



**Advanced Mathematics
Support Programme®**

Modular origami

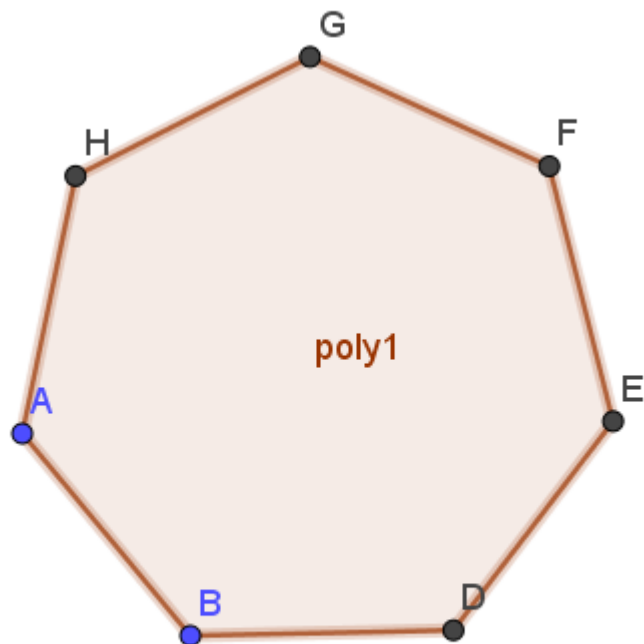
1 - making the units

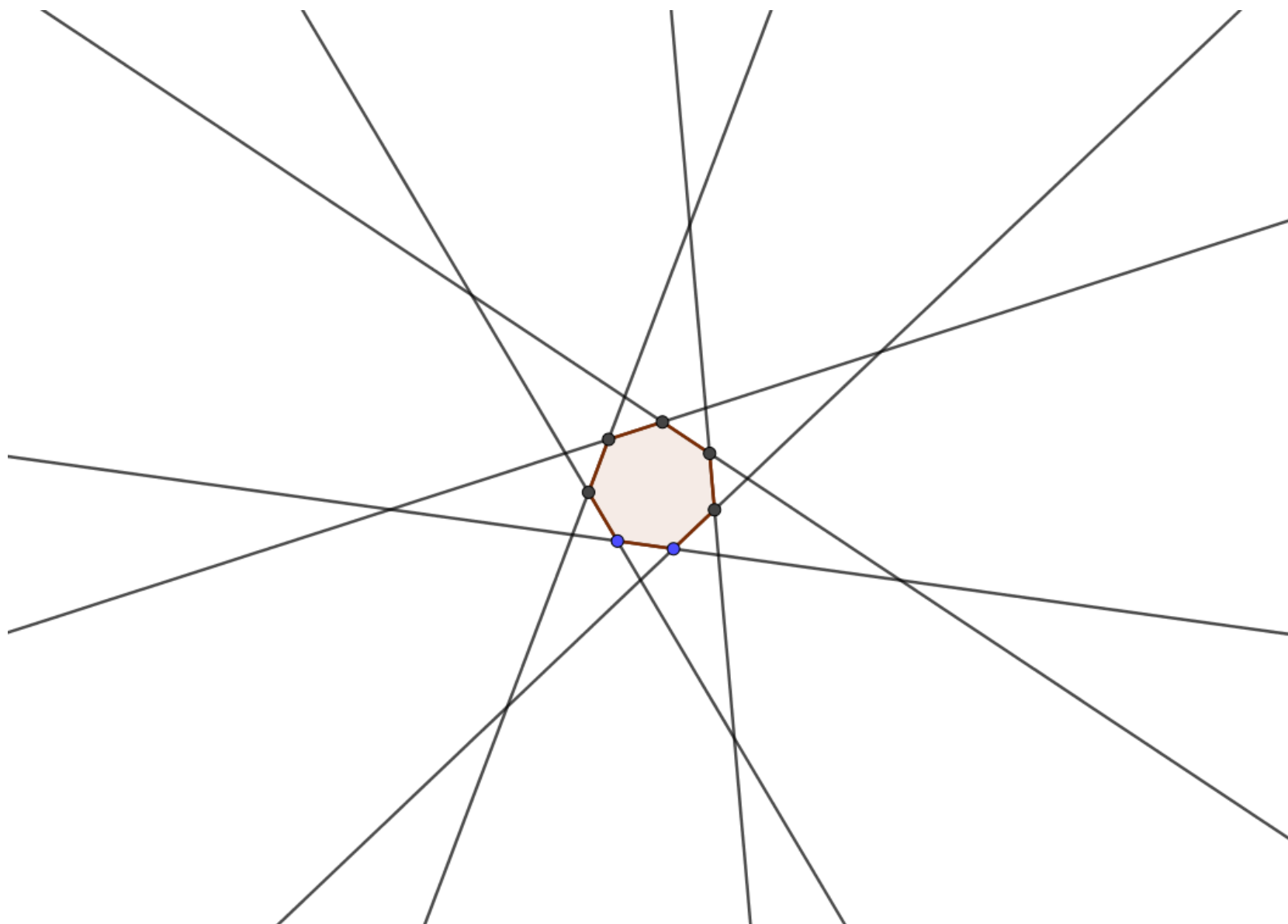
Origami paper

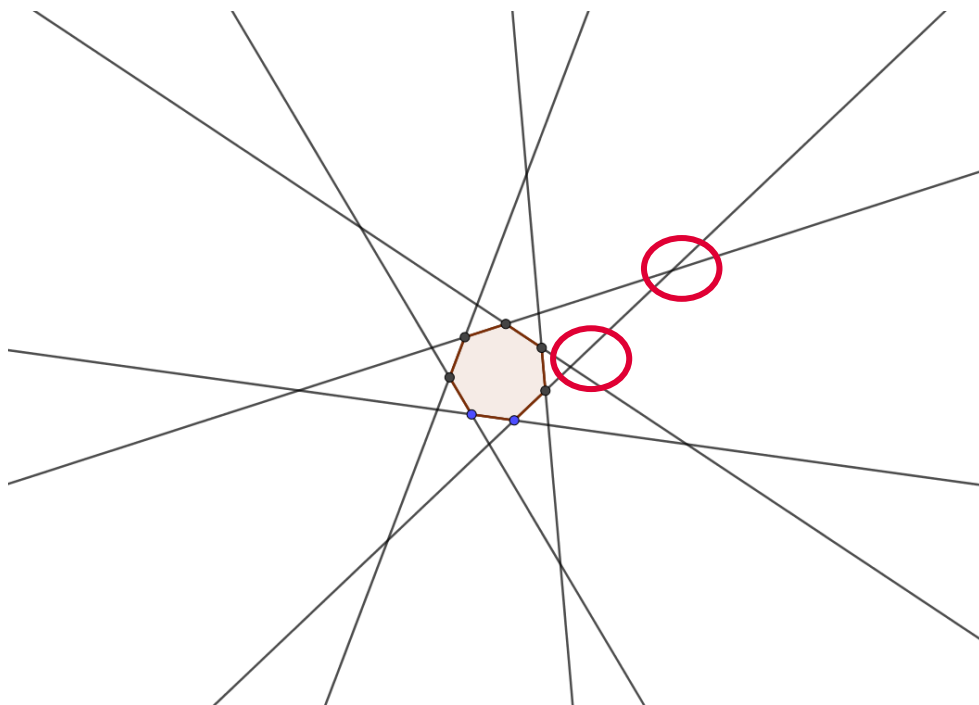
- You need square paper for all origami
- If you have no square paper, there are two methods to make squares in this video
- <https://bit.ly/squarefroma4>

