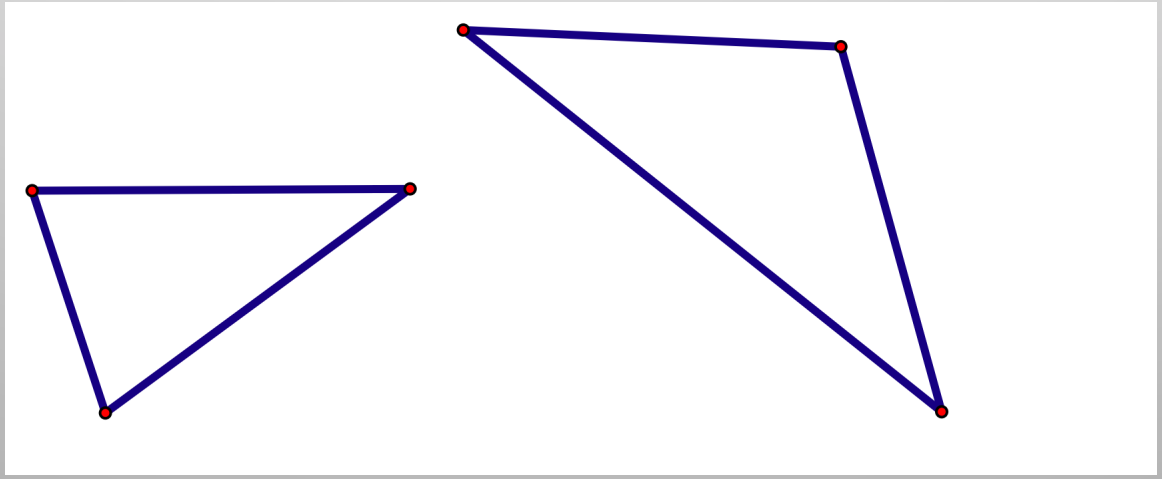
Cutting Up and Taping

If you are waiting, I encourage you to cut out a few triangles like these.



