



math circles

Annual Report 2017–2018

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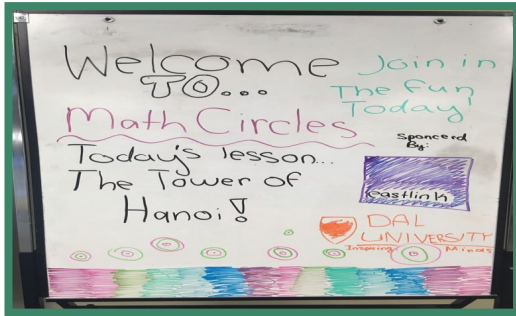
Mission Statement

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!





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.

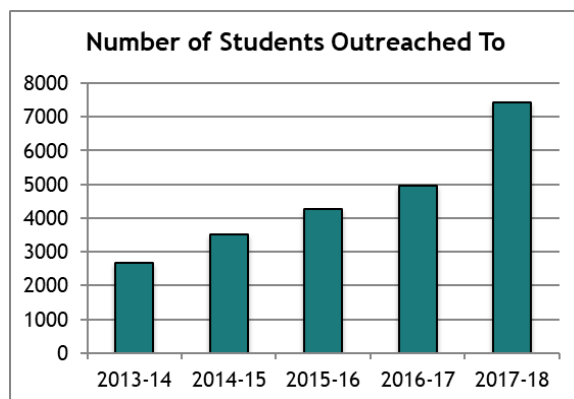
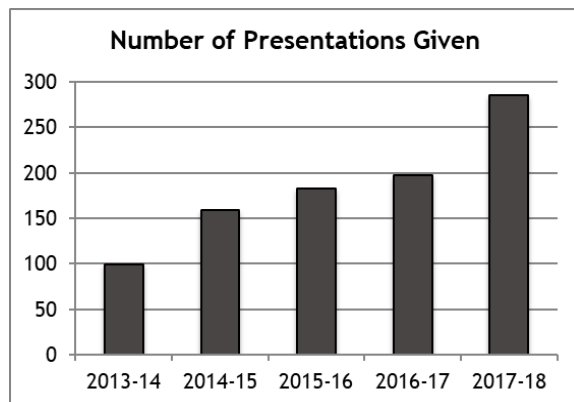
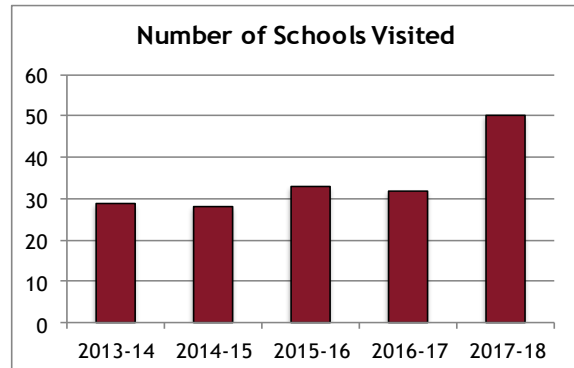
Overview

Nova Scotia Math Circles had an extremely successful year in 2017/2018. Thanks to the ongoing funding from Eastlink, we were able to continue our expansion into primary and elementary level classes, while maintaining our presence in junior high and senior high schools.

As in previous years, our fall was very busy. We had our usual week-long trips to schools in the Tri-County Regional and Cape Breton School Boards besides an average of three trips per week. We were lucky this year to have a reasonably nice winter so we were able to remain busy during the winter term.

The number of schools that booked us increased dramatically to 50 compared to 32 last year. Many of these schools were visited on several occasions or even had parallel sessions. See page 8 for a complete list of schools by school board. The number of presentations given increased from 197 to 285, and the number of students reached this year was 7429 (4950 last year).

Each event of our 'eleven'-monthly events this year attracted between 40 and 60 participants from students, parents and teachers. These events were given by a nice mix of presenters from our team, faculty members, and outside presenters. This year we hosted one of these events at the Dalhousie Agriculture Campus in Truro and 19 participants attended and enjoyed the event. We aim to extend this next year and schedule more such events in Truro. We again



thank our volunteers for giving these fun presentations. See pages 5 and 6 for a list of presenters and topics.