Modular origami

- Polyhedrons are 3D shapes made from faces of regular polygons.
- Stellated polyhedra are shapes which have continued the faces until they meet again outside the original polyhedron
- You can see how a 2D shape can become stellated [here](#)

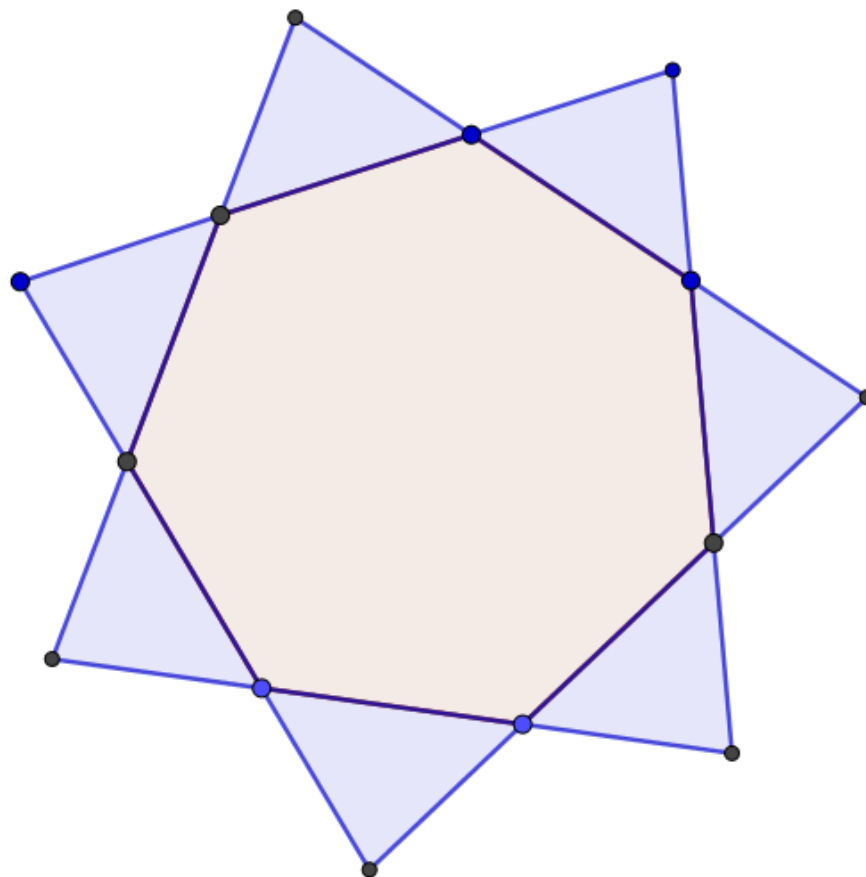




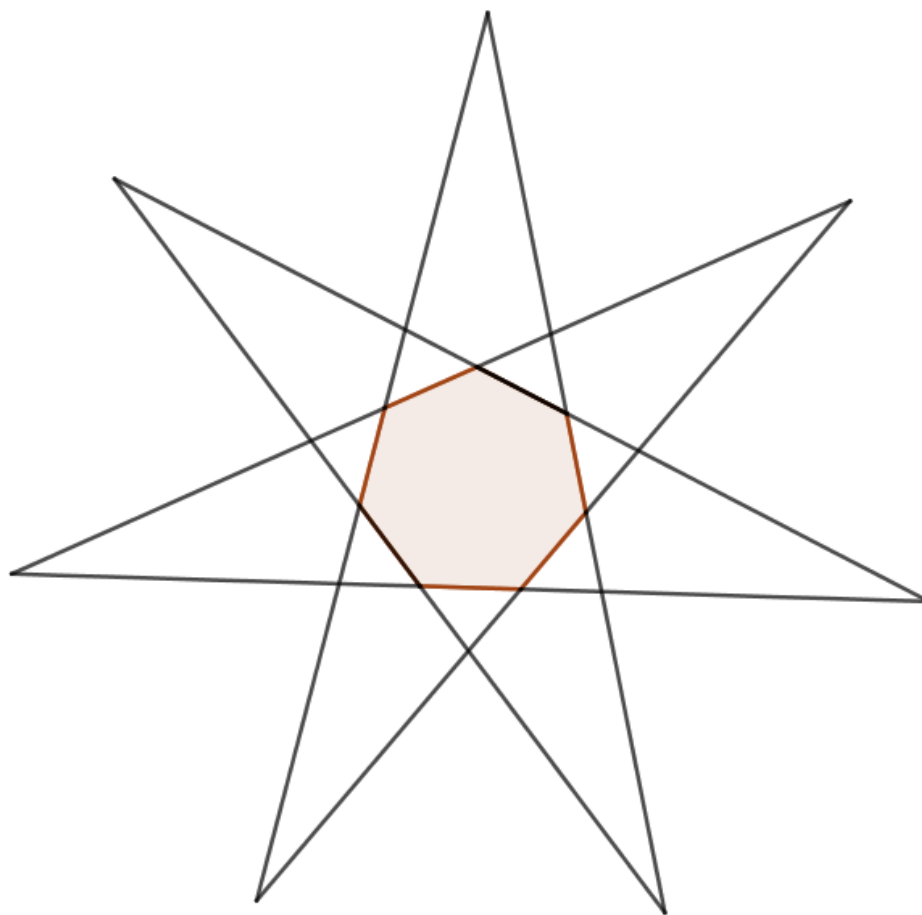


The lines extend out and in this case, they meet in two different places. These meetings create two different shapes

