

Newsletter of the Metropolitan Mathematics Club of Chicago Volume L No. 5 Feb./Mar. 2021

## **Climate Change: Creatively Use Good Mathematics to Model the Reality**

## **March Speaker Tom Reardon**



Date/Time: Friday, March 5, at 7:00 p.m.

Location: Zoom online platform

**Registration:** Register online at mmcchicago.org

Cost: No charge; donations welcome via Zelle at zelle4mmc@gmail.com

Tom has taught mathematics for 35 years at Fitch High School in northeast Ohio where he earned National Board Certification, the Presidential Award, and other recognitions. Tom also taught mathematics, computer science, and mathematics education as an adjunct instructor at Youngstown State University for 38 years. Since 2009, he has been working full time as a Senior Math Advisor for Texas Instruments in Product Development and Strategy. Tom has been providing professional development nationally and internationally since 1995, traveling to 49 states and 7 countries. Most recently, his interests are increasing ACT and SAT student success, transformational geometry, families of functions and their transformations, and math modeling data that creates social awareness.

In August 2019, Tom attended a 3-day seminar with former Vice President Al Gore and his Climate Reality Project in Los Angeles. Since then, he has given over 30 presentations about climate change and its consequences, while modeling climate data with high school mathematics. These presentations have made students aware of Climate Reality but at the same time illustrate useful applied mathematics. This past January, Tom attended an online webinar with Al Gore and received an update on the state of climate globally. This is what Tom wants to share with you for this presentation. Points & Angles 1

## **Points From the Interior** By Serg Cvetkovic

Approximately 16 years ago, I struck up a conversation on the 'L' (does anyone still call it that?) with another passenger over a novel she was reading. In typical conversational fashion, it was not long before she asked me what I did for a living, and when I said, "I am a math teacher," she replied with, "Oh wow, you must be a genius." When I asked her what made her think that, she said, "You teach a subject that nobody understands and everybody hates." Little did I know (this was EARLY in my career) that my tenure of being a math teacher would be full of such comments. Not a week goes by where I do not hear such comments as, "I hate math," "Why do we have to take math?" and "I cannot wait until next year, when I don't have to take any more math." I am sure that everyone reading this has had similar experiences. Thus, I will ask the tired question, "Why does mathematics not get the love that other subjects do?" It is a given that mathematics is and can indeed be difficult. However, is mathematics any more difficult than making sense of and interpreting a novel? Producing a captivating piece of art? Playing a musical instrument? Figuring out how to beat a video or PC game? Becoming a stellar athlete? The answer to all those questions is "not really." Then what is the great mystery, the "missing link" to why so many individuals develop a fear, hatred, or displeasure towards the beautiful subject of mathematics? Let us ponder this for a moment and ask ourselves and each other some more questions.

Is the fact that mathematics is a sequential subject, where one simply cannot turn to a random point and begin the journey, an immediate turn-off? For example, one can pick up a basketball and start shooting baskets or grab a pencil and paper and start doodling, but one cannot pick up a calculus book and expect to master the content without first having a solid proficiency in algebra and trigonometry. Do school mathematics lessons typically involve too much drilling and memorization? Do mathematics educators tend to keep the subject in an isolated silo and not relate it enough to real-world phenomena? Are lessons focused too heavily on standardized test preparation, explicit calculator practice, and ditto worksheets instead of allowing for exploratory activities and metacognitive discussion? Are too many mathematics instructors rigid and afraid to be humorous, entertaining, or personable every now and then? Is there a severe lack of compelling mathematics educational programming, beyond counting, arithmetic, and learning shapes? "Quite possibly" would be the appropriate response to all those questions. So, now that we have brainstormed some possible reasons as to why *Team Mathematics* has fewer fans in the stands (this is happening in a universe free from COVID-19) than *Team English, Team History, Team Art, Team Music,* etc., let us brainstorm some viable ways to steal some fair-weather fans from the other teams and make them permanent fans of *Team Math.* 

My personal suggestions...1) There are many concepts in geometry, combinatorics, probability, counting, number theory, graph theory, etc. that require minimal to no prerequisite knowledge. Start out the year by implementing lessons that everyone can do and be successful at. Hook them in, and gradually build up from there. 2) Have more exploratory activities that subliminally teach important mathematical concepts in the context of having fun. Origami, Mondrian art puzzles, logic games, SET, and Desmos activities come to mind. 3) Implement some lessons that relate to current events and that are sure to drive some great dialogue and critical thinking. Fair minimum wage, COVID-19, political gerrymandering, school funding, and the Electoral College are all great topics. 4) Turn the occasional lesson into a show. If an English teacher can dress up as Shakespeare or Moliere and don a fake British or French accent, a mathematics teacher can dress up as Newton or Ada Lovelace.