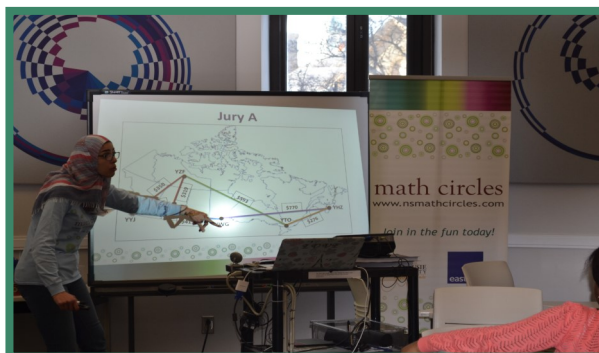
Much time this year was also spent developing, testing and adjusting our new presentations. We are very lucky to have had many teachers volunteer their classrooms for these trials.

The enthusiasm of the presenters as well as student engagement was great. They truly would have stayed and participated all morning. Thanks so much!!
- L. Jenkins, Sydney Mines Middle School

This year, the Program Director Mayada Shaha and the Faculty Advisor Dorette Pronk ran three sessions in the AARMS Girl Guides

Outreach event at the University of New Brunswick in Fredericton. This year, 73 girl guides, pathfinders and rangers had the chance to learn about the program and to participate in a very engaging activities.

Last July, we hosted the first “Math Circles Summer Camp Day”, where 19 participants enjoyed solving mathematical mysteries in the Halifax Central Public Library.



List of Presentations

Elementary Schools

- Exploding Buckets
- Exploring Mathematics
- Jury Duty *
- Fun with Fractions *
- Mathemagic *
- Pentominoes *(New P-G3)
- Problem Solving *
- Tessellations

* These presentations are new and have undergone trials and adjustments in the last year.



Junior High Schools

- Bothersome Brainteasers*
- Eulerian Circuits
- Fibonacci & the Golden Ratio
- Graph Colouring
- Jury Duty *
- Mathemagic *
- Nasty Number Tricks and Devious Divisibility *
- Prime Numbers
- Problem Solving *
- Tessellations
- Toads and Frogs
- Tower of Hanoi

Senior High Schools

- Bothersome Brainteasers*
- Cryptography
- Eulerian Circuits
- Fibonacci & the Golden Ratio
- Fractals
- Graph Colouring
- Infinity
- Logic and Reasoning
- Million Dollar Hat Problem
- Nasty Number Tricks and Devious Divisibility *
- Nim
- Numeral Systems
- Permutations & Combinations
- Pi
- Prime Numbers
- Toads and Frogs
- Tower of Hanoi

NS Math Circles Staff

Program and Assistant Directors

The Program Director and Assistant Director together are responsible for the day-to-day running of Math Circles. The Director oversees the overall program direction and the school trips, while the Assistant Director is responsible for the local events, among others.

This year, the Program Director was Mayada Shahada, a postdoctoral fellow in the department and Melissa Huggan, a PhD candidate, continued as Assistant Director. Next year, Mayada Shahada will continue as the Program Director while Asmita Sodhi will join the program as the Assistant Director.

Faculty Advisor

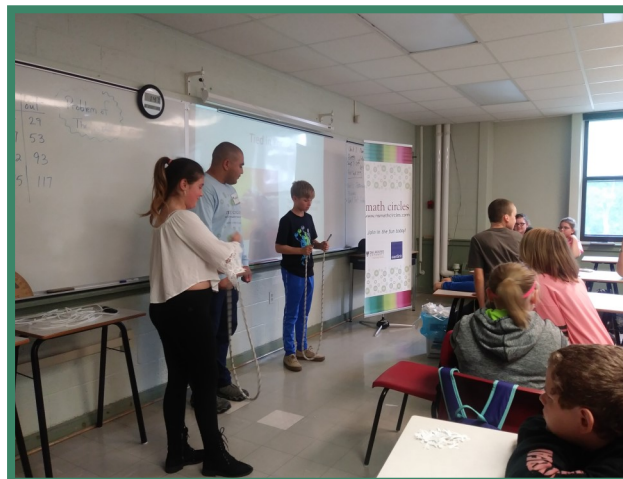
The faculty advisor is the liaison between Math Circles and the Mathematics & Statistics Department.



