Folding a Regular Pentagon from a Square

This is a modification of a method by Alice Gray.

**Overview**

The folding method is based on the pattern shown here. There are 12 triangles with angles of 36, 54, and 90 degrees (10 in the pentagon and 2 larger ones), and 4 triangles with angles of 9, 45, and 126 degrees.

Corner \(a\) is folded to corner \(b\), then point \(c\) is folded to point \(d\) to establish initial angles. The initial angles are then halved to get the other angles around the center of the pentagon.

Point \(d\) is estimated as the midpoint of the upper edge of the square, but actually it is slightly left of center. If lines \(de\) and \(ce\) have length \(X\), then the ratio of length \(db\) to \(bc\) is:

\[
\frac{X \cdot \cos(36\text{ deg})}{X + X \cdot \sin(36\text{ deg})} = 0.50953
\]

**Adjustment Guide**

For a 10 1/2 inch square, point \(d\) needs to be one tenth of an inch left of center.

For a 6 1/2 inch square, point \(d\) needs to be one sixteenth of an inch left of center.

In general, the adjustment is about 1/105 of one side of the square.

**Instructions**

1. Valley-fold corner \(a\) to corner \(b\).
2. Valley-fold corner \(a\) to corner \(b\) to make crease \(c\), and unfold. Then valley-fold point \(p\) to slightly left of crease \(c\), using the above adjustment guide.

Don't worry too much about the estimation. If you are estimating 1/16 inch, your error will probably be less than that, so an honest try is a big improvement over just aiming for the center crease.
3. Valley-fold edge a to edge b.

4. Valley-fold edge a to edge b.

5 Mountain-fold where the edges meet in the middle, folding the left side behind.

6. Dotted lines show hidden edges. Find the hidden corner P.

6a. Using a paper-cutter, cut all layers through corner P, at right angles to edge E. (Put edge E against the paper guide.)

6b. Or, to use scissors, turn the paper over and fold only the top two layers, edge e to edge E, and turning on point P. Unfold, and cut along the new crease through all layers.

7. Unfold. The pentagon (and scrap paper) have only these creases.