BLUEBIRD MATH CIRCLE
Alliance of Indigenous Math Circles

Issue 11

Share your problems, solutions, models, stories, and art:
https://aimathcircles.org/Bluebird

I do not use a pencil or a ruler to help me. I work with the clay. It's the shape of the pottery that will give me the diameters, and tell me how they are going to be equally divided.

—Delaine Tootsie-Chee
Hopi Potter

NEWSFLASH

Join LIVE Bluebird Math Circle to work on these activities together with friends and family. **Monday August 23, 5-6 PM MDT online.**

Sign up at https://aimathcircles.org/Bluebird

MATH JOKE

- 6 was scared of 7 because 7, 8, 9, but why did 7 eat 9?

- Because you're supposed to eat 3 squared meals a day!

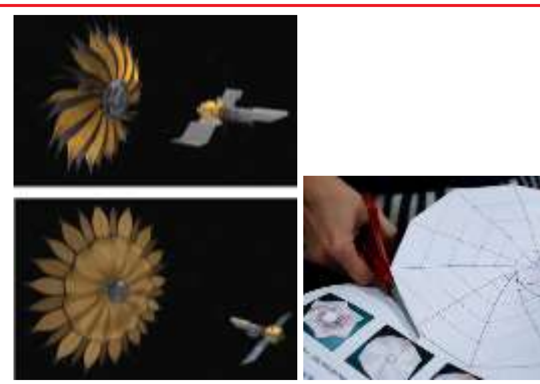
Warm-up: Where and When Are We in the World?

Geometries—yes, there are many—are math abstractions. Traditional geometries come from practices in people's art and trades. Is it all ancient history by now, all already made and finished, for us to admire and memorize? Not at all! People around the world continue making geometries for their modern projects, from string theory in physics (it has eleven dimensions!) to folding solar sails for space; from computing (made of discrete bits and pixels) to visual arts, architecture, textile design and so on. You can make your own geometry, too. Here is a geometry-maker sampler.

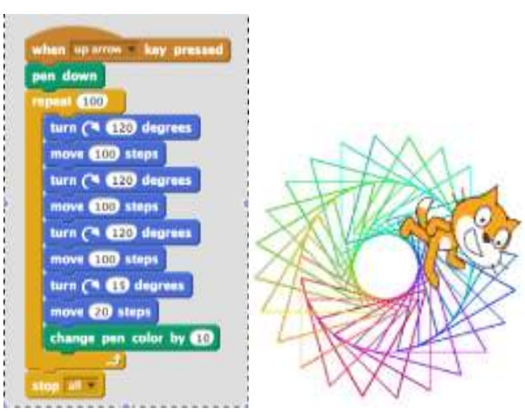
Guess or research: Where in the world is each geometry being done—or is it shared widely?
When, how, and why?
What older traditions, global trends, and contemporary cultures can you spot? (Spoilers on page 2!)

Folding paper cranes

Teachers and students admiring their compass-and-straightedge constructions



Making starshades



Drawing "Turtle Graphics" with a certain cat

Storytelling and drawing on a grid in the sand

Building brick fire altars with the peg-and-rope method

Cultures from the warm-up: Japan around 18th century; Europe around 14th century; modern—international space program; international computer programming in Logo/Scratch; Chokwe (Angola/Congo); India. Image credits: NASA, Technocage.com, Wikipedia, WikiHow.com, "Convergence" by MAA, VisualStories on YouTube

Family Circle: Geometries, Powers, and Weaknesses

Making shapes from scratch—Let's compare and contrast three toolkits that model three different geometries. What is easy with one toolkit can be hard with another toolkit. Like superheroes, different geometries have different powers and different weak spots. If you can't make a perfect shape, don't give up. Maybe there is a trick to it. Or maybe you can make an approximate shape that is close enough for many practical purposes.

Start by **free play** with each toolkit. Try this and that. Improvise. Note the shapes that occur as you use the tools.

Toolkit 1: Paper and folding

Your toolkit is paper. That's it. You can fold your paper point to point. You can fold your paper line to line.

Toolkit 2: Circles and lines

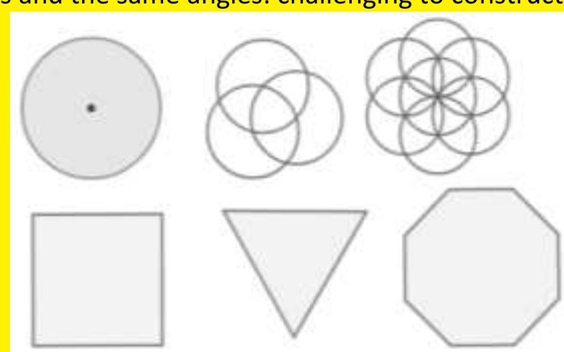
Your toolkit is a strip of paper and two pens. You can use your strip as a straightedge to make lines. Or you can punch through it with your two pens and rotate one pen to make circles.

Toolkit 3: Steps and turns

Program Scratch the Cat to walk your shape. You can tell the cat (or another sprite) to move a certain number of steps, or turn by a certain angle. Click the Tutorial button at the top to get started. **Scratch.MIT.edu**

Now, use each toolkit to reach a goal. Some of the most common shapes in modern life are circles and squares. Try making those with each toolkit. Is it easy or hard? How do you know that the shapes you made are really a circle and a square?

Next, make circle flowers, and regular polygons with different numbers of sides: triangles, pentagons, octagons and so on. A regular polygon has the same sides and the same angles: challenging to construct!



Which geometry makes each construction job easier? Which makes it harder? Look around you for more shapes. Which toolkit would you choose to make those?

What is it really all about? We model geometric constructions by making them in physical space. We explore abstract ideas like line, angle, or symmetry by hand, by our physical actions of moving, drawing, or folding.

Ask Bluebird

QUESTION—*I want to know what mathematics has to do with the Navajo Hogan.* From Dawnlei Ben

BLUEBIRD SAYS—Building a Hogan House comes with engineering know-how that is inseparable from stories and lore. The mathematical implications of building Hogans are still being explored and described, and you can join that work. For example, the roof is similar to Baravelle Spirals, but with a variable number of sides. So it's a more complex pattern. Stay tuned for a whole flier about the Hogan House Geometry and modeling its traditional tools at home.

FUN FACT OF THE FORTNIGHT	Many classic geometric problems from different cultures are about dividing lengths or angles into equal parts. How to split a plot of land fairly? How to divide a pot into equal parts for a pleasantly symmetric design? Halving tends to be easy. Meanwhile, trisecting an angle is outright *impossible* in the geometric construction system that most school children in the world learn: the compass and straightedge geometry. **wikipedia.org/wiki/Angle_trisection**