

Snapology Origami

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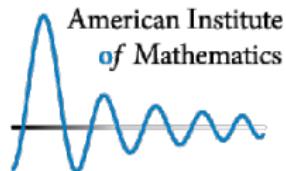
San Diego MTC



Joint Mathematics Meetings
January 11, 2018

San Diego Math Teachers' Circle

Co-located at UC San Diego and San Diego State Univ



Founded in 2011.

Monthly meetings of (mostly) middle-school teachers.



Math Teachers' Circle Network

Building Mathematical Communities

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Professional communities centered on mathematics

We connect teachers and professors through shared mathematical discovery.

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Image provided by San Diego MTC



MTCs empower teachers' voices and experiences

MTCs are highlighted as a "bright spot" in teacher professional development in a 2017 [white paper](#) published by 100Kin10.



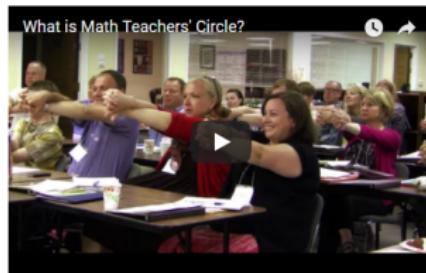
MTCircular Magazine

Our popular semi-annual magazine shares stories and insights from Circles across the country. [Subscribe here.](#)



Start a Circle

Our [Organizer Toolkit](#) contains a wealth of materials to help you start a successful, self-sustaining MTC. Our [seed grant program](#) provides start-up funding to selected Circles.



What is Math Teachers' Circle?

"Unparalleled professional development in



**HOW THESE
BECAME A MATH
TEACHERS' CIRCLE
SESSION**



What is snapology origami?

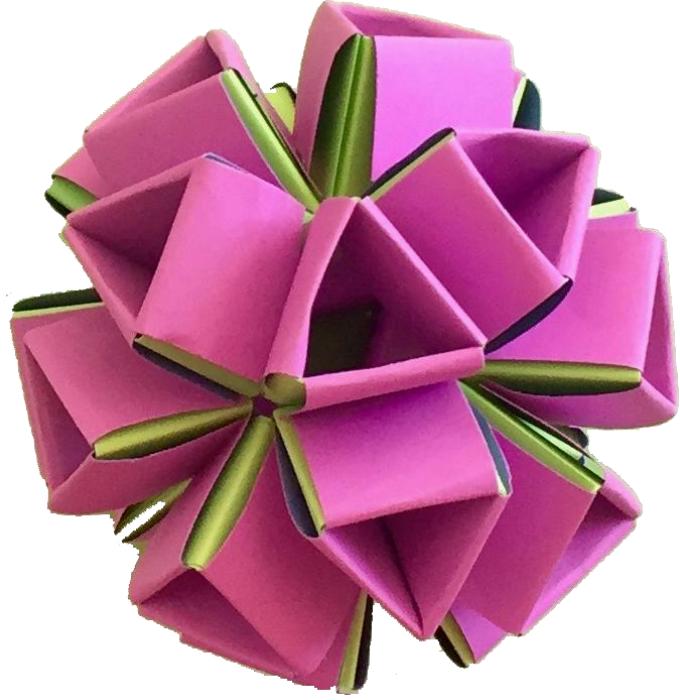


Created by Heinz Strobl, snapology origami uses only strips of paper to create shapes.

