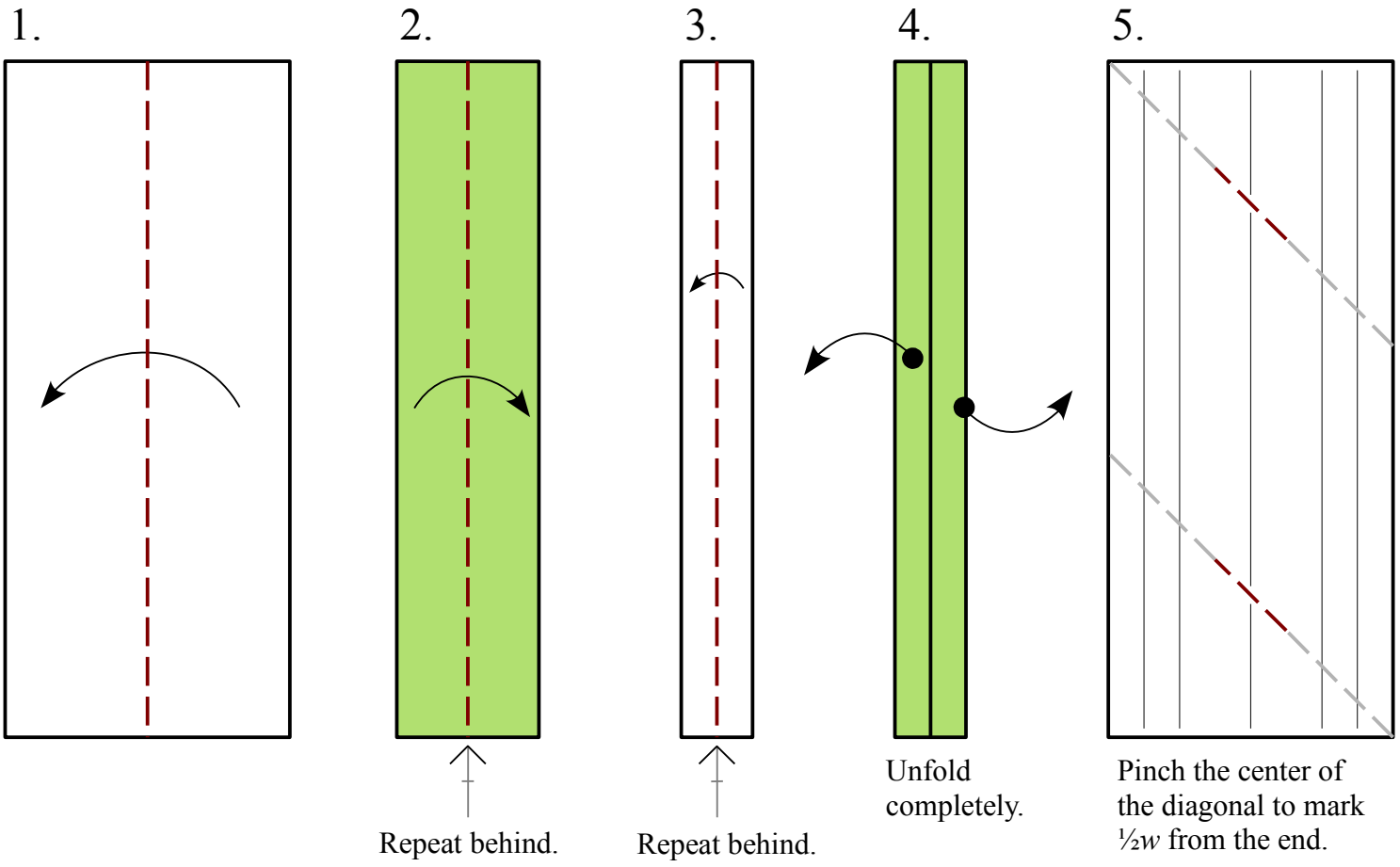
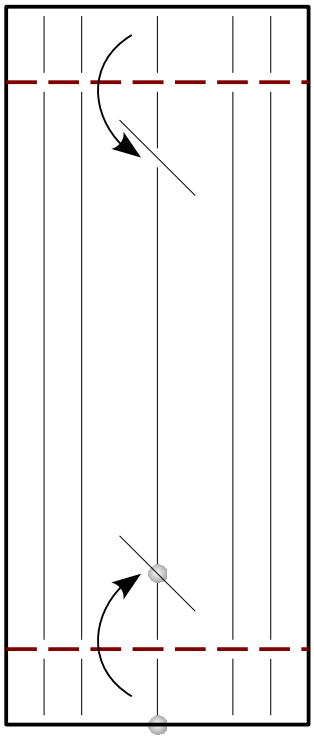
$ Paper-Clip Tray