This person also provides continuity as they usually stay in this position for several years. They advise the Di-

The kids were so engaged. One of my students walked by and said 'I love this!' and she normally doesn't enjoy math :)

- C. Fisher, Tantallon Sr. Elementary



rector and Assistant Director on any issues that might arise.

This year, Dr. Dorette Pronk continued in the program as faculty advisor.

Teaching Assistants

The teaching assistant positions are filled by graduate students who commit to working with Math Circles throughout the year for a significant number of hours. They staff many of our school visits and develop and update presentations.

Our teaching assistants this year were Abdullah Al-Shaghay, Evangelia Aleiferi and Iain Beaton. Maryam Ehya and Ethan Lawler held partial teaching assistantships with Math Circles during the fall. We welcome Tom Potter, Rebecca Ryan and Ryley Urban as our teaching assistants for next year.

Casuals

The casual presenters are undergraduates and graduate students, and postdoctoral fellows at Dalhousie that will occasionally go out on school trips.

This year, the casuals were Catherine Antwi, Ben Cameron, Curran Cameron, Emma Carline, Corey DeGagne, Maryam Ehya, Marie B. Langlois and Asmita Sodhi.

Local Events

This year, we have hosted 11 evening events at Dalhousie with an estimated 400 people in total in attendance. One of these events was at the Dalhousie Agriculture Campus in Truro.

September 27 Speaker: Asmita Sodhi

Topic: A Mathematical Mystery Tour

The priceless Golden Spiral artifact has been stolen from the Museum of Arithmetical Trinkets and Heirlooms! Detectives Ray and Marty are on the case. Can you help them solve puzzles, search for clues, and unravel the mystery?

October 18 Speaker: Svenja Huntemann

Topic: Combinatorial Game Theory

Want to spend your evening playing and learning about games? Combinatorial games are 2-player games with no hidden information and no chance elements, such as Chess, Checkers, or Go. I will introduce some of the techniques that are being used to study these games by taking a look at two specific ones: Nim and Domineering. If time allows, you can try out your new abilities on a few other games.

November 15 Speaker: Dr. Danielle Cox

Topic: Ready, SET, Go!

In this Math Circles we will explore the mathematics of the game of SET, as well as its connections to other areas of science.

December 7 Speaker: Dr. Dorette Pronk

Topic: A Mathematical Art Show

In this talk I will present art pieces inspired by mathematical principles and objects. You will see how these pieces show the beauty

I loved the way it was presented, allowed students who don't usually shine opportunity to show off some skills, also had opportunity to have discussion around how they thought it through. Great for kids to see all the different ways math is used everyday.
- L. Macintosh, Hants north Rural High

of number theory, algebra and geometry. I will discuss some of the math that is presented in the art works, and you will get the opportunity to make some art of your own (and perhaps get some ideas to try out over the December holidays.)

January 31 Speaker: Dr. Richard Nowakowski

Topic: Mathemagic

Join us for an evening of magic at Dalhousie! Mind reading, x-ray vision, card tricks, and more! Come learn the math behind these tricks and you will be able to have 'magical' abilities too!



February 21 Speaker: Dr. David Wolfe

Topic: Top-Down Induction

Some of you may have seen the mathematical proof technique known as induction. If so, I'm sorry... you've been taught it all wrong! If you haven't seen it, all the better, because top-down induction is a more powerful, less error-prone, and more natural way of discovering inductive proofs than is usually taught in school. My apologies in advance if your current math teacher doesn't agree. Along the way we'll see some beautiful theorems and a few elegant picture proofs.

