

# Tiled Hexagon Tessellation

I called this model a tiled hexagon, for lack of a better term. In essence it's just a folded demonstration of a pure hexagonal tessellation. Hexagons are one of the three polygons that can fully tessellate a plane (triangles, quadrilaterals, and hexagons).

The actual "top" of this pattern forms a flat plane of hexagons; the really interesting part is the "bottom" which is made up of triangular squashed twist folds. This particular sort of fold is a basic element in many origami tessellation patterns, whether it be a triangle, square, hexagon, or other polygonal unit. It allows the excess material that builds up at crease intersections to be dispersed in a flat-foldable way (which is also usually quite fun to fold). I think of it as something similar to popping bubble wrap.



Squashed Twist Fold

While the crease pattern(s) for this fold are usable, the model is usually folded initially from a standard pre-creased sheet of paper, using the 60 degree creasing method listed at the end of this document. Initial hexagonal shapes are roughed out from the pre-creased sheet, and the crease intersections are folded with the squashed twist. This becomes rather easy once you get the hang of it. I've included a simple single squashed twist fold to try out as an example.

Everything I release is available online at <http://www.origamitessellations.com>.

-Eric Gjerde

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A note- the lines drawn on the paper in the photos are not relevant to the diagram. please ignore them!

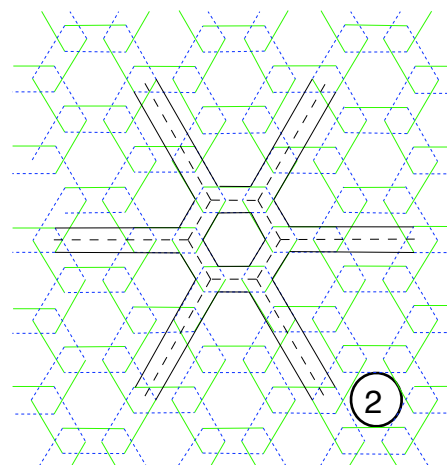
**1st step:** Pre-crease paper to preferred level of crease width- I'd suggest 4 iterations of folding, minimum. (that's 1/2, 1/4, 1/8, 1/16; but 1/32 or higher will yield better results). You can either use some of the crease patterns that I have in this document, or create your own pre-creased paper from scratch using the directions attached at the end.

**2nd step:** Identify "central" hexagon. It should have a two-pleat-width radius from the center of the hexagon. This "central" hexagon can be the exact center, or offset if that's what you prefer. Actual location is irrelevant to the final pattern, although symmetry is usually a preferred result. See illustration.

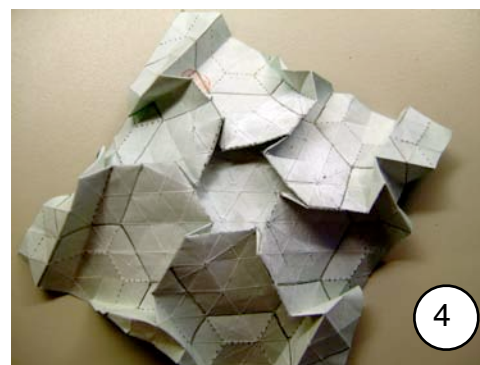
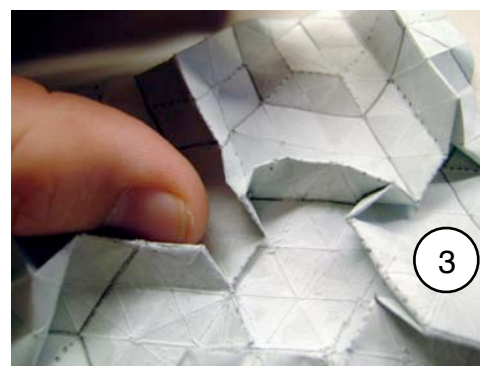
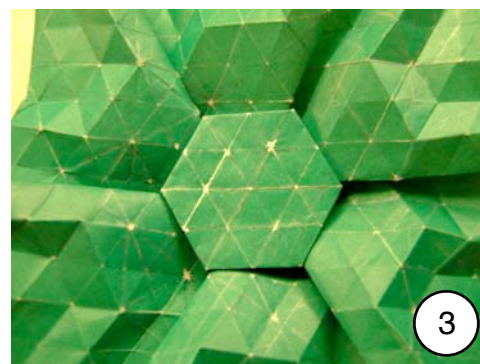
What we are doing with this model is creating a valley around every hexagon shape, which results in a tight grid of hexagons across the entire paper. We'll be folding the extra "valley" paper into the triangular squash twist folds. See illustration.

