math circles

Annual Report 2019—2020

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!
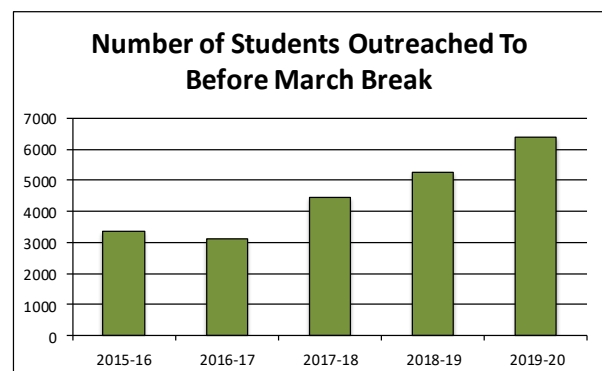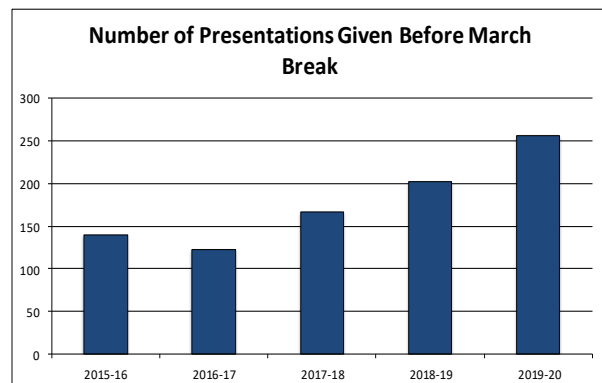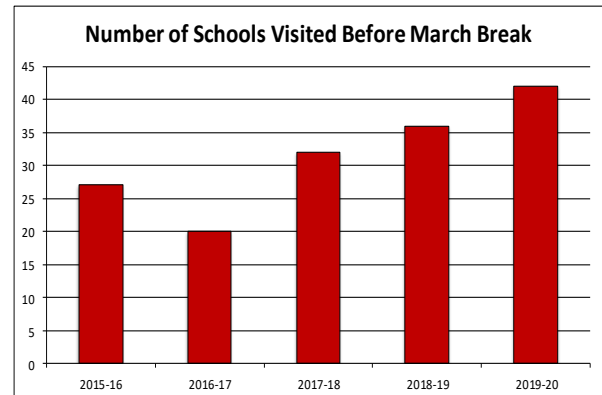
eastlink

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

During the 2019/2020 school year, Nova Scotia Math Circles remained busy throughout the year with mathematics outreach at all levels and in various ways! Despite the difficult times we are experiencing because of COVID-19 and the temporary suspension of our in-person services, this year has been a great success as we continued to increase the number of students we've presented to, visited a larger number of new schools across the province than last year, and create new presentations and activities.

We started the year off strong by sending two teams to visit 9 new schools within the Cape Breton-Victoria Regional Center for Education (CBVRCE). During the first week of November, we organized a trip to 5 new schools within the Tri-County Regional Center for Education (TCRCE). The demand on our program grew to the point that we were fully booked till the end of the school year with around 3 to 4 visits each week since the beginning of this year. Unfortunately, and because of schools' closure due to COVID-19 pandemic, the last school visit we made for this year was right before the March break on March 12th.

To the right is a comparison of the number of schools, presentations given, and students reached before the March break in the last 5 years. The number of schools that booked us including the last visit was 42 compared to 36 last year. Some of these schools were visited on several occasions or even had parallel sessions. See

Number of Schools Visited Before March Break

Year	Schools
2015-16	27
2016-17	20
2017-18	32
2018-19	36
2019-20	42

Number of Presentations Given Before March Break

Year	Presentations
2015-16	140
2016-17	123
2017-18	167
2018-19	202
2019-20	255

Number of Students Outreached To Before March Break

Year	Students
2015-16	3400
2016-17	3150
2017-18	4450
2018-19	5300
2019-20	6400

page 8 for a complete list of schools by school board. The number of presentations given increased from 202 to 256, and the number of students reached by the March break was 6378 (5251 last year for the same time period).

