BLUEBIRD MATH CIRCLE
Alliance of Indigenous Math Circles
Issue 40: Logging the Rhythm

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

When you have a chance to do work that's really meaningful, it heals you on some level. We need our own leadership to guide ourselves to good situations. Letting go of expectations and going in a new direction can be really rewarding.

—Biological scientist turned educator
Dr. Wren Walker Robbins
the 2022 Ely S. Parker Award winner.

MATH PROSE Here is a light-hearted take on the word *"logarithm."* Want to explain the logarithm notation perfectly? The word breaks down to three parts. In Greek:
- *"log"* means to speak or write an account of;
- *"a"* specifies the object;
- *"rhythm"* means a repetitive pattern.

Thus logarithm means to *"log the rhythm"* of repeated multiplication, or power.
From "Roots" by Alfreda Poteat, in publication by Natural Math

Abstract Thoughts vs. Concrete Ideas

All formal math starts in the abstract world of our thoughts, before it moves into concrete outward expressions. When learning new or seemingly difficult math concepts, it may be helpful to ask, "What was the creator trying to communicate?"

Art by Paul Klee (1921) and Sydney Bunney (1920)
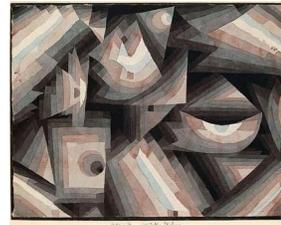
Warmup Challenge: Pattern Assist Calculations

Figure out the pattern which helps to solve this problem from **https://nrich.maths.org/**

A book has 89 pages, but the page numbers are printed incorrectly. Every third page number has been omitted, so that the pages are numbered 1, 2, 4, 5, 7, 8,… and so on. What is the number on the last printed page?

Family Circle: Logging The Rhythm

Bring lots of paper, markers or colored pencils, plus your imagination to work through these activities together.

Logarithm Introduction
Can you imagine calculations with very large numbers like 1,000,000 (*one million*) or very small numbers like 0.000,001 (*one millionth)*? Logarithms were first created as tools to help calculate with multi-digit numbers. Since then, people have discovered many other uses for the idea.

Thought Activity: What's a *logarithmic scale*?
Imagine you've invented a ten-fold logarithmic scale for measuring movements of a glass filled with water (in a safe test chamber). Level one: *barely moving the glass side to side, without losing any water.* If level two were ten times stronger, what would it look like? *The movement might be shaking the glass forcefully side to side, losing all the water.* If level three was ten times stronger than level two, what would that look like? *It might look like the glass thrown against a wall so hard it shatters into tiny pieces.* This gives you a taste of a logarithmic scale. Even though we only used 3 levels, we were able to communicate a big change. Logarithmic scales use the power of repeated multiplication to communicate large changes.

Linear versus Logarithmic Scales
In *linear scales*, change occurs by adding one ==base unit==.
In *logarithmic scales*, change occurs by multiplying by one ==base unit==.

Linear	1	3	5	7	9			
Logarithmic	1	2	4	8	16			

Finish our table. What is our base unit?

Linear Change Art

Art is called abstract when it conjures up thoughts that are open to your imagination. Art which uses more concrete images typically will conjure up more concrete ideas in your head. The indigenous art below has abstract elements. The artists use dots, lines, or geometric shapes to create repetitive patterns, which gradually change in size. The patterns feature linear change.

Images: Kifwebe mask by the Songye and Luba people in the Congo River Basin; Aboriginal Australian art; Navajo wearing blanket (The Met)

Can you point out the general appearance of linear change in the indigenous artwork? Or do you think patterns appear to change in a logarithmic manner?

Logarithmic Change Art
Sketch your own image with abstract patterns which appear to change on logarithmic scales. Prime your imagination for your artwork! Consider…
What base will I use for my logarithm's "pace"?
Which abstract forms will I choose to create my art?
What else can I add to make my art beautiful?

Ask Bluebird

QUESTION—*Why do we need math?* From Anthony L. and Alexa O.
BLUEBIRD SAYS—Excellent question! When people ask, it's always very personal for them. It's not about some scientists somewhere using math to build electronics or navigate between the planets. It's not about some hobbyists somewhere loving math puzzles. It's not about the high-paying math analyst jobs out there. It's about you, Anthony and Alexa, doing the mathematics you do, now. Why are you doing the math you do? Why right there, right now?
Like the rest of mathematical meanings, you will have to build and discover your own reasons. You'll need help from those you trust to care about who you are and where you want to go. I can share a formula, and it will work the same everywhere in the world. But "Why use this formula?" will be different in each head and each community. So, try many diverse math activities. See what different people do in their math. Ask people you trust to help you find math just for you.
When you have a chance, listen to yourself as you try math. Try to pose and solve problems, make art (with our math circle this Wednesday!), debate proofs, mess with math software and robotics, apply math to science and everyday life, and so on. Travel the big world of math. Stay in villages that catch your eye, and meet the math neighbors who like it there. Try to make sense of what different math people do. Ask around for recommendations: "Oh, if you liked this piece of math, you will love…" That's how you could find, adopt, and grow your own *math whys*.

| **FUN FACT OF THE FORTNIGHT** | Mythologies about the sky were incorporated into the guiding principles for many ancient cultures. Insights drawn from examining the sky led many to rely on the mathematically correct astronomical data. Here is a quote from LegendsOfAmerica.com about the sky myths of various Native American cultures:

 The Anasazi. In New Mexico, researchers found a cave painting that appears to depict a supernova explosion; the orientation of a crescent moon and stars indicate that the art may represent the Crab Nebula, formed in 1054 A.D. by a supernova. The Anasazi way of life remains somewhat of a mystery, but researchers found that the tribe built a solar observatory, suggesting that the sky was extremely important to the Anasazi way of life. *(Photo by PaleoRob)* |