**3rd step:** Identify the two-pleat-wide "valley" that encircles your central hexagon. This needs to be folded into a one-pleat-high mountain fold all the way around; at the hexagonal vertex points, you will need to fold it into a 3-way intersection. This also requires that you fold the 3rd angle at the intersections into the same sort of mountain fold- this should extend straight out from the vertex of the hexagon. See illustration.

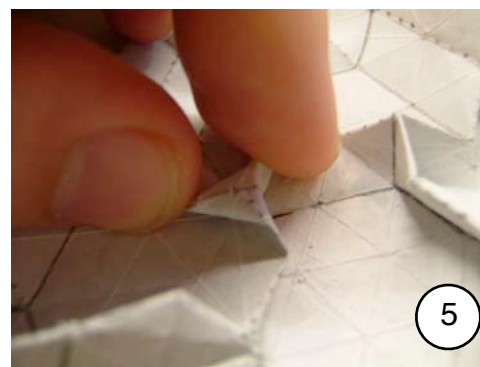
**4th step:** Continue the process of identifying hexagons and folding valleys around all of them. You should be able to fill the entire sheet of paper with these creases. Once you get into a "groove" it's quite easy to do.



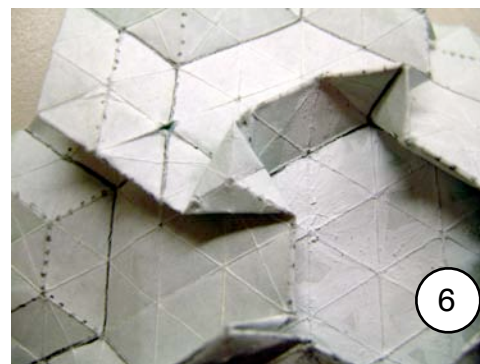
Initial hexagon identified, and 2-pleat-wide valley around it.



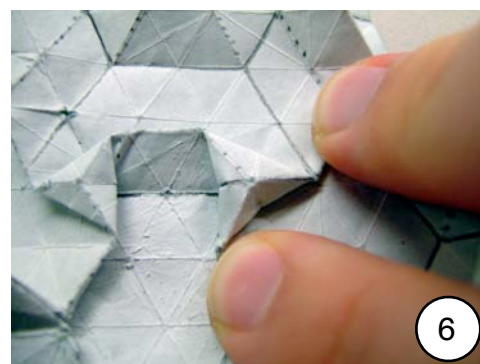
**5th step:** Here's the big step- twisting the 3-way intersections into squashed triangle twists. Start with your central hexagon (you could really start anywhere you want, but working from the center outwards is probably best) and twist the 3-way intersection as shown in the illustration. It will start taking on a triangular appearance; this is the part we are going to squash and turn into a flat triangle. As you get the three pleats twisted flat, it will more or less start squashing itself. You can give it a little help (if it needs it) by pushing on the tip of the triangular intersection. Once it starts squashing, just press down on the triangle while making sure the pleats are flattened properly all around it (otherwise the triangle will not come out correctly). This is a remarkably easy fold once you get the hang of it.



**6th step:** Once you've got the first squash done, you'll notice the next 3-way intersection around the hexagon needs to be twisted in the alternate direction. This is how it will work across the entire sheet of paper, so it's quite easy to remember- if you're folding it wrong, it won't work out and you'll notice it really quickly!



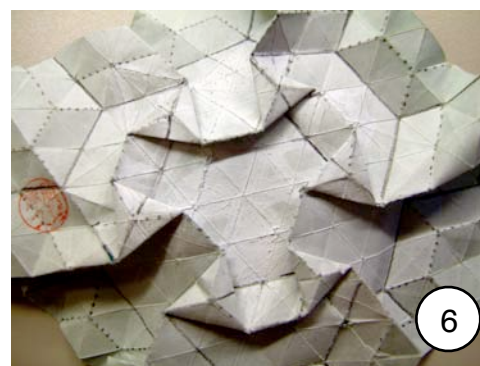
At the next intersection, one of your pleats extending from the first squash fold will already be lying flat- just twist the remaining two as you did in step 5 and squash the triangle. Continue doing this around the central hexagon and it will turn out like the illustration shows.

