

## Hands on Mathematics

Mathematics manipulatives are more rare as students progress into advanced mathematics, but there are many fascinating hands-on mathematical explorations which are fun, beautiful, and stimulate deeper understanding. In this six-week session, we will explore some of these.

**When:** Six Wednesdays from 1:30-2:45pm ET,  
October 8, 15, 22, and 29, and November 5 and 12.

**Format:** Each week, I will introduce the activity and the associated mathematical ideas and students will have time to interact while building their activities and have time for selected extensions, both in terms of mathematical content and creating variations. We will also allow time to share follow-up creations or questions related to prior weeks. Sessions will be recorded for viewing later, as well.

**Who:** Students should have an interest in learning the mathematics behind the activities and physical capacity to make somewhat precise folds and cuts. Students who know more mathematics (algebra, functions, geometry, etc.) will stand to go deeper mathematically, but no particular topics are essential. All ages are welcome but I generally expect middle/high schoolers to be best prepared. Younger students with both high manual dexterity and mathematical depth are also welcome. Class size will be capped at 12 participants.

[More about Ashley Ahlin](#)

[Register here](#) or email [Ashley Ahlin](#) with any questions

**Cost:** [\\$200 for six 75 minute sessions paid via Venmo](#)

### Materials needed:

|               | Essential                                                                        | Optional (for extensions)                 |
|---------------|----------------------------------------------------------------------------------|-------------------------------------------|
| <b>Always</b> | paper, scissors, tape, glue stick                                                |                                           |
| <b>Week 1</b> | Paper, printed from pdfs                                                         | Non-metric ruler or yard stick            |
| <b>Week 2</b> | CD case (hard plastic kind), card stock or card board, graph paper; Printed pdfs |                                           |
| <b>Week 3</b> | <a href="#">Balloon pump</a> , 260Q balloons (the offerings change regularly on  | wiki sticks or pipe cleaner (2 is enough) |

|               |                                                                                                                          |                                                                                                                                                                       |
|---------------|--------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               | Amazon. (Qualatex offers high quality balloons but they have gotten much more expensive recently; other brands are fine) | Colored pencils or pens;<br>I will highly recommend inflating some balloons before class to save time; these balloons are nearly impossible to blow up without a pump |
| <b>Week 4</b> | Square origami paper                                                                                                     |                                                                                                                                                                       |
| <b>Week 5</b> | small mirror(s) (preferably square/rectangular rather than curved)                                                       |                                                                                                                                                                       |
| <b>Week 6</b> | <b>Summaries/Extension based on student input from first weeks</b>                                                       |                                                                                                                                                                       |

### 1) Pop up Fractals (Sierpinski triangle)

Mathematical meat: Introduction to fractals (self-similarity, dimension)

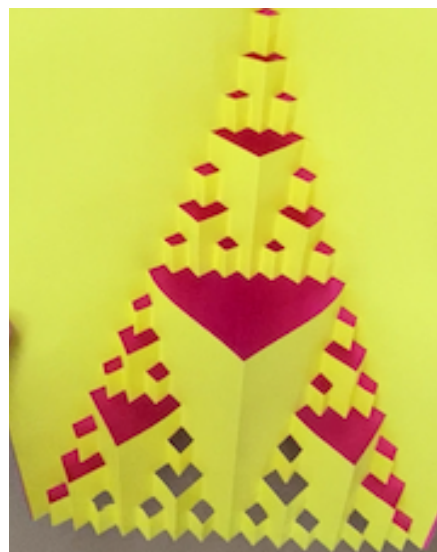
Possible extensions: connection to Pascal's triangle, Towers of Hanoi, and the golden ratio.

Skills needed: measuring and cutting neatly

What we'll build: Sierpinski triangle pop up card

References: *Fractal Cuts : Exploring the Magic of Fractal Cuts with Pop-Up Designs*

by [Diego Uribe](#) (to purchase at [Better World Books](#); to borrow from [Internet Library with free account](#))



### 2) Slide Rules

Skills needed: cutting neatly, understanding the graphs of functions

Mathematical meat: the power of logarithms for computation, distance metrics

What we'll build: several types of working slide rules



### 3) Polyhedral Balloons

Skills needed: pumping up balloons and tying them off; some students may appreciate having an assistant available to lend a hand at times with connecting balloons.



Mathematical meat: Graph theory conditions for Euler path, relationship to drawing platonic solids (degree of vertices)

Questions we'll consider: How many balloons can you use to build a tetrahedron? Cube? Are there platonic solids which you can build with just one balloon?

What we'll build: tetrahedral balloons, other polyhedral time permitting

References: [Mathematical Balloon Twisting for Education \(Bridges Conference\)](#)

#### 4) **Sonobe Origami**

Mathematical meat: discovering the platonic solids (and proving that these are all)

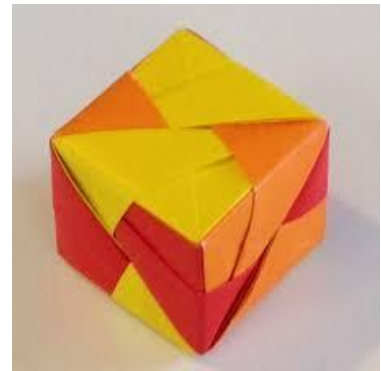
Skills needed: ability to neatly fold origami paper

What we'll build: platonic solids

References:

[Folding Your Way to Understanding\\* \(from Bridges\)](#)

[Math Monday – Introducing the Sonobe Unit \(from Museum of Math\)](#)



#### 5) **Möbius strips and fold-and-cut theorem**

Mathematical meat: topology, symmetries

Skills needed: cutting neatly

What we'll build: Möbius strips

References: [Wind and Mr. Ug](#)