By Wensdy Whitehead

Recommended Paper: U.S. dollar bill or *any* rectangle (or square) of fairly stiff paper such as copy paper.



6.



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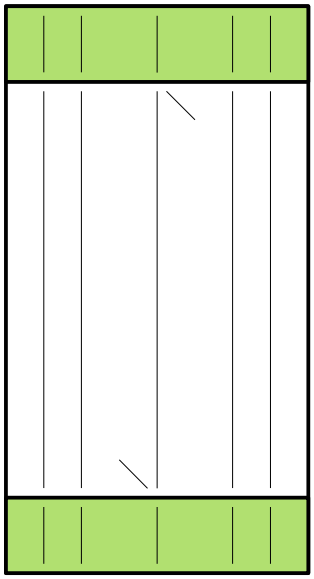
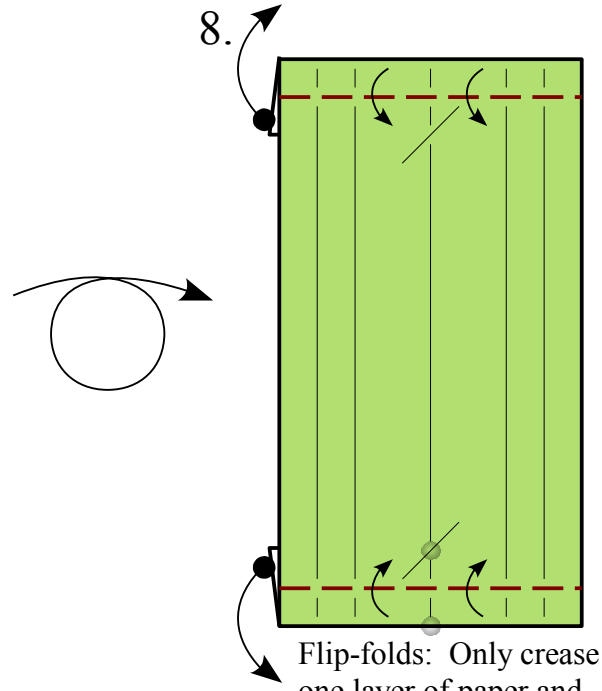
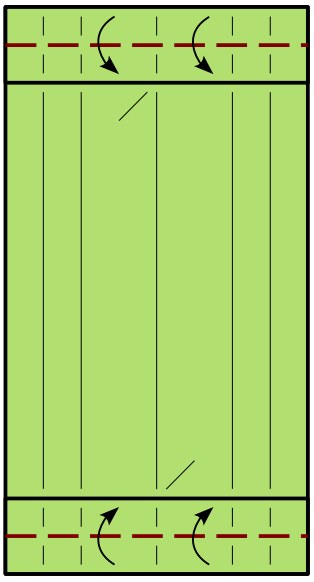


8.

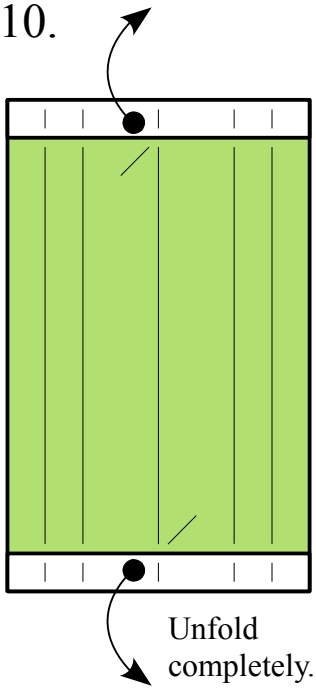


Flip-folds: Only crease one layer of paper and let the flap from behind flip around to the front.

