Pentiamond puzzles.

Two equilateral triangles may be joined edge to edge to make a 'diamond'. Adding one more triangle gives a triamond, which is a trapezoid. Adding a fourth triangle gives one of the 4 distinct tetriamond shapes. Adding a fifth triangle gives a pentiamond. There are 4 distinct pentiamond shapes, which I call G, I, J, and Y, because of their resemblance to those letters.

For each 20-triangle puzzle shape:

○ See if you can make the puzzle shape using one set of 4 pentiamonds, consisting of G, I, J, and Y. Many of the shapes can be made this way, but not all. If you suspect a puzzle shape can't be made using 1 set, see if you can *prove* that it can't. Often a good strategy is to think of all the places the G pentiamond could go. There may only be a few possible places it can go, and you may be able to show that none of the places will work. One way you may be able to see right away that putting the G in a certain place will not work is if it divides the shape into two separate areas; if each of these areas contains a number of triangles which is a multiple of 5, then a solution may be possible, but if not, then there is no solution with the G placed there.

○ Can you make the puzzle shape using 4 similar pentiamonds? (i.e. 4 G's, or 4 J's, etc.)

○ See how many different ways to make the puzzle shape you can come up with.

○ Try making the puzzle shape without using a particular pentiamond shape, for example without using the Y pentiamond.

Even if it is not possible to make a puzzle shape with 1 pentiamond set, it may be possible to make 2 copies of the puzzle shape using 2 sets. For example there is a puzzle shape which can be made from 2Y+2I, and also from 2J+2G, so with 2 sets you can make the puzzle shape both of these ways at the same time.

Try to come up with new puzzle shapes. Try to find shapes that are special in some way. As you will see, I have only included shapes which have either a reflection or a rotation symmetry, with two exceptions. One exception is the pentagon (can you find the other exception?), which is special in a different way: it is convex; this means that if you draw a straight line segment from one point inside the shape to another point inside the shape, that line segment lies entirely inside the shape. Can you find any other 20-triangle shapes which are convex?