



# math circles

## Annual Report 2023–2024

### Content:

|                                  |    |
|----------------------------------|----|
| Overview                         | 2  |
| Presentations                    | 5  |
| Staff                            | 6  |
| Monthly Events                   | 7  |
| School and Program Visits/Events | 12 |
| Future Goals                     | 13 |

### Mission Statement

Nova Scotia Math Circles is dedicated to enriching the experiences of Nova Scotia students in all areas of mathematics.

Our program vision is to foster enthusiasm for math through interactive, creative, and meaningful presentations.

Many thanks to our sponsors!



**DALHOUSIE**  
UNIVERSITY



Nova Scotia Math Circles is a mathematics outreach program run out of Dalhousie University and funded by Eastlink. Our activities are two-fold: We host monthly events at Dalhousie to enrich local students and visit schools all across the province for hands-on activities with the entire class.

## Overview

It has been another exciting year of outreach activities for NS Math Circles. The activities of NS Math Circles are twofold: travelling to schools around the province to do interactive math workshops—doing mathematics in a way that promotes engagement and builds confidence—and hosting monthly interactive presentations aimed at the junior to senior high level, which are free to attend.

This year Tom Potter continued as program director of Math Circles, and Dr. David Iron continued as faculty advisor. A number of presenters and content developers from last year continued to work with Math Circles this year; these included: Anaam Choudhury, Baorui Jia, Cali Park, Daniel Teixeira, Dario Brooks, Dulguun Norjinbat, Iresha Madduwe Hewalage, Joey Latta, Joyce Jiao, Knowledge Gule, Louis Bu, Neil Kelley, Razy Shafiee, Scott Wesley, and Vivienne Kwan. We also recruited several new presenters in order to keep up with the growing demand for Math Circles presentations; these included Aaron Fairbanks, Christine Fang, David Zeidler, Dylan Pearson, Fatema Gholami, Joy Liu, Hala Hasan, Hasan Mahmood, Navya Unnikrishnan, and Timothy Power.

Between October and December we had a very full schedule of school visits. We attended the Math Teachers Association Conference again this year and made new connections with teachers from around the province. We gave a presentation to promote our program and had an exhibit table for teachers to sample our activities and learn about our work.

Between October and March we did 5 special presentations at Dalhousie for students of African descent from Duc d'Anville Elementary and Clayton Park Jr High. These were organized together with Phillip Jackson, an African Nova Scotian Student Support Worker. The presentations, given by Dario Brooks and Knowledge Gule, were very well-received, and Mr. Jackson informs us that the students continue

to speak of their experience at Dalhousie. We have plans to continue and expand these presentations.

We continued our afterschool program for Indigenous students this year, which was overseen by Tom Potter and Dr. Dorette Pronk, together with Mandy-Lynne Markie (support worker with HRCE). We visited Bayview High School in Tantallon on an almost weekly basis, providing fun activities, homework support, enrichment for advanced students, and encouragement for a small but committed group of students. We plan to continue and expand this program next year.

In March we hosted the 2024 [Canadian Math Kangaroo Contest](#) at Dalhousie. Dalhousie was the only Kangaroo contest site in Nova Scotia, with 160 registrants. Tom Potter and Dr. Dorette Pronk were the site coordinators, who also had help from several members of the Math Circles team. We also provided two in-person training sessions for the Kangaroo contest, with the help of the Math Circles team. We also held an awards ceremony in May for those who placed regionally or nationally in the competition. This year we had 7 students receive notational recognitions.

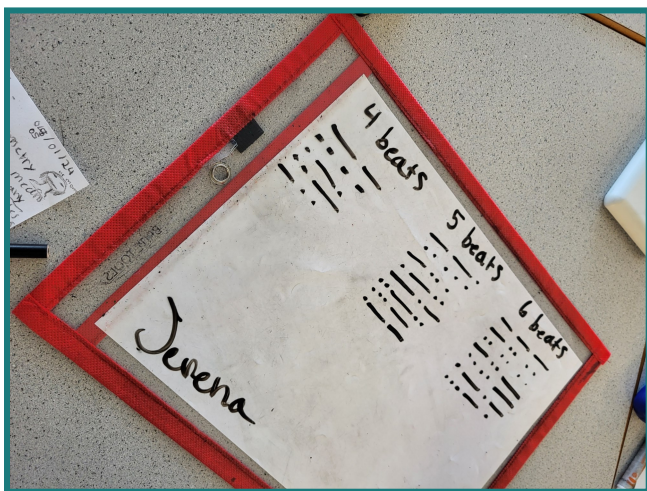
After the success of last year's breakout sessions at the South Shore Science Fair in Bridgewater, we were invited to do it again this year. We did a full day of breakout sessions for grades 6-12 for this event. We also

