math circles

Annual Report 2018—2019

Content:

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!

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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.
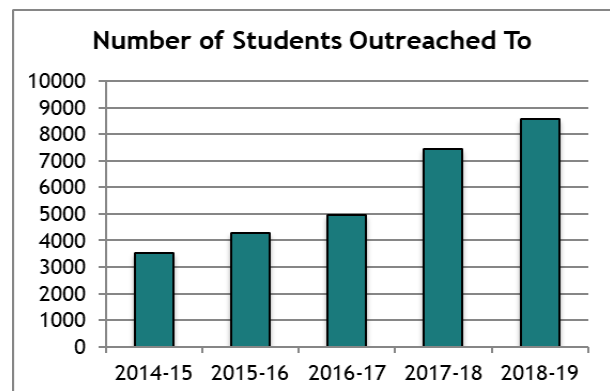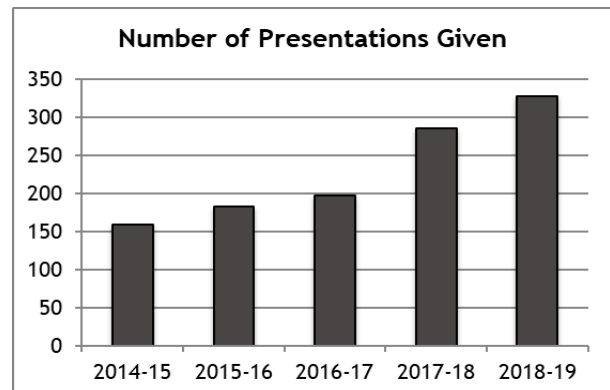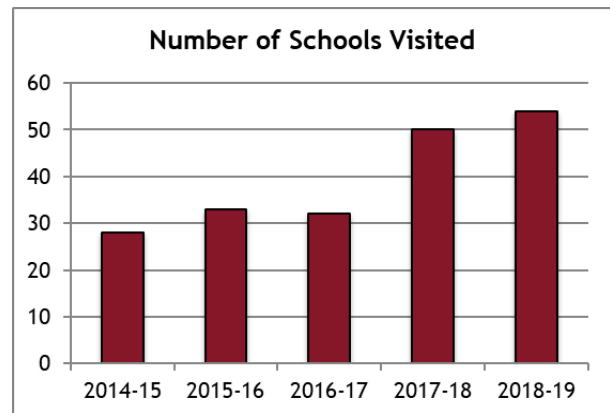
Overview

Nova Scotia Math Circles continued its extreme success in 2018/2019. 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 slightly increased to 54 compared to 50 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 285 to 328, and the number of students reached this year was 8586 (7429 last year).

Each of our ten "in campus" events attracted a nice mix of participants from students, parents and teachers. These events were given by presenters from our team, faculty members, and outside presenters. 35 to 50 participants attended nine of these events at Dalhousie Halifax campus. This year, we hosted one event at the Dalhousie Agriculture Campus in Truro and 15 participants attended and enjoyed the event. We again thank our volunteers for giving

Number of Schools Visited

Year	Value
2014-15	28
2015-16	33
2016-17	32
2017-18	50
2018-19	54

Number of Presentations Given

Year	Value
2014-15	159
2015-16	184
2016-17	199
2017-18	285
2018-19	328

Number of Students Outreached To

Year	Value
2014-15	3500
2015-16	4250
2016-17	5000
2017-18	7429
2018-19	8586

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 and updated presentations. We are very lucky to have had many teachers volunteer their classrooms for these trials.

This year, Math circles celebrates its fifth year of funding with Eastlink. Thank you Eastlink, you've made our success possible!

> You were able to grab our students' attention and keep them interested, which is sometimes a challenge. They had fun with Math!
> - T. Besso, Sherwood Park Education Centre, Sydney.

This year also, we launched the start of a series of teachers' workshops aiming to provide teachers/educators the opportunity to learn different ways of modeling and fostering enthusiasm for mathematics to their students.

List of Presentations

Elementary Schools

- Exploding Buckets
- Exploring Mathematics
- Jury Duty * (French)
- Fun with Fractions *
- Mathemagic *
- Pentominoes *(New P-Gr3)
- Problem Solving * (French)
- Tessellations *

* These presentations are either new or updated 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 * (French)
- Mathemagic *
- Nasty Number Tricks and Devious Divisibility *
- Prime Numbers
- Problem Solving *
- Tessellations *
- Toads and Frogs
- Tower of Hanoi *