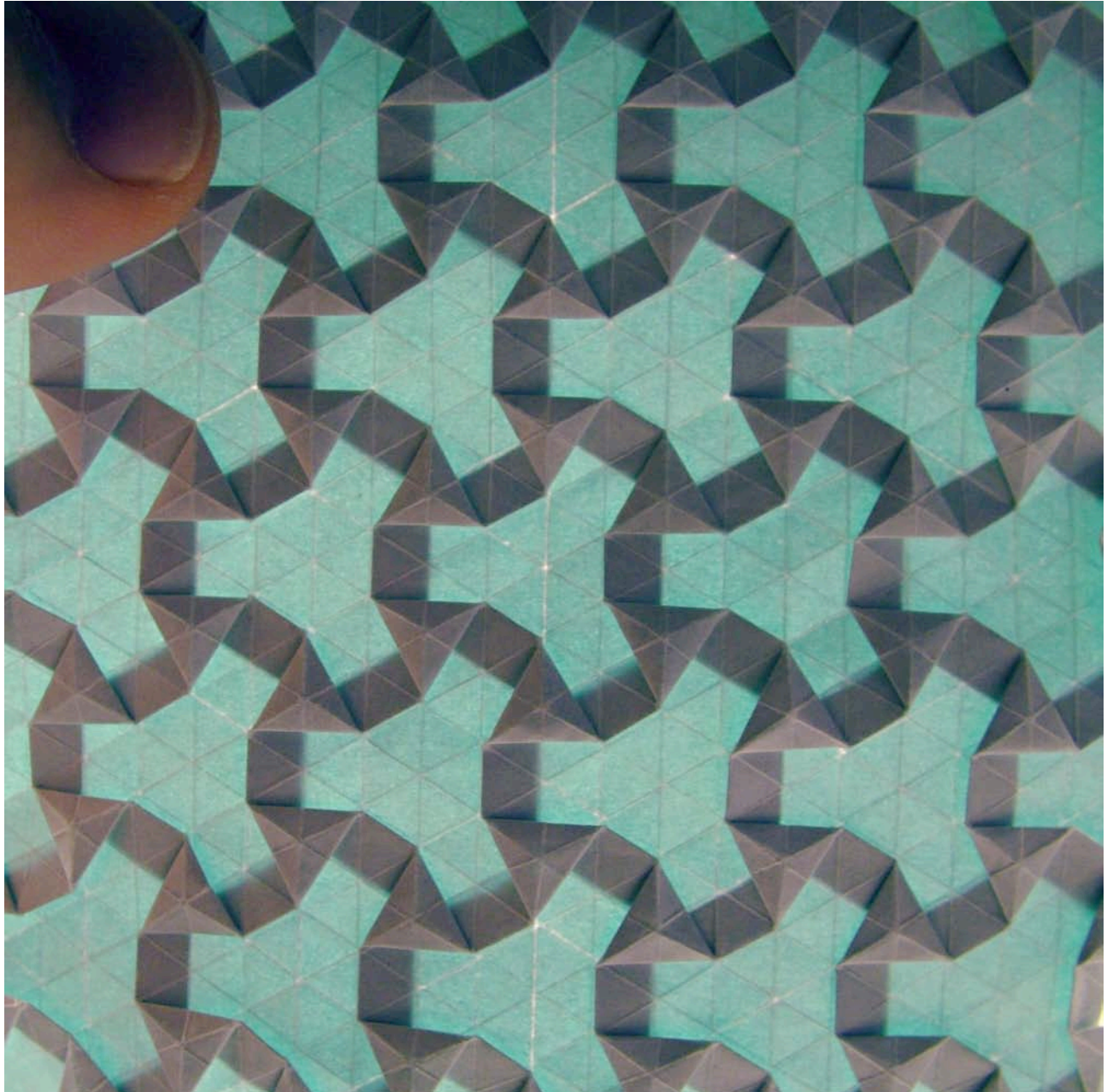


**7th step:** This really isn't a step, per se, but we'll call it that anyway. Now that you've got the central hexagon flattened, you'll see that each side of the hexagon is part of another hexagon, which needs to be squash



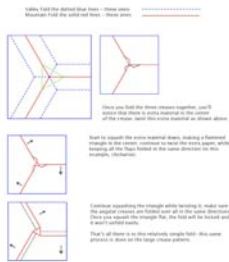
twisted in the same fashion. I'd suggest going in a linear method, by folding everything both up and down from your original hexagon, but feel free to do it however works best. Once you're complete it will look like the final illustration shown to the left. You're done!





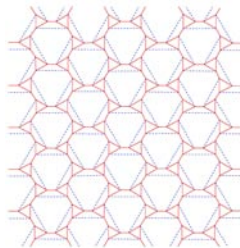
This tessellation makes a very attractive pattern when held up to a light. The folding structure locks the paper together, so you could fold additional things with a sheet of this tessellated pattern if you so desired. The squashed twist fold is a basic building block of folded tessellations, so it's a good fold to add to your repertoire.

# The Crease Patterns



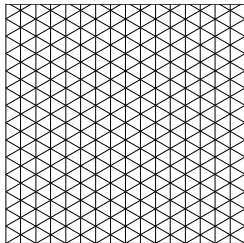
Sample squashed twist fold, diagram page 1:

This is a sample diagram of a single squashed twist. Try this one out first if you're wondering how it works, or would like something easier to practice on.