participated in the first STEM night at New Minas Elementary School this April, where our table attracted 300 students with their families. We also participated for the first time in the Kings County Academy STEAM day on May 1, where we worked with two groups of students for over 4 hours, after which the students presented their work in the school gymnasium.

NS Math Circles again provided the activities for Dal Discovery Days for the Math Department. Over three days we hosted large groups of students, from grades 5 to 9, in the Learning Centre. We did activities such as cutting Mobius Strips, Fold and Cut Theorem, Eulerian Circuits, Cryptography, and Card Tricks, and included a refreshment break for each group.

As of the end of May, we have done 110 school visits, for a total of 427 classes, in addition to the special outreach presentations mentioned above. We have visited schools all over the HRM, as well as in Canning, Cornwallis Park, Granville Ferry, Hardwood Lands, Kentville, Lantz, Stellarton, Truro, and Wolfville. We did a couple virtual class presentations as well this year, reaching a class in Fall River and another in Guysborough.

Our evening monthly events have continued to be successful and well-attended. We've continued to host our monthly evening events in a hybrid format, which has allowed to us reach more students. We've also



“The hands-on games were a big hit. The content was age-appropriate and engaged the kids. Discussions were excellent/kid friendly. Very pleased.”—Leanne Whitman, O’Connell Drive Elementary, Gr 3, May 24, 2024

provided recordings to those who wanted to attend but were unable. This year we had presentations from enthusiastic undergraduate and graduate students, a faculty member, and a local high school teacher. We also had two special monthly events which were done in collaboration with [Im-hotep's Legacy Academy](#), in which the presentation was created and delivered by Marissa Assam, a tutor from the ILA team. Over 200 students joined us so far this year. We had pizza and pop for those who attended in person. Our presenters so far this year were Tom Potter, Bram Ogus, Iresha Hewalage, Marissa Assam Andrecyk, Dr. Roman Smirnov, Dylan Pearson, and Erick Lee. We also have a presentation scheduled in June by Drs. Danielle Cox and Karyn McLellan. See our website to learn more about these excellent presentations. We are very grateful to our volunteers for giving these workshops.

Thanks to everyone who helped make this year a great success, including presenters, teachers, and math consultants and support workers in the community. We would also like to thank the support in the Math and Stats Department: Nora Amaro, Mark Monk, and Anna Marie Davis, for their work ensuring all the administrative needs were met, including pay queries, room bookings, building access, and cleanup requests. Thank you to Dr. David Iron for overseeing all contracts and expenses and helping troubleshoot any problems that arose. Thank you to Dr. Dorette Pronk for being heavily involved in the program's continued success as we worked to apply for funding renewal, and for helping oversee the afterschool program at Bayview High.

This year, Math Circles celebrates its tenth year of funding with Eastlink. In April we hosted an event for our sponsors to celebrate this milestone. The folks at Advancement and Alumni Engagement were extremely helpful in organizing this event, including Jocelyn Adams and Christena Copeland, and especially Mila McLean for

“Such excellent mental math application. Students were engaged and lots of math language being used.”—Terin DeWolf, Joseph Howe Elementary School



overseeing all aspects of our sponsor event and helping Tom prepare for it. We are extremely grateful to Eastlink for their deeply generous support, which makes our program possible!

Keep up to date with our events at [www.nsmathcircles.ca](http://www.nsmathcircles.ca). We are also on Twitter (@NSMathCircles) and Facebook (NSMathCircles1).

