

math circles

Annual Report 2016-2017

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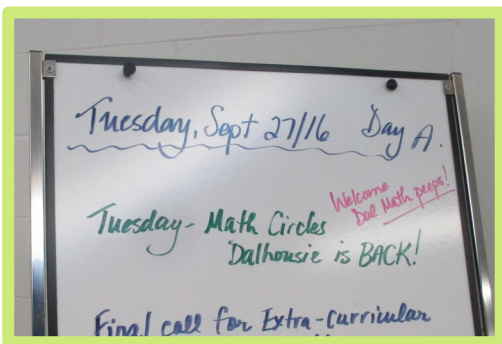
Mission Statement

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 running out of Dalhousie University and funded by Eastlink. Our activities are two-fold: We host monthly events at Dalhousie for local enriched students and visit schools all across the province for hands-on activities with the entire class.

Overview

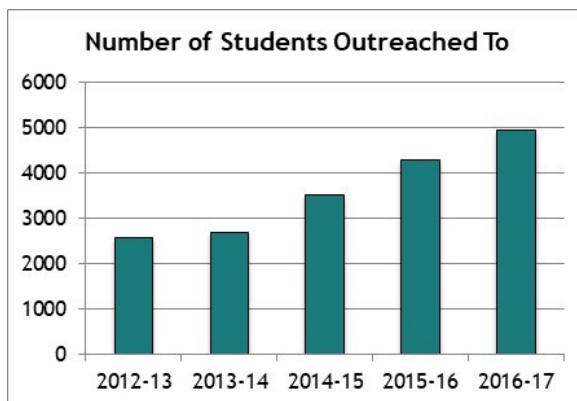
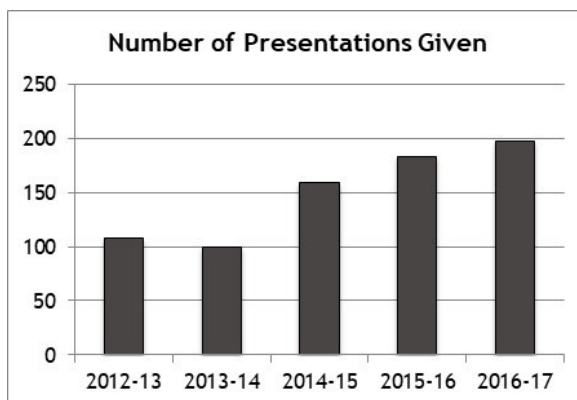
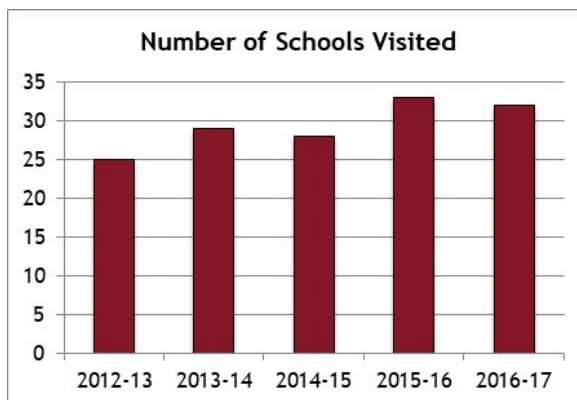
Nova Scotia Math Circles had an excellent year in 2016/2017. Thanks to the ongoing funding from Eastlink, we were able to continue our expansion into elementary schools, while maintaining our presence in junior high and senior high schools.

We started the year strong with our usual two week-long trips in the fall and several day trips. The work-to-rule job action of the NSTU then put a hold on most school visits in December through February. While we were not going out, we took advantage of the time to develop new presentations, supplementary materials for existing presentations, and an operations manual. As soon as work-to-rule ended, we became very busy again, with most weeks seeing us going out 2-3 times.

Although the number of schools that booked us, 32 this year, remained relatively consistent with previous years, 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 183 to 197, and the number of students outreached 4950 (4277 last year). Given the rather long break in the winter we had this year, we are very pleased with this development.