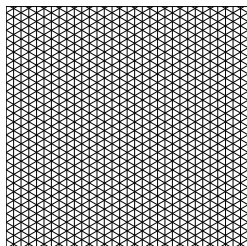
Main Pre-crease Pattern, diagram page 2:

This is what I would use to fold the tessellation, if you want to use a crease pattern. It's a bit more simplistic in the number of lines shown to make folding easier. These are all the actual creases in the final model. Fold mountain folds on solid red lines, and valley folds on blue dotted lines.



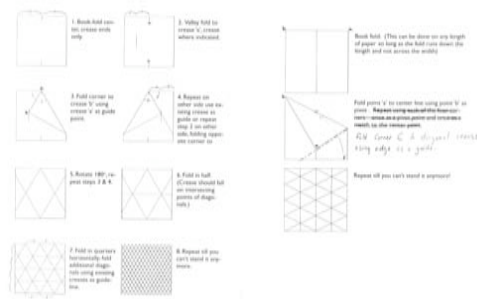
Large Hex Grid Pattern, diagram page 3:

Another pre-made grid, in a larger size. Less folding here, but of course that also means less full tiles in the end. This might be good to start with, and work your way up to the larger sizes.



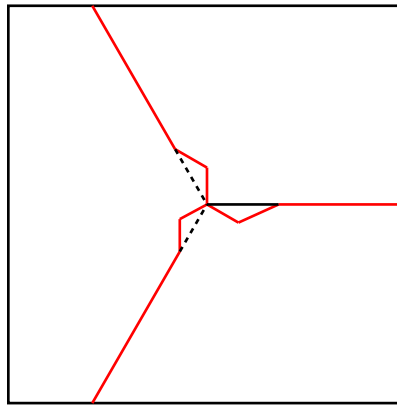
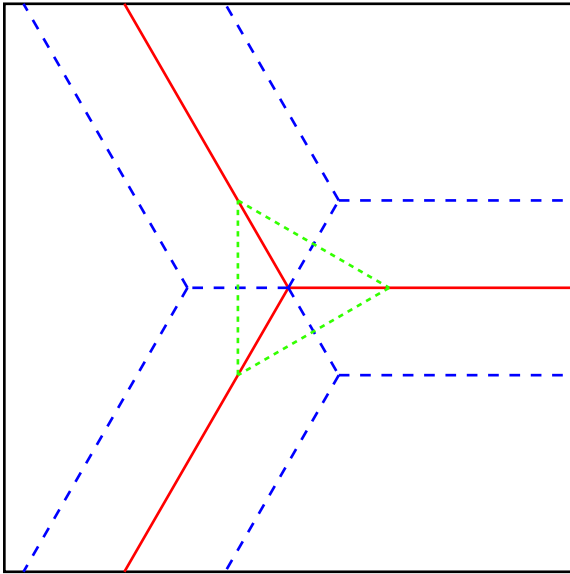
Small Hex Grid Pattern, diagram page 4:

Here's a pre-made grid of small triangles in case you don't feel like folding one from scratch. This is the size I would recommend using for a final version of the model.

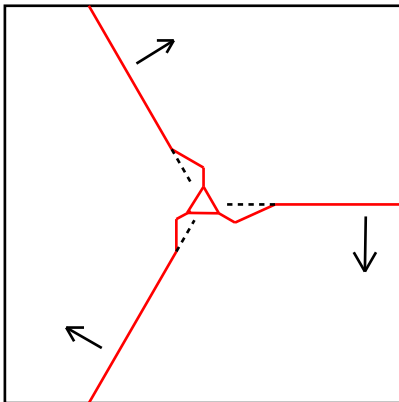


Folding from Scratch diagrams, pages 5 and 6:  
These are two different ways to generate 60 degree equilateral triangle crease patterns. I prefer page 6, but most other people use page 5.

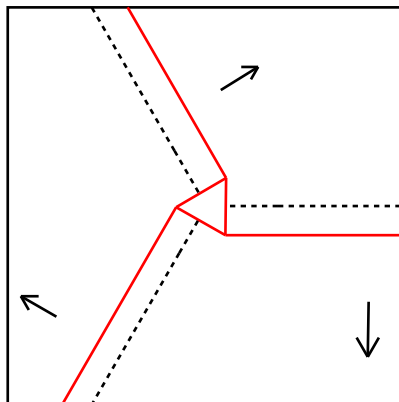
Valley Fold the dotted blue lines – these ones:  
Mountain Fold the solid red lines – these ones:



Once you fold the three creases together, you'll notice that there is extra material in the center of the crease. twist this extra material as shown above.

