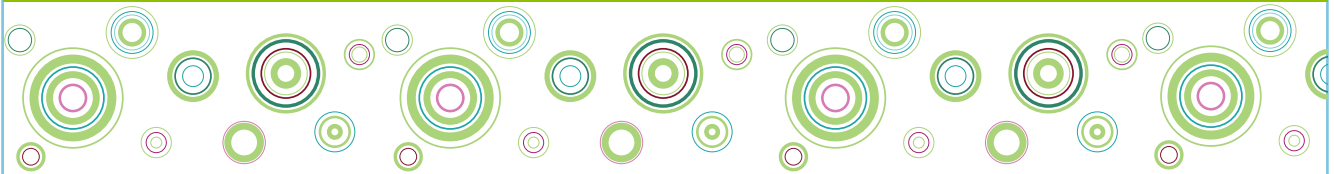


# NS Math Circles

## Year End Report 2015-2016



## 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 mathematics through interactive, creative and meaningful presentations.

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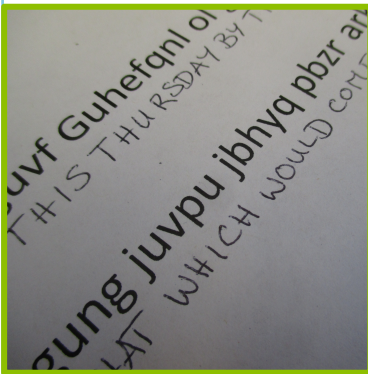
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Many thanks to our sponsors!

eastlink



# Executive Summary

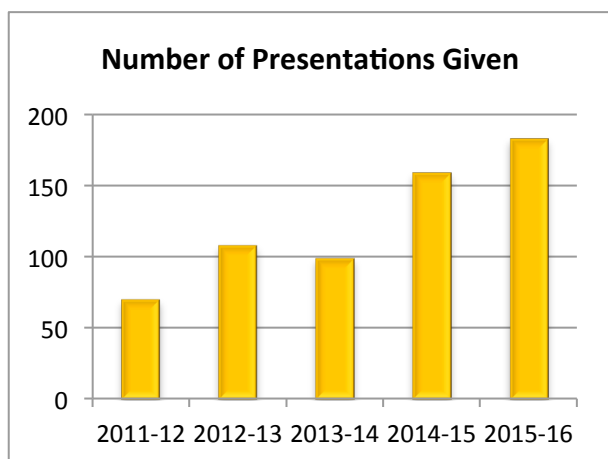
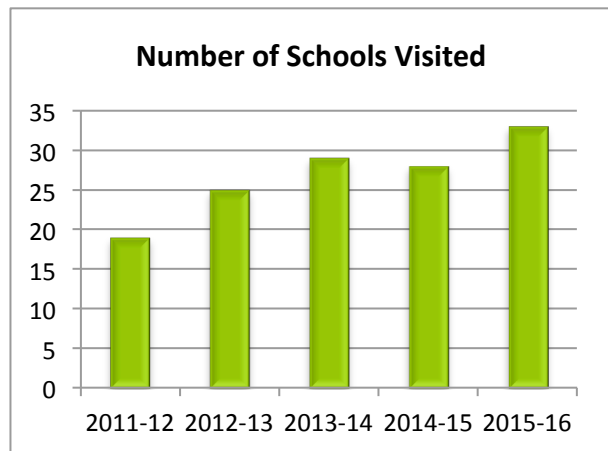
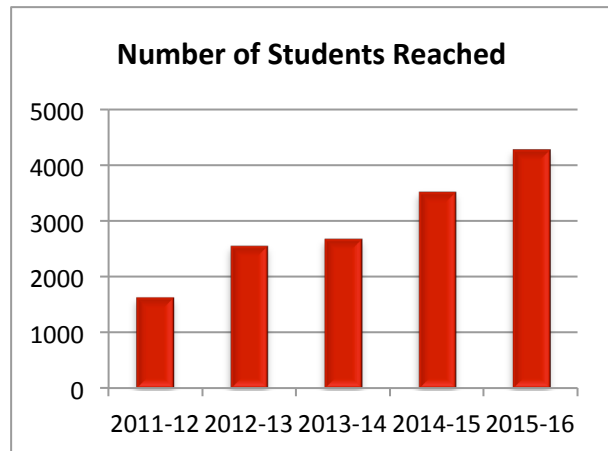
We had another very successful year at Nova Scotia Math Circles!