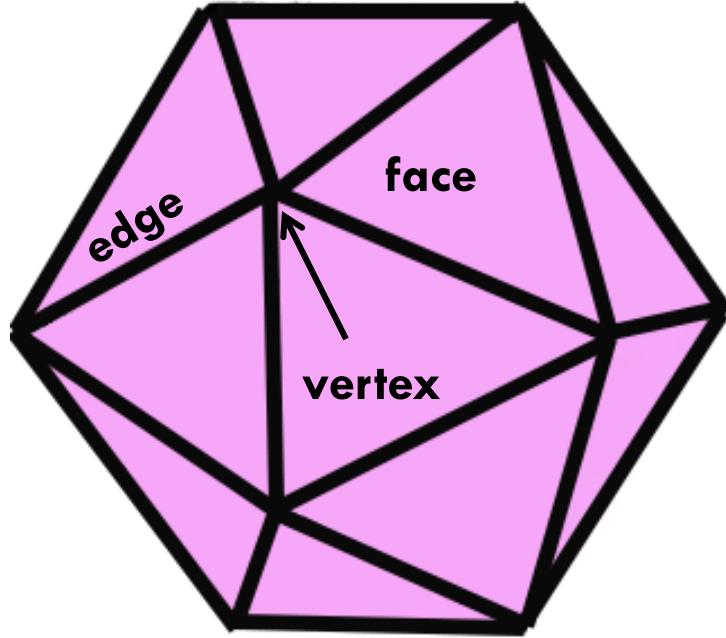
Partial list of teachers' questions

1. How many pieces of paper to build?
2. What's the area of the paper?
3. How does outer surface area compare to inner?
4. Can we swap out some shapes with others? What happens?
5. Are 12 pentagons (or multiple) needed to make these shapes?
6. Area of flat paper and surface area of shape relationship?
7. What gives shapes affective appeal?
8. Is the stress on the material uniform throughout shape?
9. Spherical = triangles and pentagons, ellipsoid needed different. Correlation between sphericity and shapes used?
10. The objects are unexpectedly heavy. What is the significance of their weight and its relationship to the shape?

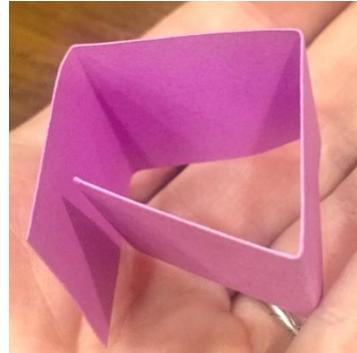
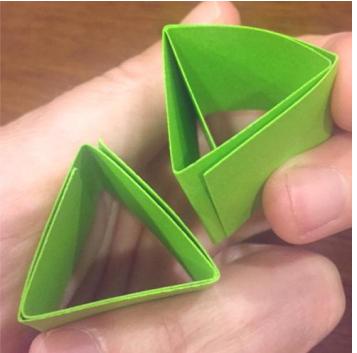
Snapology origami and polyhedra



“faces”



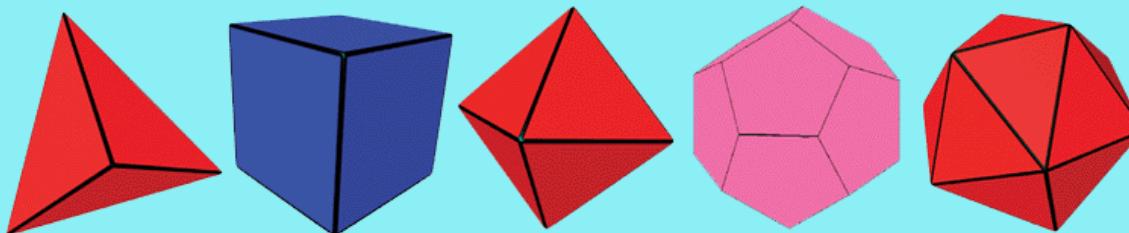
“edges”



Two “faces”
connected
by an
“edge”

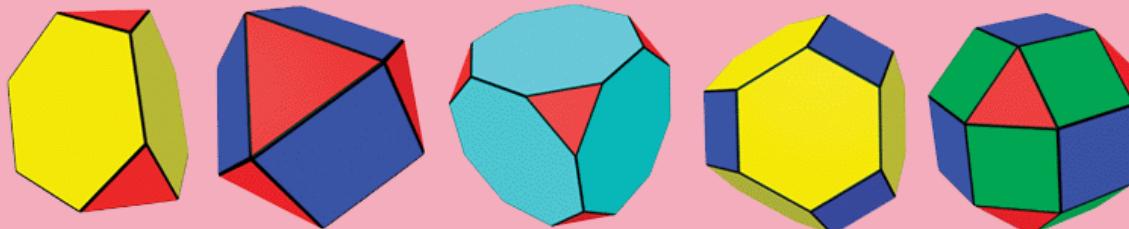


Natural starting point: Platonic and Archimedean Solids



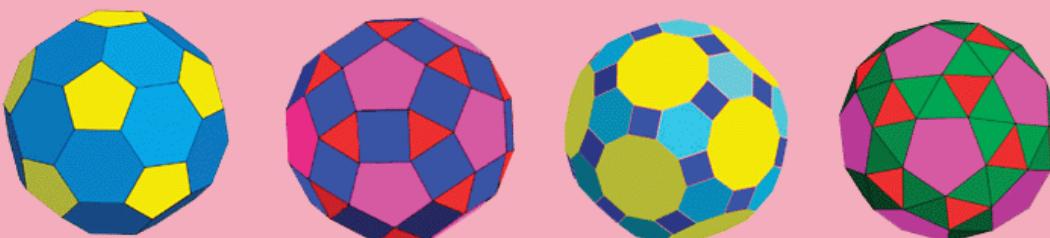
Platonic

Made of **identical** regular polygons; each vertex is symmetry equivalent to every other vertex



Archimedean

Made of **non-identical** regular polygons, all having sides of the same length; each vertex is symmetry equivalent to every other vertex.