9.

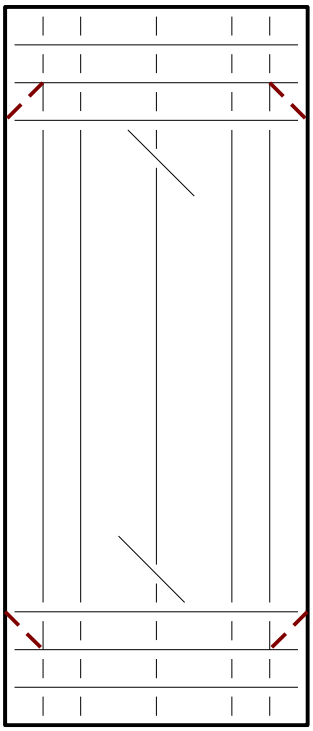


10.



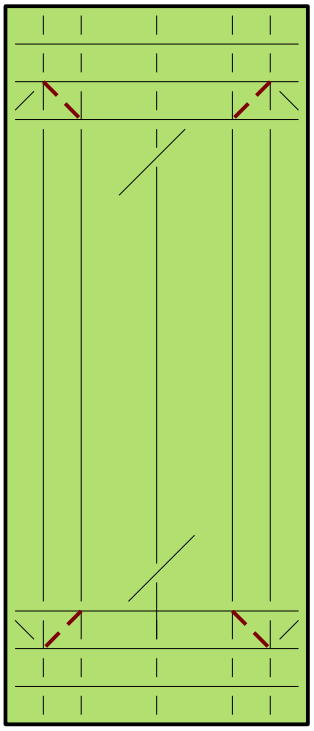
Unfold completely.

11.

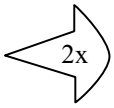


Pre-crease.

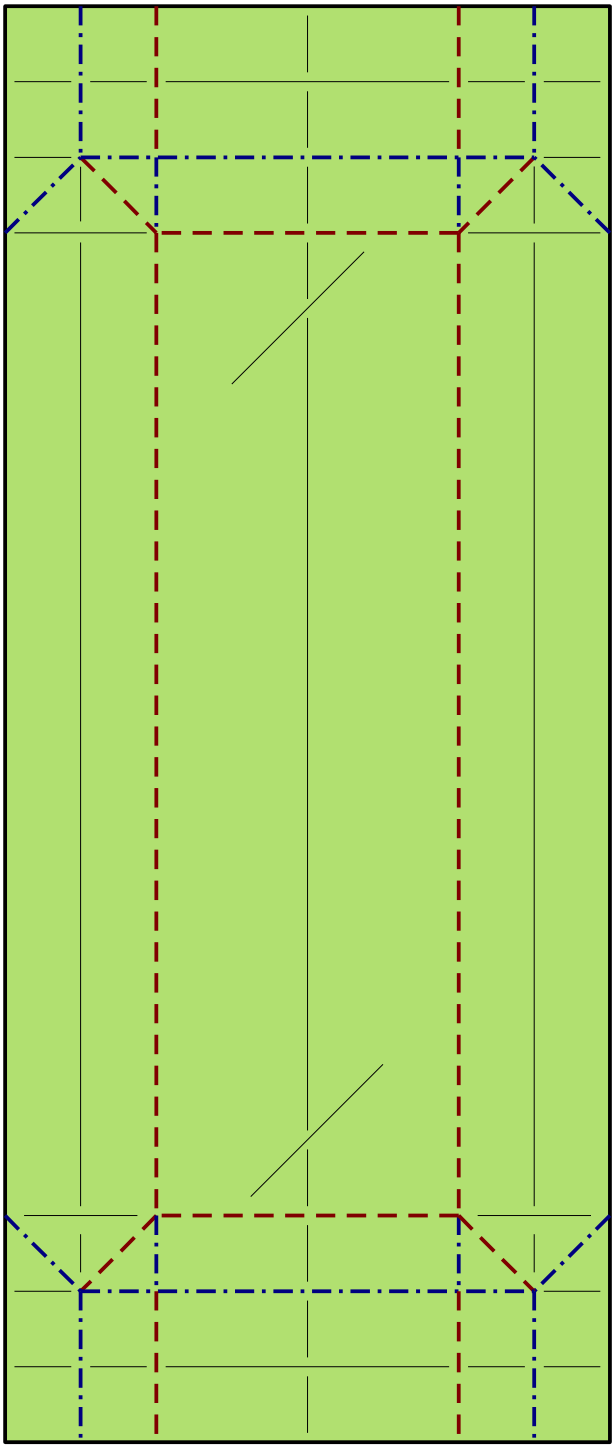
12.