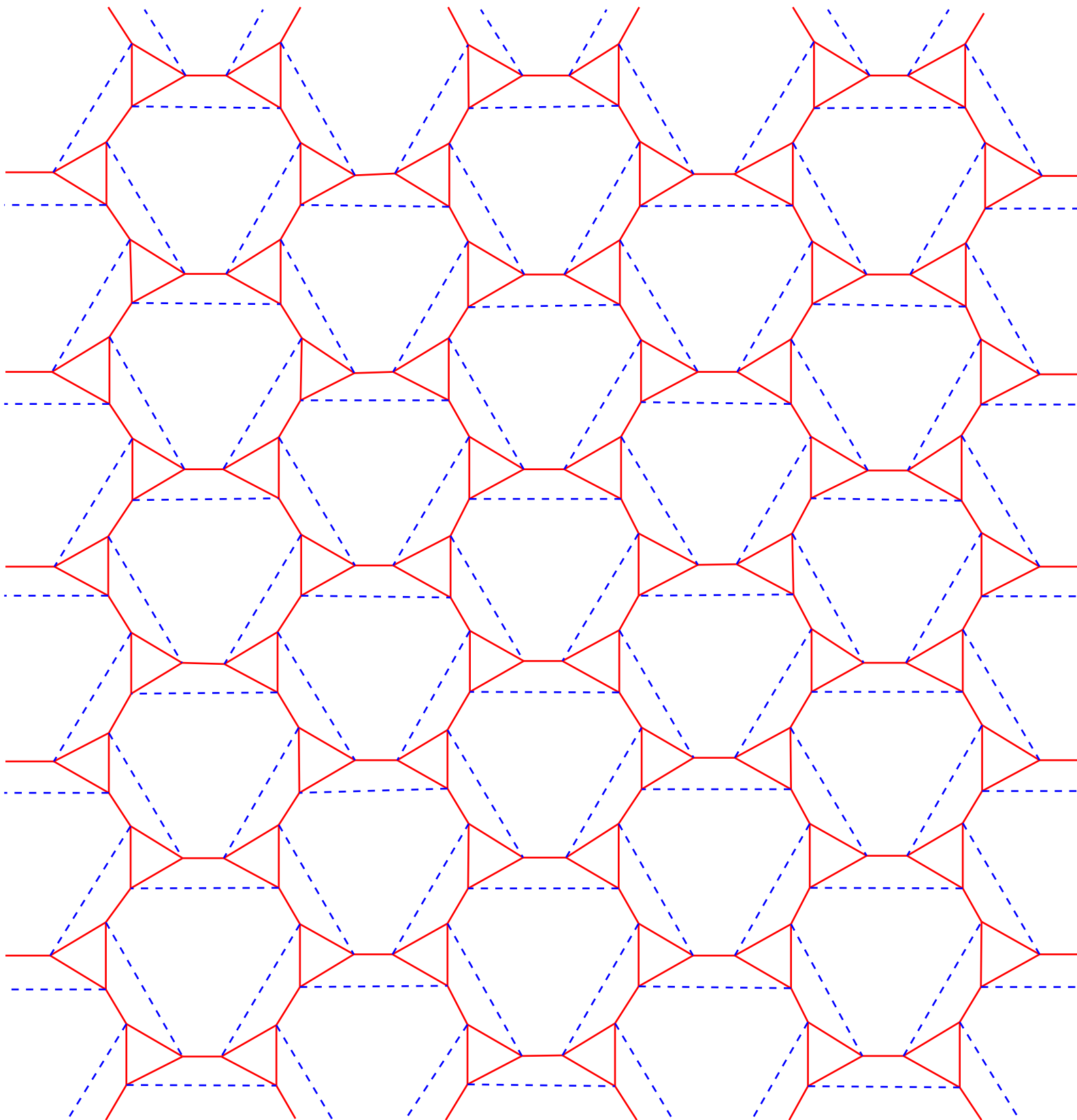


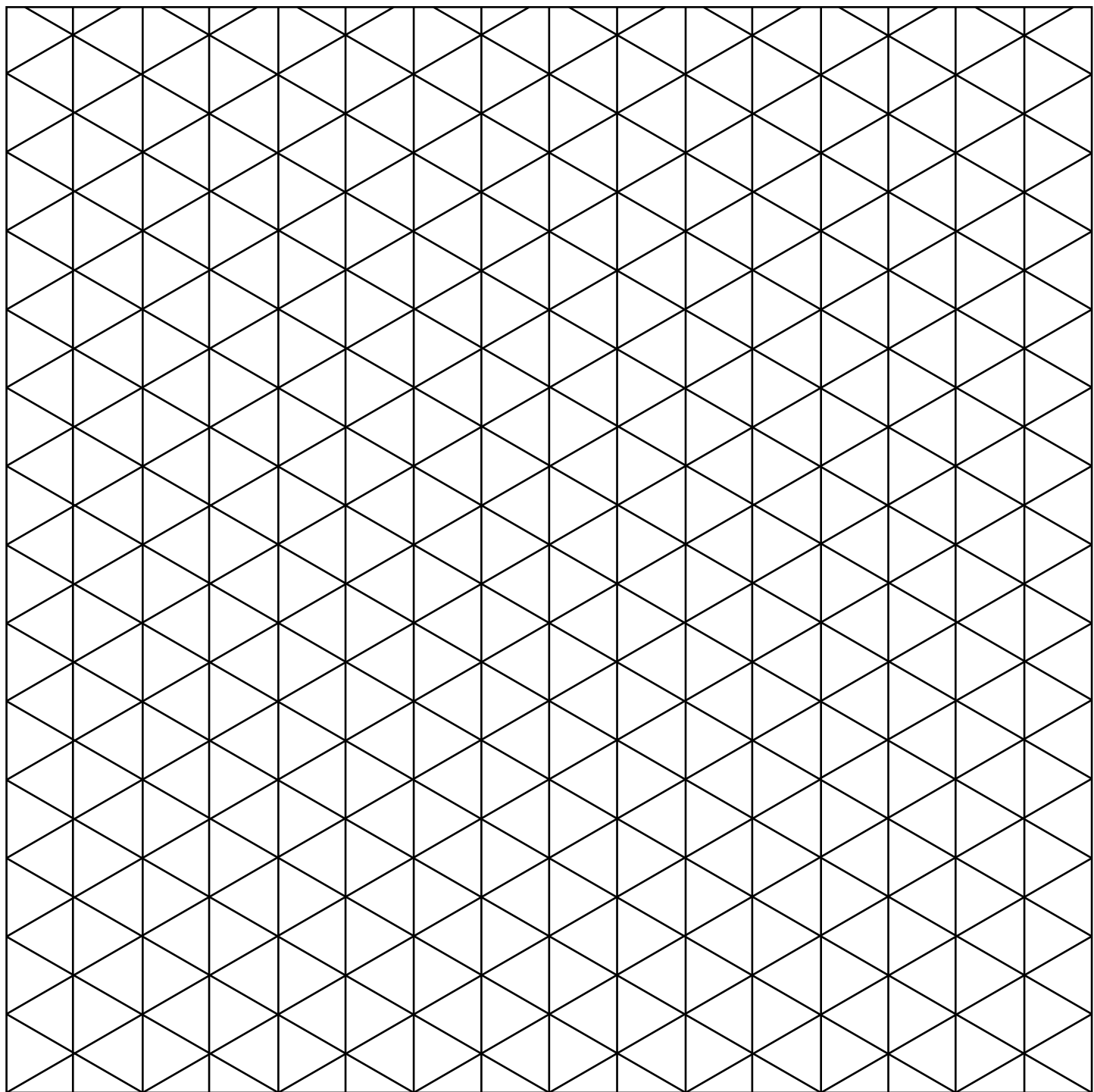
Start to squash the extra material down, making a flattened triangle in the center. continue to twist the extra paper, while keeping all the flaps folded in the same direction (in this example, clockwise).