Our monthly events were given by a nice mix of presenters from our team, faculty members, and outside presenters, with good attendance from students, parents, and teachers. In January and

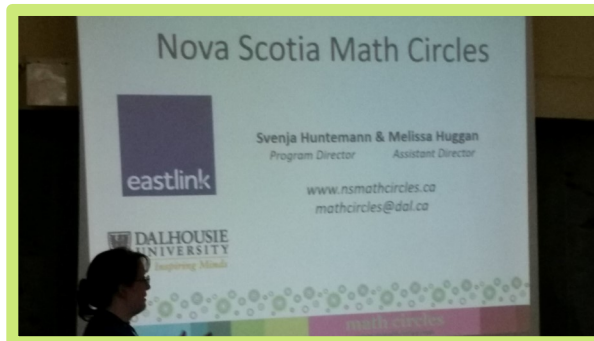


February we saw a large number of new families, as parents were looking for extra-curricular activities for their children during work-to-rule. We again thank our volunteers for giving these fun presentations. See pages 5 and 6 for a list of presenters and topics.

The students were incredibly engaged in the presentation and were excited to discover the 'why' to each problem presented. Thank you, it was fantastic!
- Ms. Wolfe, New Germany ES

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

Math Circles even went international this year! While on a research visit in Portugal, our Director Svenja Huntemann and Assistant Director Melissa Huggan gave a presentation about the program at the Recreational Mathematics Colloquium in Lisbon. Svenja and our teaching assistant Corey DeGagne also visited schools and gave presentations while on vacation in Germany and the UK, respectively.

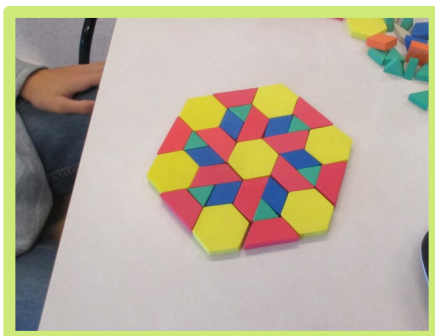


List of Presentations

Elementary Schools

- Exploding Buckets *
- Exploring Mathematics *
- Jury Duty *
- Mathemagic **NEW gr 3&4**
- Problem Solving
- Tessellations

* These presentations have undergone trials and adjustments in the past year.



Junior High Schools

- Eulerian Circuits
- Fibonacci & the Golden Ratio
- Graph Colouring
- Jury Duty
- Mathemagic
- Prime Numbers
- Problem Solving
- Tessellations
- Toads and Frogs
- Tower of Hanoi

Senior High Schools

- Cryptography
- Eulerian Circuits
- Fibonacci & the Golden Ratio
- Fractals
- Graph Colouring
- Infinity
- Jury Duty
- Logic and Reasoning
- Mathemagic
- Million Dollar Hat Problem
- Nim
- Numeral Systems
- Permutations & Combinations
- Pi
- Prime Numbers
- Tessellations
- 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.

As in previous years, Svenja Huntemann was the Program Director, while Melissa Huggan took over as Assistant Director in 2016.

In the past, these positions have always been filled by graduate students in the Mathematics & Statistics Department at Dalhousie. As our program has been expanding over the past few years, it has become very difficult to take care of administrative duties while also working on a graduate degree. As of August 2017 the Program Director will be a postdoctoral fellow who will be responsible for Math Circles part-time, while the Assistant Director will remain a graduate student. We welcome Mayada Shahada to the reworked Program Director position for 2017/2018! We also thank Melissa Huggan for agreeing to continue as Assistant Director.

Faculty Advisor

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

This year, Dr. Dorette Pronk took over as faculty advisor, and has already been very involved in the reworking of our leadership. We would also like to thank Dr. Richard Nowakowski for his years of guidance and advice in this position, and wish him a happy retirement.

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 Asmita Sodhi, Corey DeGagne, and Evangelia Aleiferi. Evangelia Aleiferi will continue in this position for the fall term, and Abdullah Al-Shaghay and Iain Beaton will be joining us for the full year.

Casuals

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

This year the casuals were Bassemah Alhulaimi, Abdullah Al-Shaghay, Nicholas Banks, Marie B.Langlois, Ben Cameron, Hoda Chuangpishit, Chris Duffy, Joshua Feldman, Morgan Garnier, Amitabh Halder, and Sean O'Neil.

The presenters were simply excellent. They are able to get each and every student in the classroom involved and excited about math (which can be a very tall order!). Patient, understanding, informed and enthusiastic! Top notch presentation!
- Jason Kavanaugh, Breton Education Centre

Local Events

As in previous years, we have hosted 10 evening events at Dalhousie with an estimated 350 people in total in attendance.

September 21 Speaker: Dr. David Wolfe

Topic: Clock Arithmetic, Pandigital Numbers, Checkerboards, and Fun Proofs

Take the number 123456789. Now double it. Double it again. And again. No, really, try it. See anything strange happen? We'll figure out a way of doing arithmetic on a clock that explains why.

