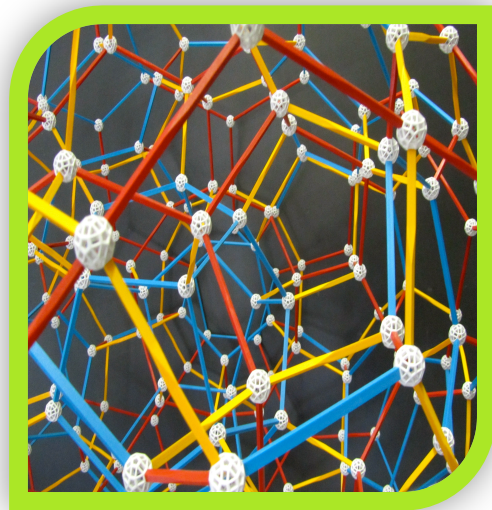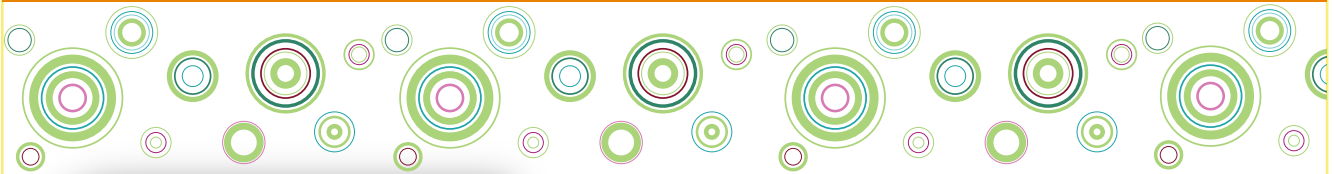# NS Math Circles

Year End Report 2012-2013

Mission Statement

Nova Scotia Math Circles is dedicated to enriching the experiences of Nova Scotia high school students in all areas of mathematics. Our program vision is to foster enthusiasm for mathematics through interactive, creative and meaningful presentations.

Many thanks to our sponsors!

Executive Summary

The 2012-2013 school year marks the fourth year of our expansion and final year of funding from the Imperial Oil Foundation. This past year NS Math Circles visited several school boards not previously visited and also had several new graduate students join the team.

We continued our outreach in the Tri-County School Board and the Halifax Regional School Board, but further expanded our outreach in areas such as the Strait Regional School Board, Chignecto-Central School Board and Annapolis Valley School Board. We also maintained a relationship with home educators within Halifax.
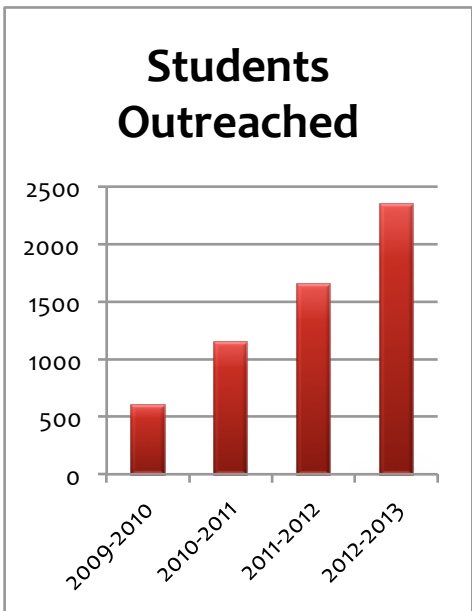
As in previous years, Dr. Richard Nowakowski was the Faculty Advisor for the program. Danielle Cox continued to be the Program Director for the 2012-2013 school year. Karyn McLellan was the Assistant Program Director and worked closely with the Program Director to organize trips and promotional activities.

One of the new promotional activities implemented this year was a letter campaign to high school principals. As with past years, all promotional materials are branded with the logos of our sponsors. This letter campaign resulted in schools calling to obtain more information regarding the program, which in turn led to visits.

This year, Darlene MacKeen-Hudson, a Math Consultant, invited Danielle and Karyn to give support to a teacher who was looking to further develop her

"It was a fun, engaging way of teaching math. It was great!"

-D. LeBlanc
Inverness Education Centre/Academy

Students Outreached

Year	Students
2009-2010	~600
2010-2011	~1150
2011-2012	~1650
2012-2013	~2350

"Fantastic. The material was a perfect fit. Great follow up to a unit completed 2 months prior."

