New York Math Circle Spring 2019 Newsletter

In this issue

Challenge Yourself!

1. **MS A** In how many different ways can we form a committee if we must choose 1 out of 4 fourth graders, 1 out of 3 fifth graders, 1 out of 6 sixth graders, and 1 out of 7 seventh graders and himself?

2. **MS A** Alex had some marbles. On his birthday, his father doubled the number of Alex's marbles. Alex gave 5 marbles to his best friend. Then he divided the remaining marbles into three equal groups to share with his two brothers and himself. If Alex ended up with 11 marbles, what was the original number of marbles that Alex had before his birthday?

3. **MS A** How many blocks will there be in the 43rd image? How many blocks will there be in the nth image?

4. **MS B** Find the area of square NYMC if the radius of circle B is 10 inches
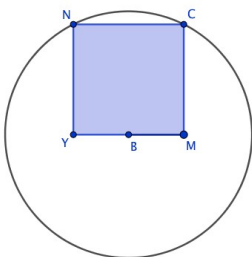
5. **MS C** A googol is the number which is a 1 followed by 100 zeros. A googolplex is a 1 followed by a googol zeros. What is the prime factorization of a googolplex?

6. **MS C** Find the largest prime factor of $99!+100!$

Director's Report

Kovan Pillai

Welcome to New York Math Circle's seventh newsletter! Spring 2019 has continued on the same path as Fall 2018, with our new Brooklyn MSA class and College Bridge class continuing to draw strong interest.

We are excited to learn that Dr. Gleb Pogudin, who taught College Bridge, has collaborated with two of our students (William Qin and Eli Paul) to publish a research project; we encourage further research collaboration with our College Bridge students.

Both of our Summer Programs continue to fill up rapidly and will be located at Stuyvesant High School for the next 3 years while the Courant Institute undergoes Summer maintenance; we will continue to use the NYU building during the Fall and Spring semesters.

We will introduce a Middle School contest topics mini-course in the Fall and continue with this theme if there is sufficient demand.

We rely on **donations** to balance our books, even allowing for the generous donation of space by NYU, as we give generous support for those students who can't afford our modest fees. We greatly appreciate any (tax-deductible) individual and corporate contributions to help offset the expense of providing this support:

DONATE NOW

Challenge Yourself!

7. **MS C** Suppose the greatest common divisor of a and b is 42^3 and the least common multiple of a and b is 210^4. How many such pairs of whole numbers a and b are there, if a is less than or equal to b?

8. **HS A** A 3×7 grid is composed of unit squares. How many rectangles with gridlines as its sides can be constructed on the grid?
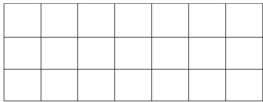
9. **HSB** Prove that the equation

$$x^2 + y^2 + z^2 = 2xyz$$

has no solutions in positive integers.

10. **HSB** There are several (finitely many) circles inside a square with side length 1. The sum of the circumferences of the circles is 10. Prove that there exists a line that intersects at least 4 of the circles.

11. **HS C** Suppose that a, b, and c are complex numbers represented in the complex plane by the points A,B and C respectively. Prove that $\triangle ABC$ is equilateral if and only if $a^2 + b^2 + c^2 = ab + bc + ca$.

12. **College Bridge** Given $\triangle ABC$, the A-mixtilinear incircle is the circle which is tangent to sides AB, AC, and tangent internally to the circumcircle of $\triangle ABC$. Let T_A be the point of tangency of the A-mixtilinear incircle and the circumcircle of $\triangle ABC$. The B-mixtilinear incircle and the C-mixtilinear incircle are defined similarly. Prove that the lines AT_A, BT_B, and CT_C are concurrent

13. **College Bridge** Prove without using a calculator that $1000009 = 235^2 + 972^2$ is composite.

14. **College Bridge** Let ω be a circle of radius 5^n with its center at $(0,0)$. How many points with integer coordinates does ω have?

Student News

Student Spotlight — Ty Lewis

By Alison Mak, Program Manager

Ty with Arthur Benjamin - 10th Anniversary talk

Ty Lewis is our student spotlight for this newsletter. We're very proud to feature Ty as he is a very bright young man at NYMC with great academic accomplishments coupled with being a fun free-spirited young student.

His journey into mathematics began when he was just four years old. At this very young age, he found himself doing multiplication and long division. He was very creative in learning. "When I was little, I used to create my own math games with fuzzy dice, racing cars, and a number line on the floor. Later, I expanded that game to involve imaginary and complex numbers as well."

Ty joined us in Spring of 2017. At age 11, Ty is already in our HS A class. "NYMC has contributed to my love of math because I had Ms. Maggie Feurtado who always wore a math shirt to class with a joke on it. She also did a very good job teaching, always answered my questions, and never stopped me from raising my hand."

Ty loves visiting MoMath. He's learned to do mental math from Dr. Arthur Benjamin's videos. He actively learns mathematics from Khan Academy, Youtube math channels, Why U and Numberphile. He encourages parents to "set up math games (for example, involving dice or card games), do mental math, visit the Washington, DC Math Festival, and MoMath."

He also likes to play basketball, baseball, swim, run track and practice martial arts. He enjoys biking and hiking, and currently has a math tutoring business.

Currently enrolled at Sussex County Community College, he is working on his Associate's degree in math. He plans to join the Air Force and earn multiple degrees and eventually his PhD at Princeton University. He hopes to become a mathematician.
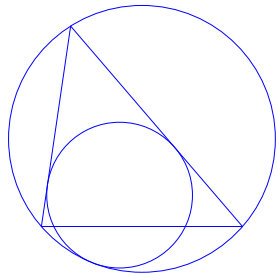
We wish Ty the best of luck in his future goals!

Where are they Now?

Hanna Yang, NYMC student from 2015-2016 will major in Mathematics at MIT in the Fall.

Daniel Acosta, NYMC student from 2018-2019 will major in Mathematics at MIT in the Fall.

Catherine Ye, NYMC student from 2013-2017 will major in Applied Mathematics at Harvard in the Fall.

Raphie Rosen, NYMC student in 2018 will major in Mathematics at University of Chicago in the Fall.

Ron Nissim, NYMC student from 2016-2018 is currently majoring in Mathematics at NYU.

Matthew Kendall, NYMC student from 2015-2017 will major in mathematics at Princeton in the Fall.

Max Kaliner, NYMC student from 2016-2018 will major in Mathematics at Columbia University in the Fall.

Abraham Derival, NYMC student from 2016-2018 is currently attending CUNY.

Tatyana Lazareva, NYMC student in 2017 is currently majoring in Chemical Engineering at the University of Pennsylvania.

Eli Paul, NYMC student from 2016-2018 will be majoring in mathematics at Caltech in the Fall.

Isabella Tran, NYMC student from 2012-2016 is currently majoring in Business Administration at Northeastern University.

Joy Aun, NYMC student from 2010-2015 is currently majoring in Mechanical Engineering at University of Michigan.

Kadhir Pillai, NYMC student in 2015 will attend Carnegie Mellon's School of Computer Science in the Fall

Daniel Brous, NYMC student from 2017-2019 will major in Mathematics at University of Chicago in the Fall

Where are **YOU** now? Please contact us at info@nymathcircle.org - we'd love to hear from you!