March 21 Speaker: Dr. Robert Milson

Topic: Proportional Games and Magic Numbers

We will explore the golden ratio and the Fibonacci numbers by playing games and mastering astounding feats of mathematical magic.

April 11 Speaker: Marie B.Langlois and Ben Cameron

Topic: Radical Relay 2018

It's April, which means that it's time for a new Math Circles Relay! We will break into teams and answer challenging questions, earning points as you move from station to station. There will be a small element of pop culture and historical trivia so there will be questions for everyone! If you finish the race you will be rewarded with some bonus questions and prizes for the team with the most points. These problems are hand-picked to be challenging and fun, so come ready to think and work together! We have new problems awaiting you this year so that new and previous participants can enjoy the challenges!



May 10 Speaker: Dr. Mayada Shahada (Truro Campus Event)

Topic: Algebra is a powerful tool!

G. H. Hardy (a famous 20th Century mathematician) wrote:

'Beauty is the first test: there is no permanent place in the world for ugly mathematics'

Let's face it—algebra can be hard and there will be a point for everyone when they find using algebra is difficult. But, believe it or not, algebra can be really beautiful and it

is, in fact, a powerful tool! Algebra can give a great sense of achievement every time a problem is solved and it can, definitely, provide effective methods to break down and solve problems. Join us in this talk to feel such a satisfaction and to see how algebra allows you to take a situation and make it more general by examining nasty number tricks and devious divisibility.

May 16 Speaker: Erick Lee (HRSB)

Topic: Math Party!

It's a Math Party! In this session we'll explore Ramsey's Party Problem along with several other games, puzzles and problems with a party theme. Do you know the best way to cut a cake? What's the most efficient way to wrap a present? We'll learn about number theory and problem solving as we tackle these puzzles.

June 8 Speaker: Dr. Mayada Shahada (Halifax Campus)

Topic: Algebra is a powerful tool!

G. H. Hardy (a famous 20th Century mathematician) wrote:

'Beauty is the first test: there is no permanent place in the world for ugly mathematics'

Let's face it—algebra can be hard and there will be a point for everyone when they find using algebra is difficult. But, believe it or

The content in which the math was presented was super fun! The students were very engaged and excited to try the tasks. I like how it was at the end that the 'math' was explained! I also really like how you connected the whole thing back to our real world!

- T. Richard, Oldfield Consolidated

not, algebra can be really beautiful and it is, in fact, a powerful tool! Algebra can give a great sense of achievement every time a problem is solved and it can, definitely, provide effective methods to break down and solve problems. Join us in this talk to feel such a satisfaction and to see how algebra allows you to take a situation and make it more general by examining nasty number tricks and devious divisibility.

School and Program Visits

Week-long trips

We were again able to organize two week-long trips in the fall to areas difficult to reach for day trips. On each of these trips we visit five different schools, and are usually booked out quickly. The first was to Cape Breton and covers the Cape Breton-Victoria Regional School Board (CBVRSB) and parts of the Strait Regional School Board (SRSB). During the five days there, we reached 623 students, and had a mathematics consultant observing at one school.

The second trip was to the Tri-County Regional School Board (TCRSB), reaching 652 students. In this trip we were delighted to visit each class in Islands Consolidated School. The small community at Freeport thanked Math Circles for this visit by posting a write up about the program in their local newspaper.

Special Groups: G1LI, Homeschooling and ESL

This year, we worked with the Generation 1 Leadership Initiative group (G1LI), a community based not for profit initiative for youth of African descent. G1LI strives to provide free, unique, fun, interactive and inspiring experiences in Science, Technology, Engineering and Math (STEAM). The group has visited the department and enjoyed a new presentation specially designed to suit their goals (the event's photos can be found on

<https://www.facebook.com/Generation1-Leadership-Initiative-1283451511689435/>)

In addition, we continued our regular work with the homeschooling group in Dartmouth, offering sessions for elementary school and junior high school aged children on five different occasions. Also, we had several visits to ESL classes at Dalhousie.