Pre-crease.

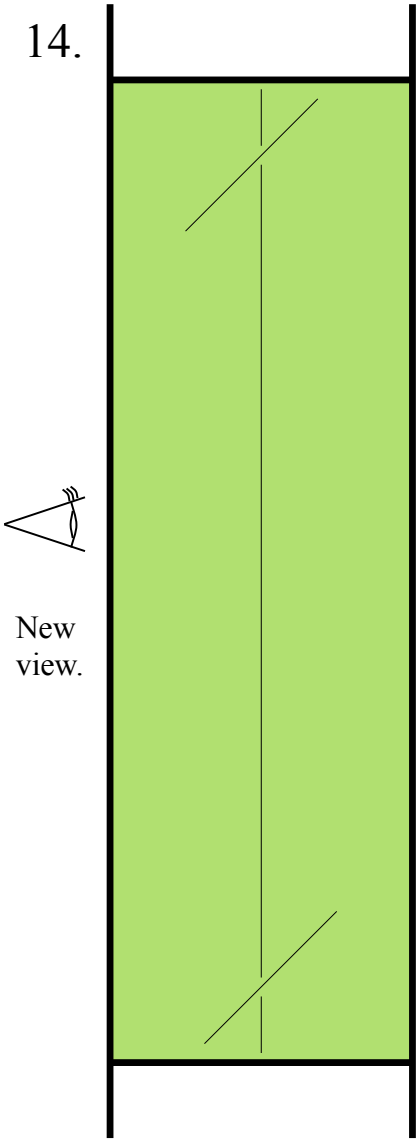


13.



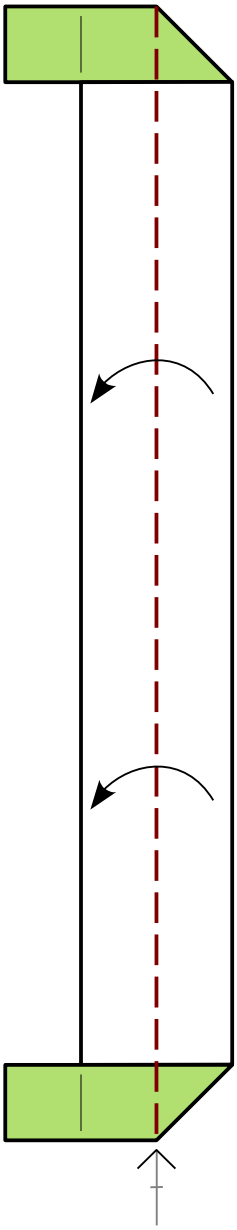
Collapse.

14.