-D. Dorcette
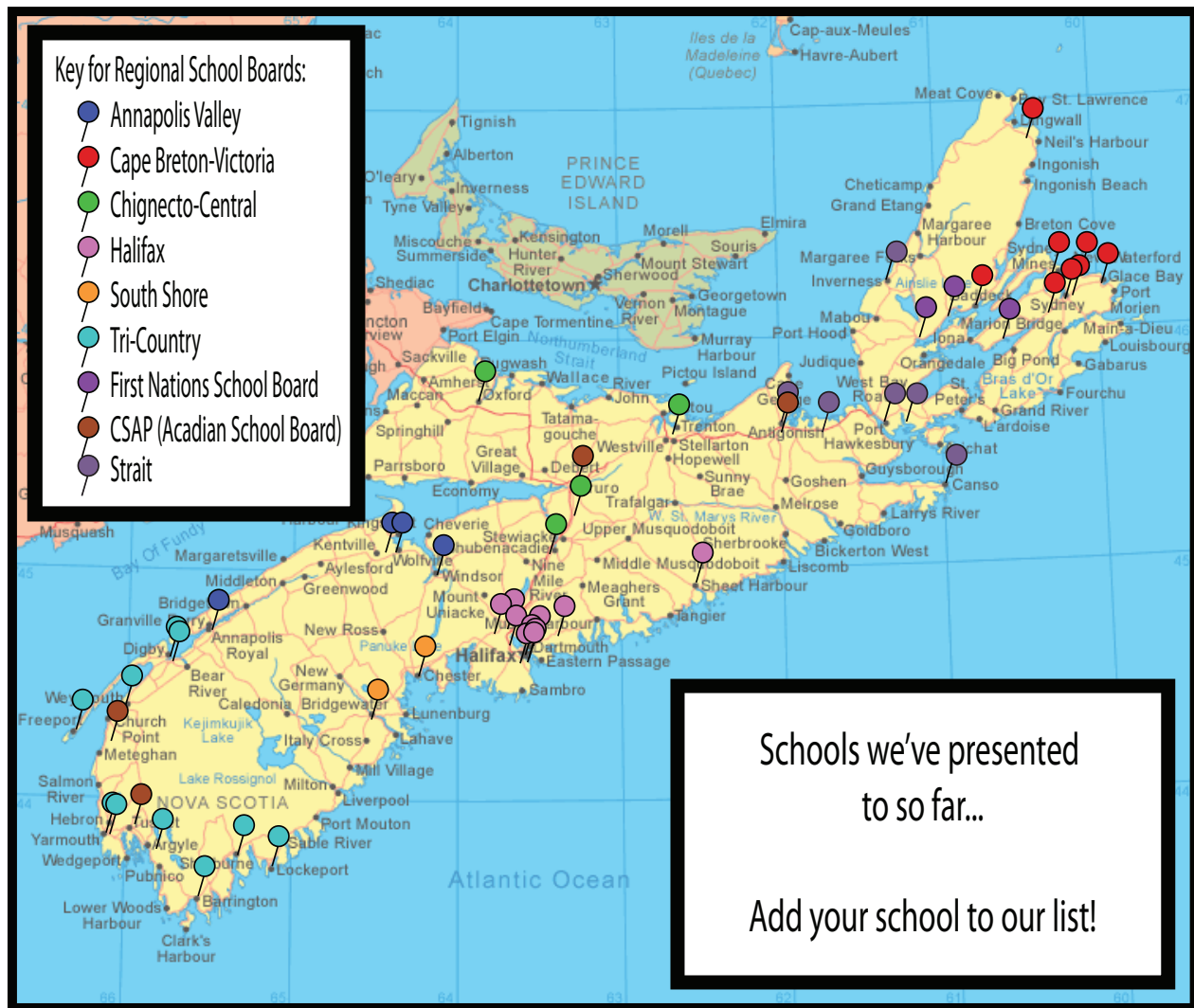*Oxford Regional Education Centre*

"Many thanks from all my students. The session on Friday was very motivating and I know I will use your examples as I begin the probability unit.

-J. Dory Richmond Academy

teaching skills with respect to providing engaging classes. As part of the grade 10 pre-IB classes at Cole Harbour District High School, students were required to attend an NS Math Circles local event. This resulted in students continuing to come to the local events, even after the one visit requirement!

We continue to survey teachers for all presentations given. Their input guides our topic choices and decisions as we move forward. This year 7 new talks were created and past presentations were further developed to incorporate teacher feedback.

