Iris Eye Cutouts

Introduction:
Students sometimes ask about the real-world useful-ness of geometry. Of course it has many real-world uses, but one use that is not often mentioned is that it can help make interesting and attractive art!

Iris eyes are simple, mandala-like designs that can be quite pretty, and should inspire students and their parents (especially at the meet-the-teacher night!).

Lesson Objective:
Students will make an iris eye design from construction paper.

CA Dept. of Education Math Standards (see below):
4th grade: Congruence, bilateral and rotational sym-metry, types of triangles
5th grade: Perimeter and area, drawing triangles

Important Terms (see below for definitions):
Circle, center, diameter, radius, chord, circumference, pi, symmetry, mirror symmetry, rotational symmetry, point symmetry

Supplies:
Construction paper of several different colors
Scrap paper

Tools:
Scissors
Protractor

Instructions:
(1) On a piece of colored construction paper, draw an equilateral triangle with a radius of 5cm. (This can be done easily with the Barry Scientific protractor. See our Draw A Regular Polygon lesson plan.)

Cut this triangle out. Make sure to leave the paper outside the triangle intact; you'll be using the paper, not the triangle you cut out.
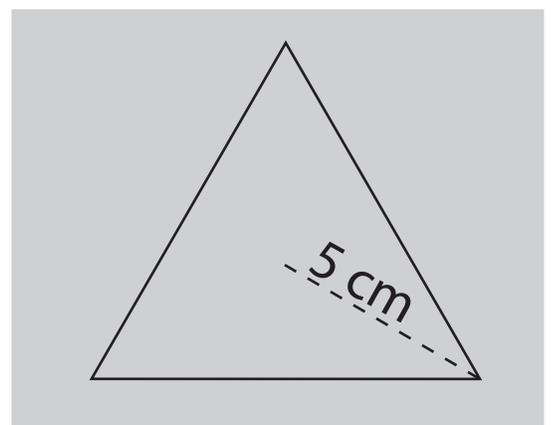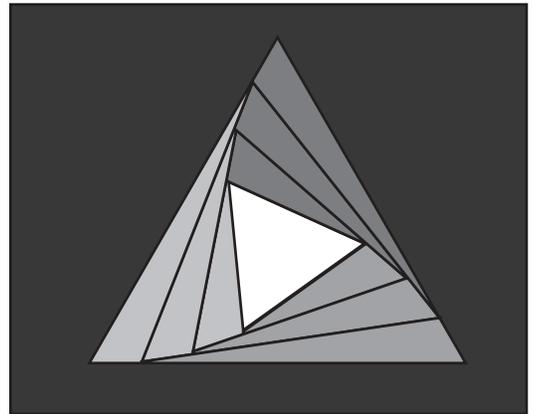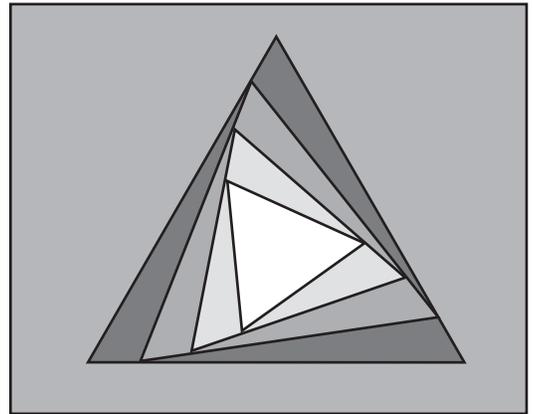
(2) Draw a congruent triangle on a piece of scrap paper. This will be your "pattern" triangle. Mark the center with a dot. (You can do this by filling in the grommet hole of the protractor.)

(3) On the pattern triangle, use the center point and the protractor to make a new triangle, this time with a radius of only 4cm. Draw it so that its vertices fall on the line segments of the first (5cm) triangle.
(You may have to show your students how to do this. It is done by putting the grommet over the center point, then swinging one ray of the protractor until the 4cm mark intersects a line segment.)
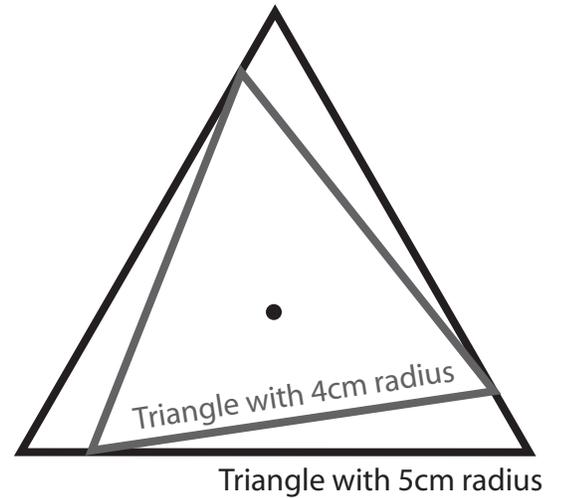
Inside the 4cm triangle, use the same method to draw a 3cm triangle. Inside that, draw a 2cm triangle. You can point out to your students that all of these triangles are similar.
(Make sure that each triangle is rotated the same way, so a spiraling pattern is created.)

