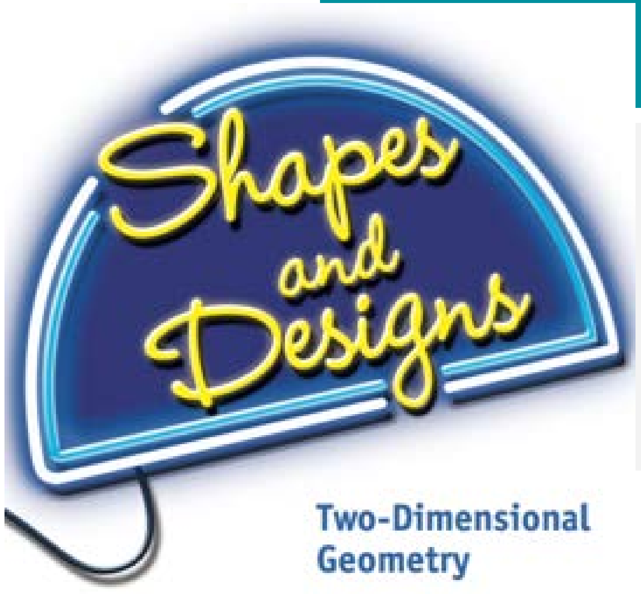
Grade 7 Student Work

Shapes and Designs Problem 2.2



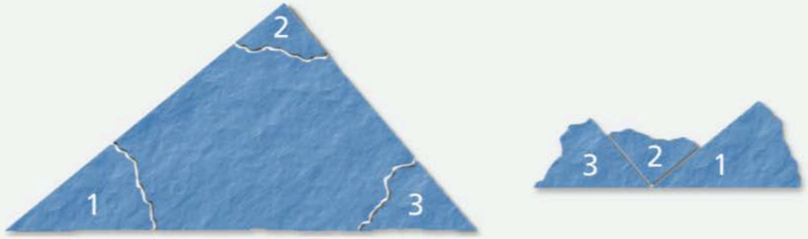
Shapes and Designs Problem 2.2 asks students to make an important generalization about the angle sum property for any polygon. In the previous Problem 2.1, students have discovered the generalization for regular polygons. Problem 2.2 offers three different strategies from fictitious students Devon, Trevor, and Casey for making the generalization.

Students are introduced to the strategies of three students and asked to make sense of the strategies for finding the angle sums of polygons.

Problem 2.2

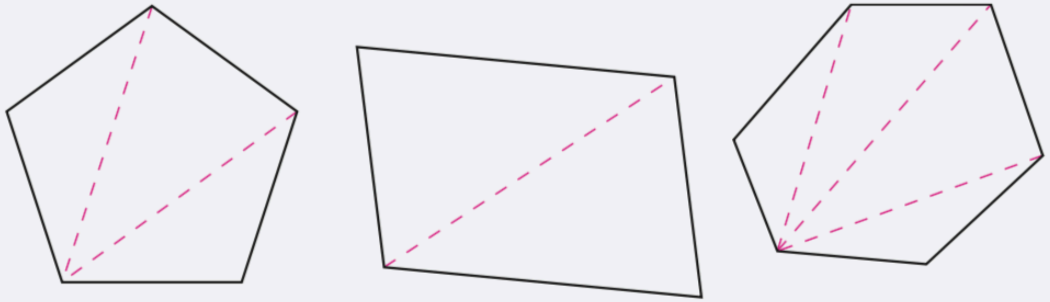
Devon, Trevor, and Casey tried three different ways to find a formula relating the angle sum of any polygon to the number of sides.

A Devon began by drawing irregular triangles and quadrilaterals. Then he tore the corners off of those polygons and 'added' the angles by arranging them like this:



Problem 2.2 continued

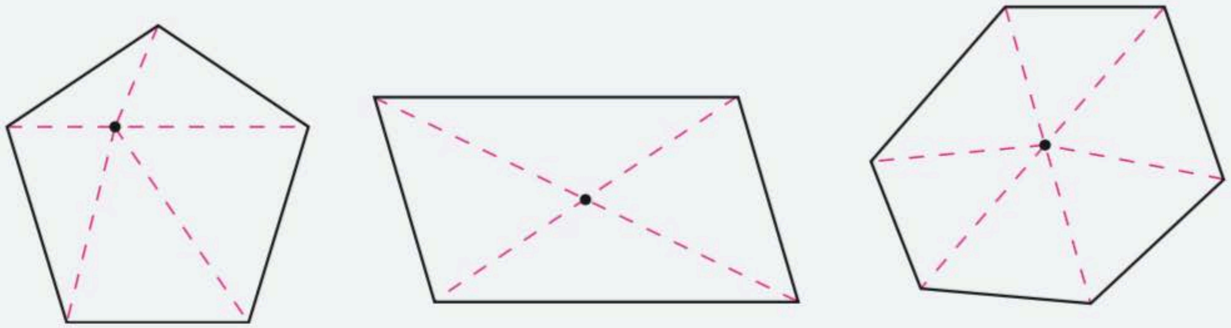
B Trevor examined Devon's results from his study of irregular triangles. This gave him a new idea to study polygons with more sides. He divided some polygons into smaller triangles by drawing diagonals from one vertex.



1. Describe the relationship between the number of sides of a polygon and the number of triangles formed.
2. Find the angle sum of each polygon. It might help to use Trevor's drawings and what you learned earlier about the angle sum of any triangle.
3. Will Trevor's method work to find the angle sum of any polygon? If so, what equation would relate the angle sum S to the number of sides n? If not, why not?