# List of Presentations

## Elementary Schools

- Candy Game \*
- Dots and Boxes\*
- Exploding Buckets\*†
- Exploring Mathematics\*
- Jury Duty\*†
- Fun with Fractions\*
- Mathemagic\*
- Pascal's Triangle\*
- Pentominoes†
- Problem Solving\*†
- Tessellations\*

\* These presentations have been adapted for virtual class visits.

† These presentations have undergone revisions and improvements this year.

## Junior High Schools

- Bothersome Brainteasers\*
- Candy Game\*
- Classical Cryptography
- Dots and Boxes\*
- Eulerian Circuits
- Fibonacci & the Golden Ratio
- Fractions Fun†
- Graph Colouring
- Jury Duty\*†
- Mathemagic\*†
- Nasty Number Tricks and Devious Divisibility
- Pascal's Triangle\*
- Prime Numbers
- Probability (Work in progress)†
- Problem Solving\*†
- Tessellations\*
- Toads and Frogs\*
- Tower of Hanoi

## Senior High Schools

- Bothersome Brainteasers\*
- Classical Cryptography
- Eulerian Circuits
- Fibonacci & the Golden Ratio
- Fractals
- Graph Colouring
- Infinity
- Logic and Reasoning
- Million Dollar Hat Problem
- Master Your Cards
- Modern Cryptography
- Nasty Number Tricks and Devious Divisibility
- Nim
- Numeral Systems
- Pascal's Triangle\*
- Permutations & Combinations
- Pi
- Prime Numbers
- Probability (Work in progress)†
- Toads and Frogs\*
- Tower of Hanoi



# NS Math Circles Staff

## Program Director

The Program Director is responsible for the day-to-day running of Math Circles. The Director oversees the overall program direction and the school trips, online class visits, local, online, and other events, as well as social media.

This year, the Program Director was Tom Potter, a Ph.D. candidate in the department. This is Tom's fourth year in this position, after being a presenter and content developer for NS Math Circles for two years previously.

## Faculty Advisor

The faculty advisor is the liaison between Math Circles and the Mathematics & Statistics Department. This person also provides continuity as they usually stay in this position for several years. They advise the Director and any Assistant Directors on any issues that might arise.

This year, Dr. David Iron was our faculty advisor.

## Presenters and Content Developers

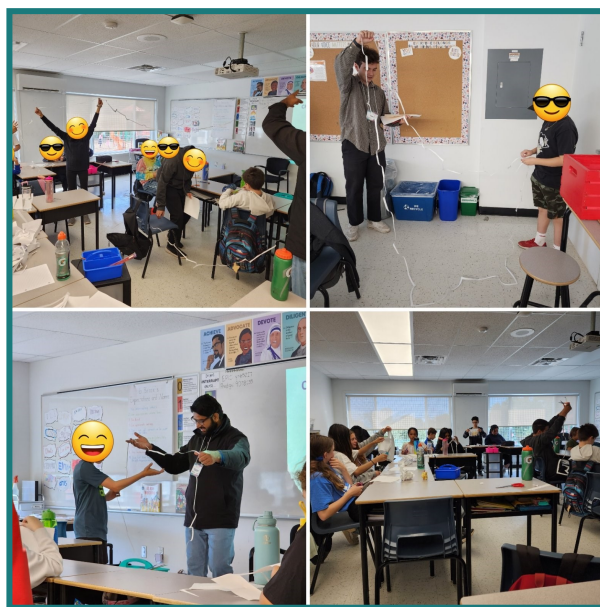
The presenter/content developer positions are filled by undergraduate and graduate students who commit to working with Math Circles throughout the year for a significant number of hours. They staff many of our school/class visits and develop and update

“Neil and Fatema were wonderful presenters who were patient with the students, helped them to understand the concepts and encouraged them to give it a try, even if they weren't sure. It was a fun day for the students. Hopefully, we can have them back again! Thank you so much for your time and dedication to the students.”—Kailey Condran, Gorsebrook Jr High

presentations. Our presenter/content developers this year were Aaron Fairbanks, Anaam Choudhury, Baorui Jia, Christine Fang, Daniel Teixeira, Dario Brooks, Dulguun Norjinbat, Fatema Gholami, Hala Hasan, Hasan Mahmood, Iresha Madduwe Hewalage, Joey Latta, Joy Liu, Joyce Jiao, Knowledge Gule, Louis Bu, Navya Unnikrishnan, Neil Kelley, Scott Wesley, Timothy Power, and Vivienne Kwan.

