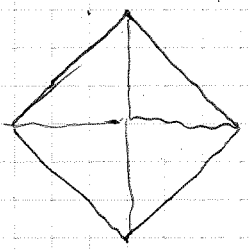
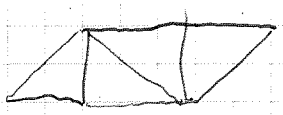
Øvelse

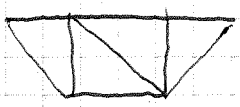
Fold et A4 ark til et kvadrat.

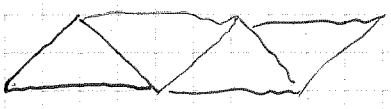
Lav fire kongruente ligebenede trekanter, hvor den største side er siden i kvadratet

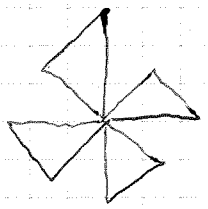
Lav figure og beskriv figurene.









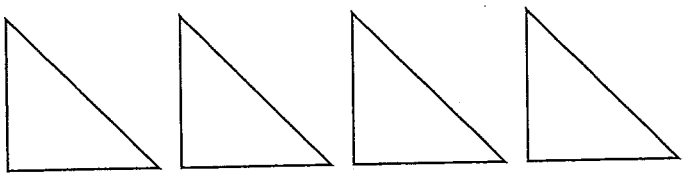


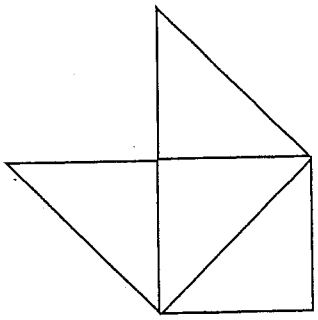
17

WHAT SHAPES CAN YOU MAKE?

The Problem

Use four isosceles triangles as shown, and place all of them together along edges with no overlapping. How many different figures can be made? One example is shown.





Range of Possible Teacher Questions

- What strategies are you using to find shapes?
- If you turn or flip a figure, do you get a different figure?

Where's the Math?

This spatial problem requires that students manipulate shapes. Students must consider congruence to determine whether a new arrangement is really different from others. Classification skills can be practiced as students sort their shapes as triangles, quadrilaterals, pentagons, and hexagons. Subclassifications of the quadrilaterals—rectangles, squares, parallelograms, and trapezoids—can also be considered. In addition, this problem is about counting. Students can investigate whether a pattern exists between the number of triangles used and the number of shapes that can be made.

SAMPLES OF HOW THE PROBLEM WAS SOLVED

STUDENTS from prekindergarten to high school and their teachers found the "What Shapes Can You Make?" problem to be interesting, motivating, and fun. The variety of responses that we received demonstrates the rich potential of this problem to challenge spatial sense, extend understanding of geometric shapes, enhance classification skills, encourage classroom discourse, provide opportunities for group work, and allow students to express their creativity.

Two of Sherial McKinney's prekindergarten students produced ten different shapes with some assistance in putting sides together so that they "touched side to side and not point to side and had the same length." One student put the four triangles together as a large triangle without assistance, and a second student produced a rectangle with some assistance. The students repeated some shapes and needed help to turn them to recognize that they looked like shapes that they had previously made.

Laurie MacKay, a third-grade teacher, and Karen MacKay presented this problem to five- and six-year-olds in Karen's first-grade class. They asked the children to glue their four triangle shapes onto another piece of ten-by-twelve-centimeter grid paper, then cut around the outline of the four-triangle shape so that the four triangles were still visible. As the children made new shapes, they related them to their environment and known objects. Laurie MacKay and Karen MacKay sent the examples in figure 17.1 to share some of the children's ideas for their shapes.

Although many children were confused about the criteria and used more than four triangles or arranged the triangles with only their corners touching, others worked with the criteria in mind right away. One child commented, "It's like making a puzzle." The teachers noticed that once one new combination was discovered, the children suddenly realized that many new shapes were possible. As the work progressed, one child commented, "Some of our shapes have to be the same because people have the same ideas."

The MacKays's reflections led them to wonder whether the results might have been different if the children had first spent some time using the same triangles to create *any* shape they wished. Then the "What Shapes Can You Make?" problem would have been an extension of the initial exploratory activity, with added restrictions.

Rebecca Anderson is a consultant who works with programs for gifted students in kindergarten through sixth grade. She participated in Ann Whan's and Kim Erichsen's second-grade classrooms for one week. The children began the week by using tangrams and geoboards to explore ways to make different sizes and shapes of triangles. Through these lessons, the students were introduced to the shape of a parallelogram.

Anderson wrote, "Many of the students [thought that] *parallelogram* was too difficult a word to remember. We discussed other big words that they might know, such as *brontosaurus*, *tyrannosaurus rex*, and other dinosaur names. The students agreed they could remember those types of names and were willing to try to remember the name parallelogram."

Anderson observed that Logan and Nathan wanted to discuss only shapes that they could recognize and name as a familiar shape or polygon, such as *triangle*, *square*, and *rectangle*. After making these familiar shapes with their triangles, they believed that no other shapes were possible. They continued to manipulate the triangles, when Logan called out, "Oh, oh, we've got one! Mrs. Anderson, we've got one!"

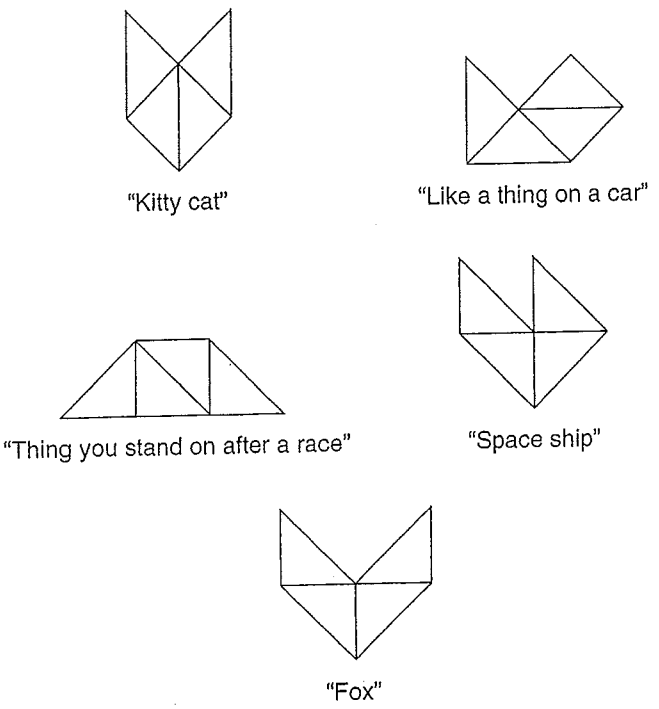


Figure 17.1. Children related their shapes to familiar objects.