This shape is created from the crossings nearest the original polygon

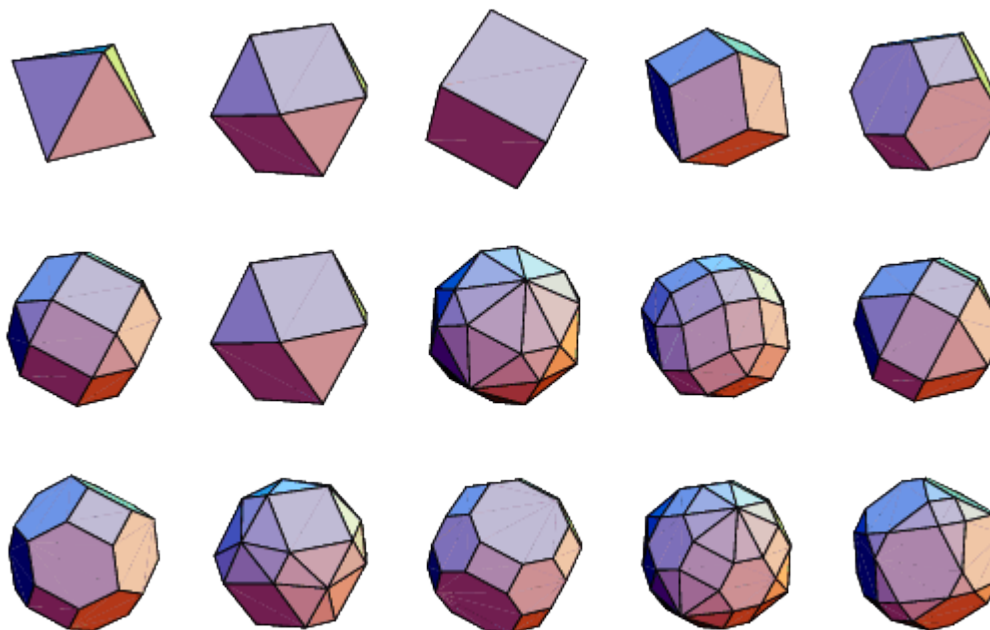


This shape is created from the crossings
 furthest from the original polygon



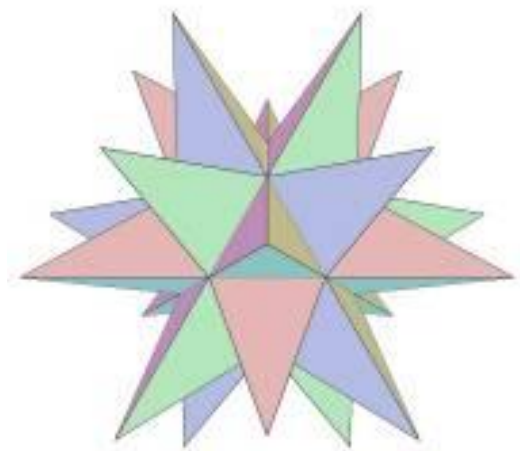
Stellated polyhedra

- Polyhedra are 3D shapes where every face is a polygon.
- Here are some examples of polyhedra



Stellated polyhedra

- Polyhedra are 3D shapes where every face is a polygon.
- Here are some examples of stellated polyhedra



Modular origami

- The traditional method of making origami is making a shape out of one sheet of paper.
- There is a recreational maths area which makes origami models out of modules – more than one copy of the same shape.

Modular origami

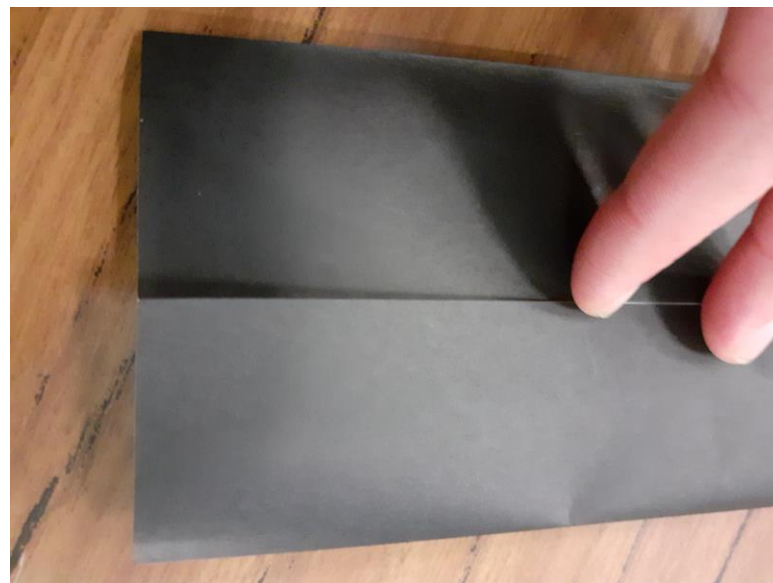
- We will make a shape (two different options)
- With this shape you can use
 - ❑ 6 shapes to make a cube.
 - ❑ 12 shapes to make a stellated octahedron.
 - ❑ 30 shapes to make a stellated icosahedron.
- You can also use 90 shapes to make a stellated truncated icosahedron – basically a spiky football with pentagonal and hexagonal faces. However this would take a *long* time.

