BLUEBIRD MATH CIRCLE
Alliance of Indigenous Math Circles

Issue 20: Math Question Generator

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

"Relationships are foundational to Native people."
—Matika Wilbur, Swinomish and Tulalip people; Project 562

"Math is about similarities in different things, and differences in similar things."
—Anonymous

"Why is a raven like a writing desk?"
—Lewis Carroll's famous riddle/joke

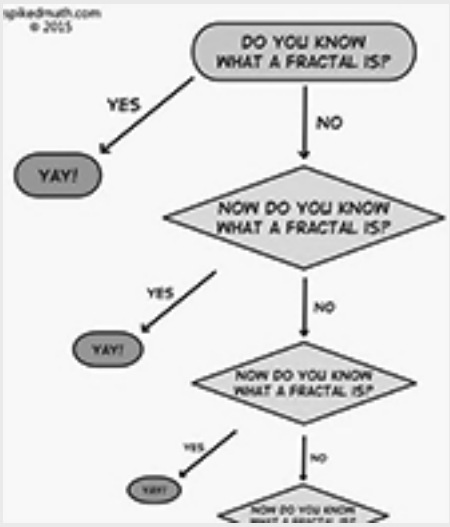
NEWSFLASH

Join LIVE Bluebird Math Circle to work on these activities together with friends and family.

Monday January 24, 5-6 PM MST online.

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

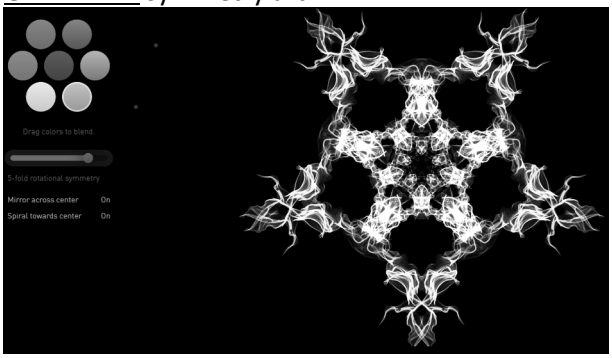
MATH JOKE



Introduction: Automagic Math Art Generators

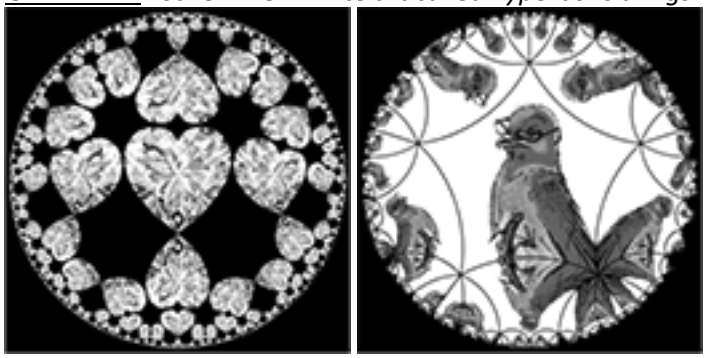
Get a taste for *parametric generators*. Jump right in and input a few parameters, such as your favorite numbers and colors. Make your own math art with a friendly robot's help. What math do these generators help you notice, as you make art?

INPUT: a number from 2 to 6, a color, and relaxed doodles
GENERATE: symmetry art



WeaveSilk.com or Weave Silk iOS app

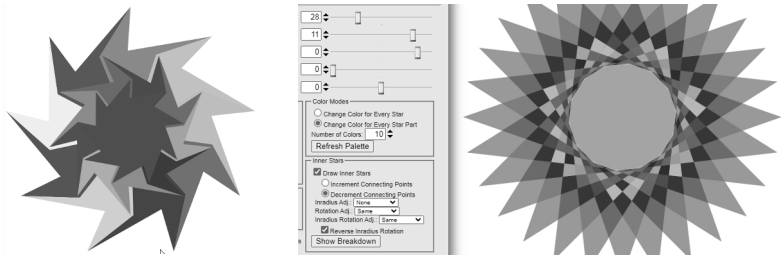
INPUT: two numbers from 3 to 7, and an image
GENERATE: Escher-like infinite art called *hyperbolic tilings*



https://www.malinc.se/m/ImageTiling.php

INPUT: star-making numbers and options
GENERATE: star polygons

StarPolygons.com



Family Circle: Math Question Generator

Every time the Bluebird Math Circle meets, participants listen to the bluebird song and think of math questions. Sometimes, it's difficult for participants to make up a question—any math question. Where do math questions come from? How can we pose a lot of them?

