New York Math Circle Fall 2017 Newsletter

Challenge Yourself!

1.**MS A** How many perfect squares are factors of 8100?

2.**MS A** What is the remainder when 7^{99} is divided by 9?
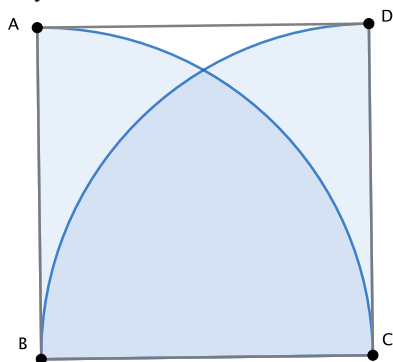
3.**MS A** Given a square with side length 1 and two arcs drawn above, what is the area of the unshaded region?

4.**MS B** Pick a three-digit number with consecutive digits, called x, say. Let the three-digit reverse image of this number be y.
(a) Calculate the positive difference between x and y. Why do you get the same result, no matter what x you start with?
(b) Calculate the sum of x and y. Why do you always get a multiple of 37?

5.**MS C** How many factors of $96,000^{96,000}$ have exactly $96,000$ factors?

6.**HS A** When $\frac{1}{2^{2017}}$ is written as a decimal, how many places are there to the right of the decimal point?

7.**HS B** Let a, b, c be positive numbers. Prove that all three of the following statements cannot be true simultaneously:
$a(1-b) > .25, b(1-c) > .25, c(1-a) > .25$.

Director's Report

Kovan Pillai

Welcome to New York Math Circle's fourth newsletter! Fall 2017 has got off to a great start after an eventful summer during which we celebrated our **10th anniversary** with entertaining talks by Dr. Arthur Benjamin and Dr. Po-Shen Loh.

We recognize that there are now more options available to parents in the New York area, so we will emphasize the main aspect of our program that sets us apart from others: the quality of our teaching, and the building of community—all our instructors are experienced classroom teachers and we provide a wide range of courses in a friendly setting that is unmatched in the New York area. We have kept our rates fixed for the third consecutive year in order to be accessible to all students.

We have ironed out some teething problems in our **College Bridge** program and are now pairing our instructors with NYU faculty for two 5 week minicourses. Students in this class will therefore experience college instruction at a fraction of college prices. Our first NYU faculty offering was a course in differential equations which involved hands-on coding of mathematical models. We will be offering a Computer Science related math class next semester.

For Spring 2018, we are working with Queens' parents to improve outreach, offering more Sunday classes in Manhattan, and opening a new **Brooklyn** program, starting with an MSA class at NYU Tandon — see our website for details on a **free** introductory session in early January.

REGISTER NOW

This semester, we have welcomed **Pei-Hsin Lin** to our faculty as a High School instructor. An MIT Graduate, she has coached math teams and taught middle school

Pei-Hsin Yin

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!

8.**HS C** Let t_n be the number of ways that the $3 \times 2n$ rectangle can be tiled by 2×1 and 1×2 rectangles. (Let $t_0 = 0$.) Find the generating function for the sequence $t_0, t_1, t_2, \ldots$. Use this to find a non-recursive formula for the t_n.

9.**College Bridge** Find the solutions $x(t)$ and $y(t)$ of the following system of ordinary differential equations:

$$x'(t) = y(t) - 2x(t), x(0) = x_0 \qquad (1)$$

$$y'(t) = \frac{y(t)}{t+1} - y(t), y(0) = y_0 \qquad (2)$$

Challenge 1 2017 AIME I, #15 Find the area of the smallest equilateral triangle with one vertex on each of the sides of a 3-4-5 triangle.[a]

Challenge 2 Let $ABCD$ be a convex quadrilateral. Let P, Q, R, S be the midpoints of the sides of the quadrilateral and let M and N be the midpoints of the diagonals AC and BD. Prove that MN, PR and QS are concurrent.

Challenge 3 There are 41 rooks on a standard chessboard (one per square, some squares empty). Show that you can select 6 of them so that the selected rooks do not threaten each other.

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[a]The side lengths of the triangle, as they appeared in the AIME problem, were $2\sqrt{3}$, 5, and $\sqrt{37}$.)

Alumni News

Alumni Spotlight — Ron Nissim

By Alison Aun, Program Manager

Ron Nissim

Ron Nissim is a senior at Columbia Grammar and Preparatory School, and a HSC and College Bridge student at NYMC.

His journey into our math circle began in Spring of 2016. Although his high school has a math club and he has competed in small competitions through aretelabs.com, it did not have an official math team. He attributes his accelerated math and science grades, and interest in math competitions to NYMC. In 2016, he took the AMC 10 exam but did not score very high. However in 2017, Ron took the AMC 12 and improved dramatically, and just narrowly missed the cutoff for the AIME. He attributes a large part of improvement to the NYMC.

In 2016, Ron attended a class at the Columbia University summer immersion program called "Survey of Modern Mathematics." The following summer, he participated in the NYMC High School Summer Program in Level C.

Ron also likes physics and computer science. He enjoys playing soccer and basketball, and teaches coding to children at a local community center. He hopes to major in mathematics and one day, possibly pursue a career as a Professor of Mathematics. He has recently applied to NYU, Carnegie Mellon, and Washington University in St. Louis.

We wish Ron the best in his senior year!

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.

Serina Hu, NYMC student from 2013–2016 and Summer Teaching Assistant is currently at Harvard 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. He received honorable mention in the last two years at the William Lowell Putnam Mathematical Competition.

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.