Patty Paper Worksheet 5

The Largest Equilateral Triangle

inspired by Thomas Hull's "What's the biggest Equilateral Triangle in a Square" in *Project Origami, activites for exploring mathematics*.

1. First fold you square to produce a $30^\circ - 60^\circ - 90^\circ$ triangle inside it. Explain your method and *justify* that you made a $30^\circ - 60^\circ - 90^\circ$ triangle . Hint: these special triangles have the property that the hypothenuse is twice as long as one of this sides.

2. Find a way to fold an equilateral triangle inside a patty paper. Explain your method and *justify* that you made an equilateral triangle.

3. If the side length of your original square is 1, what is the length of a side of the equilateral triangle you describe above in question 2? Would it be possible to make the triangle's side length bigger?

4. If an equilateral triangle is maximal, can we assume that one of its corners will coincide with a corner of the square? Why? Could we say anything about the other corners of the equilateral triangle?

5. Assuming question 4, draw a picture of what you equilateral-triangle-in-the-square might look like, where the "common corner" of the triangle and square is in the lower left.

6. Let θ denote the angle between the bottom of the square and the bottom of the triangle. What angle should θ be to maximize the size of the equilateral triangle in the patty paper? *Justify* your conclusion.

7. How much time did you spend on this worksheet outside of class?