I'll also talk about a counting problem on a checkerboard. The question is, "How many ways can you put checkers on the squares of a checkerboard so that every square (whether it has a checker on it or not) is adjacent to an odd number of checkers?" Here's one way on a 4x4 checkerboard:

X		X	
X	X	X	
X	X	X	
X		X	

Rotating the board gives you 3 more ways. How many ways total are there? You can try other board sizes or even rectangular boards.

October 12 Speaker: Dr. Richard Nowakowski

Topic: The ABCs of Dice, Euclid, Fibonacci and Games

Game 1: To start, choose two positive integers, after that a move is to remove a multiple of the smaller from the larger. The winner is the player who reduces one of the numbers to 0. For most people, knowing how to win involves Fibonacci. We'll show that Euclid knew better.

Game 2: Challenge: I choose a positive integer (heap) less than 100, and you put a 6 sided die (cube) on the table. I start by turning the cube by a quarter turn and take the number showing the top face away from the heap. We alternate turning and taking. The player who cannot move loses. Can you beat me?

November 16 Speaker: Marie B.Langlois

Topic: Continued Fract...

This presentation will go over a fun and useful topic of number theory: continued fractions! We will first go over the basics of GCDs and the Euclidean algorithm. Then we will define continued fractions and use the previous to transform any rational number into one of these. Afterwards, we will see that continued fractions can be used to give a "period" to irrational numbers, and lastly we will use these to solve equations.



December 7 Speaker: Dr. Karl Dilcher

Topic: How did we calculate before there were calculators?

Electronic calculators didn't become widely available until the early to mid-1970s. Before that, it was slide rules and logarithmic tables that played similar roles as do pocket calculators today, at least in high schools and universities.

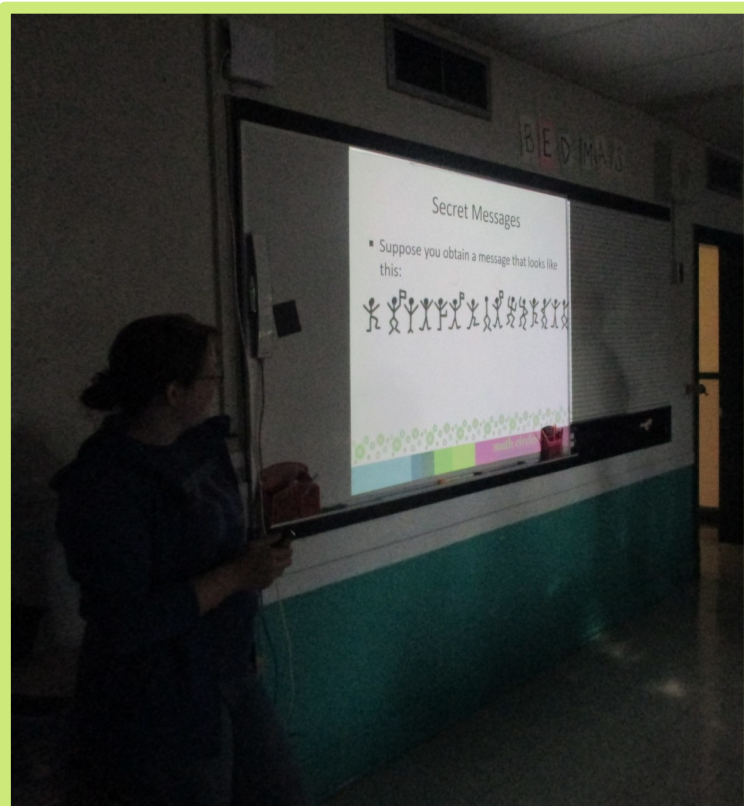
In this session I will present some of the history of log tables and slide rules, along with some of the underlying theory. We will also do practical examples with actual log tables

and with simple paper slide rules. Every participant will receive an old Dalhousie booklet of mathematical tables, including log tables, to take home.

January 18 Speaker: Asmita Sodhi

Topic: Alice's Adventures in Numberland

Charles Lutwidge Dodgson, better known as Lewis Carroll, was an Oxford mathematician and the author of Alice's Adventures in Wonderland. This children's classic recently celebrated its 150th birthday and is full of the riddles and rhymes (and nonsense!) that Dodgson loved so much, but also more math than you may realize. In this session we'll take a trip with Alice down the rabbit hole and through Wonderland, discovering some of the mathematics hidden there along the way!



February 22 Speaker: Dr. Danielle Cox

Topic: The Mathematics of Spatial Puzzles

Many recreational math problems are spatial problems and puzzles. In this Math Circles we will explore the topic of Topology and try to solve some famous (and not so famous) spatial puzzles.