## Casual Presenters and Content Developers

The casual presenters/developers are undergraduates and graduate students, and postdoctoral fellows at Dalhousie that will occasionally go out on school trips or help develop/improve materials. This year, our casual presenters were Cali Park, David Zeidler, Dylan Pearson, and Razy Shafiee.



# Monthly Events

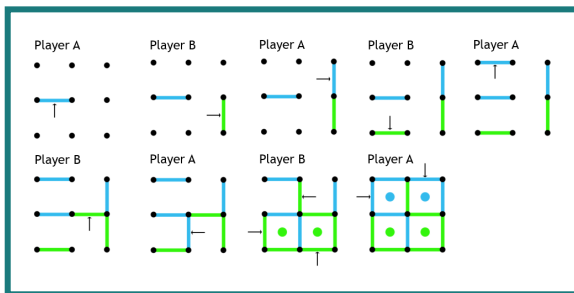
This year we hosted 9 evening events, all of which were offered in a hybrid format, with approximately 242 students in total in attendance.

**September 27<sup>th</sup>**

**Presenter: Tom Potter (Dalhousie)**

*Topic: Dots and Boxes*

Dots and Boxes is a game invented by French mathematician Édouard Lucas, who first published a paper on it in 1895. Lucas called it la pipopipette. It is generally a two-player game, although it can be adapted to three or more players. The game is played on a grid of dots, and the goal is to form the most boxes by filling in edges between the dots. Dots and Boxes is an excellent introduction to games involving strategy. Learning this game can increase your capacity for strategic thinking, but it is also a lot of fun! We will guide you through the simple rules by going through an example, and then let you play and experiment to see what outcomes you can achieve. If time permits, the audience can play a round against the presenter!



**October 25<sup>th</sup>**

**Presenter: Bram Ogus (Dalhousie)**

*Topic: When Math Stops Making Sense*

When we think of Mathematics, we don't usually think about problems that contradict our intuition. Seemingly valid proofs for things that should obviously be false. When we look at paradoxes, everything we know about math is flipped on its head. All horses are pink, we can create perpetual motion using only a cat and a slice of toast, we can fill up an infinite hotel with infinite people and still have more space, and so much more. In this presentation, we will explore

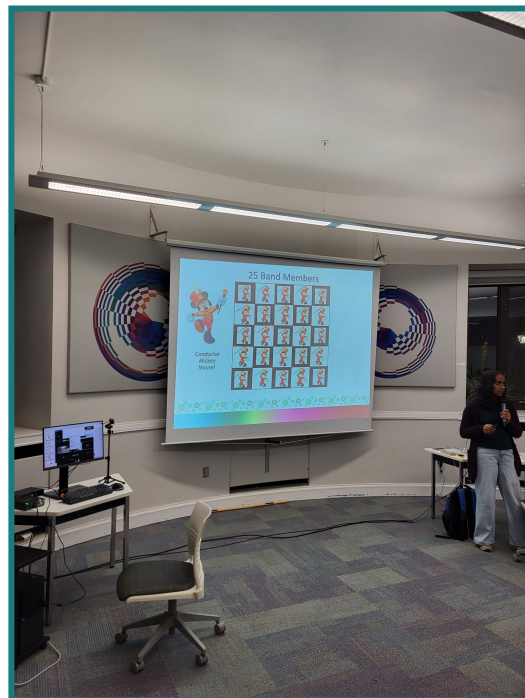
the world of the paradoxical by learning and using some basic notions of set theory like union and intersection, cardinality, and induction.

**November 29<sup>th</sup>**

**Presenter: Iresha Madduwe Hewalage (Dalhousie)**

*Topic: Problem Solving*

Problem solving is central to mathematics. In this presentation we will work on a series of fun and challenging problems. Students will be encouraged to attempt their own solutions and share their ideas with us. If joining us on Zoom, you'll need pencil and paper.