This year we organized 6 "in-person" events at Dalhousie that attracted a nice mix of participants from students, parents and teachers. These events were given by pre-

> 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.

senters from our team, faculty members, and outside presenters. 40 to 50 participants attended these events on the Dalhousie Halifax campus. In June, we hosted one online event through our website. Our subscribed participants explored geometries via an interactive presentation prepared by Dr. Daniele Turchetti. The presentation was followed by a few more short videos explaining interesting activities on geometries that the whole family can do at home. Feedback on the participants' creations on these activities was provided by our team. See pages 5 and 6 for a list of presenters and topics.

Schools' closure because of the COVID-19 pandemic gave us the opportunity to develop and adjust several new presentations and activities. Below is a list to our presentations for all levels of which several are offered in both English and French.

List of Presentations

Elementary Schools

- Dots and Boxes (New)
- Exploding Buckets *
- Exploring Mathematics *
- Jury Duty *
- Fun with Fractions *
- Mathemagic *
- Pentominoes *
- Problem Solving *
- Tessellations *

* These presentations are offered in English and French.

Junior High Schools

- Bothersome Brainteasers *
- Classical Cryptography (New)
- Dots and Boxes (New)
- Eulerian Circuits
- Fibonacci & the Golden Ratio
- Fractions Fun (New)
- 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 *
- Classical Cryptography (New)
- Modern Cryptography (New)
- Eulerian Circuits
- Fibonacci & the Golden Ratio
- Fractals
- Graph Colouring
- Infinity
- Logic and Reasoning
- Million Dollar Hat Problem
- Master Your Cards (New)
- 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 Dr. Mayada Shahada, a postdoctoral fellow in the department and Asmita Sodhi and Maryam Ehya, PhD candidates, shared the Program Assistant Director position.
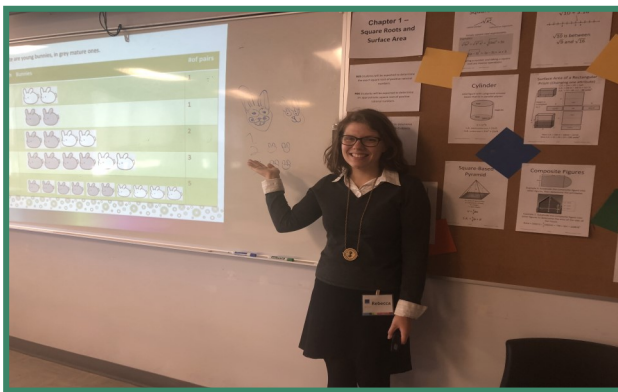
Faculty Advisor

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.

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

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.

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, Heesung Yang, Justin Makary and Leila Mohammadi.

Casuals

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

This year, the casuals were Rebecca Ryan, Mozhgan Saeidi, Daniele Turchetti, Giuseppe Pasqualino, Fatima Ammar and Sophie Winer.

Local Events

This year, we hosted 6 evening events at Dalhousie with an estimated 240 people in total in attendance. One event this year was an online event published on our website.

September 25th
Speaker: Dr. Peter Selinger (Dalhousie)
Topic: Fun with Slide Rules

The slide rule, based on an invention by John Napier in the 17th century, was the most important calculation tool for scientists and engineers for almost 350 years. It was still in widespread use in the 1950s and 1960s, but disappeared almost completely after it was replaced by the electronic calculator in the 1970s. In this math circle, you will learn how to use a slide rule to compute multiplications, divisions, roots, powers, and other operations. You will also learn some of the theory behind how a slide rule works. Each participant will assemble their own working slide rule out of materials that will be provided.

October 23rd
Speaker: Dr. Keith Taylor (Dalhousie)
Topic: Cardinal Sins of the Infinite

The concept of infinity has fascinated people since ancient times. In this math circle, we will carry out a number of activities that naturally involve infinity in some manner. From a practical problem of stacking blocks with maximum overhang off a supporting edge to a totally impractical supernatural tale about a Genie and his pets, we will explore the sometimes surprising consequences of processes repeated infinitely often. Participants should be prepared to do a little arithmetic and some algebra.