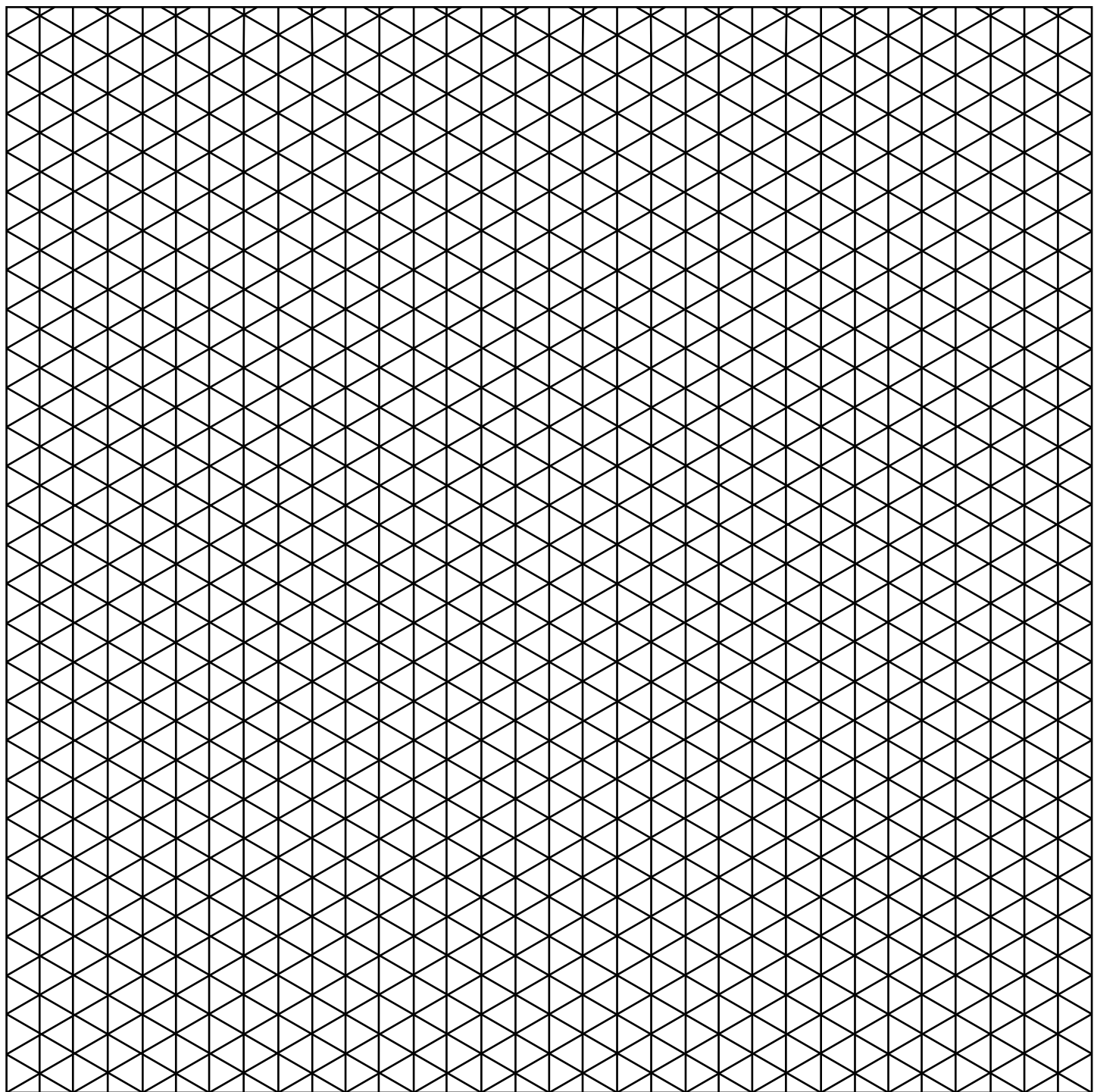


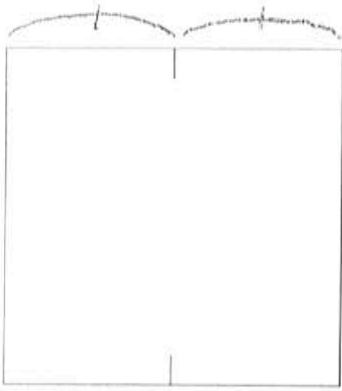
Continue squashing the triangle while twisting it; make sure the angular creases are folded over all in the same directions. Once you squash the triangle flat, the fold will be locked and it won't unfold easily.

That's all there is to this relatively simple fold– this same process is done on the large crease pattern.

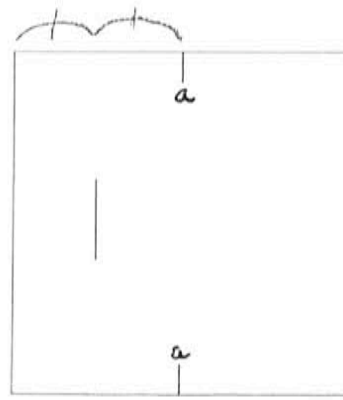




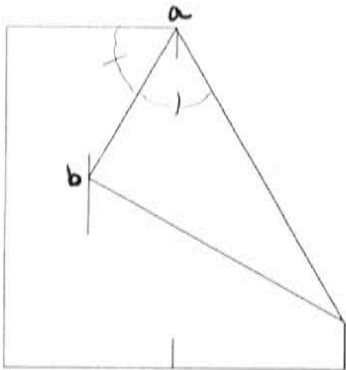




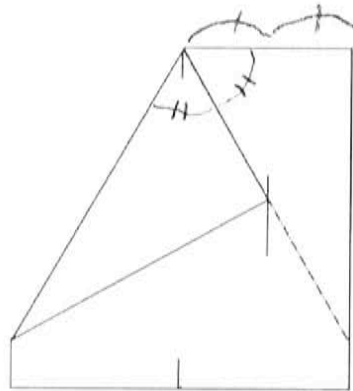
1. Book-fold center, crease ends only.