Senior High Schools

- Bothersome Brainteasers*
- Cryptography 1 *
- Cryptography 2 *
- Eulerian Circuits
- Fibonacci & the Golden Ratio
- Fractals
- Graph Colouring
- Infinity
- Logic and Reasoning
- Million Dollar Hat Problem
- Master Your Cards *
- 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 Asmita Sodhi, a PhD candidate, held the Assistant Director for Campus Events position. Next year, Mayada Shahada will continue as the Program Director while Asmita Sodhi and Maryam Ehya will join the program as the Assistant Directors.
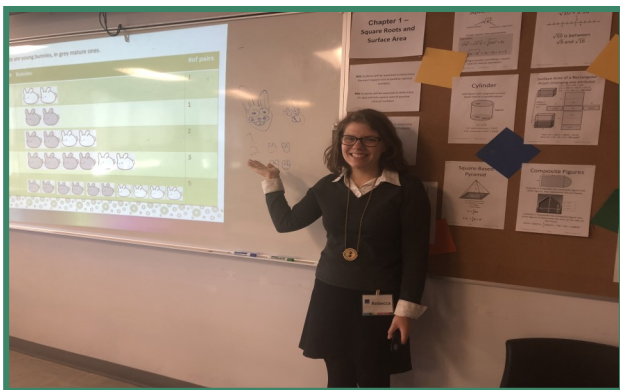
Faculty Advisor

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 Assistant Director on any issues that might arise.

I loved your presentations! The kids were interested, curious and engaged and they really got a lot out of them. Thank you!
- M. Snow, Maple Grove Education Centre, Yarmouth.

The hands on aspect and having the numbers in a way they could move them around. The presenters did a great job going around the room and talking to all the groups
- H. Raymond, Shubenacadie District School, Shubenacadie.

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 Tom Potter, Rebecca Ryan and Riley Urban. We welcome Tom Potter, Heesung Yang, Justin Makary and Leila Mohammadi 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 Annamieka Aerts, Corey DeGagne, Maryam Ehya, Joey Latta, Mozhgan Saeidi and Christina Walker.

Local Events

This year, we have hosted 10 evening events at Dalhousie with an estimated 250 people in total in attendance. One of these events was at the Dalhousie Agriculture Campus in Truro.

September 26th Speaker: Asmita Sodhi
Topic: Pentomino Puzzlers

A pentomino is a shape made by joining five equal squares side-by-side—think TETRIS, but with five squares instead of four! In this talk we'll discover the different possible pentominoes, and explore some games and tiling puzzles that use these shapes.

October 19th Speaker: Dr. John McLoughlin (UNB)
Topic: Random Walks and other Mathematical Journeys

Wandering without knowing where one will be next can be surprisingly effective in addressing mathematical problems. Insights into probability and other mathematical ideas will emerge through focusing attention on *random walks*. The journeying will not end there as surely some mathematical detours into interesting problems, curious numbers, and other forms of travel will find their way into the evening.

November 23rd Speaker: Dr. Svenja Huntemann (Mount Allison)
(Truro Campus Event)
Topic: A History of Problem Solving

Join us while we take a stroll through some of the most influential and interesting problems throughout history. We will see if we can solve some of them on our own!

December 12th Speaker: Eric Lee (HRSB)
Topic: Chopsticks, Ciphers and Curves

 What do chopsticks, ciphers and curves all have in common? Come find out how modular arithmetic plays a role in all of these as we explore some games, puzzles and even do some art.

> Well paced … Students were engaged and eager to share their insights :)
> - B. Vaughan, Halifax Central Junior High school, Halifax.

January 16th Speaker: Dr. Peter Selinger
Topic: Counting and Symmetry

It is always fun to count how many ways there are of doing something. Counting can be especially challenging when there are symmetries involved. How many ways are there of tiling a 3x3 square with black and white tiles, if two tilings that differ by a rotation are considered equal? How many ways of coloring the 6 sides of a cube with 3 colors, up to a rotation of the cube? We will explore Polya's counting method, which can be used to answer these and similar questions.

February 20th Speaker: Dr. Roman Smirnov
Topic: Linear Inequalities and Economic Problems

We will explore how linear inequalities can be used, for example, to help a local chocolate company to produce two very popular on Valentine's Day brands of chocolate—Hearts and Friends. Both brands of Chocolate are made of milk and cocoa butter only. Suppose that in order to manufacture each box of Hearts and Friends, the following quantities are required:

- Each box of Hearts requires 1 unit of milk and 3 units of cocoa butter.
- Each box of Friends requires 1 unit of milk and 2 units of cocoa butter.

The company has a total of 5 units of milk and 12 units of cocoa butter. On each sale made on Valentine's Day, the company expects to make a profit of

- $6 per box of Hearts sold.
- $5 per box of Friends sold.