March 29 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 19 Speaker: Ben Cameron and Marie B.Langlois

Topic: Radical Relay 2017

It's April, which means time for a new Math Circles Relay! We will break into teams and answer challenging questions to move from station to station. 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 3 Speaker: Erick Lee (HRSB)

Topic: Money Problems

Do you have money problems? No this isn't a session on financial literacy... we'll be exploring several number theory problems, puzzles and games with a common theme... money! Can you solve the money square? Can you beat your friends at the "Coins in a Row" game? Can you collect more money than the taxman? We'll learn a bit about number theory and problem solving as we tackle these puzzles.

June 8 Speaker: Svenja Huntemann

Topic: Numeral Systems

Take a journey that will take you to the very first systems of numerals in ancient civilizations. Learn the needs that lead the Egyptians to develop clever arithmetic methods to fill their everyday needs, the origin of our system for measuring time and much more!

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 the Tri-Country Regional School Board (TCRSB), reaching approximately 475 students. We also had a first on this trip: When we arrived at Barrington Municipal High they were dealing with a power outage and all students were sent home at the end of the first period.

The second trip was to Cape Breton and we had five regular school visits. This trip 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 680 students, and had an education class from Cape Breton University observing at one school.

Homeschooling and other groups

We continued our regular work with the homeschooling group in the HRM, offering sessions for elementary school and junior high school aged children on five different occasions. We also visited this year with a homeschooling group in Bridgewater. In addition, we hosted two presentations for a new youth group, the Generation 1 Leadership Initiative. Other groups include the Brookhouse Brownies and several visits to ESL classes at Dalhousie.

Elementary Schools

The continuing expansion into elementary schools has been very successful. Many of our new presentations have finished going through trials and adjustments, and feedback from teachers has been very helpful

and encouraging. We have also started to develop several more presentations which will hopefully start trials in the new year.

The students love Mathemagic! They have a blast when you 'read their minds'. It makes them want to learn how to do it themselves. As teachers, the presenters are very helpful, repeat directions multiple times and provide 1:1 help for those who need it! Great job! =)

- C. Weldin, Redcliff Middle School

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. We had five round robin sessions this year in which students solved logic puzzles, played mathematical games, and generally just had fun. A sixth session was planned but was unfortunately cancelled by the school at the last moment. We reached almost 200 grade 6-9 students at this event. We would also like to thank the Faculty of Science for the financial and administrative support for the Discovery Days.

Work-to-Rule

During the work-to-rule job action of the Nova Scotia Teacher's Union in December through February we were unable to visit public schools. During this time we redirected our efforts into material development. Attendance at the monthly local events also saw an upsurge during these three months as parents were looking for extra-curricular activities.

This year we were able to reach schools in 8 different school boards:

Excellent presentation - the level of engagement exceeded my expectations. Staff was energetic - taught to outcomes and made math fun! Well done!

- Alisa Johnson, Bridgewater ES

Annapolis Valley Regional School Board

Wolfville School

Cape Breton-Victoria Regional School Board

Breton Education Centre, Donkin Complex, Malcolm Munroe Memorial

Chignecto-Central Regional School Board

Hants North Rural High, Kennetcook District School, Redcliff Middle School (3 visits), South Colchester Academy



First Nations School Board

Lnu Sipuk Kinamuokuom

Halifax Regional School Board

Cunard Junior High, Eastern Passage Education Centre (3 visits), Five Bridges Junior High (6 visits), Grosvenor Wentworth Park, Halifax Central Junior High (2 visits), Holland Road Elementary, Madeleine Symonds Middle School (2 visits), Park West School, Ridgecliff Middle School, Sackville Heights Junior High, Seaside Elementary (2 visits), Sir Charles Tupper Elementary School

Straight Regional School Board

Dr John Hugh Gillis Regional High, Richmond Academy, Whycomomagh Education Centre

Even my students who typically get frustrated were excited and engaged.

- Nicole LeGrow, Holland Road ES

South Shore Regional School Board

Bridgewater Elementary School (2 visits), Forest Heights Community School, New Germany Elementary

Tri-County Regional School Board

Digby Regional High School, Lockeport Regional High School, Maple Grove Education Centre, Saint Mary's Bay Academy

Private Schools

Newbridge Academy

2017-2018 Program Goals

While continuing our strong presence in schools in 2017-2018, we are planning to spend additional time developing new presentations and supplementary materials for teachers for all existing ones.



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