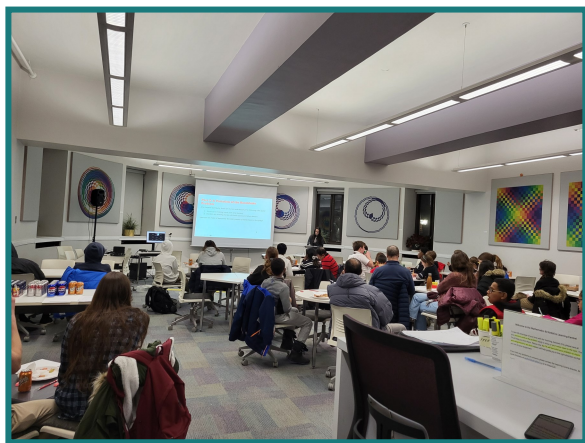


**January 31st**

**Presenter:** Marissa Assam Andrecyk (Dalhousie, with [Imhotep's Legacy Academy](#))

**Topic:** *How Many Handshakes?*

Counting techniques are very important in many areas of mathematics. In this presentation, students will look at a classic counting problem and its variations as a brief introduction to combinatorics. They will be encouraged to try their own solutions and share their ideas. Those on zoom will need pencil and paper.



**February 28th**

**Presenter:** Dr. Roman Smirnov (Dalhousie)

**Topic:** *What is  $\pi$ ?*

Everyone knows that the ratio of the circumference of a circle to its diameter is a constant number that is the same for all circles, and this number is called  $\pi$ . This conclusion can be reached by asking the question: why are all circles similar to each other? Because of this similarity, it is natural to assume proportionality in their linear dimensions.

The fact that the ratio of the circumference of a circle to its diameter is constant has been known since ancient times. The first use of this number's symbol, the Greek letter  $\pi$ , is found in the work "Synopsis Palmariorum Matheseos" ("Overview of Mathematics Achievements") by the English teacher William Jones (1675-1749), published in 1706. The symbol  $\pi$  for the ratio of the circumference to the diameter became widely used after it was employed in the works of Leonhard Euler (1707-1783) – one of the greatest mathematicians in history. His work

spans all areas of mathematics and he wrote 80 volumes of research.

We will give a mathematically rigorous definition of  $\pi$  by actually proving that the ratio of the circumference of any circle to its diameter is a constant value.

"Kids loved the hands-on activity and enjoyed making the animal shapes. The presenters were calm, encouraging, and helpful. They were well-organized. Every student was able to access the activity in some way. Loved it!"—Ella Porter, Gr. 1, Truro Elementary School



**March 27th:**

**Presenter:** Dylan Pearson (Dalhousie)

**Topic:** *The Game(s) of Cops and Robbers on Graphs*

Cops and Robbers is a two-player game played on a graph. The game is simple: one player controls a cop, and the other player controls a robber. The cop's goal is to capture the robber, and the robber's goal is to evade capture forever.

Despite having a straightforward ruleset, this game is very well-studied. We will explore some notable results, including a char-



acterization of exactly when the cop wins, and talk about some variations of the game.

**April 24<sup>th</sup>**

**Presenter: Marissa Assam Andrecyk (Dalhousie, with [Imhotep's Legacy Academy](#))**

*Topic: Cryptography*

Cryptography is the study of hidden writing, and reading or writing secret messages or codes. In this presentation students will be introduced to cryptography, its importance in modern day computing, and get to learn how to encrypt and decrypt their own messages using various popular methods.