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

November 20th
Speaker: Sarah Meng Li (Dalhousie)
Topic: Logic and Puzzles

Math is not just computation. Mathematical thinking is a way of observing and understanding the world. Math allows us to see hidden order in real world chaos. This workshop will introduce you to anther aspect of Mathematics, logic. We will show you how to use mathematical thinking to solve problems, identify the hidden patterns, and think like a mathematician.

In the first part of the workshop, we will talk about the fundamental building block in mathematics, namely set theory. There will be a buffet of set puzzles for you to investigate sets. We will use Venn diagrams to understand operations on sets and use these diagrams to solve puzzles.

In the second part of the workshop, we will play with logic! Logic is a systematic way of thinking that allows us to parse the meanings of sentences and to deduce new information from old information. We will use logic to distinguish Truth Tellers from Liars, and use logical inferences to play Werewolves.

December 11th
Speaker: Eric Lee (HRSB)
Topic: Prime Time!

In this session we'll be exploring prime numbers. Do you know how to quickly find all the prime numbers from 1 to 100? Do you know why prime numbers are important in computer security? We'll answer these questions as well as tackle some prime number problems, puzzles and games in fun and engaging session.

January 22nd
Speaker: Dr. Danielle Cox & Dr. Douglas Whitaker (MSVU)
Topic: SET & Spot It

In this Math Circles we will play & explore the connections between statistics & SET, and examine the mathematics of Spot it! If you have your own game of SET or Spot It, feel free to bring it along to play!

February 26th

Speaker: Dr. Robert Milson (Dalhousie)

Topic: Proportional Games and Magic Numbers

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

June 10th

Speaker: Dr. Daniele Turchetti (Dalhousie)

This is an "online" event

Topic: Exploring Geometries

Geometry is the branch of mathematics that studies space and everything that connects to it, including shapes, angles, points, dimensions, distances, and much more. Geometers quickly realized that not only there are a lot of interesting shapes, but also (and more surprisingly!) that there is a huge variety of different spaces, with different rules governing them. In this talk, we will explore

some weird, fun, interesting spaces that caught the attention of great mathematicians of history such as fractals, hyperbolic surfaces, and finite geometries. At the end, I will propose some activities that you can do with your family to have fun with these spaces too!

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.

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 by day trips. The first was to Cape Breton and covered the Cape Breton-Victoria Regional Centre for Education (CBVRCE) and parts of the Strait Regional Centre for Education (SRCE). During the five days there, two teams visited 9 new schools, 1313 students were reached, and 48 talks were given. During the same week, 12 homeschoolers from Sydney enjoyed two talks given by Mayada Shahada in the Sydney public library. The second trip was to the Tri-County Regional Centre for Education (TCRCE), visiting 5 new schools, reaching 745 students, and giving 22 talks.

Special Groups: Homeschooling and CBBC Career College

This year, we continued our regular work with the homeschooling groups in Dartmouth and Tantallon, offering sessions for elementary school, junior high and senior high school aged kids several times each semester. This year, Math Circles also offered a 2-hour long hands-on activity session to teacher students in the CBBC Career College.

Our First "Online" Event

In June 10th, Math Circles hosted its first "online" event. Our subscribed participants explored geometries via an interactive presentation prepared by Dr. Daniele Turchetti. The presentation was followed by a few more short videos explaining interesting activities on geometries that the whole family can do at home. Feedback on the participants' creations on these activities was provided by our team.

Materials' Development and French Translation

The continuing materials' development has been very successful this year. The lockdown due to COVID-19 gave us the opportunity to spend more time in developing new interactive presentations and activities in two different formats (online and in-person). This year, we added 10 new presentations to our list and translated several of our existing ones into French.

Serving Nova Scotia French Community

This year, we continued to grow our presence in the French community within Nova Scotia by offering visits to students in the French immersion program at 3 different public schools. We also gave several presentations in two popular French forums; the French for the Future Forum and the Bilingual Career Exploration Day.

Outreach to African Canadian and Indigenous Communities

Although we had scheduled several visits to groups of African Canadians this year, we regret we were not able to run them due to the COVID-19 pandemic. Reaching out to these communities is among our goals for the next academic year.

