New York Math Circle Spring 2018 Newsletter

Challenge Yourself!

1.**MS A** Each of the cucumbers in 100 pounds of cucumbers is composed of 99% water, by weight. After some of the water evaporates, the cucumbers are now 98% water by weight. What is the new weight of the cucumbers, in pounds?

2.**MS A** Find the smallest positive integer which is divisible by 225 all of whose digits are either zero or one.

3. **MS B** One way to write the Roman Numeral for 4000 is 'MMMM'. What is another way?

4.**MS C** (From the Berkeley Math Circle): Some number of frogs sit on a row of 2000 lily pads. Every second two frogs that happen to be on the same lily pad jump off, one going to the lily pad to their left and one going to the lily pad to their right. The frogs cannot jump if they are on a lily pad at one of the ends of the row. Show that the frogs must eventually stop jumping.

5.**HS A** Find the sum of the first 21 terms of an arithmetic progression if the sum of the fourth, seventh, eleventh, fifteenth, and eighteenth terms is 8.

Director's Report

Kovan Pillai

Welcome to New York Math Circle's fifth newsletter! Spring 2018 has got off to a great start and our new Brooklyn program filled up quickly.

Our College Bridge program was well-received so we have continued with the same format - a mini-course taught by one of our instructors (Jan) followed by a mini-course on polynomial approximations given by an NYU Computer Science Professor (Gleb Pogudin). This course is particularly good value as students get exposure to a college course at a fraction of the cost.

Our Summer High School Program has been honored yet again by the American Mathematical Society with its Epsilon Award and has attracted the interest of 340 applicants. We are also offering our Summer Middle School program in a new format - two weeks of weekday classes in July as opposed to six weekends.

REGISTER NOW

This semester, we have welcomed **Leah Khevelev** to our faculty as a Middle School instructor. She has 12 years of experience teaching both Middle and High School and is currently teaching at Stuyvesant.

Leah Khevelev

We rely on **donations** to balance our books, in spite of the donation of space at NYU as we give generous support for those students who can't afford our modest fees. Individual and corporate contributions (which are tax-deductible) to offset these increased costs would be greatly appreciated:

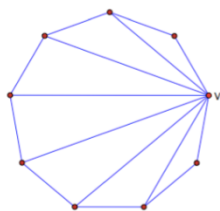**DONATE NOW**

Challenge Yourself!

6.**HS A** The Fibonacci Sequence begins with two 1's and each subsequent number is the sum of the preceding two terms. Find the sum of the squares of the first 30 Fibonacci numbers. It may be useful to know that the 27th and 28th Fibonacci numbers are 196418 and 317811 respectively.

7.**HS B** Find, with proof, the maximum number of mutually non-attacking knights one can place on a 5×5 board.

8.**HS B** Find the maximum possible value of $x(1-x)^3$ without using calculus.

9.**HS C** A permutation is a one-to-one (and onto) map from a finite set to itself. The permutation of $\{1, 2, 3, 4, 5\}$ given by $1 \to 4$, $4 \to 2$, $2 \to 1$, $3 \to 5$, and $5 \to 3$ has two cycles, while the permutation $1 \to 4$, $4 \to 2$, $2 \to 3$, $3 \to 5$, and $5 \to 1$ has one cycle. Prove that the average number of cycles in a permutation of a set with n elements is $1 + 1/2 + 1/3 + \cdots + 1/n$.

10. **HS C** Suppose we are given a regular nonagon which can be inscribed in a circle of radius 1. What is the product of the lengths of the eight segments connecting the vertices of the nonagon to one particular vertex?

11.**College Bridge** Is it true that if a polynomial takes integer values at all integer points, then it has integer coefficients?

12.**College Bridge** Prove that if a polynomial $p(x)$ of degree at most n is integer-valued at 0,1,...,n then $p(m)$ is an integer for every integer m.

Alumni News

Alumni Spotlight — Michelle He

By Alison Aun, Program Manager

Michelle He

We would like to congratulate our alumni spotlight, Michelle He, on her acceptance to MIT for the Fall semester. She plans to major in Computer Science/Math with a minor in Management.