The sonobe unit

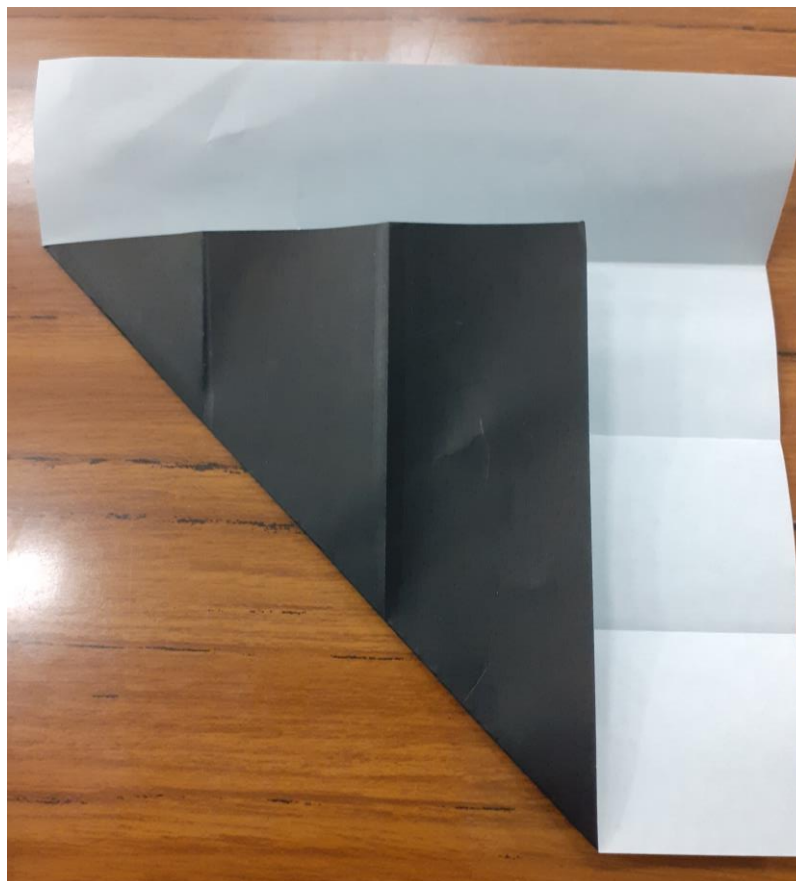
- There are two units that you can choose to use to make these shapes.
- They can be made with square origami paper or square post-its (post-its get fiddly as they are small, and work best with unit 1 rather than unit 2).
- Use one type of unit for the whole shape...

Unit 1

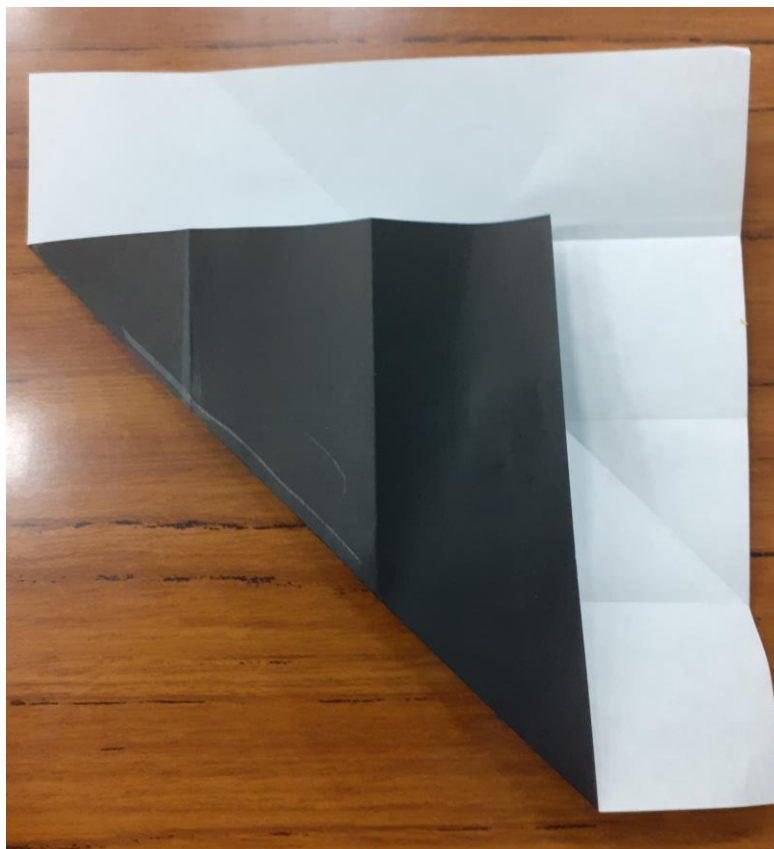
- Fold your square in half, unfold, then fold in to the centre crease so your paper is in quarters



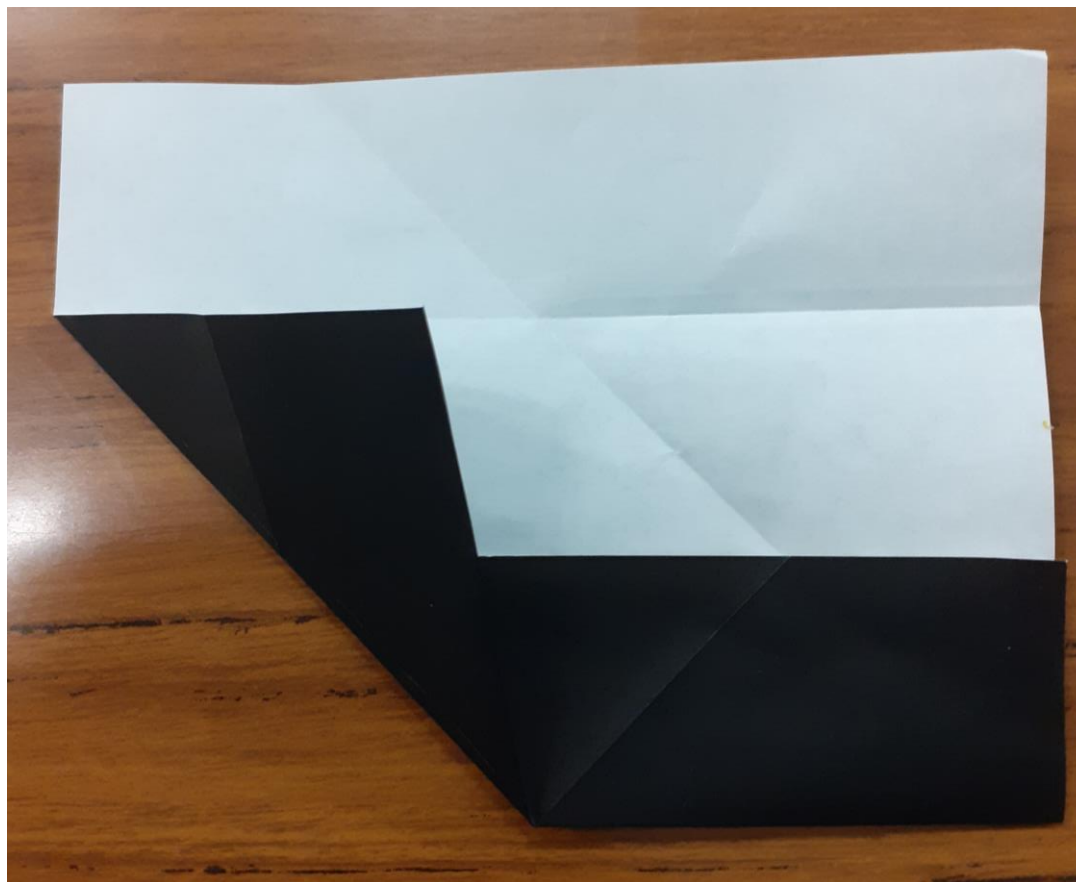
- Unfold, then fold the bottom left corner up to the line $\frac{3}{4}$ of the way up the paper