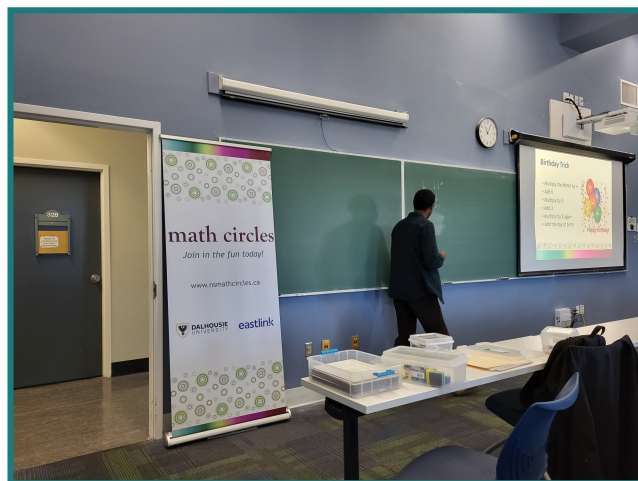


**May 29<sup>th</sup>**

**Presenter: Erick Lee (HRCE)**

*Topic: Twists and Turns - Exploring Mathematical Loops and Spirals*

Join us as we create and explore spirrolaterals. These geometric patterns are created by following simple rules. The twisting and turning lines create graceful works of mathematical art. We'll also try our hand at solving a Loops puzzle and see how this puzzle is connected to Knot Theory. If we have time, we'll also play the classic math game Sprouts. This is a simple paper and pencil strategy game that has a surprising amount of depth.

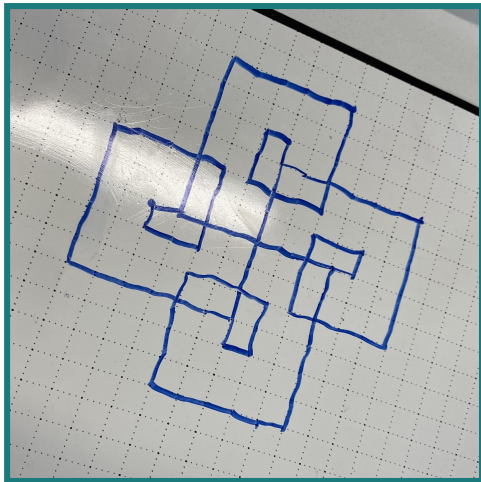


June 19<sup>th</sup>

**Presenters: Drs. Danielle Cox and Karyn McLellan (MSVU)**

*Topic: Exploring Mathematical Research*

What is math research? In this talk we will learn how a mathematician discovers new results, look at some famous math problems that sparked interesting research and let you try your own hand at discovering some mathematical theorems of your own.



“Can you come back tomorrow?”—student at Astral Drive Elementary

“I want to join your team in future”—student at Sunnyside Elementary

“This is the best kind of math ever.”—student at Millwood Elementary School



This year we were able to reach schools in 4 different centres for education (school boards):

### Halifax Regional Centre for Education (HRCE)

Madeline Symonds Middle School (3 visits), Park West School (7 visits), Ridgecliff Middle School (2 visits), École Rockingham School, Rocky Lake Junior High (8 visits), Grosvenor-Wentworth Park Elementary (2 visits), Prospect Road Elementary, Sunnyside Elementary, Kingswood Elementary, Brookhouse Elementary School, Sackville Heights Jr High (3 visits), Elizabeth Sutherland School (4 visits), Maple Ridge Elementary (2 visits), Duc d'Anville Elementary School (2 visits), LeMarchant St. Thomas Elementary School, Ash Lee Jefferson Elementary (2 visits), Humber Park Elementary, Alderney Elementary School, Gorsebrook Junior High (2 visits), Astral Drive Elementary (9 visits), Astral Drive Junior High, Beaverbank Monarch School (3 visits), Joseph Howe Elementary (2 visits), Harold T. Barrett Jr High (2 visits), Halifax Central Jr High (2 visits); Hillside Park Elementary (2 visits), Harbour View Elementary (2 visits), Mount Edward School (2 visits), Clayton Park Jr High, West Bedford High (2 visits), Shatford Memorial Elementary, Colby Village Elementary, Millwood Elementary School (3 visits), Hilden Elementary School, Inglis Street Elementary, Graham Creighton Jr High (3 visits), Citadel High (2 visits), Tantallon Senior Elementary, Hammonds Plains Consolidated (4 visits), Sir Charles Tupper Elementary, Central Spryfield Elementary, Saint Mary's Elementary, O'Connell Drive Elementary (2 visits)