The question is how many boxes of each brand should the company produce to maximize its profit on Valentine's Day? Join us tonight to learn more about mathematical modeling of economic problems.

March 13th Speaker: Dr. Danielle Cox and Alan Godin (MSVU)

Topic: Recipes for Pi

People are fascinated with Pi, so much so it has its own day, March 14th. In this Math Circles we will talk about some fascinating techniques used to compute digits of Pi, learn some tricks for memorizing digits of Pi and explore the interesting history of our favourite mathematical constant.

April 26th Speaker: Dr. Mayada Shahada

Topic: Cryptography

Cryptography is the study of protecting, coding, storing and transmitting information and messages so that only those who are intended to may read it. In other words, it is the study of secret messages and codes. *Encryption* is the conversion of messages to the secret code, called *ciphertext*. In order to read the information normally, one must decrypt the ciphertext, converting it back into *plaintext*. In this talk, we will look at some different types of cryptography that are used.

May 17th Speaker: Dr. Angela Siegel and Dr. Dorette Pronk

(Special thank you Escape Room Event for Eastlink)

Topic: Oak Island Mathematical Treasure Mystery

The Oak Island treasure has been stolen, and your team are the only people who can foil the thieves! But they've locked you in a room and are about to make their getaway. Can you get out in time to rescue the treasure? Join us for an evening of puzzles and mystery to find out!

> The presentation was at the right level—therefore, students were engaged and able to make some connections to our curriculum
> - J. Steele, Rocky Lake Jr. High School, Bedford.

June 5th Speaker: Annamieka Aerts and Sarah Li

Topic: Probability Buffet

What are the chances of rolling at least 10 with three dice? What about the same problem, given that you know one of the rolls is a 2? How likely is it that someone in your class has the same birthday as you? Join us as we sample a number of dishes at a buffet of probability topics, and learn to solve problems like these and more!

> Everything was great, the presenters were prepared and engaging. My students were so into it and loved every minute of it!
> - N. LeGrow, Holland Road Elementary School, Fletchers Lake.

School and Program Visits/Events

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 Centre for Education (CBVRCE) and parts of the Strait Regional Centre for Education (SRCE). During the five days there, we reached 839 students, and had a mathematics consultant observing at one school. The second trip was to the Tri-County Regional Centre for Education (TCRCE), reaching 573 students.

Special Groups: G1LI, Homeschooling and Public Schools' Excel Programs

This year, we worked again with the Generation 1 Leadership Initiative group (G1LI), a community based not for profit initiative for NS youth of African descent. The group has visited the department and enjoyed a new presentation specially designed to suit their goals (For more information see **https://www.facebook.com/Generation1-Leadership-Initiative-1283451511689435/**). In addition, we continued our regular work with the homeschooling groups in Dartmouth and Tantallon, offering sessions for elementary school and junior high school aged children on several occasions. This year, Math Circles offered several 2-hour long hands-on activity sessions to students in the after school program "Excel" in two schools within HRSB.

Special "Thank you Eastlink" Event

This year, Math Circles celebrates its fifth year of funding with Eastlink. With an Oak island treasure hunt theme, a special "thank you Eastlink" escape room event was enjoyed by 36 participants. Mr. Lee Bragg, executive Vice-Chair of Eastlink, Dr. Teri Balser, Dalhousie Interim President and Vice-Chancellor and Dr. Chris Moore, the Dean of Science, among others, attended the event.

AARMS Girl Guides Outreach Event and Auburn High School visit to Dalhousie

This year, Math Circles contributed to the AARMS girl guides outreach event at Dalhousie. A total of 51 girls were reached and a couple of talks were delivered. Also, Math Circles delivered 2 talks to students from Auburn High School during their visit to explore the sciences at Dalhousie. This visit was organized by Dr. Keith Taylor from the Math Department.

Materials' Development

The continuing materials' development has been very successful this year. Feedback from teachers has been very helpful and encouraging for adjustments. Also, several new presentations have been developed for primary, elementary and high school levels. Trial runs for these new presentations were started 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. On April 25th and 26th from this year, we scheduled four sessions scheduled where 128 grade 6-9 students solved mysteries, learned some card tricks, created art works and enjoyed a snack break.

Math Circles First PD Day Teachers' Workshop

On April 11th, we hosted our first PD Day workshop for teachers. Such workshops intend to provide teachers the opportunity to learn new ways of modeling math for their students. 61 teachers and staff from Park West School attended our workshop "Teaching Problem Solving: Challenges with Hidden Math". We plan to offer more workshops on different topics (including mathematical learning skills) next year.

This year we were able to reach schools in 8 different centres for education (school boards):

Cape Breton-Victoria Regional Centre for Education (CBVRCE)

Malcolm Munroe Middle School, Sherwood Park Education Centre, Rankin School of the Narrows.