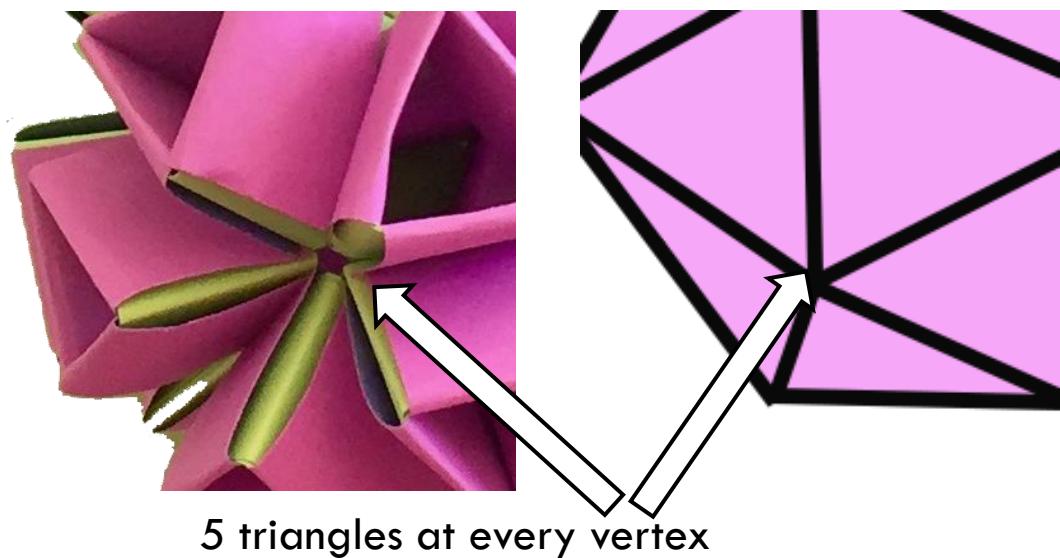


Why are Platonic/Archimedean solids so well suited to snapology origami models?

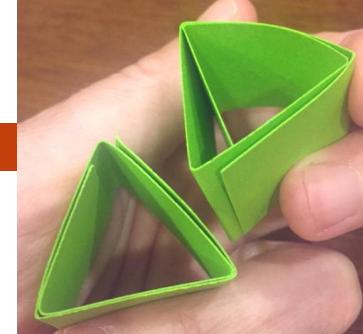
1. Made of regular n-gons, so “faces” are $2n$ -unit long strips



2. Each vertex is symmetry equivalent to every other vertex; so there's just one simple formula for making them! For example:



Now look at how many strips of paper we need



Example: Icosahedron

20 triangular faces , so 20 of 3×2 units long strips

Calculate number of edges:

Each face is surrounded by 3 edges, and each edge is shared by two faces.

So the number of edges is $\frac{20 \times 3}{2} = 30$.

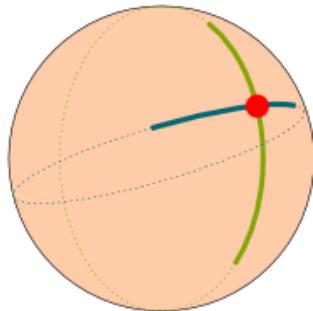
We will need 30 of the 4 unit long strips.

Natural extensions:

1. How many pieces of notebook paper?
2. What is the cost of the paper?
3. What is the weight of your finished solid (paper has known density.)?

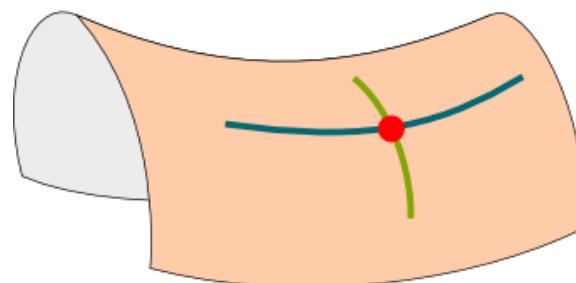
What about tori? Need to create saddle points.