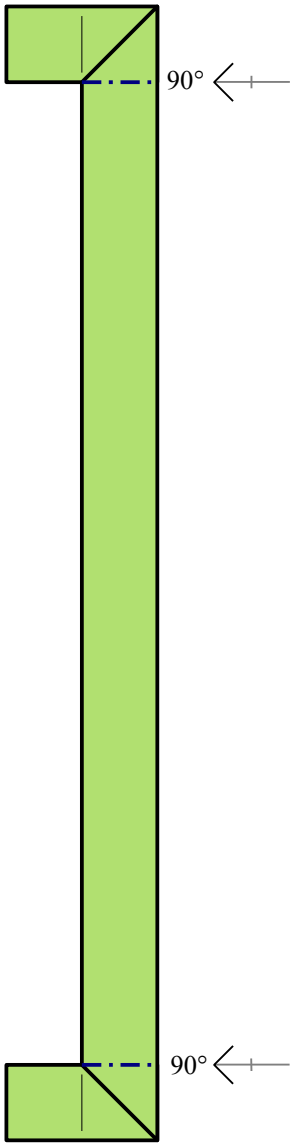
New view.

15.



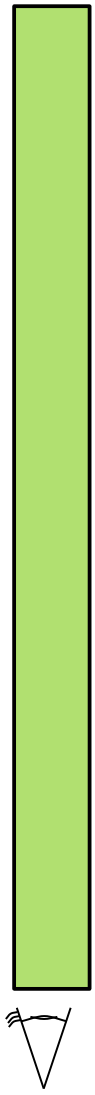
Repeat behind.

16.



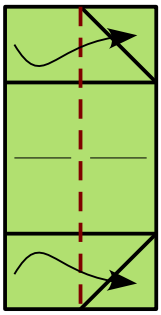
Mountain folds.
Repeat behind.

17.



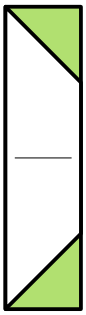
New view.

18.

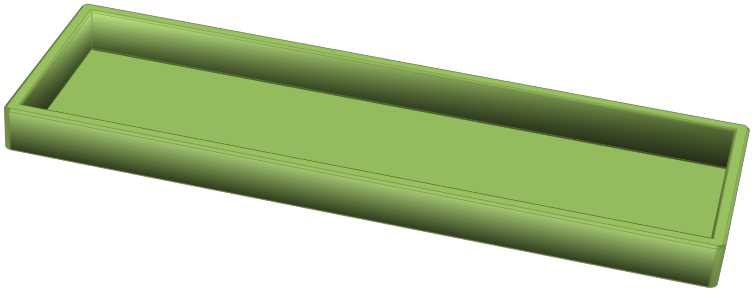


Valley fold and tuck the corners into the pockets.
Repeat behind.

19.



Done!



Math of the Model

This model can be made with a rectangle of any proportion, but it would be nice to know the size of the box a given piece of paper will make. The following formulas describe the length (l), width (w) and height (h) of the box given the length and width of the paper. Notice that the length of the box depends on both dimensions of the paper, but the width and height of the box depend only on the width of the paper.

$$w_{box} = \frac{w_{paper}}{2} \qquad l_{box} = l_{paper} - \frac{3\,w_{paper}}{4} \qquad h_{box} = \frac{w_{paper}}{8}$$

Of course, it would be useful to be able to work backward and calculate the paper size given the size of the desired box. Height will still depend on the width, while the length and width of the box specify the size of paper needed according to the following formulas.

$$w_{paper} = 2\,w_{box} \qquad l_{paper} = l_{box} + \frac{3\,w_{box}}{2}$$

Thus a square will make a 1:2 box and a 4:5 rectangle will make a square box. These equations hold for all $l \geq w$, which is of course the norm; length is long side. However, since a square is a 1:1 rectangle and forms a 1:2 box, some rectangles should work with length and width reversing their roles. According to the equations, rectangles from 1:1 to 3:4 work either way. This is useful to get relatively taller boxes. (A box of zero length would be an envelope.) To determine paper size from box height and length instead of box width and length, use the following formulas.

$$w_{paper} = 8\,h_{box} \qquad l_{paper} = l_{box} + 6\,h_{box}$$

This is easy to prove using beginning algebra, diagram 13 and a general understanding of what parts of the paper become the sides, ends and bottom of the box, or you can just believe and use the formulas. As so many math books say, the proof is left as an exercise for the reader.