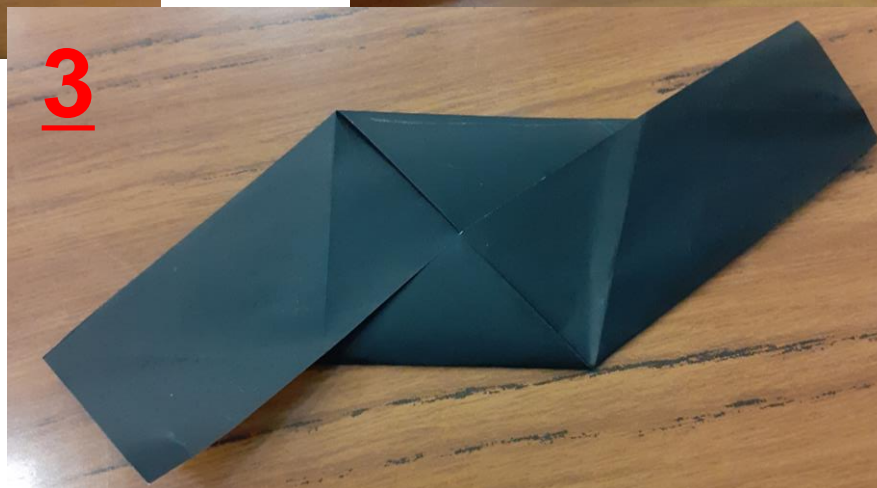
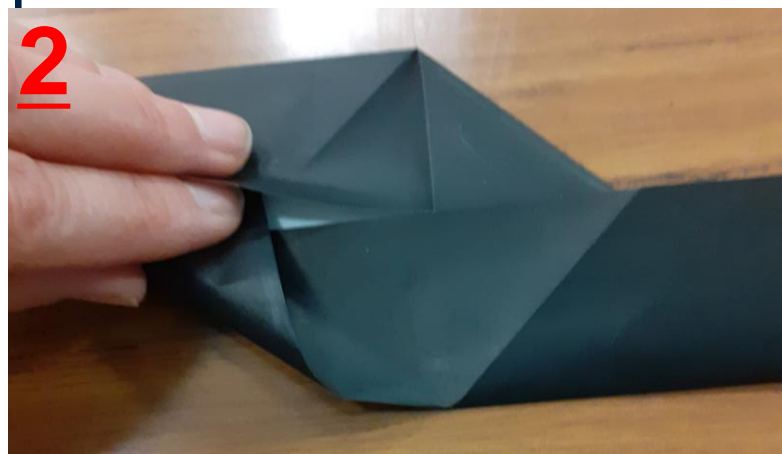
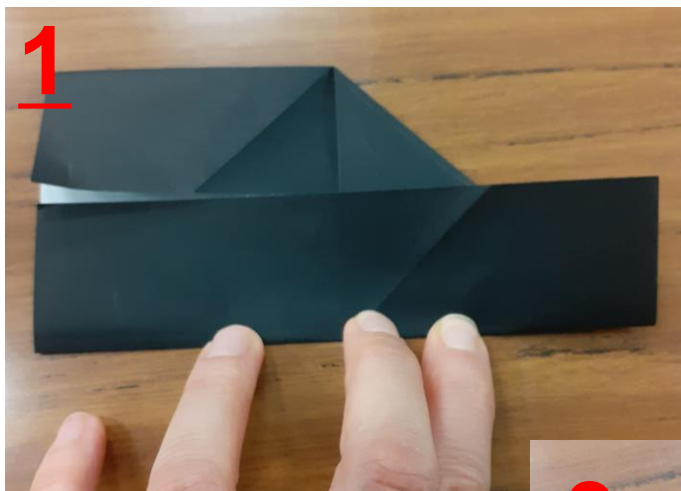
- Unfold, rotate the paper 180° then repeat



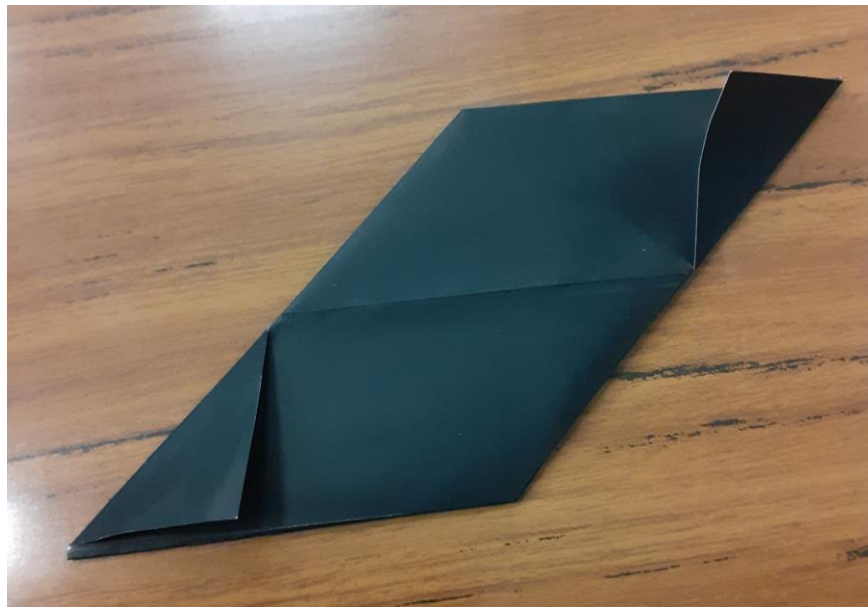
- Unfold, fold the bottom quarter up, then fold the corner in along the diagonal



- Rotate and repeat (do not unfold)
- When folding in along the diagonal, tuck in under the horizontal flap