Overall, we visited 25 schools, 13 of which were new. Two week long trips were taken this year, one to the Tri-County Regional School Board, the other to the Strait Regional School Board. This was our first visit to the Strait region. This year we gave 10 evening talks with a total attendance over 400 people. We gave 84 talks across Nova Scotia. This resulted in over 1900 students outreached to on trips. **In total, 94 talks to over 2300 students took place in 2012-13.**

Key for Regional School Boards:
- Annapolis Valley
- Cape Breton-Victoria
- Chignecto-Central
- Halifax
- South Shore
- Tri-Country
- First Nations School Board
- CSAP (Acadian School Board)
- Strait

Schools we've presented to so far...

Add your school to our list!

NS Math Circles Staff

Danielle Cox continues to be the Program Director. She is responsible for the organization and general direction of the program. She continues to establish and build relationships with members of the regional school boards, NS Math Teachers Association and math teachers throughout the province. Danielle gave a presentation at the NS Math Teachers Association Conference in October 2012 and has been asked to give another one at the 2013 conference.

This year Karyn McLellan, past Presentation/Ideas Team Coordinator, took on the role of Assistant Program Director. She worked with the Program Director regarding the coordination of school visits, coordinating local evening events and with promoting of the program. Karyn initiated the Problem of the Month and the Mathematician of the Month website links. She and Danielle also worked together on the production of presentation materials.

Dr. Richard Nowakowski remains the Faculty Advisor for the program. He acts as a liaison between the program and the university and works with Danielle to further the vision of the program.

With the increase in school visits, our Presentation Team has expanded! Abdullah Al-Shaghay, Julien Ross, Hoda Chuangpishit, and Alain Gamache continue to be active members of presentation team. New members include graduate students Kira Scheibelhut, Svenja Huntemann, Elham Roshanbin and Leigh Herman.

List of Presentations

- Mathemagic
- Tessellations
- Jury Duty
- NIM
- Infinity
- Graph Colouring

- Limiting Processes
- Population Modeling
- Logic & Reasoning
- Fractals
- Eulerian Circuits
- Toads & Frogs

- Fibonacci & Golden Ratio
- Planarity
- Numeral Systems
- Tower of Hanoi
- Pi

- Prime Numbers
- Circle Geometry
- Coding Theory
- Probability
- Cryptography
- Problem Solving

- Math & Music
- Benford's Law
- Pascal's Triangle
- Permutations & Combinations
- e

Outreach

Local Events

This year marked record attendance for our local events! We held 10 events, September through to June. Attendance ranged from 20-65 people with an average of 40 people. Most students were in the grades 9-11 range, but several younger participants from upper elementary schools attended, since they were interested in mathematics. We also had a strong attendance from home educators from within the HRM. The local events attendance was over 400 people during the school year.

September 26, 2012 Speakers: Danielle Cox & Karyn McLellan

Topic: Mathemagic

Join us for an exciting evening of magic and illusion! Come be mystified and amazed at our feats and even learn the secrets to perform them yourselves. Learn how to memorize a deck of cards, influence the flipping of a coin, magically untie yourself from ropes. Is it really magic? No! It's math. This talk will introduce concepts such as binary and ternary numbers, modular arithmetic, divisibility rules and even topology
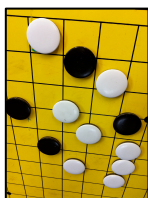
October 17, 2012   Speaker: Dr. Richard Nowakowski (Dalhousie University)

Topic: Toppling Peaks

Come explore some combinatorial game theory by investigating the game of Toppling Peaks.

November 21, 2012 Speaker: Alain Gamache (CSAP)

Topic: Benford's Law

Alain challenges you to the following experiment. Record the result of 200 tosses of a fair coin. The twist? You can cheat!! Yes, you have 2 choices: toss the coin 200 times and record the result of every toss or fake the 200 tosses. Alain will attempt to use a mysterious law to try to determine who actually did the experiment and who faked it.

### December 12, 2012 Speaker: Danielle Cox

Topic: Towers of Hanoi

We will be play with the Towers of Hanoi, look at recurrence relations and other patterns in the game.

