Symmetry in Kaleidoscope Designs

(title used from *Connected Mathematics 2*)

Lesson Plan

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Goal: The primary goal of this lesson is to review the reflection and rotation symmetries via identifying and creating them in designs, specifically kaleidoscope designs. One key to this goal is accurately describing the symmetries with proper mathematical language and without ambiguity. In addition, students should be able to find (and describe) a basic design element which may be used to reproduce a kaleidoscope design.

Grade and Course: 8th grade algebra (or other math course)

KY Standards: MA-08-3.2.1 (Geometry)
Students will describe, provide examples of, and apply to real-world and mathematical problems rotational symmetry (90º, 180º, 360º).

Objectives: Students will be able to:
- ✔ Identify reflection and rotation symmetries in a kaleidoscope design.
- ✔ Clearly describe the lines of symmetry (to be understood without a picture).
- ✔ Determine the angle of rotation for rotation symmetry.
- ✔ Identify a basic design element of a kaleidoscope design.
- ✔ Create their own designs using particular symmetries.

Resources/materials needed:
> Design pieces handout or equivalent (see below)
> Scissors
> *Connected Mathematics 2: Kaleidoscopes, Hubcaps, and Mirrors*
> Overhead projector
> Transparency copy of design pieces

Description of Plan:

Students should have already been introduced to reflection and rotation symmetries and the terms "line of reflection" and "angle of rotation.

Each student is given a design pieces handout and a pair of scissors; the students are given instructions to cut out the six design pieces. The teacher asks what the students notice about the pieces. The goal here is to identify the pieces as equilateral triangles and to begin recognizing the symmetries the pieces can create.

The teacher gives the instructions that each student will be creating designs with the pieces with the following rule: Any time two pieces touch along a side, the side must act as a "local" mirror or line of reflection. The overhead projector and transparency pieces can be used for illustration and for selected students to display their designs for the rest of the class to see. Students should work individually yet be encouraged to share their work and discuss with classmates near them. The teacher monitors the activity, asking questions and pointing out when a student breaks the above rule.

Every few minutes (to be judged by the students' progress), the teacher gives a different goal, such as:
- create a design that has a "global" vertical line of symmetry
- …a horizontal line of symmetry
- …both lines of symmetry
- …rotational symmetry
- etc…

The last goal is to create a design with both reflection and rotation symmetries. The teacher should display a student's design that is one of the possible kaleidoscope designs.

After the activity, the teacher leads Lesson 1.3 in the mentioned *Connected Math 2* book (or some equivalent). Problem 1.3 should be worked on via the best method for the particular class, given the remaining time. (For example, a class may work best coming together to discuss the questions after first working individually.) The teacher may use designs created during the earlier class time for more examples.

<u>Lesson Source:</u>

> *Connected Mathematics 2: Kaleidoscopes, Hubcaps, and Mirrors*
>> (© 2006 Michigan State University)
> Lesson 1.3: *Symmetry in Kaleidoscope Designs* (pp. 10-11)

> Original exploration activity/worksheet.

<u>Instructional Mode:</u> Interactive discussion/activity

<u>Date Given:</u>   February 20, 2007

<u>Estimated Time</u>: 90 minutes

<u>Date Submitted to Algebra[3]:</u> July 4, 2007

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