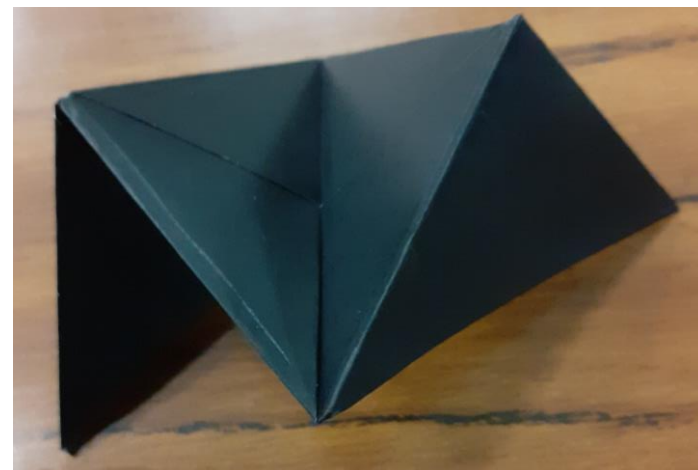
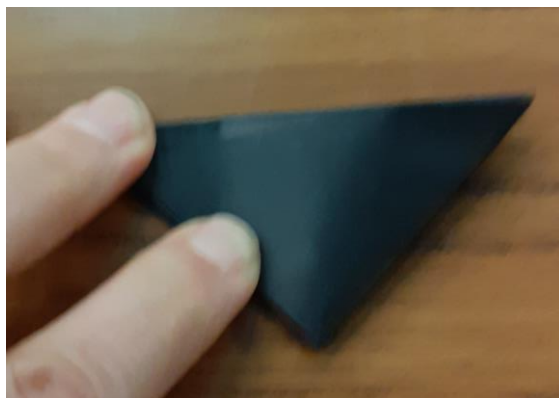
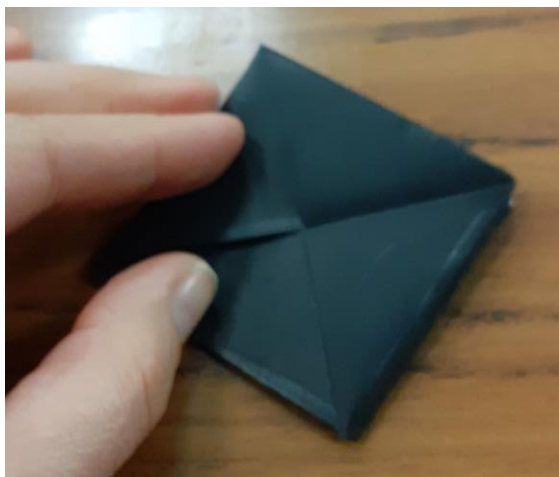
- Flip your piece over, then fold in the triangles



- Flip back over and fold each side in to make a square

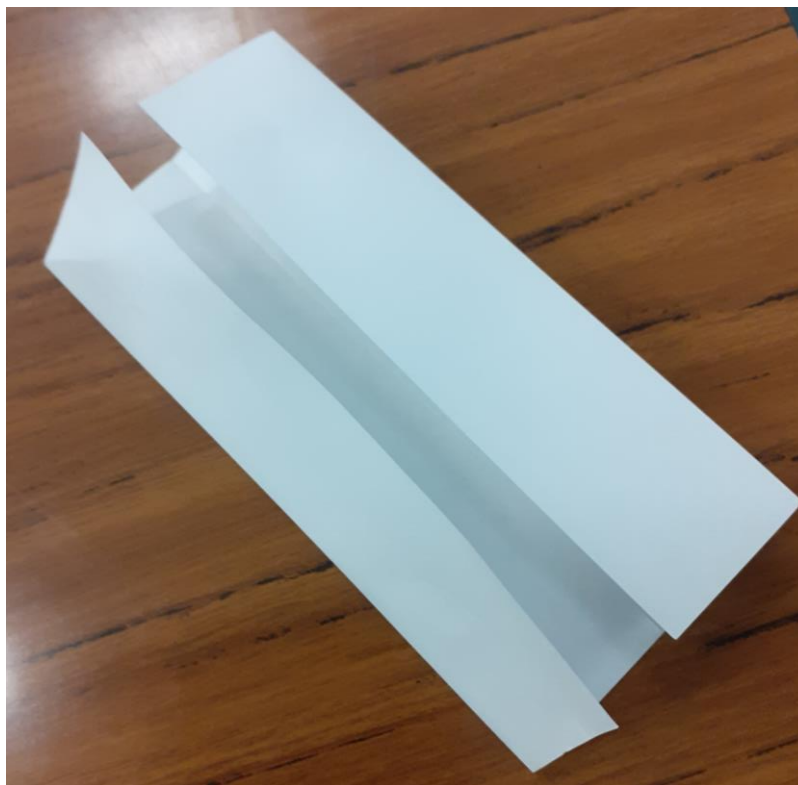


- If you are making a unit that is for the stellated octahedron or icosahedron you need to add a crease down the diagonal as shown.



Unit 2

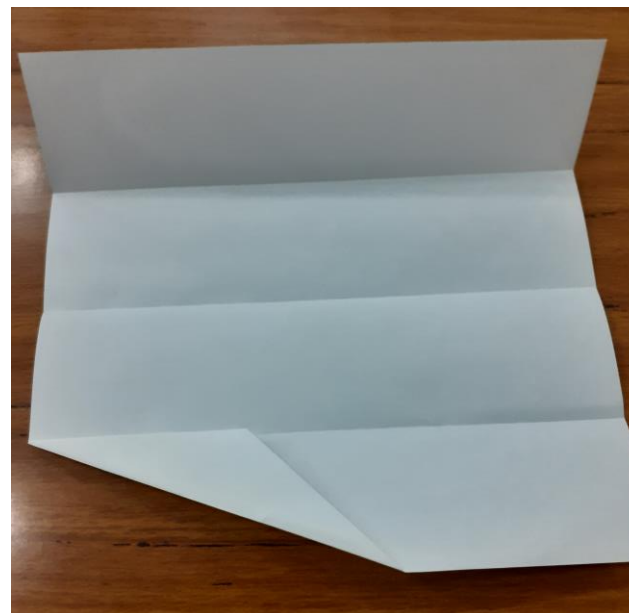
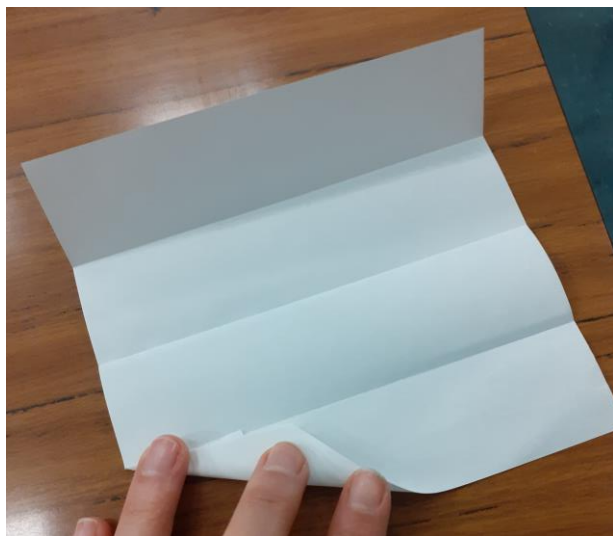
- Start with folding your paper in to quarters the same way as with unit 1