We have now had funding from Eastlink for two years, and this has allowed us to create several new presentations for elementary and junior high schools, as well as continuing to visit many schools and programs.

As usual, the fall term was very busy with week-long trips to the Tri-County Regional School Board (TCRSB) and the Strait Regional School Board (SRSB), and many more day trips. The winter and spring were a bit quieter, allowing us to also create new presentations and rework a few older ones.

Our numbers keep showing a steady increase in interest. This year, we visited 33 different schools (some of which more than once), giving 183 presentations in total, working with over 4200 students!

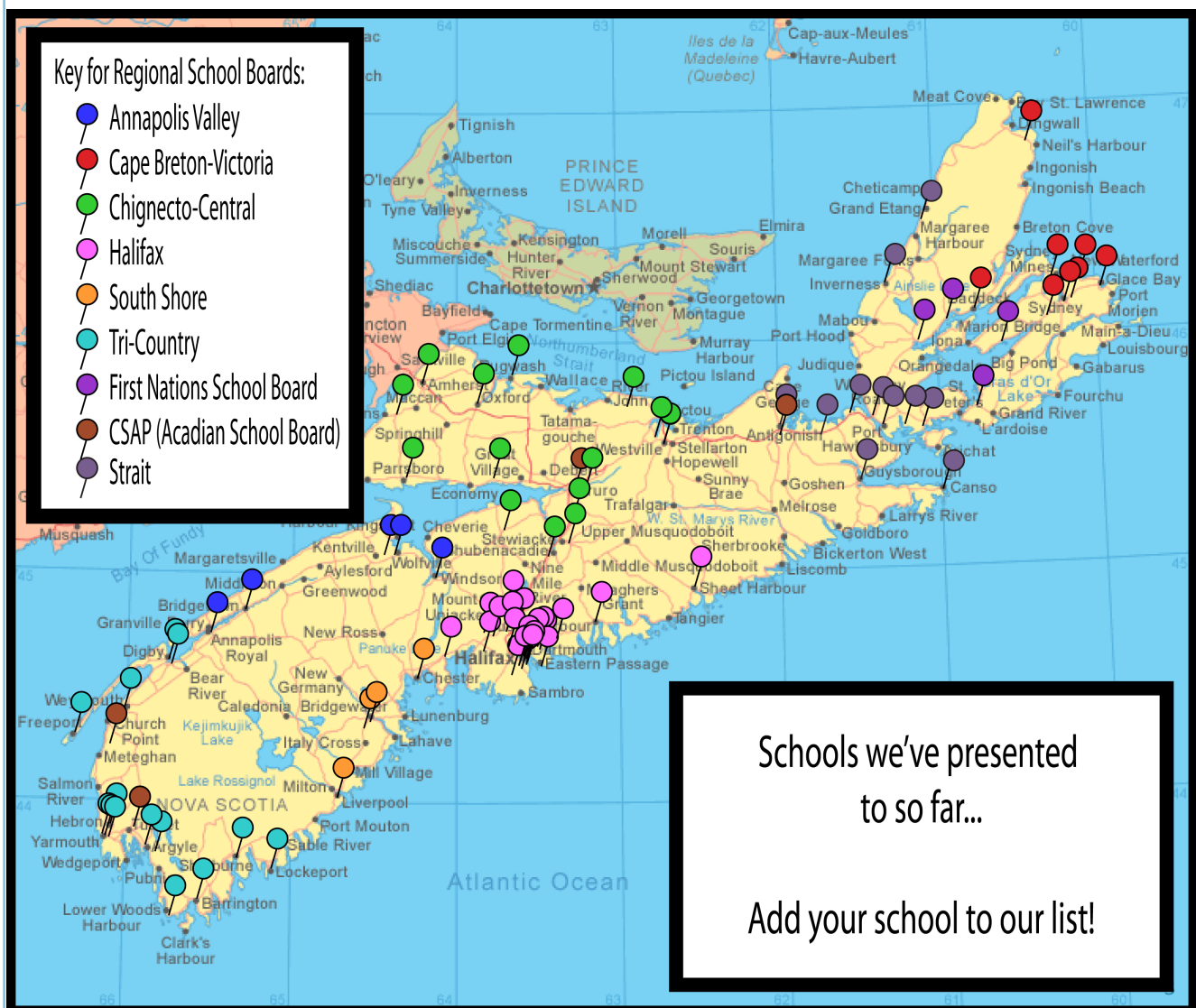
Our monthly talks at Dalhousie have been popular as in previous years, with students of varying age, their parents, and teachers, as well as some Dal students attending. As always, we have to especially thank our volunteer presenters for creating and giving these fun, hands-on workshops.