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

This year we were able to reach schools in 5 different centres for education (school boards):

Cape Breton-Victoria Regional Centre for Education (CBVRCE)

John Bernard Croak Victoria Cross School, Tompkins Memorial Elementary, Jubilee Elementary School, Sydney Mines Middle School, Ferrisview Elementary School, Seton Elementary School, Shipyard Elementary School, Reverview High School.

Chignecto-Central Regional Centre for Education (CCRCE)

Uniacke District School, Redcliff Middle School (2 visits).

Halifax Regional Centre for Education (HRCE)

Madeline Symonds Middle School (2 visits), Five Bridges Junior High (4 visits), Astral Drive Elementary School (5 visits), Ecole Rockingham School, Park West School, Halifax Central JH School (2 visits), Eastern Passage Education Centre, John W. MacLeod Fleming Tower School (3 visits), Rocky Lake

JH School (3 visits), Sycamore Lane Elementary School (2 visits), Smokey Drive Elementary, Hammonds Plains Consolidated School (3 visits), Westmount Elementary School, Georges P. Vanier Junior High School, Ridgecliff Middle School, Joseph Howe Elementary School, Halifax West High School,

Bell Park Academic Centre, Dartmouth South Academy, LeMarchant-St. Thomas Elementary, Prospect Road Elementary School, East St. Margaret's Consolidated School.

Straight Regional Centre for Education (SRCE)

St. Mary's Education Centre/Academy.

Tri-County Regional Centre for Education (TCRCE)

Forest Ridge Academy, Hillcrest Academy, Shelburne Regional High School, Plymouth School, St. Mary's Bay Academy.

> 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.

Private Schools/Groups

Sydney Homeschooling Group, Tantallon Homeschooling Group (2 visits), Dartmouth Homeschooling Group (3 visits), French for the Future Forum, CBBC Career College, Bilingual Career Exploration Day-St. Mary's University.

2020-2021 Program Goals

We are planning to grow our presence online during 2020-2021. We will spend additional time developing and creating interactive presentations and activities that all kids can enjoy anytime and from anywhere.
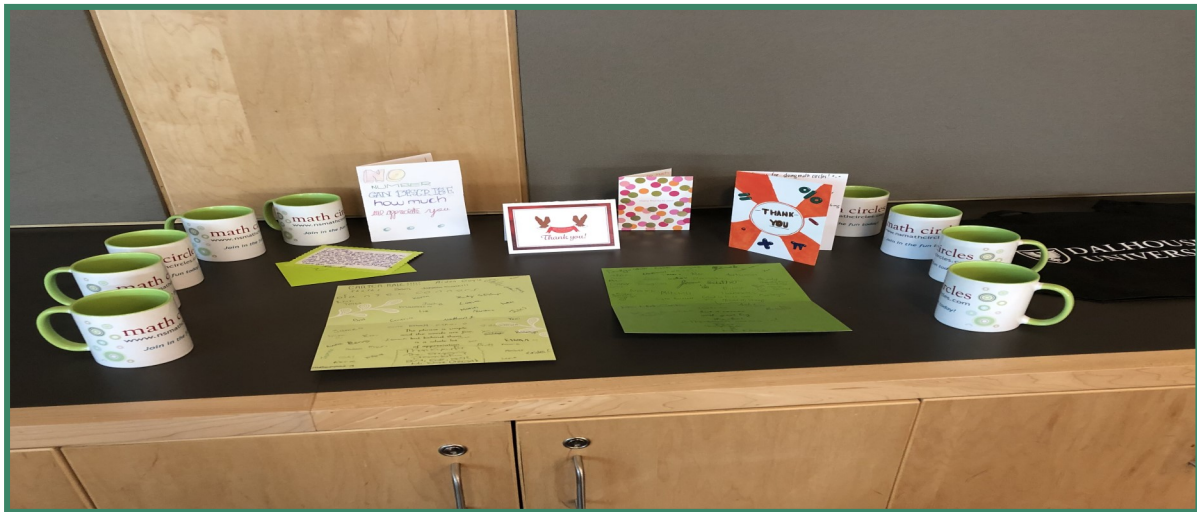
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