James King, University of Washington

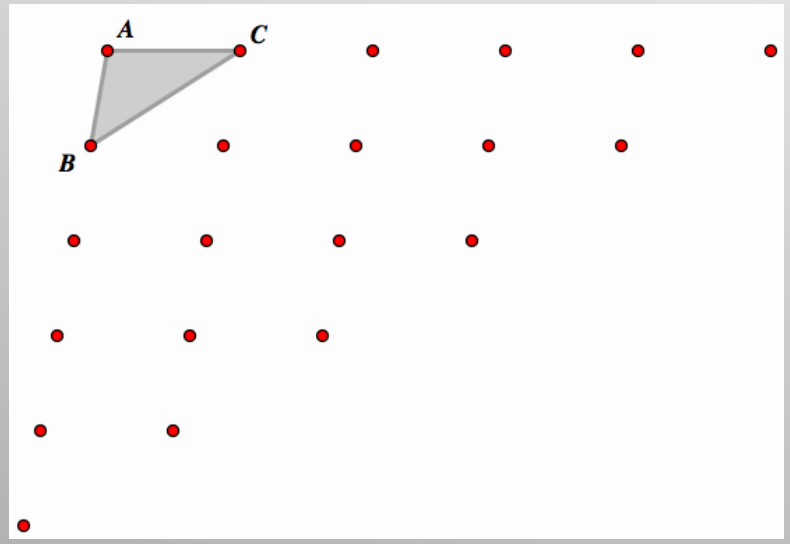
Dissection and Assembly in Geometry

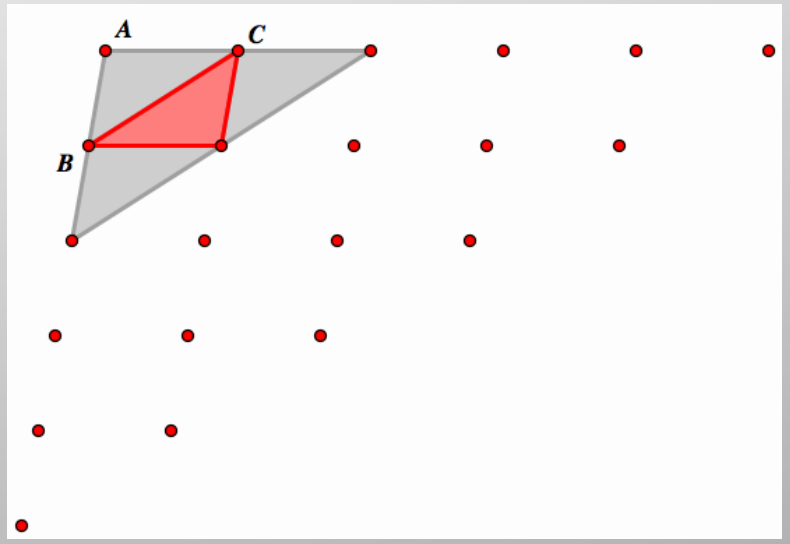
- In this workshop, we will explore three examples of ways in which one can get insight into geometry (and maybe algebra too) by dissecting (Cutting Up) geometrical objects from simpler pieces or building up (Taping) such objects.
- I hope you will work together and share your ideas and also the tools on the table. Please do write or cut when appropriate and do not save your handout to take home. That will defeat the purpose of enjoying the math. All these papers will be on my website next week, so you can print out all the copies you want.

Triangles Inside Triangles

- This first activity is the only one that actually has no call for scissors. This activity works well with cut-out congruent triangles but the number of triangles required for this workshop was daunting. So this one is strictly pencil (or pen) and paper.
- The idea is to build (draw) larger and larger similar triangles from a single triangle building block, then do some counting of triangles as the size increases.

Connect the Dots to Build Bigger Triangles





Count the Triangles

Triangle Counting

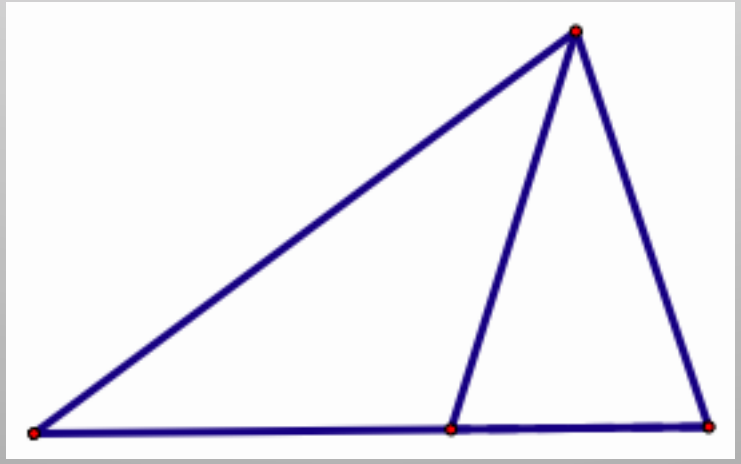
- Scaling up lengths by ratio n should scale area by n^2. Did you find this?
- The number of "up" triangles and "down" triangles are also special numbers. What are they?
- Is this *square* relation surprising in a triangle?

Special Acute and Obtuse Triangles

- Cut out some of the acute triangles *A* and obtuse triangles *O* on card stock.
- Use *A* and *O* as jigsaw puzzle pieces to build larger triangles similar to *A* and *O*. You may opt to use a little tape for the larger constructions. (It is OK for this hands-on exercise to ignore "round-off" and assume that any angles that appear to be straight angles are really straight, etc.)

Angles of the Special Triangles

- Deduce the angles of *A* and *O* from your ability to make these larger triangles.



Ratios in the Special Triangles

- If you denote the original sides of the triangle *A* as 1 (the short side) and *k* (the other two sides). Two of the side lengths of *O are* also k.
- Find the value of *k* by considering the relationships in the triangles that you have built.
- What is the length of the third side of O?

