Bluebird Math Circle
A Virtual Math Community
What is the Bluebird Math Circle?

- It is a special program of the Alliance of Indigenous Math Circles (AIMC)
Mission

The mission of the Alliance of Indigenous Math Circles (AIMC) is to create mathematical opportunities for Indigenous students and to build community among math teachers of Indigenous students while respecting Indigenous culture.

Vision

Our vision is to increase by an order of magnitude the number of Indigenous students who choose to pursue post-secondary STEM degrees.
Indigenous people are underrepresented in STEM disciplines and especially in mathematics.
Mathematics, like music and poetry, is the birthright of every human, and mathematical talent is spread uniformly among all people. Thus, underrepresentation suggests that Indigenous students’ talents remain unrealized because of reasons beyond their control, and not because of a lack of capacity or interest. Moreover, indigenous people will bring their unique viewpoint and thus will enhance and expand the professions.
School mathematics hides mathematics’ role as a cornerstone of human civilization, leading to student disinterest in the subject.
Besides opening many doors to STEM and other professions, mathematics is the best tool for developing logical thinking and training analytical abilities. Not studying math deprives students of an excellent opportunity to build their “mental muscles”.
Schools serving large percentages of indigenous students face high turnover among math teachers, making it difficult for students to build the kinds of connections with role models that sustain students’ interests in pursuing mathematics.
Building a community of math teachers’ who have a network of connections to peers and mathematicians around the country provides professional and emotional support. Decreasing teacher turnover has a high return on investment and supports student persistence.
AIMC addresses these programs:

- Math Circles partners with indigenous communities to uplift the beauty and power of mathematics.
- Network of professional mathematicians facilitates math circle demonstrations, math festivals, teacher workshops.
- Respected teacher-leaders from indigenous-serving schools and organizations serve as regional coordinators.
AIMC Directors
AIMC links indigenous community to the mathematical community.

- Mathematical Association of America (MAA)
- American Mathematical Society (AMS)
- American Indian Science and Engineering Society (AISES)
AIMC by the numbers annually (pre-pandemic)

500+ K-12 students served through Math Circles educational approach

80+ K-12 teachers served through Math Circle workshops in schools that served Native American students.

1 7th - 12th grade FREE 6-day summer math camp for indigenous students at Navajo Preparatory School

4 Math Circles teacher professional development in Santa Fe, Oklahoma, Tuba City & Las Vegas (NM)

27 Mathematician presentations to schools in the Navajo Nation, Hopi and other locations.
And then the pandemic started…

We couldn’t go to the communities we’
serving in person.
Instead, we started an online program:
Bluebird Math Circle
Bluebird Math Cir

Virtual Math Community

Launched in March 2021 it is a supportive community of teachers, students and their families – everyone who cares or is curious about mathematics, education and indigenous young people’s futures.
Look us up at   https://aimathcircles.org
Bluebird Math Circle flyer released with fun and engaging math activities that are accessible to everyone. People are encouraged to play with the activities in class and at home.

https://aimathcircles.org/bluebird/

Following Monday

A live online circle meeting is held to discuss and solve the activities.
Every page issue of the newsletter has a certain structure:
BLUEBIRD MATH CIRCLE
Alliance of Indigenous Math Circles

Issue 21: Making Things Equal

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

NEWSFLASH
Join LIVE Bluebird Math Circle to work on these activities together with friends and family.
Monday February 7, 5-6 PM MST online.
Sign up at https://aimathcircles.org/Bluebird

MATH PUZZLE
How many numbers do you see here?

From my experience, no one expects you to be perfect on the first try and there is honor in knowing where you’re lacking. Take the time to better yourself - to not give up.

—Alexis Keeling, Cherokee Nation, Industrial and Systems Engineer
Warm up: Cut It Up Equally

Split the figure on the grid into two equal parts (so that you can place one part on top of the other one and they completely coincide). You can move the pieces any way you want – slide, turn them around or flip them. Artwork: Coyote (Zuni fetish).
Main activity (usually consisting of one or two challenges)

**Family Circle: Making Shares or Numbers Equal**

**Problem 1:** Once upon a time on a faraway planet there was an island nation called Bluebird Nest. When the people of Bluebird Nest wanted to appoint the leader, they asked candidates to demonstrate their cleverness, generosity, and fairness. Each candidate was given 100 coins, each coin of different value: 1 blue dollar, 2 blue dollars, 3 blue dollars, etc, all the way to 100 blue dollars, and they were told to distribute the money among people. Whoever distributes the money among the largest number of people in such a way that every person gets the same total value becomes the leader. Could you help?

Artwork: *The Money Changer and His Wife* by Quentin Matsys (oil on panel painting, 1514).

Here is an example: If we have three coins of 1, 2, and 3 blue dollars, we can split them evenly between two sacks as shown.

Can we split the coins between more than 2 sacks?

If we have coins of 1, 2, 3, 4 blue dollars, we can split them evenly between two sacks.

Can we split the coins between more than 2 sacks?

