An 8 × 12 piece of paper is folded. The upper left corner A is brought to a place on the perimeter. Your goals in this project are to find formulas describing the length of the fold as a function of the location on the perimeter (and the domain where each formula is valid), sketch the graph, and determine extreme values.

There are several different geometric cases. One situation is illustrated below. The corner A is folded over so that it lies somewhere on edge BC and the ends of the folds are on edges AB and AD, as shown below.

1. For the case illustrated above:
   a) Find a formula for the length of the fold y as a function of z.
   b) Find the domain over which this formula is valid.
   c) Graph y(z) over the domain.
   d) Determine at what z the minimum of y occurs.
   e) Evaluate the minimum value of y.

We now want to think of the fold length as a function of the distance around the perimeter. If we let s be the distance around the perimeter of the corner A, starting at A and moving clockwise, we wish to find the fold length y as a function of s. Thus the entire domain will be 0 ≤ s ≤ 40 (=8+12+8+12). However, the geometry
changes as the corner A moves around the perimeter. You will need to break the problem up into cases.

Case 1 has corner A on edge AB. Case 2 has corner A on edge BC and fold ends on edges AB and DC. In Question 1 you did Case 3, except the independent variable was z rather than s. Since \( s = z + 8 \), it is a simple matter to alter your answers to Question 1 to get everything in terms of s for this case.

2. Describe in words each case you will need (there are more than 3). Sketch pictures of the folded paper for each case.

3. For each case, find a formula for the fold length \( y \) as a function of the distance \( s \) around the perimeter.

4. For each case find the domain over which your formula in Question 3 is valid.

5. Graph \( y \) over the entire domain \( 0 \leq s \leq 40 \).

6. Find all relative extrema, i.e., find all points \((s_0, y(s_0))\) such that \( y \) has a relative maximum or relative minimum at \( s_0 \).

7. Find the absolute maximum and absolute minimum values of the fold length \( y \).