Student Project

The parallelogram area formula

Goal: Students will design and deliver a demonstration of the parallelogram area formula, presupposing knowledge and understanding of the manner of computing the area of a rectangle.

Part I. The purpose of this part is to develop a personal understanding of the mathematical ideas. We start with a parallelogram *ABCD* with base *BC*. Let *AE* be the perpendicular from A to the line containing *BC* and let *DF* be the perpendicular from *D* to the line containing *BC*.

A. If either *E* or *F* is in *BC*, then by a single cut we divide *ABCD* into two pieces that reassemble to give a rectangle. Show how, and provide a careful account that shows that the construction does what is intended.

B. For some parallelograms, neither *E* nor *F* is in *BC*. In this case, how can the parallelogram be cut along lines perpendicular to the line containing *BC* and reassembled to form a rectangle?

C. Wrap a parallelogram *ABCD* around a cylinder that has circumference equal to |*BC*|, with *BC* going around the circumference. Cut the cylinder by a line perpendicular to the base. What does this have to do with the previous question?

D. Euclid's Proposition 35 of Book I provides an alternate way of seeing that any parallelogram has the same area as a rectangle. Explain.

E. Derive the formula for triangle area form the formula for parallelogram area.

Part II. Determine the mathematical definitions and propositions that your demonstration in Part I used. Did you use any facts about parallel lines? What facts about area did you need? About similarity?

Part III. Prepare a five-minute talk with visuals that can be used to deliver your findings from Part I.

Part IV. As the culmination of this project, a member of your team selected at random will deliver this talk to the class.