Chignecto-Central Regional Centre for Education (CCRCE)

Shubenacadie District Elementary, Redcliff Middle School (5 visits).

Halifax Regional Centre for Education (HRCE)

Madeline Symonds Middle School, Ecole Burton Ettinger School (4 visits), Five Bridges Junior High (3 visits), Auburn High School, Astral Drive Elementary School (2 visits), Kingswood Elementary School (2 visits), Crichton Park Elementary School, Ecole Rockingham School (2 visits), Holland Road School (4 visits), Springvale Elementary School (2 visits), Park West School (3 visits), George Bissett Elementary, Colonel John

Stuart Elementary, Halifax Central JH School, Grosvenor Wentworth Park School (2 visits), Eastern Passage Education Centre, Harry R. Hamilton Elementary School (3 visits), Robert Kemp Turner Elementary, John W. MacLeod Fleming Tower School (2 visits), Portland Estates Elementary, Hawthorn Elementary (2 visits), Harbour View Elementary School, Rocky Lake JH School (2 visits), Sycamore Lane Elementary School (2 visits), Smokey Drive Elementary, Hammonds Plains Consolidated School, Sir Robert Borden JH, Sir Charles Tupper Elementary, Saint Mary's Elementary, Bel Ayr Elementary School, Waverley Memorial Elementary, Fairview Heights Elementary, St. Stephen's Elementary School, South Woodside School, Westmount Elementary School.

Straight Regional Centre for Education (SRCE)

East Richmond Education Centre.

> The presentation was engaging and encouraged various forms of mathematical reasoning and strategies that helped in developing mathematical thinking in the students.
> - E. Ridgley, John W. MacLeod-Fleming Tower Elementary School, Halifax.

South Shore Regional School Board

Bayview Community School.

Tri-County Regional Centre for Education (TCRCE)

Maple Grove Education Centre, Meadowfields Community School, Yarmouth Consolidated Memorial High, Digby Regional High School, Lockeport Regional High School.

Annapolis Valley Regional Centre for Education (AVRCE)

Wolfville School, West Hants Middle School, L. E. Shaw Elementary, Coldbrook and District School.

Private Schools/Groups

Summit Academy of Active Learning, Tantallon Homeschooling Group (3 visits). Dartmouth Homeschooling Group (5 visits), Maritime Muslim Academy, Generation 1 Leadership Initiative, Churchill Academy.

2019-2020 Program Goals

We will continue our strong presence in schools during 2019-2020. 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), supplementary materials for all existing ones and several teachers' workshops for PD days.
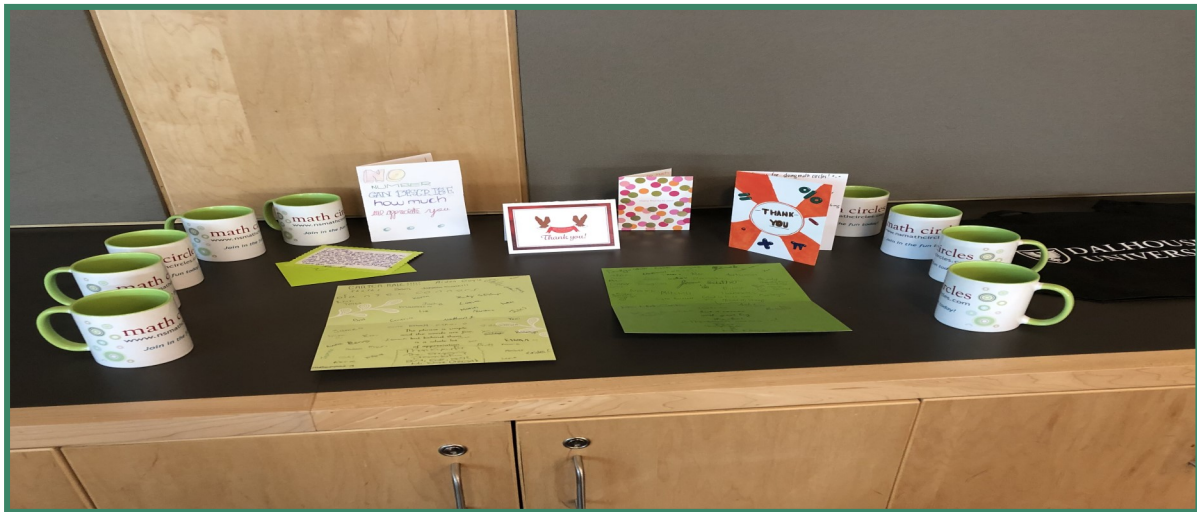
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