We spent quite some time this year developing presentations for elementary schools, and testing them. In this, we received a lot of help from Dr. John McLoughlin, a professor of mathematics and education in New Brunswick. This was much appreciated since the pedagogical needs of this younger age group are very different from what we are used to from junior high and senior high students.

Much work also went into our website: minor redesigns of home page and menu bar, and major rework on the listing of our presentations, including addition of outcomes addressed by each. We also began using a new mailing list management program, allowing people to sign up for the mailing list on their own.

As in previous years, we attended the Math Teachers Association conference in October, which is a great chance for us to promote the program to new teachers. We receive much feedback at this event as well, hearing of teachers using activities we introduced them to, and of students talking for days after our visits about the workshop topics.



## NS Math Circles Staff

As in the previous year, Svenja Huntemann was the Program Director. Ben Cameron supported her as Assistant Program Director. Together, they are responsible for the organization and general direction of the program. Melissa Huggan is taking over for Ben for the upcoming year.

Dr. Richard Nowakowski was the faculty advisor again this year. We thank him for his many years of support and providing advice to the program. Dr. Dorette Pronk has taken over at the end of the year, and we are looking forward to working with her.

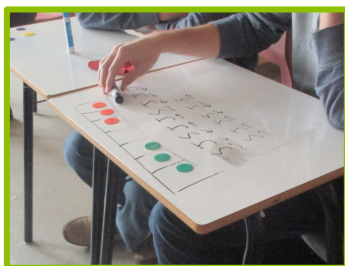
Our presentation team this year consisted of three teaching assistants, Marie B.Langlois, Melissa Huggan, and Lucas Mol. Continuing presenters were Bassemah Alhulaimi, Abdullah Al-Shaghay, Hoda Chuangpishit, Brandon Elford, Francisco Rios, Elham Roshanbin, and Julia Tufts. New members of the team are graduate students, Eva Aleiferi, Dario Brooks, Corey DeGagne, and Asmita Sodhi, as well as undergraduates Todd Best, Kyle MacQuin, Sohraub Pazuki, and Hayley Tomkins.

In the fall, three new teaching assistants will be visiting schools (together with other members of the presentation team) as well as help create new presentations.

## List of Presentations

### Elementary Schools

- Exploding Buckets **NEW!**
- Exploring Mathematics **NEW!**
- Jury Duty **NEW!**
- Mathemagic
- Problem Solving
- Tessellations



Several new presentations for elementary and junior high schools are being developed and we are hoping to add to this list in the upcoming year.

### Junior High Schools

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

### Senior High Schools

- Cryptography
- Eulerian Circuits **REDONE!**
- Fibonacci & the Golden Ratio
- Fractals
- Graph Colouring
- Infinity
- Jury Duty **REDONE!**
- Logic & Reasoning **REDONE!**
- Mathemagic
- Million Dollar Hat Problem
- Nim
- Numeral Systems
- Permutations & Combinations
- Pi
- Prime Numbers
- Tessellations
- Toads and Frogs **REDONE!**
- Tower of Hanoi

# Outreach

## Local Events

We held 10 evening events, September through to June. The local events attendance was an estimated 300 people during the year.



### September 16, 2015 Speaker: Ben Cameron

*Topic: Shake Hands with Graph Theory!*

The basics of graph theory will be reviewed, just enough to present the famous Handshaking Lemma. This is a very basic result in graph theory but can be used to prove some interesting statements. We will also spend some time trying to reduce ties in one famous tie-breaking game, again by using only the basics of graph theory. If time permits, we will also play a game called Hex and discuss how the Handshaking Lemma is related.

### October 21, 2015 Speakers: Abdullah Al-Shaghay & Marie B.Langlois

*Topic: Prime Time*

This talk will be about prime numbers, we will answer the following questions about them: what is so special about them, how can we find them (well, find numbers that are not primes), how many are there, etc. Along the way we will explore number theoretical concepts such as divisibility, modular arithmetic and mathematical proofs.