Michelle's journey and love for math began in the 7th grade at Hunter High School. After mastering over 50 math competitions, Michelle continues to feel the "adrenaline rush" of competing.

Although Michelle is passionate about math, she is very active in many extracurricular activities at Hunter High School. She is the captain of the math team, on the varsity lacrosse team, Layout Editor for her school's math magazine, Radicals, and plays the clarinet for her senior band and at Chamber Music Center. She also has a love for art, and conducts scientific research at the Icahn School of Medicine at Mt. Sinai, studying computational biology and diabetic kidney disease.

Michelle was first accepted to New York Math Circle, Level C, in the summer of 2015. "I had an amazing three weeks learning about problem-solving strategies and various math topics. I looked forward to coming every morning, even though it meant waking up a bit earlier during the weekdays since I was able to come see my new friends and learn new tips and topics from amazing teachers. I truly learned a lot during NYMC, and it inspired me to continue spending my summers doing math programs."

She also attended two summers at PROMYS in Boston, and had "the opportunity to conduct math research on Benford's Law in linear recurrences and continued fractions and worked with others to write a paper". Michelle is an active member of New York City Math Team and was the captain of PuMAC and HMMT competitions.

Michelle's recommendation for our current younger students:

"I would recommend current younger NYMC students to be willing to reach out to collaborate with others and not be afraid to ask for help. Even though there are individual math competitions and absorbing math knowledge and problem-solving skills is an individual process, a big part of my experiences learning math have been fueled by the math team community. Working with others to solve problems is extremely helpful, and surrounding yourself by others with the same passion as you makes math all the more fun.

My friendships with older captains, students, and coaches all motivated me to work harder and inspired me to pursue math. I couldn't have conducted math research without the help of my team. So many people are always willing to help and share their solutions. I am so grateful that the NYC math community was so welcoming, and I encourage all younger students to join it."

Selected from a competitive pool of applicants, Michelle will also be joining New York Math CIrcle's staff this summer as a Teacher's Assistant. We wish Michelle the best at MIT!

NYMC would like to congratulate an amazing mathlete and former NYMC student, **Calvin Lee**, on winning an individual silver medal, and the U.S. team on winning the gold medal at the 8th Romanian Master of Mathematics (RMM) in 2016. Calvin was previously a High School C level student at NYMC in 2012–2013. Graduating early from Stuyvesant H.S., he was among the six students selected for the U.S. team.

Max Fishelson, former NYMC student during the period 2010–2015 has been attending MIT since September 2016.

David Townley, NYMC student from 2015–2016 is currently at Yale University.

Vaughan McDonald, NYMC student from 2010–2016 is currently at Harvard University.

Brian Riedel, NYMC student from 2009–2011 is now studying at Carnegie Mellon University.

Zachary Marcone, a current student at Columbia University, participated in NYMC's Summer Program in 2013. Congratulations to Zachary on receiving the Rabi Scholarship at Columbia University, the most prestigious math/science undergraduate recognition in the institution.

A current student at MIT, **Justine Jang**, studied at NYMC from 2011–2012.

Edward Fan is currently at student at MIT. He was a student at NYMC in 2011.

Dessie DiMino was a student at NYMC from 2011–2012 and is now studying at CalTech.

Hannah Field, an NYMC student from 2010–2014, was a Summer Teaching Assistant in 2015 and is currently at MIT.

Karen Chen, an NYMC student in 2015, worked as a Summer Teaching assistant for us in 2017 and is currently at Harvard University.

Joy Aun, an NYMC student from 2012-2015, worked as a Weekend Coordinator for us from 2017-2018, and will be attending University of Michigan in Fall 2018.

Fatima Begum, an NYMC student in 2015, will be attending Dartmouth College in Fall 2018.

Keshav Raghavan, an NYMC student in 2014, is currently at Yale University.

Serina Hu, an NYMC student from 2013-2016, worked as a Summer Teaching assistant for us in 2017 and is currently at Harvard University.

Congratulations to **Calvin Lee** for his top 20 finish and **Serina Hu** for her high ranking in the 2017 Putnam Exam. **Brian Riedel** also received honorable mentions in 2014 and 2015 for the same competition.