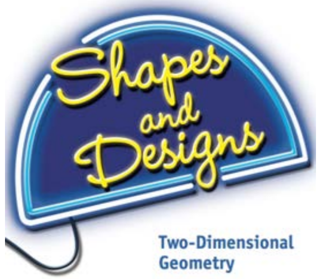
Problem 2.2 continued

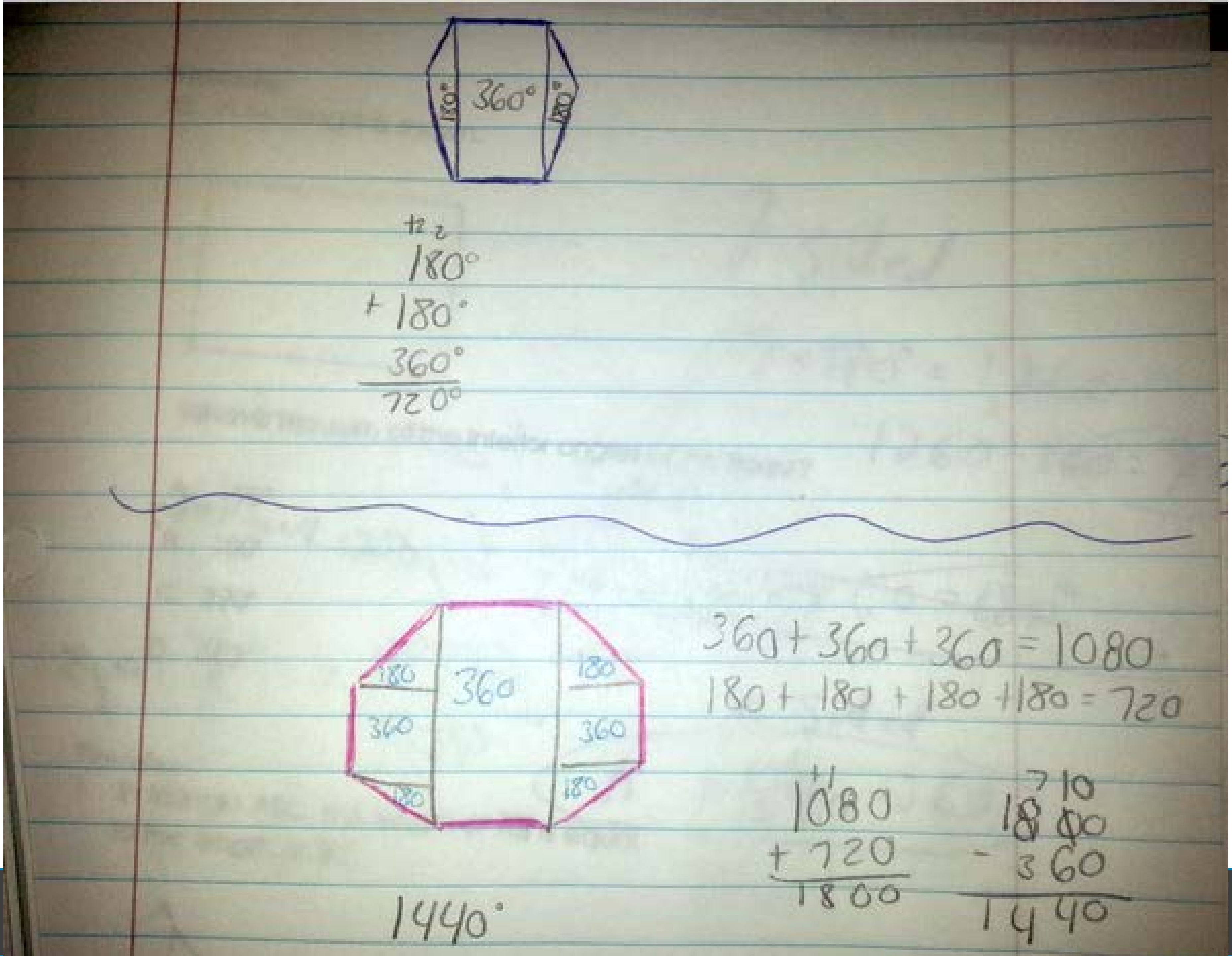
C Casey used Devon's discovery about triangles in a different way. She divided polygons into triangles by drawing line segments from a point within the polygon.



Teacher Comments

Yesterday we completed Shapes and Designs Problem 2.2. We had some productive discussions about the different methods posed for finding interior angles sums of polygons by creating triangles inside the polygons.... just as we have many times through the years. Today when the students came to class, a student showed me a picture she drew to show new ways to find the angle sums of polygons. I was excited and asked her to share with the class.

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Teacher Comments

At first everyone agreed her idea would work with both shapes. Then another student spoke-up, she didn't think the second shape (the octagon) had the correct interior angle sum. This led us into a wonderful 10-minute exploration about what was going on in the drawings. The second student showed why there was a need to subtract another 360 degrees from the angle measures. The original student did a great presentation of her thinking and the resulting classroom discussion helped to refine the strategy for finding the angle sum for an octagon using the new strategy.

Teacher Comments

I was so excited that a student went home, explored something on her own, and had the desire to let me know as she came into class. It was really exciting to build off the ideas we had seen in Problem 2.2, where we had to subtract angles "not needed" when placing a vertex inside the shape. I will be using this young student’s work for years to come to extend student thinking during the school year and teacher thinking during professional development in the summer. The ideas from Problem 2.2 can be used in both of the examples; the student just needed a little nurturing to adjust the strategy in the second drawing.

Shapes and Designs
Two-Dimensional Geometry