### November 25, 2015 Speaker: Dr. Karl Dilcher

*Topic: A Mathematical Mystery Tour: Large Numbers and Great Mathematicians*

15 questions will be presented in the format of a quiz show. To each question you will have four possible and believable answers to choose from; however, only one is correct. In being given the solutions in the second part, you will learn interesting facts about some famous mathematicians and the culture around mathematics. While mathematics is certainly more than just numbers, in this presentation you will come across some large and some very large numbers.

### December 9, 2015 Speaker: Dr. Richard Nowakowski

*Topic: Toppling Peaks*

Toppling Peaks is a game played on strip of squares. Each square contains an arrow pointing to the left or to the right. A move is to choose a square and eliminate all the squares, including the chosen square, in the direction of the arrow. The player who deletes the last square wins. We will develop a winning strategy of this and for the game in which the player who eliminates the last square loses! The game has a connection to the Catalan Numbers, the most referenced number sequence in the Online Encyclopedia of Integer Sequences, one of which helps with the analysis of the game, another actually helps us play the game.

**January 20, 2016 Speaker: Dr. David Wolfe**

*Topic: Probability for Fun and Profit*

We will talk about how probability affects our everyday lives in surprising ways. We'll investigate how the Inspection Paradox explains why your wait at the bus stop seems longer than it should be, why polls are so often hard to get right, and why countries with lots of immigrants have artificially inflated life expectancies. We will also learn how a very simple probability paradox teaches one how to be a successful investor.

**February 10, 2016 Speakers: Svenja Huntemann and Ben Cameron**

*Topic: Mathemagic School*

Reading minds, x-ray vision, predicting the future. Those are all magical abilities the Math Circles team will demonstrate. And by the end of the evening, you will have them as well!

**March 9, 2016 Speaker: Dr. John McLoughlin (UNB)**

*Topic: Curious and Interesting Numbers*

Numerical curiosities abound. Yes, there exist a large number of curious and interesting numbers. Whether numbers simply attract other numbers to them or have a property of their own, it is fun to play with numbers. Be prepared to play with ideas, patterns, properties, and more. Number tricks, problems, and thinking outside familiar boundaries will enable us to uncover some of the wonder of numbers. Please join us.

**April 13, 2016 Speakers: Ben Cameron and Marie B.Langlois**

*Topic: Radical Relay*

It is math relay time! 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. These problems are hand picked to be challenging and fun, so come ready to think and work together!

**May 18, 2016 Speaker: Erick Lee (HRSB)**

*Topic: Geometric Puzzles with Squares and Rectangles*

Please join us as we explore several geometric puzzles dealing with squares and rectangles. We'll start with the "No Rectangles" problem. This problem asks you to find the maximum number of points within an  $N \times N$  grid such that no set of 4 points form the corners of a rectangle (with horizontal and vertical sides). We'll explore several similar problems with connections to art, combinatorics, geometry and number theory.

**June 9, 2016 Speaker: Dr. Danielle Cox (MSVU)**

*Topic: Can you be the last one standing?*

In this Math Circles we will play a multi-player game, where you are the game pieces! Exploring winning strategies will uncover some interesting math, which can be used to solve another 'famous' game and has some important applications to the world around us.



Photo credit: Danny Abriel

**Our June event was a special edition celebrating the first two and very successful years of funding by Eastlink!**

We began the evening with a few short remarks by Joachim Stroink (MLA, Halifax-Chebucto), Jeff Gilham (Vice President Eastlink), Erick Lee (Math Consultant, Halifax Regional School Board), and Dr. Ian Hill (Acting Dean of Science, Dalhousie). Everyone then got to enjoy pizza and dessert, while pondering over a large variety of logic puzzles.

The evening wrapped up with our monthly talk, given by Dr. Danielle Cox from MSVU. The focus of the workshop was a game in which students got to be the pieces, incorporating even some physical exercise into the mental workout!

## School and Program Visits

As in previous years, we visited a large variety of schools and programs. We held workshops at 33 different schools all across the province from Yarmouth up to the Cape Breton Highlands. We also worked with a home educators group, the ESL classes at Dalhousie, as well as the behaviour class at the IWK.