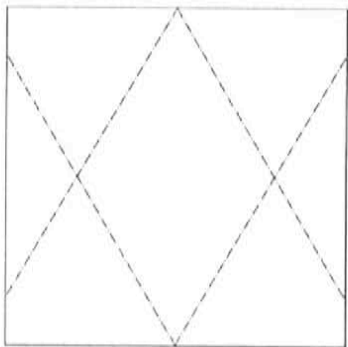
2. Valley fold to crease 'a', crease where indicated.



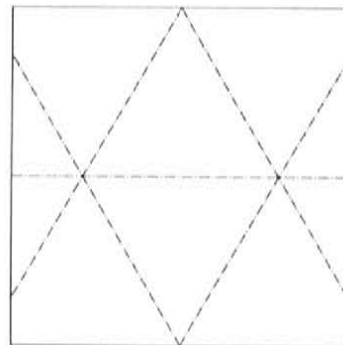
3. Fold corner to crease 'b' using crease 'a' as guide point.



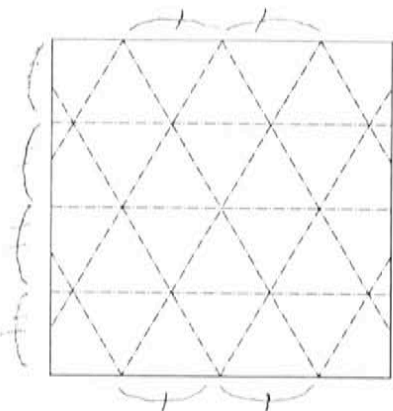
4. Repeat on other side use existing crease as guide or repeat step 2 on other side, folding opposite corner to



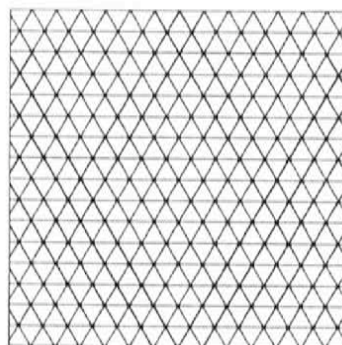
5. Rotate 180°, repeat steps 3 & 4.



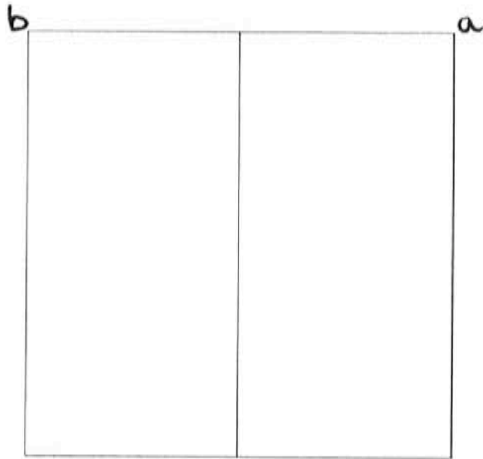
6. Fold in half. (Crease should fall on intersecting points of diagonals.)



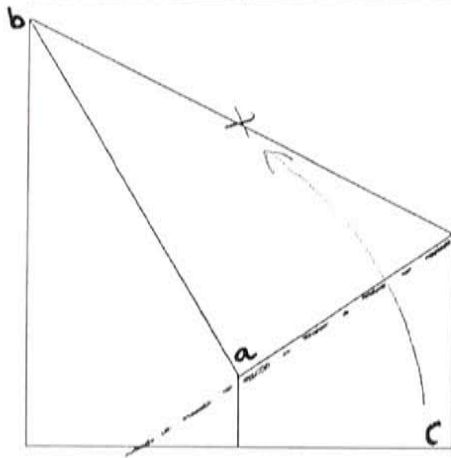
7. Fold in quarters horizontally; fold additional diagonals using existing creases as guideline.



8. Repeat till you can't stand it anymore.

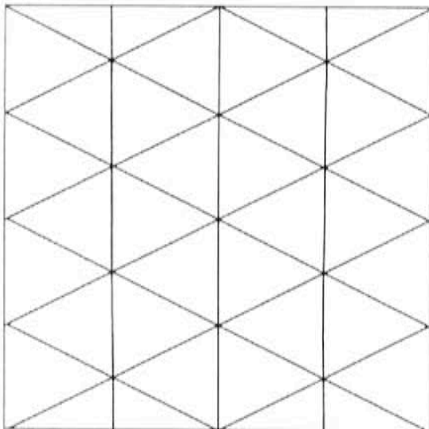


Book fold. (This can be done on any length of paper so long as the fold runs down the length and not across the width)



Fold point 'a' to center line using point 'b' as pivot. ~~Repeat using each of the four corners—once as a pivot point and once as a match to the center point.~~

*Fold corner C to diagonal crease using edge as a guide.*



Repeat till you can't stand it anymore!