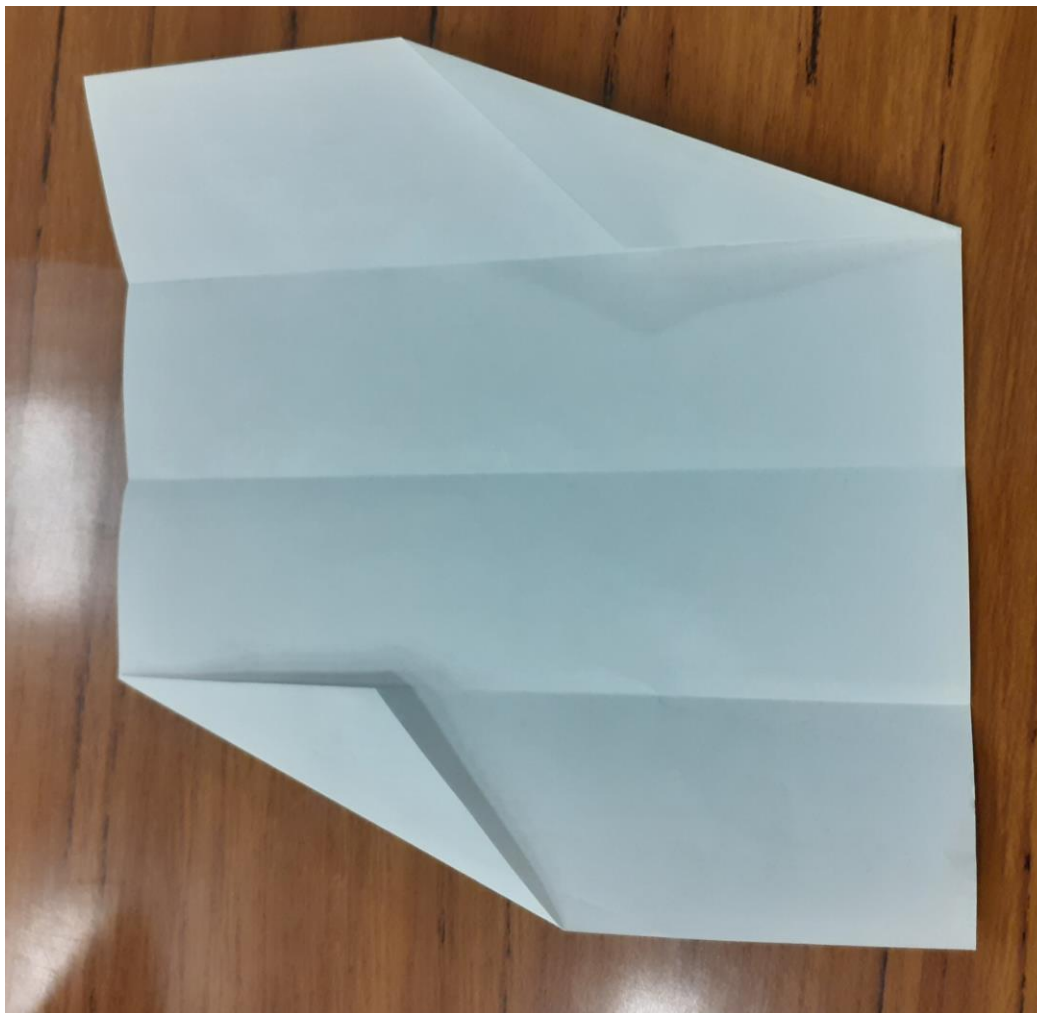
- Fold up the bottom left corner to the **first** line



