One Cut Geometry: Angle Bisectors

Grade Levels

This activity is intended for students grade 5th – 7th. This activity assumes the student are familiar with the axis of symmetry for polygons. If necessary, see One Cut Geometry: Axis of Symmetry.

Materials and Resources

- The handout below
- Scissors
- Pencils
- Compass and ruler

Objectives and Outline

A regular or semi-regular polygon is drawn on a sheet of paper. The question here is, how can you fold the sheet to be able to cut out the polygon with only one straight cut with a pair of scissors?

In this activity, students work together to discover the angle bisector. Students begin by working on the handout either alone or in small groups of two or three, with a handout for each student. Starting with the isosceles triangle, fold the polygon along the axis of symmetry. Then fold along the angle bisector to put the base of the triangle on top of the other side, and now a cut can be made to form an isosceles triangle.

Apply the same procedure to the other polygons:

- Fold the polygon along the axis of symmetry, and repeat as many times as possible
- Next, fold along angle bisectors and eventually put all sides on top of each other
- Finally, make the cut

Initially, the students may not understand the relationship between making one straight cut with scissors, and cutting out a polygon. A reformulation of the problem is: how can you fold the paper to put all sides of the polygon on top of each other (to align all sides). Eventually, discuss the outcome as a class when a majority of the students have successfully completed the handout.

Discussion

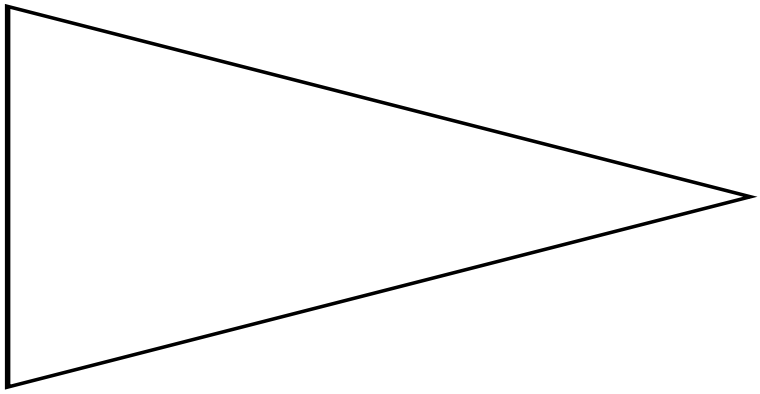
After the majority have successfully cut out the isosceles triangle, have students explain the idea that they used. The goal is to give a definition of an angle bisector—it could be either an axis of symmetry of the angle or a line that cuts the angle in half. Either definition will suffice. If both definitions come up, try to see if they are equivalent, and why. Do not mention the word "bisector" until after the first discussion.

Attack the other polygons using the same trick, and afterward discuss how the students made the folds, and which sides are brought together by folding. Compare the folds of an isosceles and equilateral triangle. Point out that in some polygons, the axes of symmetry and angle bisectors lie on the same line.

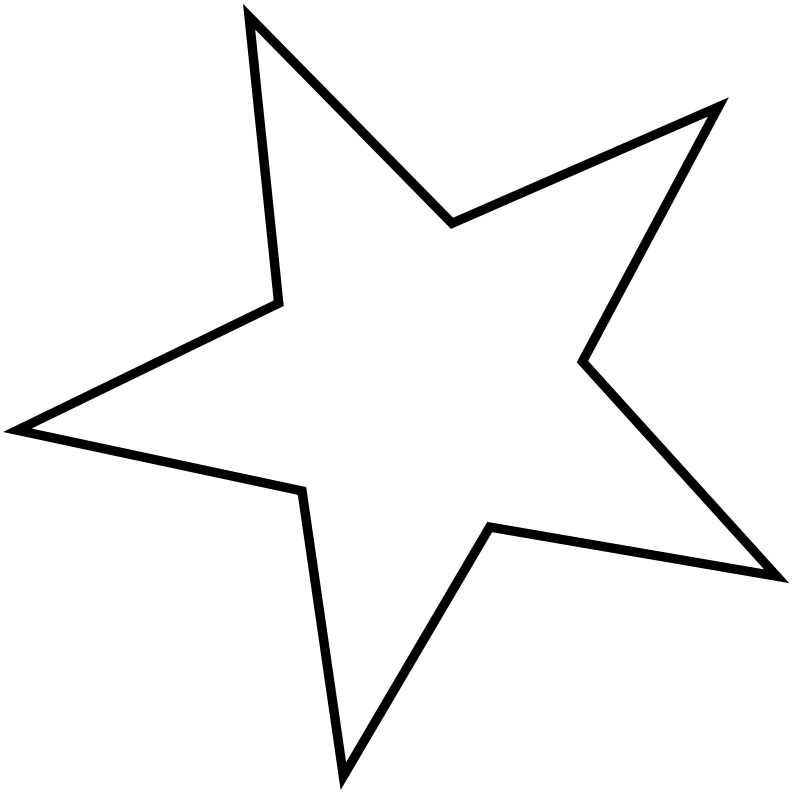
One-cut Geometry: Bisectors

Cut the paper into two pieces along the line. Can you fold the paper so that only one cut is need to cut out the following shapes?