What are your thoughts and ideas? Please feel free to share at an upcoming MMC event!

#### Are your MMC communications being sent to your school address while you are teaching remotely?

You can update your membership address by contacting Mary Wiltjer at mwiltjer@glenbrook225.org.



## Some Great Middle and High School Mathematics Lessons Worthy of More Attention By Steve Starr

Zalman Usiskin has presented at the end of every even-year MMC dinner meeting for decades now, so this was decidedly an odd presentation. But notwithstanding, it was an inspiring, masterful, engaging, and eminently useful presentation--a ten course feast of teaching mathematics from Zal.

Zal began by asking, "What is a lesson? ... A *lesson* is **an** *interaction* **between content and learner about a specific idea that has (relatively) wide applicability."** The "wide applicability" in the lessons he chose ranged from relationships to other mathematics, to generating excitement, to applications in the world.

But before going on with the lessons, Zal gave kudos to our own MMC member, Doug O'Roark, who has just won the Rosenthal prize from the Museum of Mathematics in New York City for the best mathematics lesson submitted this year. Congratulations, Doug!



The brief summaries that follow don't do justice to his presentation, so fortunately, Zal has generously offered to share his slides for the asking at z-usiskin@uchicago.edu.

#### Lesson 1: The Number-Numeral Distinction

"Number is a concept; what is written is a numeral." Fractions, decimals, and percents are not numbers; they are various representations of a number. This lesson was a strong reminder for us to strive to make clear this basic idea and a reminder that students' struggles are often about various representations and the algorithms developed around these representations, especially with equivalence between representations: "If 20% = 1/5 and 25% = 1/4, is it true that 45% = 1/5 + 1/4?"

#### Lesson 2: "When the real world is staring you in the face and you don't see it."

Students see that a cardioid sort of resembles a heart (even without knowing the etymology). What beautiful mathematics can students explore if they have time to try to make it even more heart-shaped?! "What else can we describe by a single mathematical equation?" We are encouraged to make connections to the world outside our classroom, not only mathematical connections but visual and emotional connections as well.

#### Lesson 3: A "Nat King Cole" Lesson ("Unforgettable")

"Think back to when you were a student...Is there any single mathematics lesson that you remember? Generally, such a lesson has to be a departure from the class's usual routine, and it has to have something you can take with you outside the classroom." Zal showed a sequence of lessons starting with students learning enough about origami to make a jumping frog, an amazing use of geometry in itself, and then going on to use their frog to explore statistics about how it jumps. Two aspects of mathematics tied into one emotional experience!

#### Lesson 4: The Product of Two Negative Numbers

After quickly describing three usual methods of presenting this topic, Zal showed us his favorite method, using the geometry of multiplication applied to vertex coordinates of a simple polygon on the coordinate plane. What happens when the coordinates are multiplied by a positive number? A negative number? The same negative number twice? A stunning visual demonstration of why the product of two negative numbers returns to positive.

#### Lesson 5: Real Situations with Polynomials of Any Degree

How many of us have struggled to make polynomials relevant to our students? One student inspired Zal to create a lesson beginning with this scenario: "Each birthday from age 12 on, Mary has received \$100 from her grandparents. She saves the money and can get 4% interest a year. How much will she have by the time she is 16?" If the sum is calculated year after year, each year introduces a new term and raises the exponent of previous (exponential) terms. It's a polynomial!

## Zalman Usiskin's Talk Summary (cont.)

#### Lesson 6: A Summary Lesson for a Unit on Volume

One painful memory I hear from many people about their mathematical education is "I hated memorizing all those formulas." So after students have successfully struggled to find volumes for prisms, pyramids, cylinders, and cones, and the oblique versions of each, and then spheres, it's a satisfying achievement when they realize those nine formulas can be generalized into just three:

Prisms and Cylinders: V = hB

Pyramids and Cones:  $V = \frac{1}{3}hB$ 

Spheres (the weird one):  $V = \frac{4}{3}\pi r^2$ 

But in the highest spirit of mathematical generalization, can these all be seen as examples of one object with one volume formula? Zal showed us that yes, they can! We were astonished! I'll leave it to you to visit Zal's talk or (hint) explore the object known as the General Prismatoid.