Triangle with 4cm radius

Triangle with 5cm radius
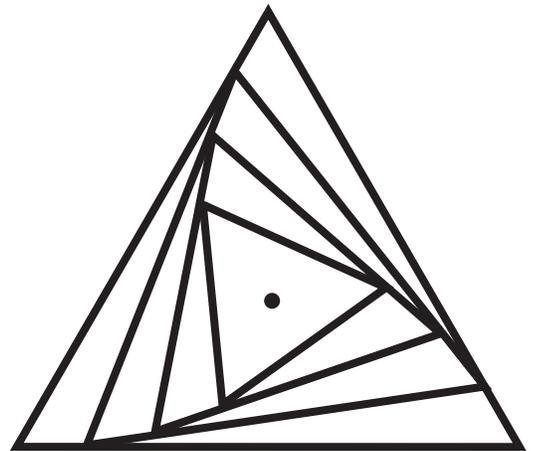
(4) Number the open spaces on your triangle, as shown at right.

(5) Place the triangular hole in the construction paper over the pattern triangle so that they match perfectly. Lightly tape the two pieces of paper together so they won't move, but so that they can be taken apart later.

(6) Cut up some construction paper into strips. (Recycling tip: This is a good way to use construction paper scraps from other activities.)
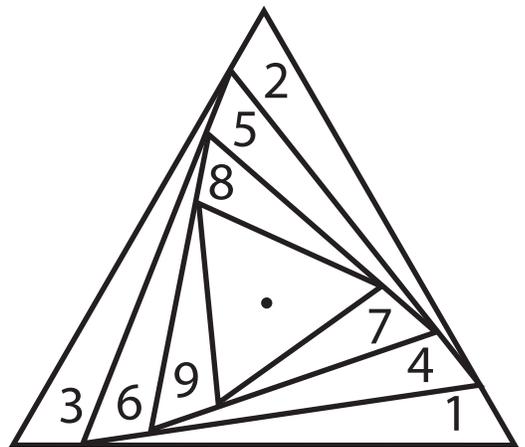
Tape one colored strip over the section labeled "1" on the pattern triangle, so that it entirely covers this section and nothing more. Tape a second strip over the section labeled "2", and so on, until you cover all the numbered sections.

(7) Remove the paper with the pattern triangle, and turn over the construction paper. You have your iris eye! Challenge your students to come up with creative color patterns. For example, a fun pattern is to use the same color strips for sections 1, 4, 7; for sections 2, 5, 8; and for sections 3, 6, 9.

(8) You can follow up by having your students do a number of mathematical exercises:
Measure the perimeter and area of the various triangles
Measure the angles of the triangles using the protractor. Should they expect all the interior angles to be the same?
Identify what kinds of symmetry the triangles exhibit.
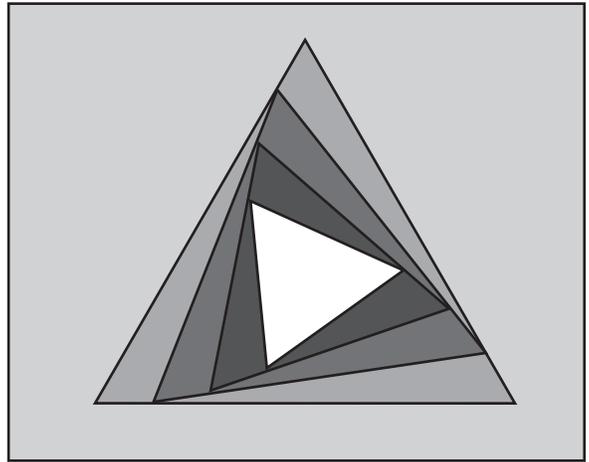
California Department of Education Math Standards:
4th grade: Congruence, bilateral and rotational symmetry, types of triangles
> **3.3** Identify congruent figures.
> **3.4** Identify figures that have bilateral and rotational symmetry.
> **3.7** Know the definitions of different triangles (e.g., equilateral, isosceles, scalene) and identify their attributes.

5h grade: Perimeter and area, drawing triangles
> **1.4** Differentiate between, and use appropriate units of measures for, two- and three-dimensional objects (i.e., find the perimeter, area, volume).
> **2.1** Measure, identify, and draw angles, perpendicular and parallel lines, rectangles, and triangles by using appropriate tools (e.g., straightedge, ruler, compass, protractor, drawing software)

Important Terms Defined
Equilateral triangle: A triangle with three equal sides.
Radius (polygon): The distance from the center of a regular polygon to a vertex.
Congruent: Figures are congruent if they have the same size and shape.
Similar: Figures are similar if they their corresponding sides are proportional (in other words, if they are the same shape but not the same size).
Vertex: The point of an angle where the two sides meet.
Line segment: Two points on a line, and all the points between those two endpoints.
Perimeter: The sum of the lengths of all the sides of a polygon.
Area: The number of square units that covers a shape or figure.
Symmetry: A figure with symmetry can be rotated or reflected without being altered.