Extremal directions curve
in the same directions



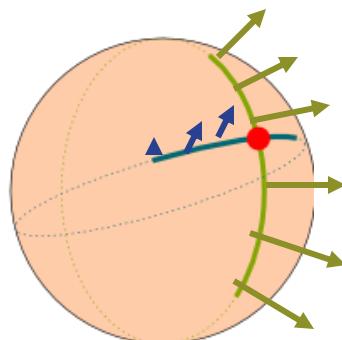
Positive Curvature

Extremal directions curve
in opposite directions

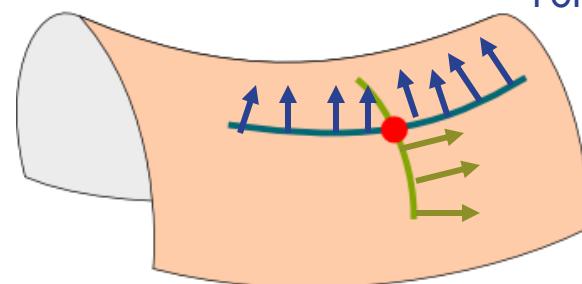


Negative Curvature

Note the differences in the positions of the normal vectors along the paths

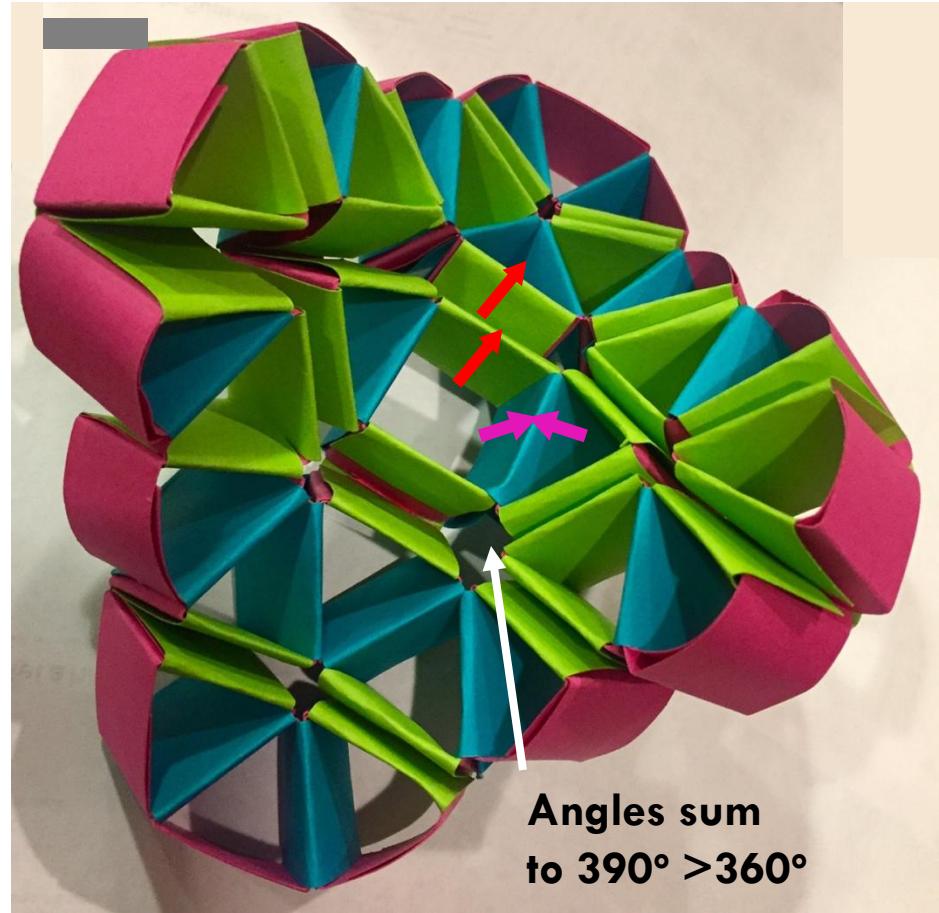
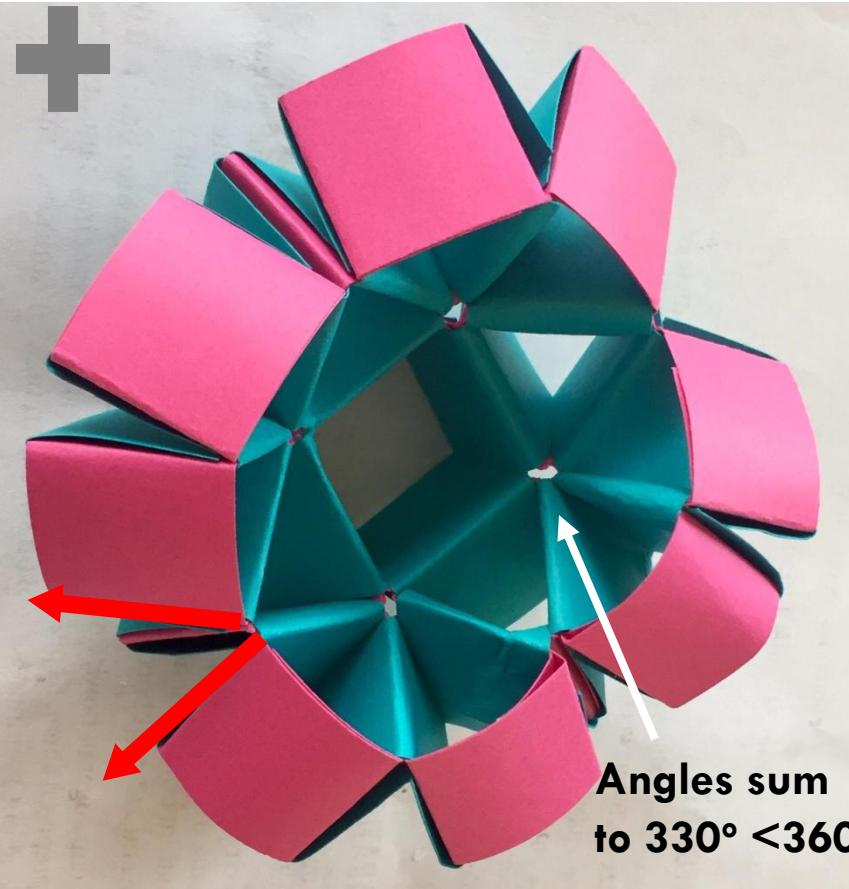


