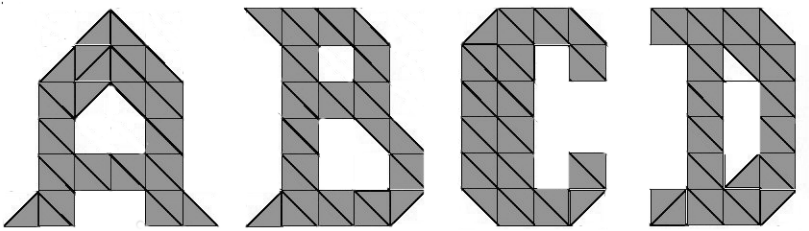




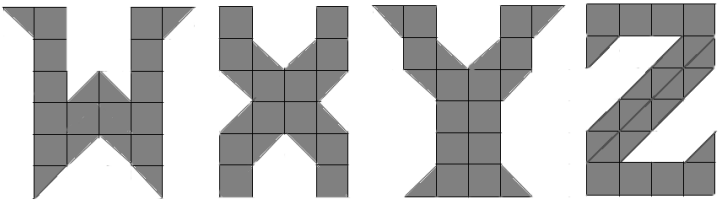


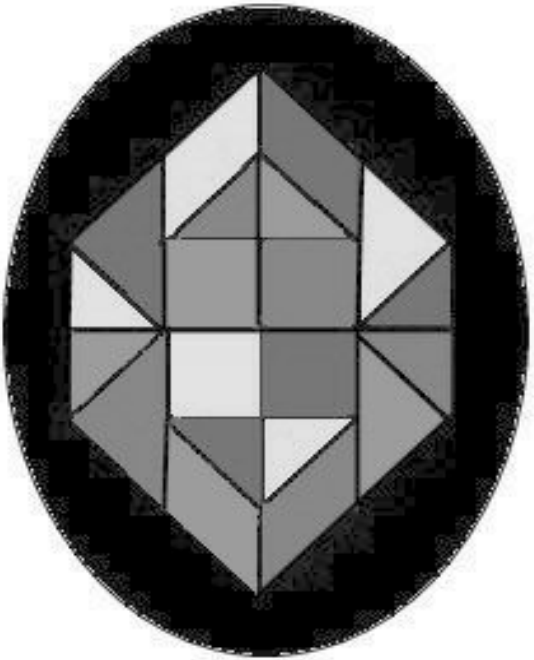
Note that the tiles forming the "fence" are fully connected by their sides, not just by a tip or corner. They need not be symmetrical. How long a fence can you build, with the largest possible enclosed space? You can easily improve on these samples. Send us yours.

# The Alphabet



The 20 Twenty-Tans tiles cover 16 squares or 32 triangles, and we can design shapely letters containing that area. We provide the ABCD and the WXYZ. You are invited to design the letters E through V in the same style and then solve them. For prettiest effect, arrange the four colors so same colors don't touch. Send us your designs!





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