### Annapolis Valley Regional Centre for Education (AVRCE)

Kings County Academy, Glooscap Elementary (2 visits), Clark Rutherford Memorial School, Horton High, Wolfville School, Northeast Kings Education Centre, Champlain Elementary School

### Chignecto-Central Regional Centre for Education (CCRCE)

Redcliff Middle School (4 visits), Riverside Education Centre, Truro Elementary School, Dr. W.A. MacLeod Consolidated

### South Shore Regional Centre for Education (SSRCE)

Bayview Community School

### Private Schools/Groups

Halifax Grammar School, Sandy Lake Academy (2 visits), Armbrae Academy

“They offered puzzles that allowed the students to work collaboratively and challenged their thinking. Even my students who were not keen math learners were engaged. Very kind presenters who seemed to enjoy working with my grade 5 students. Thank you!! :)”—Ruthanne Cormac, Armbrae Academy



“Mysterious! Tells a story with math! Everyone was engaged and interested to work to find the answers. Loved the variety of math concepts in this presentation. Presenters were very patient and very clear when explaining instructions and answering student questions. Thanks so much!”—Maureen Finch Purcell, Gr. 5, Ash Lee Jefferson Elementary

# School and Program Events and Activities

## Week-long trips

This year it was not possible to accommodate any long trips, partly due to timing issues and staffing constraints, but we would like to do a long trip to Cape Breton in the fall, where there has been great interest in having us back.

## Materials' Development

We made a strong effort again this year to improve the quality of our presentations, along with our PowerPoint slides for these. We are constantly working to improve our repertoire of activities, based on feedback from teachers, students, and presenters. We updated the materials and made improvements to a number of our presentations, including the popular Jury Duty and Exploding Buckets presentations. We also updated the branding and template on all our PowerPoint slides. We have some interesting ideas for possible new presentations which we would like to try out next year.

## Training and Professional Development

We continued to add training materials to the repository of videos on the Math Circles community page on the Dalhousie Brightspace system. These videos will be accessible to future generations of Math Circles presenters. So far, we have created 45 videos. These give the opportunity for more thorough training and onboarding of new presenters.

## Other Activities

As mentioned in our Overview, we have increased our outreach to underrepresented communities in math. We hope to continue



“This was an amazing experience! my students and myself loved it, it was all very positive feedback.”—  
Emma Atkinson, Gr. 9, North Kings  
Education Centre

to expand this work, along with other special outreach activities. This year our after-school program for Indigenous students at Bayview high included 17 sessions. We also did 5 special presentations at Dal for groups of African Nova Scotian students, with another planned for later this month. This was organized with Mr. Phillip Jackson, a local student support worker. Other highlights include: the MTA conference, the KCA STEAM day, the NMES STEM night, the South Shore Science Fair, 2 afterschool sessions at Armbrae Academy, Dal Discovery Days, and organizing the only branch of the Canadian Math Kangaroo contest in Nova Scotia.

“Students very engaged in the activities. The presenters were great with the students.”—Karen Davis,  
Hillside School

# 2024-2025 Program Goals

We will continue our strong presence in schools during 2024-2025. Future goals include:

- Visiting parts of rural Nova Scotia that we haven't recently visited, in particular, Cumberland County, Guysborough County, Northern Cape Breton, and the tri-county region.
- Continue and expand our outreach to Indigenous students and students of African ancestry. This includes continuing our joint events with [ILA](#), and expanding our afterschool program at Bayview High.
- Adding a presentation on Topology, and trying out our Probability presentation in schools. Possibly adding a presentation on Mathematics through movement.
- Completely updating our Fractals presentation
- Refreshing our High School presentations.
- Continuing to tweak and perfect our Elementary and Junior High repertoire.
- Connecting with the French program at Dalhousie to make French-language presentations a more consistent possibility.



## NS Math Circles

Department of Mathematics & Statistics  
6297 Castine Way, Halifax,  
NS B3H 4R2  
PO Box 15000  
Halifax, NS B3H 4R2

[www.nsmathcircles.ca](http://www.nsmathcircles.ca)

Cell: 902-401-4075  
Email: [mathcircles@dal.ca](mailto:mathcircles@dal.ca)