Counting in the Special Triangles

- Study your examples of larger special triangles.
- Order them by size and tabulate the number of *A* triangles and the number of *O* triangles in each.
- If you have a calculator, compute the ratio of the number of *O*'s to the number of *A*'s

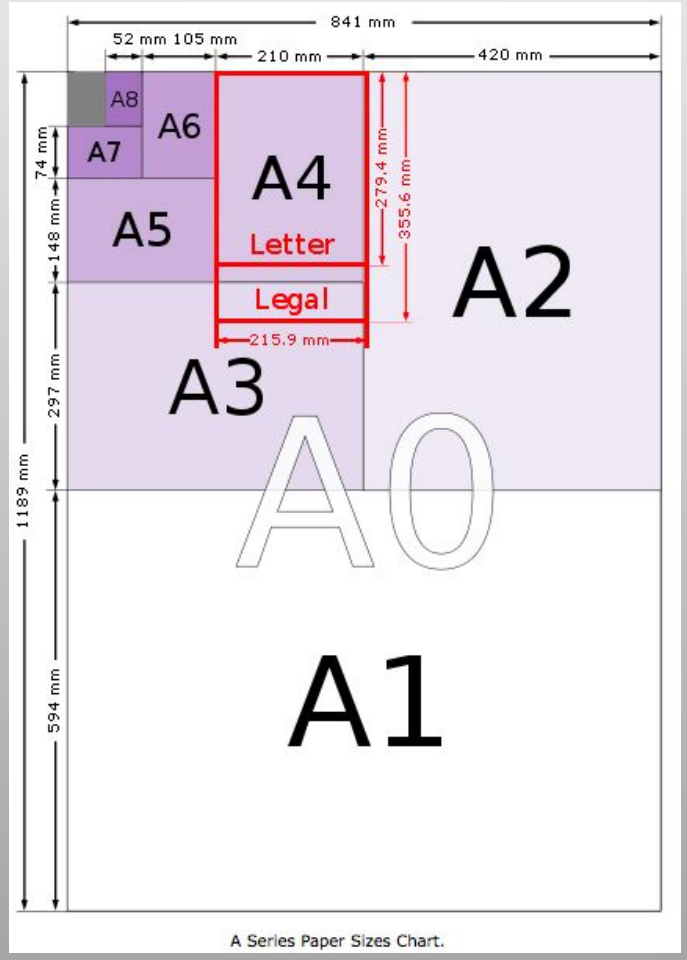
A Special Regular Polygon

- Assemble a regular polygon from the A and the O triangles.
- What is this shape? From what you know about the triangles, what is the ratio of a diagonal to a side in this regular polygon.
- If you do the counting game again with larger versions of this polygon, you will also get an interesting ratio.

The Silver Rectangle

- When are two rectangles similar? How can you see this visually?
- If one folds regular 8.5 x 11 paper in half to form two smaller rectangles, are the new rectangles similar to the original?
- Try this experiment with the “silver” rectangle paper.
- What is the ratio of the sides of this paper?

A4 and A-series paper



A-series sizes

Table of Paper Sizes From 4A0 to A10

Size	Height x Width (mm)	Height x Width (in)
4A0	2378 x 1682 mm	93.6 x 66.2 in
2A0	1682 x 1189 mm	66.2 x 46.8 in
A0	1189 x 841 mm	46.8 x 33.1 in
A1	841 x 594 mm	33.1 x 23.4 in
A2	594 x 420 mm	23.4 x 16.5 in
A3	420 x 297 mm	16.5 x 11.7 in
A4	297 x 210 mm	11.7 x 8.3 in
A5	210 x 148 mm	8.3 x 5.8 in
A6	148 x 105 mm	5.8 x 4.1 in
A7	105 x 74 mm	4.1 x. 2.9 in
A8	74 x 52 mm	2.9 x 2.0 in
A9	52 x 37 mm	2.0 x 1.5 in
A10	37 x 26 mm	1.5 x 1.0 in

To obtain paper sizes in centimetres, convert mm values to cm by dividing by 10.

3D Models from this Rectangle