TITLE: Origami Cube

Lesson Plan

Cube Fellow: Rachelle R Bouchat **Teacher Mentor:** Pam Callahan

Goal: To have students compare two lengths using the area of a square and to be able to write down the relationship between these two lengths using ratio notation.

Grade and Course: 9^{th} and 10^{th} grade algebra courses

KY Standards: MA-HS-1.1.1 (Number Sense)
MA-HS-1.4.1 (Ratios and Proportional Reasoning)
MA-HS-2.1.1 (Measuring Physical Attributes)
MA-HS-3.1.1 (Shapes and Relationships)

Objectives: At the end of this lesson the students should feel more confident with solving equations by taking the square root of both sides. Students should also feel comfortable with ratio notation and setting up equations relating two different lengths in a given diagram.

Resources/materials needed: Paper for constructing the cube and worksheet.

Description of Plan: As a class, the students and the teacher will follow the instructions to fold a cube out of the sheet of paper using the origami folding sequence described on the worksheet. After the cube is successfully constructed, students will get into groups to work through the remaining questions on the worksheet.

Lesson Source: http://www.mathematische-basteleien.de/oricube.htm

Instructional Mode: Group work.

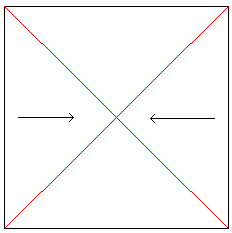
Date Given: 1/18/07 **Estimated Time**: 75 minutes

Date Submitted to Algebra^3: 2/26/07

Form 8-18-06

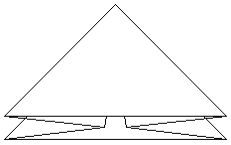
Origami Cube

Our first task is to construct a cube out of a square piece of paper by following the steps below.

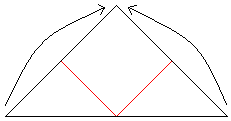
1. 

Fold and unfold a square sheet of paper on the red diagonals.

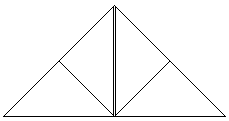
Put the paper at both arrows together. Lay the triangles at the top and at the bottom on top of each other.

2. 

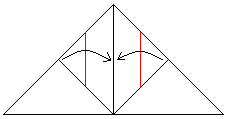
The result is known as the waterbomb base.

3. 

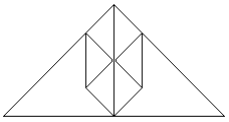
Fold upward on the red lines.

4. 

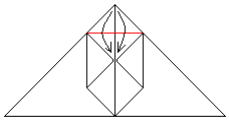
Then it should look like this.

5. 

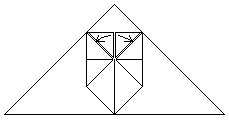
Fold on the red lines

6. 

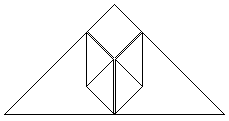
Then it should look like this.

7. 

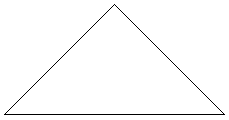
Fold the two little triangles on the red lines downward.

8. 

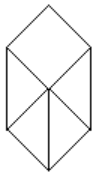
Put the small triangles that you just made into the two pockets on the right and on the left.

9. 

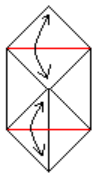
Then it should look like this.

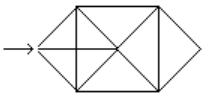
10. 

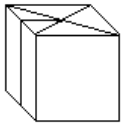
Turn the whole triangle over and repeat steps 3-9.

11. 

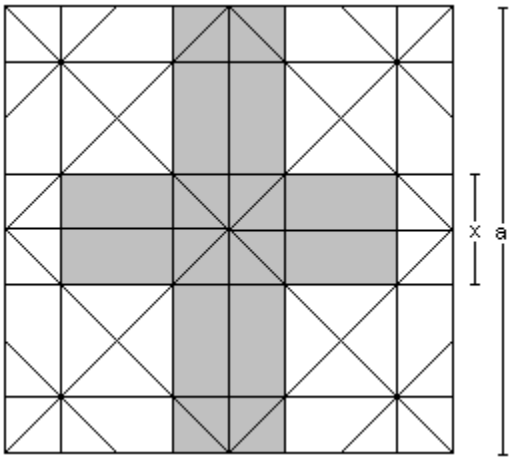
Then it should look like this.

12.  Fold and unfold on the red lines.

13.  Take the folded cube and blow into the hole at the top. Carefully form the cube.

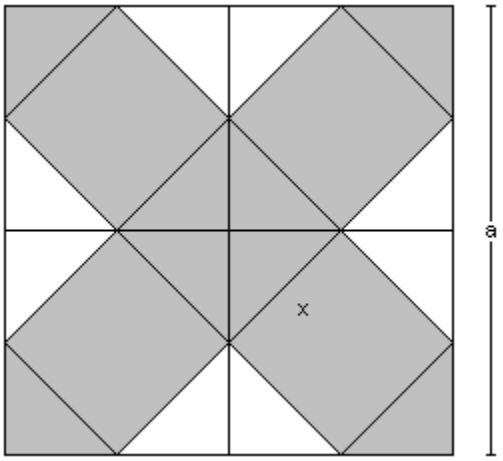
14.  The cube is now finished!

Now we want to compare the length of the original paper, to the length of a side of our cube. If you unfold the cube, your paper will look as follows:



The highlighted region is the surface of your cube. As in the diagram, let a be the length of the original paper, and let x be the length of a side of your cube. Can you relate a and x to each other? What is the ratio $a:x$? (Hint: You might want to think about using areas. For instance, the area of the paper is a^2, but can you write the area of the paper in terms of x^2 as well?)

The shaded region below can also form a cube. As before, we will let a be the length of the original paper, and let x be the length of a side of your cube.



Using the same method as you did for the last diagram, can you relate a and x to each other? What is the ratio $a : x$?

If you would like to make the biggest cube possible out of your square sheet of paper, what is the ratio of the length of the side of the sheet of paper, a, to the length of a side of the cube, x? (Hint: Think about how many sides a cube has. Then compare the total area of the sides of the cube to the area of the original sheet of paper).