### January 16, 2013 Speaker: Dr. Jason Brown (Dalhousie University)

Topic: A Hard Day's Math: Connections between Math & Music

In this talk I'll survey some of the most interesting connections between mathematics and music, including: - trigonometric identities and tunings - small fractions and musical intervals - circular seating arrangements, scales and rhythm guitar - derivation of the blues and graph colourings - the musical art of being ambiguous (or not) - musical and mathematical transformations I'll end off the talk with a discussion of some application of mathematics I carried out on some musical mysteries surrounding The Beatles.
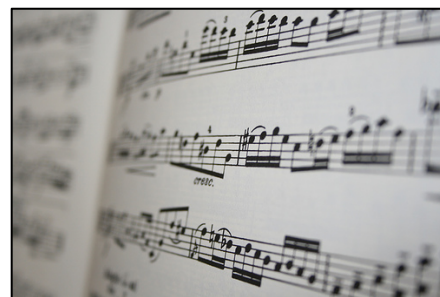
February 13, 2013 Speaker: Dr. Karl Dilcher (Dalhousie University)
Topic: How did we calculate before there were calculators?
Electronic calculators didn't become widely available until the early to mid-1970s. Before that, it was slide rules and logarithmic tables that played similar roles as do pocket 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 computer simulated slide rules (a bit of an irony ...) and/or paper slide rules. Every participant will receive an old Dalhousie booklet of mathematical tables, including log tables, to take home
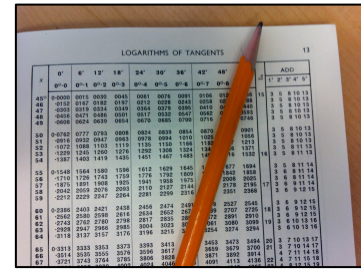
March 20, 2013 Speaker: Svenja Huntemann
Topic: How can games help us correct errors in data?
Why can we play a DVD that has a scratch? Why can we understand people on the phone even in bad weather? How can a scanner read a barcode with a crease in it? And what does cryptography have to do with this? The answer: MATH!!! We will discuss how we can use games and some closely related math to correct errors in data.

April 17, 2013 Speaker: Dr Dorette Pronk (Dalhousie University)
Topic: Changing the Rules of Geometry
Have you ever wondered what inspired M.C. Escher to create his circle limits? Did you know that mathematicians after Euclid tried for many centuries to show that the parallel axiom had to follow from the other axioms? And are you now wondering how these questions are related? Then come to this session of math circles. We will play some games with funny rules, and then learn about a new version of geometry that is more useful than you would have expected! (One of my colleagues says that this is the only mathematics he has actually used in a practical way in his life.)

May 15, 2013 Speaker: Elham Roshanbin
*Topic: Learning How To Count: Combinatorics*
Combinatorics is a branch of mathematics that includes lots of entertaining problems and uses different creative approaches! In this talk we are going to have a glance at some of these interesting approaches including some counting tricks, coloring and tiling techniques, as well as some fun problems.

June 5, 2013 Speaker: Dr. Suzanne Seager (Mt. St. Vincent University)
Topic: Finding Patterns
We look at how a simple children's game on the internet can lead to some interesting and entertaining mathematics by applying the general principle of finding patterns.

School Visits

The school visits this year have been wonderful! We revisited regions and achieved our goal for 2012-2013 of strengthening our presence in the Chignecto-Central and Strait Regional School Boards. This past year we visited 25 schools, 13 of which were schools we had not previously visited! We also ran session for home educators groups, ESL classes at Dalhousie University and piloted a junior high problem solving workshop with several classes.
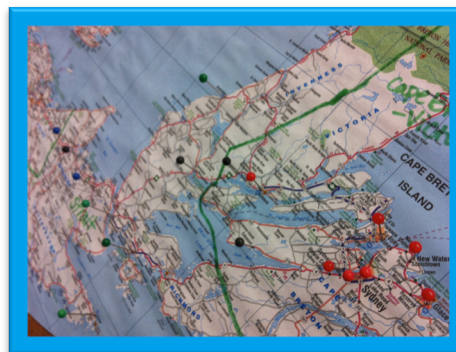
Tri-County Regional School Board (TCRSB)
Every Fall the NS Math Circles team visits the TCRSB. Both students and teachers anticipate and enjoy this outreach event. This year we again visited the TCRSB for a week long outreach trip. Math Consultant for the TCRSB, Patsy Height-Lewis, worked with NS Math Circles to organize this event. During the week 6 schools were visited, 14 presentations given and over 420 students were outreached to.

Strait Regional School Board (SRSB)
A program goal for 2012-2013 was to increase our presence in the SRSB, and that was certainly achieved! We spent 1 week in the SRSB, which resulted 24 presentations at 5 different schools, 4 of which we had not previously visited. During this trip we outreached to over 480 students. Although this was our first big visit to the region, many schools had us give multiple presentations since they had heard positive comments from colleagues from other school boards. One school we had visited last year, Dr. John Hugh Gillis, booked us for 2 full days of talks during this trip since they enjoyed the presentations so much the previous year! Our visit to the region was organized with the cooperation of the Coordinator of Mathematics for the board, Mark Pettipas.