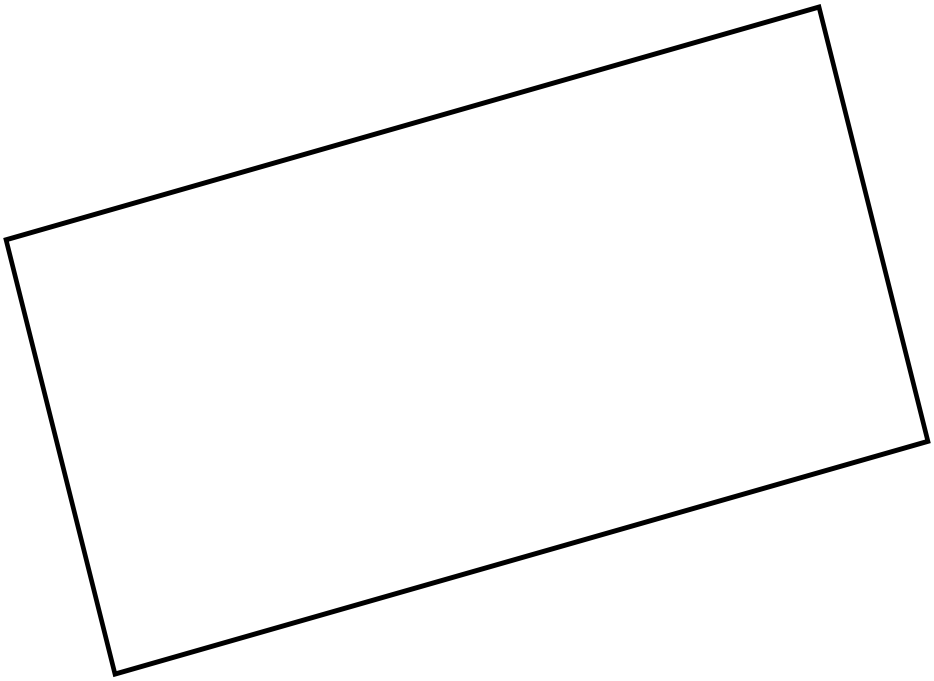
Isosceles Triangle



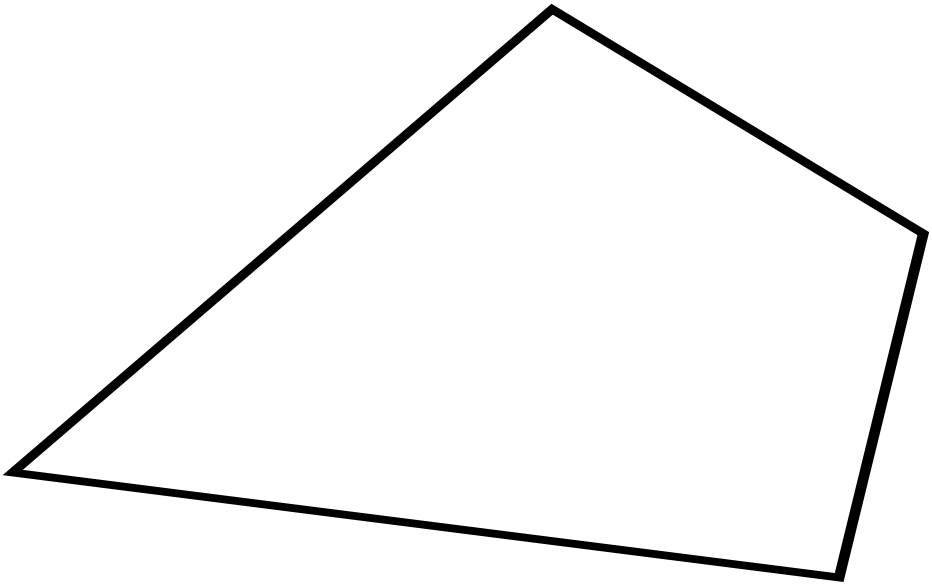
Regular Star



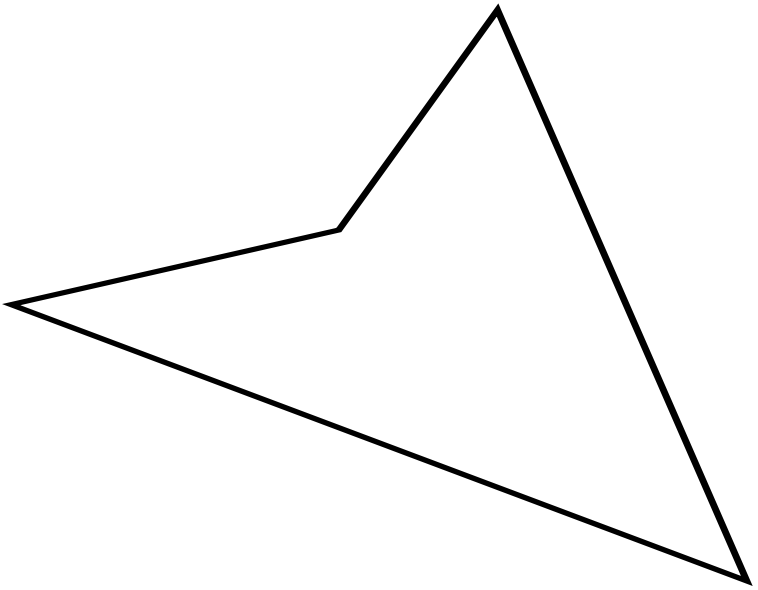
Rectangle



Kite



Arrowhead



Regular octagon