Pointing inward



Pointing outward

Positive and negative curvature implemented in snapology origami



Parting words about saddle shapes



Saddles are necessary for making tori with any number of holes, Klein bottles, and any surfaces that contain areas of negative curvature.

Learn How!

Dave Honda has made a series of instructional videos teaching how to make an icosahedron:

<http://tinyurl.com/snaporigami>

Also, please go see Dave's dodecahedral 11-hole torus as part of the Mathematical Art Exhibition in the exhibit hall!



Update (1/15/18): Dave's entry won **first place** for "best textile, sculpture, or other medium" at the exhibition!

Resources

Visit Dave Honda's website: snaporigami.weebly.com

HONDA'S SNAPOLOGY ORIGAMI

HOME SUBMISSIONS TO THE 2017 BRIDGES ART EXHIBITION POLYHEDRA BUCKYBALL VARIATIONS TOPOLOGY
FRACTALS MISCELLANEOUS

Welcome to my Snapology Origami page. Just a place to share the products of my obsession. The projects within are based upon the folding and paring strips of paper. I originally started by learning from the works of Heinz Strobl. Since then I've pushed myself and started to design my own creations. Hope you enjoy.



 **San Diego Math Teachers' Circle**

Welcome to the San Diego Math Teachers' Circle!

The San Diego Math Teachers' Circle is an informal monthly program that aims to engage teachers and mathematicians in working together on intriguing and stimulating problems. Through this collaborative process, we seek to provide teachers with an opportunity to learn new knowledge and skills, to develop their problem solving abilities, and to enhance their critical thinking, engineering success in many fields, and that, preceding those abilities is teachers will, in turn, foster the same in their students.

The San Diego Math Teachers' Circle is free to all middle school math teachers in San Diego County. We meet once a month on Saturdays from October to April (click [here](#) for a detailed schedule). A \$10 meal is provided at each meeting.

The San Diego Math Teachers' Circle does not offer classes at any school or school district and is open to teachers from public schools, private schools, or home schools. It is a program similar to the [San Diego Math Circle](#), but geared primarily for middle school teachers. Activities will be led by math teachers and university level mathematics majors, parents, business people, our staff, and others.

[Click here](#) for more information about us.

Upcoming Events
[Mathemagics Cup January 13, 2018](#)

About Our Logo

Our logo reflects both our coastal location and the mathematical nature of what we do. Reminiscent of a seashell, the logo is composed of a series of triangles that was generated by dividing a disc into 12 equal parts and then connecting the vertices of every second triangle. This process creates seashell-like shapes that is not only aesthetically pleasing, but also gives rise to a number of depth and difficulty. What type of triangles form the seashell shape? How are they

<http://mathcircle.sdsu.edu/mathcircle/san-diego-math-teachers-circle/>

GDG to learn more.





San Diego Math Teachers' Circle: sdmathteacherscircle.org