#### Lesson 7: The "Big Four" – Powerful, Amazing, and Usually Neglected Trig Identities

It's often hard to motivate the usual trig identities. Many are at first surprising  $(sin^2(x) + cos^2(x) = 1)$  or have enough of a pattern that students deal with them, but why not astonish students with "the big four"? The first of these is: In every  $\triangle ABC$ ,

 $\tan A + \tan B + \tan C = \tan A \cdot \tan B \cdot \tan C$ .

I confess--I'd never seen it before, and it sent me straightaway back into trig! What a great motivational lesson! Lesson 8: The Probabilities of Winning Lotteries in The United States

Zal showed a table of various lotteries in the U.S. with their probabilities of winning the top prize. He talked about the rich mathematical fodder here, from calculating various combinations to exploring expected returns (always negative). He suggested we avoid asking students for calculations where the mathematics is readily available online and offered instead, "This is a great lesson to have students become teachers, explaining the mathematics that leads to the various probabilities."

#### Lesson 9: The First Three Lives of Angle Measure Addition - And A Fourth!

Zal emphasized that even before recognizing angles "as geometric shapes that are formed wherever two rays share a common endpoint" (CCSS MATH.CONTENT.4.MD.C.5), there is "an earlier manifestation of that property that is accessible earlier, involving physical turns. Children can do full turns – that is, turn all the way around – and half-turns and quarter turns. And these can be combined. And they can turn to their right and to their left to set the stage for combining counterclockwise and clockwise turns." After that basic intuition, adding measures of adjacent angles and a mathematical model of rotation come later in a student's career.

But then Zal asked us to consider representations of a rotation by a matrix. "And what we find by representing a rotation by a matrix is an insight that tends to astonish those who see it for the first time." And yes, how many of us remember what we first felt when we discovered that a rotation of magnitude x about (0,0) was

 $\begin{bmatrix} \cos x & -\sin x \\ \sin x & \cos x \end{bmatrix}$ ? Wow! And multiplying the matrices for rotations of magnitudes x and y gives us the formulas for  $\cos(x+y)$  and  $\sin(x+y)$  all on one line. Wow twice!!

#### Lesson 10: Measuring the Effectiveness of Vaccines

Taking his own advice to heart (see lesson 2), Zal gave us some ideas about incorporating this most relevant of topics into our lessons. He showed the reported efficacy rate of the three current vaccines and asked, "But what does the efficacy rate mean? What does it mean to say that a vaccine is 95% effective?" Many rich and urgent mathematical questions are here: How is efficacy calculated? How can it be expressed in different ways (percent saved, odds of catching the disease)? How good are these estimates?

A strong affirmative then to Zal's final charge: "I hope you leave this Zoom presentation feeling that at least one of these lessons will influence your teaching."

# MMC Scholarship for High School Seniors

The Metropolitan Mathematics Club of Chicago is offering a \$2,500 scholarship for a high school senior who will pursue a career in the teaching of mathematics. In addition, up to two Filliman Scholarships may be awarded for the same amount (funded by a gift from the Filliman estate). The selected students will be honored at the MMC meeting in May.

A selection committee of MMC members appointed by the Board of Directors will determine the scholarship awards. To be eligible, an applicant must be sponsored by a current member of MMC, submit the application, submit a transcript, request a letter of recommendation from a mathematics teacher, and respond to the prompts in point E below. All materials must be received by March 5, 2021. Feel free to email your submissions. You will receive a reply, so you know that it is being considered. The committee will evaluate applications and will make a recommendation to the Board of Directors as to the awarding of the scholarship.

The guidelines used for selection shall be:

A. Demonstration of overall academic scholarship with an inclusion of at least eight semesters of college preparatory mathematics (with a minimum cumulative grade point average of 3.0, where A = 4)

B. A statement of the intention to pursue a career in mathematics teaching

C. Indication of participation in extracurricular activities, especially those that may have a positive influence on a teaching career

D. A letter of recommendation from a math teacher who is familiar with the applicant's academic performance and his or her potential as a mathematics teacher (The teacher must be an MMC member.)

E. A short response from the candidate (1-2 paragraphs) to each of the following prompts:

- a. What qualities do you possess that will help you in a teaching career?
- b. Describe a teacher who has had an impact on your education.
- c. Was there a time when you struggled with a concept in a math (or other) class? What did you do?
- d. What was your favorite math class? Why?
- e. Describe your favorite math problem. What makes it so great?
- f. What excites you about mathematics?
- g. Why do you want to teach mathematics? This response may be longer than the others if necessary.

#### In addition to the application form (at mmcchicago.org), applicants must also send:

- 1. A letter of recommendation from a mathematics teacher, preferably not sent through the applicant\*
- 2. A current transcript for seven semesters of high school\*
- 3. Responses to the prompts in point E above

\*Letters of recommendation and transcripts may be sent by separate mail or e-mail.