- Fold the bottom left corner again up to the **first** line



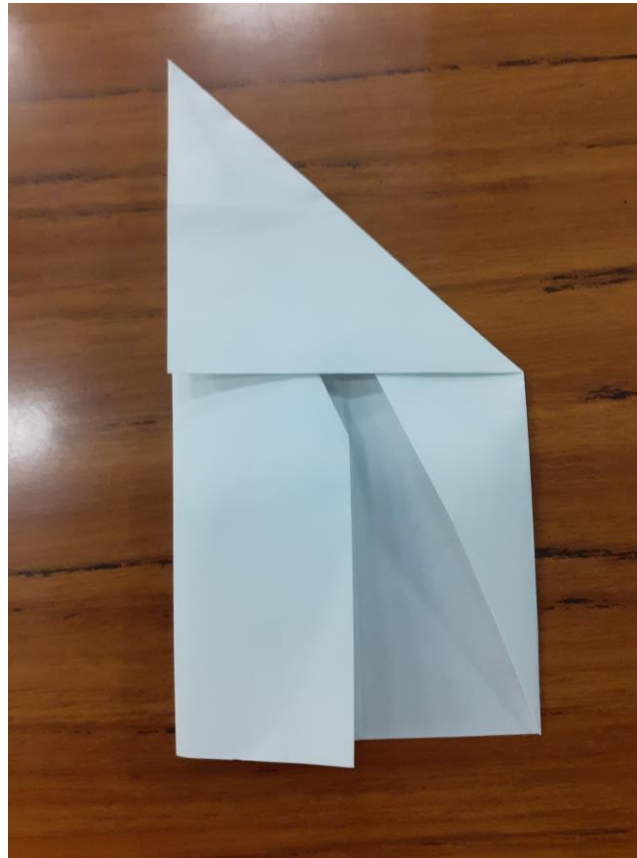
- Rotate your paper 180° and repeat



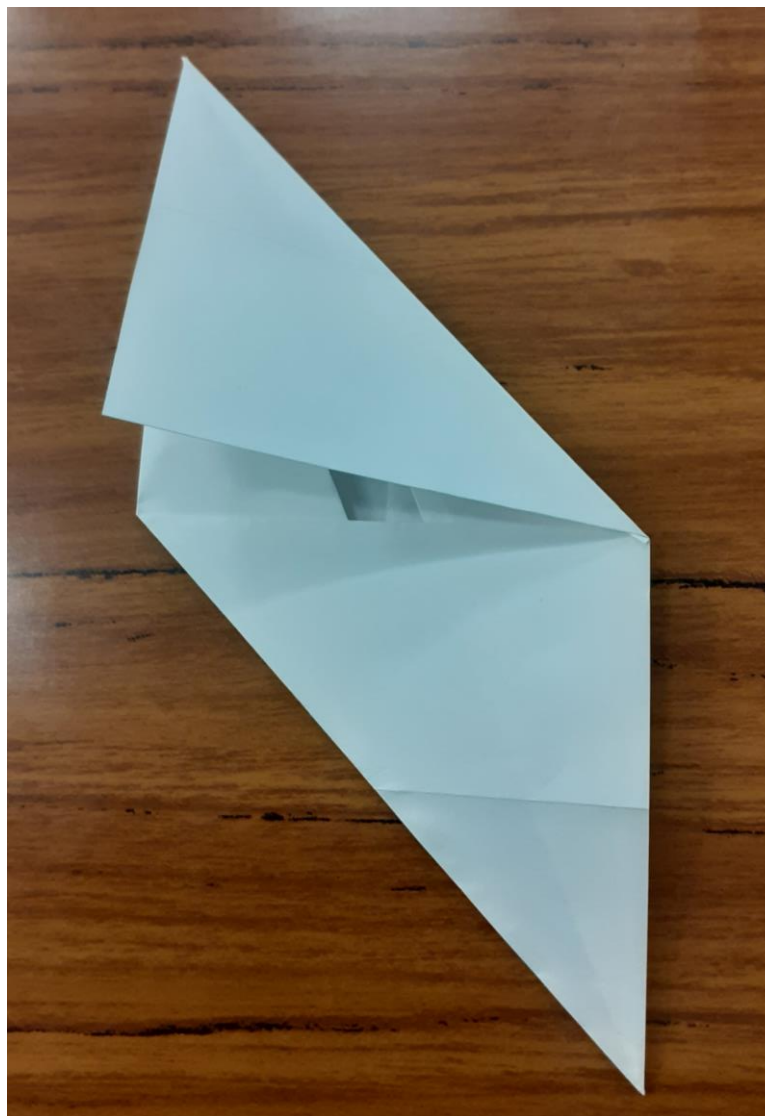
- Fold both sides in to the centre line and move your paper to the portrait position



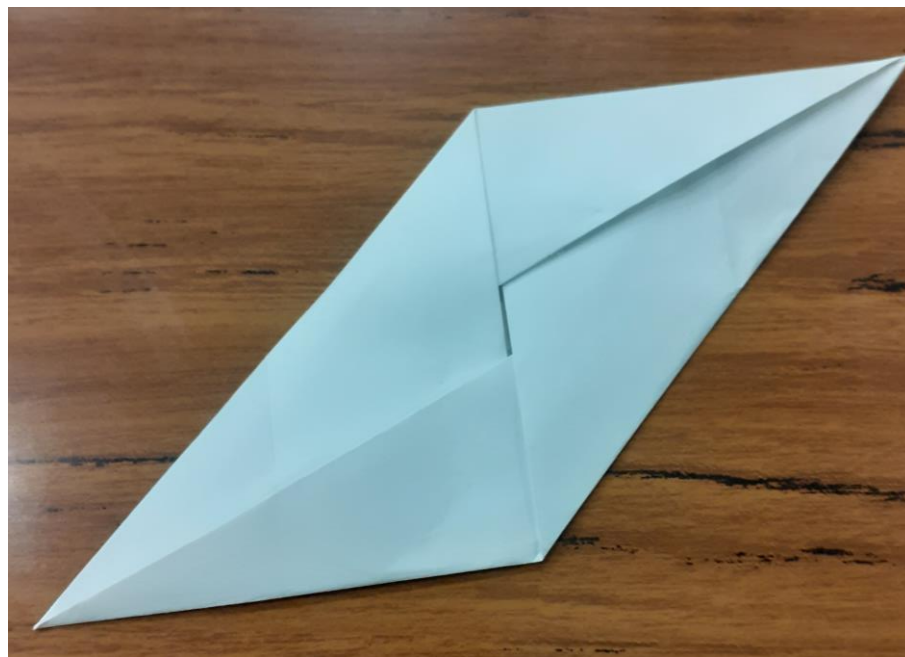
- Fold down the top right corner so it meets with the left edge



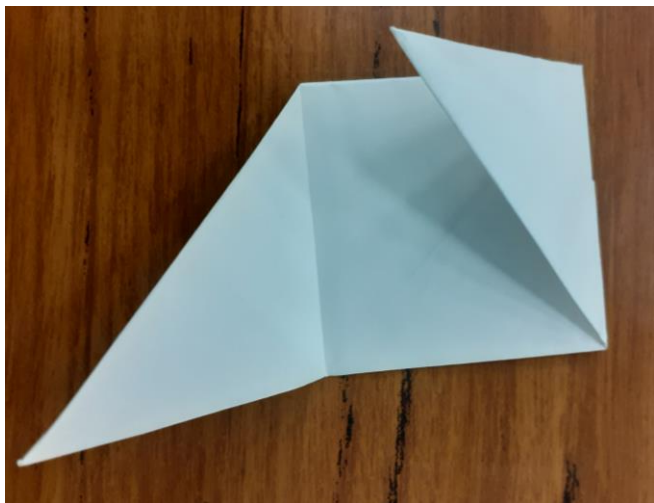
- Rotate your paper 180° and repeat



- Tuck the large flaps under the small flaps so it looks like this.



- Flip the paper back over and fold the points in to make a square



- If you are making the octahedron or icosahedron, fold along the diagonal to make an 'M' shape.

Creating the shape

- Once you have enough units made, you can start constructing the shapes
- The next presentation has instructions for creating a cube and a stellated octahedron