What if there were 101 coins (of 1 blue dollar, 2 blue dollars, 3 blue dollars, ..., 100 blue dollars, 101 blue dollars)? What if there were 2020 coins?

**Problem 2:** Make the piles equal. The game starts with \( N \) piles of stones. The first pile has just 1 stone, the second pile has 2 stones, the third pile has 3 stones, etc. A move consists of adding 1 stone to each of any two piles of our choice (see the example).
Bluebird’s answer to a question posed at a past meeting

Ask Bluebird

**QUESTION**—What is the smallest perfect number? — from Chris K.
**BLUEBIRD SAYS**—A perfect number is one that is equal to the sum of all its divisors including 1 but excluding itself. Let’s look at the following table:

<table>
<thead>
<tr>
<th>Number</th>
<th>All its divisors</th>
<th>The sum of all the divisors excluding the number itself</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1, 2</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>1, 3</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>1, 2, 4</td>
<td>3 (=1+2)</td>
</tr>
<tr>
<td>5</td>
<td>1, 5</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>1, 2, 3, 6</td>
<td>6 (=1+2+3)</td>
</tr>
</tbody>
</table>

(Can you see why the table starts with number 2 instead of 1?)

From the table we see that the smallest perfect number is 6. Try to find the next perfect number, it won’t take long. Many interesting facts are known about perfect numbers. Bluebird’s favorite ones are the following two:

1. Nobody knows whether or not there exist odd perfect numbers; this may be the oldest open problem in mathematics.
2. It was the study of perfect numbers that led Pierre de Fermat (a 17th century French mathematician) to discovery of the principle of mathematical induction, which is now the standard method for proving results about all the natural numbers.
Last but not least part of the newsletter:

Fun Fact of the Fortnight:

**FUN FACT OF THE FORTNIGHT**

1. At any given moment on the earth’s surface, there exist two antipodal points (on exactly opposite sides of the earth) with equal temperatures and barometric pressures.

2. In geometry, a *polyhedron* (plural *polyhedra*) is a three-dimensional shape with flat polygonal faces, straight edges and sharp corners (or vertices). We are well familiar with many polyhedra such as cubes, pyramids, rectangular boxes. Polyhedra occur in nature as crystals; jewelers shape up stones as intricate polyhedra. We can imagine (or construct) polyhedra of many, many different forms (try it!). But it is a fact that every polyhedron must have at least two faces with the same number of vertices. If you want to see why this is so, write to Bluebird and we’ll talk about this fact.

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[Diagram showing types of polyhedra: Regular Polyhedron and Irregular polyhedron.]
After the meeting, we publish a recap where Circle members and friends share the ideas they developed in the meeting, ask questions, and suggest future topics.
The next two slides contain an excerpt from "Recap 1: Sizes of Infinity"
In each problem, we need to decide how to distribute tickets with numbers 1, 2, 3, 4, and so on among all the ducks. We want to make sure that every duck, no matter where it is in a row or how far down a column, eventually gets a ticket with a counting number on it.

After about 20 minutes we all came back together again and talked about our discoveries.

People from one room reported, “We are so happy to report that in our room we have solved both problems.” To explain, Dawnlei Ben showed the following two pictures:
Then she went on to tell us more about her solutions: “This one had a starting point. So that's where we started, and I just zigzagged back and forth and thought of a Christmas tree. That’s the perfect way to put lights on a tree mathematically. Yeah, that’s how all our trees should look now:

"I put up my tree yesterday, so it started making me do that. And then when you put the star on the top you see the ornaments and the lights from the top view and then your cords wrap around it. That gave me the idea of just looking from the top of the tree down here:
All our newsletter issues and recaps can be found at our website.
Also, our website has a special tab for teachers:

For Teachers

Dear Teacher,

The Alliance of Indigenous Math Circles appreciates your involvement with the Bluebird Math Circle. We offer you a certificate granting 3 PD hours when you:

- participate in a live Bluebird MC meeting.
- use the materials after the meeting with a group of people: students, or parents, or neighbors, or other teachers.
- submit a short reflection paper on your experience.

You are welcome to receive these certificates multiple times—as many times as you come to Bluebird MC meetings and implement the materials as described above.

Teacher interview

Alicia Gonzales, Pojoaque Valley Middle School, Santa Fe, NM

Download the interview

“The main reason that I love to teach math is because I was never good at math when I was a student. I always was the student that thought, “I’m so bad at this, and I’ll never get it.” Then, when I was offered the opportunity to get my math teaching degree, I had a new teacher who said, “No, you can do this. You can do this.” And I thought, ‘Wow, I can do this. I can do it. I can do it.’ And it helped.”
Come to our live meetings. Register at https://aimathcircles.org/bluebird/

We would like you to spread the word about AIMC and Bluebird Math Circle. We encourage you to bring Native American students, teachers and families to join us for engaging math.

We welcome you to join our community as participants or leaders.
Join AIMC!

We want to partner with you. Please fill out our Contact Us online form at our website: www.aimathcircles.org
Book featuring activities used in Math Circles at Navajo Nation.
THANK YOU!

Contact us at:

www.aimathcircles.org