Send to: Carrie Fraher Glenbrook South High School 4000 West Lake Avenue Glenview, IL 60026 (cfraher@glenbrook225.org)



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## MMC Board Election Candidate Biographies:

## **President-Elect Candidate:**

**Laura Kaplan**: I have been a teacher since 2000 and a member of MMC since 2005. I served on the Board of MMC from 2011-2017 and as Scholarship Chair from 2012-2017. I currently teach at Regina Dominican High School where I am the National Honor Society moderator. I would be truly honored to serve as MMC President and continue to bring our services to the Chicago area math education community.

## **Board of Directors Candidates:**

**Beth Ann Ball**: Beth Ann attended her first MMC meeting 20 years ago while student teaching and has been a member ever since. She is in her 19th year teaching mathematics at Maine South High School. As the mother of 3 grown children, she joined the MMC Board 3 years ago because she now has time to give back to the organization that she knows made her a better mathematician and a better mathematics educator. She welcomes the opportunity to serve a second term.

**Steve Condie**: Steve is retired from the Illinois Mathematics and Science Academy (2018) after teaching there for 23 years. He has been an active member of MMC for 25 years and has been on the board of MMC since 2018.

**Carrie Fraher**: I'm a past president of MMC and teach at Glenbrook South High School. It's been awesome to see our members benefit from virtual meetings during this time. I want to continue finding innovative ways to provide professional development and networking events to Chicago-area educators and math fans. I am currently the Scholarship Chair and hope that you are all looking for a student to nominate this year!

**Danielle Grenader**: Danielle has taught math for 5 years and currently teaches 6th grade math at Cicero East Elementary School. She previously taught high school math at Mundelein High School and Roberto Clemente Community Academy, where she started the school's first math team. Danielle plays an active role in her district by serving on her School Leadership Team and District Math Curriculum Committee. She also advocates for students more broadly through her role as a Teach Plus Illinois Policy Fellow. Danielle is a long-time math enthusiast and greatly enjoys surrounding herself with others who find just as much beauty and joy in the subject. She is currently the Social Media Chair on the MMC Board of Directors and would love the opportunity to continue in this role!

### **Gratitude for Conference of Workshops** By Maryjoy Heineman and Nicolette Norris, 2021 MMC Conference Co-chairs

The first virtual MMC Conference was held on Saturday, February 13, and it was a success. Thank you to all the speakers who were willing to present their talks in this new format. The attendees enjoyed being able to connect with the math content and pedagogy. You gave us some type of normalcy during these times.

A huge thanks goes out to the planning committee: Aimee Hart, Serg Cvetkovic, Rose Sterr, and Mary Wiltjer. Your dedication made it possible for this conference to transpire.

Peter DeCraene did a wonderful job with the registration and sending out all the links to the attendees. Thank you for also being available on conference day to help people with their links and other issues that arose.

The MMC Board volunteers who helped with the Zoom meetings were awesome. You helped to make sure each session ran smoothly.

We certainly know that teachers have enough on their plates, but fortunately, many felt that you needed more engagement and attended our after-session to talk to other colleagues about what was learned in the morning. It was great to see so many teachers excited and ready to use what they learned at the conference.

Soon, you will be hearing about the MMC Conference of Workshops 2022. We hope that we can have the conference in person. Please be on the lookout for information and the call for speakers during the summer.

Is your membership current? Check your mailing label to see when your membership expires. You can renew by mail with the form below or renew in person at the next dinner meeting.

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Make check payable to <u>MMC</u>	SPEAKER FUND \$			
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## **Upcoming Events**

Fri., Mar. 5 Tom Reardon	<b>Climate Change: Creatively Use Good Mathematics to Model the</b> <b>Reality</b> (via Zoom)
Fri., Mar. 5	<b>MMC Scholarship Applications Due</b>
Thurs., Apr. 15	MMC Ballots Due (Ballots will be mailed soon.)
Fri., May 14 Jackie Palmquist	<b>5</b> Surprising Benefits of Number Talks in Secondary Math Classrooms (via Zoon)



MMC Conference of Workshops speakers **John Benson** and **Steve Viktora**, who have spoken at every MMC Conference, led participants through some "Impossible Problems" at this year's remote conference.

Send upcoming event items to sburnett\_308@yahoo.com no later than the date of the MMC dinner meeting preceding the issue in which the item should appear. All items are subject to editing.

Your membership renewal date appears in the upper right corner of the label

I644 Portage Run Glenview, IL 60025