Math and science people have been collecting *generative questions* for centuries. "Generative" has two meanings. First, the question itself isn't too hard to ask (to generate). Second, the question starts (generates) mathematical explorations. Want to try?

ACTIVITY 1: MATH MAD LIBS

Think of two nouns: Thing One and Thing Two. If you don't know what to pick, look around you, and use the first couple of objects you notice. Put your things into these math questions:

- What shapes do you see in <Thing One>?
- How many of <Thing Two> can fit into a hogan house?
- What are similarities and differences between <Thing One> and <Thing Two>?

These questions invite us to explore size, shape, and structure. That's where a lot of mathematics comes from! Can you answer these three questions (about your things)?

Artwork: Jim and Tori Mullen

ACTIVITY 2: BLUEBIRDBOT QUESTION GENERATOR

Visit **NaturalMath.com/BlueBirdBot/** to make various math questions. The question bot is made of templates: it needs your words to work. Which questions did you like the most? What did you like about them?

ACTIVITY 3: YOUR OWN QUESTION TEMPLATE

Write a "mad libs" math question with empty slots that other people can fill in, like the three templates you see in Activity 1. Your question template can have a slot for any thing (a noun, like "cat" or "circle"), for an action (a verb, like "run" or "multiply"), or for a property (an adjective, like "fluffy" or "curved"). You can also choose to be more specific and ask a math question that works with a number, a shape, an algebraic equation, a function, and so on.

Share your template at **https://aimathcircles.org/Bluebird** and our Bluebird will add it to the question generator!

Ask Bluebird

QUESTION—*Why are the planets' orbits elliptical?* From Beth Cammarata, Santa Fe Indian School

BLUEBIRD SAYS—Spoiler: they aren't! We often *model* planetary orbits as perfect ellipses, because that's close enough for many Earthly purposes. For example, three planets line up in the sky about every 40 years. We can use the elliptical orbit model to predict when we'll see these planetary alignments.

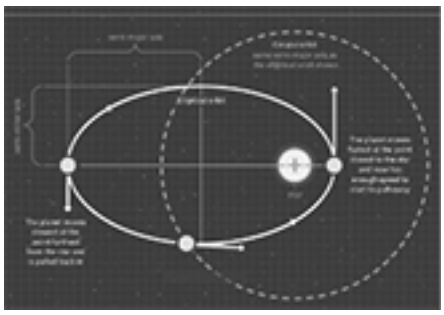


Image: ScienceFocus.com

The elliptical model is precise enough for us because it uses both *strongest forces* affecting the planets. First, the huge *gravity of the sun* pulls each planet toward the sun. Second, a planet's enormous *speed* pushes it to keep running away into space along a straight line. By themselves, these two forces would make the orbits into perfect ellipses.

Yet there's more to the story, more forces at play. The planets pull and push on one another. If we model that, the ellipses become bumpy! These complex shapes are harder to model. We have to be that precise sometimes, for example, when we send ships to planets.

FUN FACT OF THE FORTNIGHT NASA scientists use computer modeling to generate "What-If" scenarios for space missions. For example, they input, "Exercise treadmill fails" and the generator shows how much the astronauts' health and productivity will go down. NASA's generators have many more parameters than the generators we explore in this flyer, yet are similar in spirit. **https://www.nasa.gov/feature/nasa-develops-what-if-scenarios-to-protect-astronauts-predict-mission-events**