### **Tri-County Regional School Board (TCRSB) and Strait Regional School Board (SRSB), Potlotek First Nations**

Every fall the NS Math Circles team schedules week-long trips to areas harder to reach through day trips from Halifax. This year, we visited the TCRSB and SRSB during two separate trips. These trips always book out within a very short time as teachers are looking forward to them. On both trips, the team of four presenters visited 5 schools each, often running parallel sessions. During the trip to the TCRSB we saw over 620 students, and almost 900 students in the SRSB.

This year, we also received a request to visit Potlotek First Nations, and we spent two days in the Spring visiting their elementary and high school.

### **Home Educators Groups, ESL Groups, IWK behaviour class**

As in previous years, we were able to offer several workshops throughout the year for homeschooled students in the HRM, and a few presentations to ESL students at Dalhousie planning to go into science or engineering. New to us this year was a visit to the IWK behaviour class.

### **Junior High & Elementary Schools**

The junior high programming, which began in 2013/2014, continues to be our most popular. Feedback from teachers provided us with several ideas for new workshops, which are being developed for next year, as well as improvements for a few existing ones. The elementary school program has further expanded to now also include grades 1-3 through our Exploding Buckets and Exploring Mathematics talks. Several new presentations are being worked on here as well.

### **Discover Math Days**

After doubling our sessions last year already, interest for the Discover Math Days was so high this year that we added another two sessions, for a total of 6. Our round-robin workshops on April 25<sup>th</sup>, 26<sup>th</sup>, and May 2<sup>nd</sup> focused on magic tricks based on different math techniques. We were able to entertain a total of 204 students.

### **Outreach to Teachers**

Whenever we visit a classroom, we of course implicitly outreach to the teacher as well. Many use our activities in their other classes or get ideas for new approaches to a concept. We also offer workshops specifically for teachers though, which we were able to give this year during the Professional Development Day for teachers at private schools in the area.

We again attended the Math Teachers Association conference as well, teaching several small activities at our exhibitor's table.



We visited and worked with schools in 7 of the Nova Scotia school boards this year. These schools are:

### **Conseil Scolaire Acadien Provincial**

École Secondaire du Sommet

### **Chignecto-Central Regional School Board**

A.G. Baillie Memorial School, Hants North Rural High School, Kennetcook District School, Pugwash District High School, Redcliff Middle School (2 visits)

### **First Nations**

Potlotek Elementary School, Potlotek High School

### **Halifax Regional School Board**

Cunard Junior High (2 visits), Eastern Passage Education Centre (2 visits), Ellenvale Junior High, Five Bridges Junior High (3 visits), Georges P. Vanier Junior High, Halifax Central Junior High (2 visits), Herring Cove Junior High, Holland Road Elementary, Madeleine Symonds Middle School (3 visits), Rocky Lake Junior High (2 visits), Saint Mary's Elementary

### **Straight Regional School Board**

Cape Breton Highlands Academy, Chedabucto Education Centre/Guysborough Academy, Dr. John Hugh Gillis Regional High School, Richmond Education Centre/Academy, Saint Andrew Junior School

### **South Shore Regional School Board**

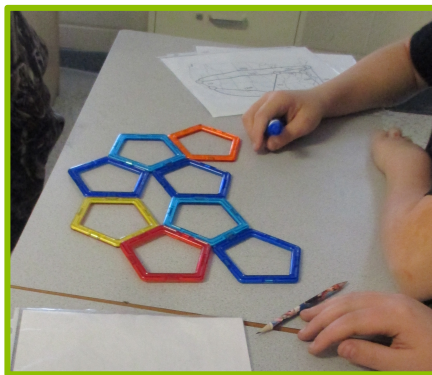
Hebbville Academy

### **Tri-County Regional School Board**

Digby Regional High School, Drumlin Heights Consolidated School, Maple Grove Education Centre, Saint Mary's Bay Academy, Shelburne Regional High School

### **Private Schools**

Armbrae Academy, Sacred Heart Elementary School (3 visits)



In the upcoming year, we will continue to spend much of the fall term in regions further from the HRM while the weather is reliable enough for travel. We are also planning to combine the Cape Breton portion of the SRSB with the Cape Breton-Victoria Regional School Board for one of the week-long trips, and visit other areas of the SRSB separately.

# 2016-2017 Program Goals

We are planning to continue expanding our programming for elementary and junior high schools in the upcoming year. Several presentations are already in the works, and we have been collecting ideas for many more.



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