Chigencto-Central Regional School Board (CCRSB) & Annapolis Valley Regional School Board (AVRSB)
Another region for which we wanted to strengthen our presence in was the CCRSB. NS Math Circles has a strong relationship with the Math Consultant for that region, Darleen MacKeen-Hudson, who is also a member of the executive committee for the NS Math Teachers Association. This year we visited 4 new high schools in the CCRSB, resulting in 15 presentations to over 320 students. We also visited Annapolis West Education Centre (AVRSB) for the first time in the Fall, gave 2 presentations to 50 students, and they invited us back for a second visit in the Winter semester. Also, a group of students from Bridgetown Regional High School (AVRSB) came up to Dalhousie University for a presentation on Combinatorial Game Theory.

Home Educators Groups, ESL Groups & Junior High Enrichment Programs
Last year we developed a relationship with the home educators in the HRM. This year we continued to provide outreach to this group and they attended our local events. We also gave presentations to the ESL classes at Dalhousie University. Last year we provided presentations to enriched junior high students within the Halifax Regional Municipality (HRM) and this year we piloted a problem-solving workshop to 18 junior high classes within HRM totaling over 200 students.

Additional Outreach Activities

This year NS Math Circles took part in two outreach activities that took place at Dalhousie University.

Discover Math Days

We gave 3 presentations during this event, which resulted in 88 students outreached to. The schools that came to visit were from the AVRSB, CCRSB, HRM and Conseil Scolaire Acadein Provincial.

Outreach Days

On June 5th, in conjunction with the Education Session for the Canadian Mathematical Society's (CMS) 2013 Summer Meeting, NS Math Circles hosted an outreach day for local students which resulted in 100 students attending mathematical workshops.

Summer Math Camps

We are scheduled to speak at the CMS & Black Educators Association Math Camps, Aboriginal Health Science Junior University and Shad Valley over the summer months.

Schools Outreached to Over the Past 4 Years

Halifax Regional School Board

Prince Andrew High School, Cole Harbour District High School, Gorsebrook, Ellenvale , Duncan MacMillian, Five Bridges, Citadel High School, Sir John A MacDonald, Lockview High School, Sacred Heart, Armbrae Academy, Halifax Grammer, Ecole Secondaire du Sommet, Astral Drive Jr High,

Cape Breton/Victoria Regional School Board

Holy Angels Academy, Cabot High, Baddeck Academy, Breton Education Centre, Glace Bay High, Memorial High, Rankin School of the Narrows, Riverview High, Sydney Academy

Strait Regional School Board

Canso Academy, Dr. John Hugh Gillis, Inverness Educational Centre, Strait Regional Education Centre, Richmond Academy, East Antigonish Education Centre

Tri-County Regional School Board

Lockeport Regional High School, Barrington High, Digby Regional High School, Digby Adult High School, Drumlin Heights Consolidated, Island Consolidated, Shelburne Regional High School, St. Mary's Bay Academy, Yarmouth Consolidated Memorial High

South Shore Regional School Board

Bridgewater Jr/Sr High, Forest Heights Community School, Parkview Education Centre

Annapolis Valley Regional School Board

Annapolis West Education Centre, Avon View High School, Bridgetown Regional High School, Horton High School, Kings Edge Hill

Chignecto-Central Regional School Board

Cobequid Education Centre, Hants East Rural High School, Hants North Rural High School, Northumberland Regional High School, South Colchester Academy, Oxford Regional High School

First Nations School Board

Eskasoni High School, Chief Allison Bernard Memorial High School, Wagamatook School

Conseil Scolaire Acadien Provincial

Ecole Acadienne de Pomquet, Ecole Acadienne de Truro, Ecole Acadienne de Claire, Ecole Acadienne de Pas-en-Bas, Ecole Acadienne de Sommet

2013-2014 Program Goals

Over the past 4 years, thanks to the generous funding from the Imperial Oil Foundation, NS Math Circles has been able to positively impact high school students across the province. We have developed a solid reputation of giving fun, engaging presentations which students and teachers alike enjoy and learn from.

Moving forward, we are looking for additional sources of funding so that we can continue providing our workshops, free of charge, across NS. We also plan on expanding to junior high (grades 7-9). We have received $3500 from the Atlantic Association for Research in the Mathematical Sciences (AARMS) for a junior high outreach trip in the Fall of 2013.

Thank You to the Imperial Oil Foundation for the past 4 years of support. As the following student quote demonstrates, a program like NS Math Circles is important and positively impacts the math students across the province, giving them a glimpse at math they do not always encounter in class.

"In school we need to stay on the sidewalk, and it's fenced in, but the interesting math, like we saw today, is on the other side of the fence, and we don't get to go there in class". -Johnathan (student) Ecole Secondaire du Sommet

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