Other Outreach Events

This year, Math Circles contributed to two

outreach events, the AARMS girl guide outreach event and the CMS Math Camp. In both events, a total of 104 students were reached and several talks were delivered.

Materials' Development

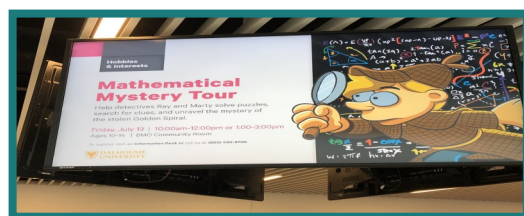
The continuing materials' development has been very successful this year. Many of our presentations have been going through trials and adjustments, and feedback from teachers has been very helpful and encouraging. Also several new presentations have been developed for primary, elementary and high school levels. Trials runs for these new presentations were started during the winter and will continue through next year.

Discovery Math Days

Discovery Days continue to be a very popular chance for schools to visit Dalhousie and have their students be involved in hands-on activities in the sciences. The math version has been hosted by Math Circles for several years now. Unfortunately, out of the six scheduled sessions, we ended up leading only four after two schools had to cancel at the last moment. In spite of this, 185 grade 6-9 students solved mysteries, learned some card tricks, created art works and enjoyed a snack break. We would also like to thank the Faculty of Science for the financial and administrative support for the Discovery Days.

Math Circles First Summer Camp Day

On July 13th, we hosted our first summer camp day at the Halifax Central Public Library. 19 participants aged from 10 till 16 years old enjoyed a morning session solving puzzles, searching for clues and unraveling a mathematical mystery.



This year we were able to reach schools in 7 different school boards:

Cape Breton-Victoria Regional School Board

Sydney Mines Middle School, Memorial Composite high School, Riverview High School

Chignecto-Central Regional School Board

Hants North Rural High, Kennetcook District School, Redcliff Middle School (4 visits), South Colchester Academy

Halifax Regional School Board

Cunard Junior High, Eastern Passage Education Centre (3 visits), Five Bridges Junior High (4 visits), Halifax Central Junior High (2 visits), Holland Road Elementary (2 visits), Madeleine Symonds Middle School (2 visits), Park West School (4 vis-



its), Sackville Heights Junior High(2 visits), Seaside Elementary, Sir Charles Tupper Elementary School, Herring Cove Junior High School (2 visits), Oldfield School, LeMarchant St. Thomas Elementary School (After School Excel Program),

Dartmouth South Academy, Tantallon Senior Elementary School, Elizabeth Sutherland School, Cavalier Drive School (2 visits), Waverley Memorial Elementary School, Ecole Burton Ettinger School (After School Excel Program), Sir Robert Borden Junior High School (2 visits), St. Margaret Bay School, Sambro Elementary School, Colonel John Stewart Elementary School (2 visits), John W. Macleod Tower School (2 visits), Crichton Park School (2 visits), Bedford South School, Saint Mary's Elementary School, Astral Drive Elementary School (3 visits), Ecole Burton Ettinger (2 visits), Millwood Elementary School, Bel Ayr Elementary School

The presentation was lively, energetic and enthusiastic. The puzzles encouraged problem solving skills and team building. The activities were age appropriate and fun. Great educational experience!

- C. Kelly, Plymouth School

Straight Regional School Board

Dr John Hugh Gillis Regional High (2 visits), Richmond Education Centre/ Academy, Strait Area education centre

South Shore Regional School Board

Forest Heights Community School, Bayview Community School

Tri-County Regional School Board

Islands Consolidated School, Plymouth School, Port Maitland Consolidated Elementary, Drumlin Heights Consolidated School, Barrington Municipal High School

Private Schools

Sandy Lake Academy

2018-2019 Program Goals

We will continue our strong presence in schools during 2018-2019. We are also planning to host more events at the Dalhousie Agriculture Campus in Truro as well as spend additional time developing new presentations (for all levels) and supplementary materials for all existing ones.



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