Mini-Focus

THE NEWSLETTER OF THE GOLDEN SECTION OF THE MAA

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Monique Chyba Wins Section Teaching Award

Monique Chyba, of the University of Hawai‘i at Mānoa, won the 2023 MAA Golden Section’s Distinguished College or University Teaching of Mathematics Award. The award was presented at the 2023 Golden Section Meeting held at Santa Rosa Junior College, on February 25, 2023. (See Monique Chyba’s complete award citation online.)

Since joining the faculty at Mānoa in 2002, Dr. Monique Chyba’s classroom instruction, place-based pedagogy, student mentoring, and community outreach initiatives have impressed her students and colleagues. A colleague stated “She not only shines individually through her clear and engaging style but also has worked to make substantive changes in the teaching infrastructure at the University of Hawai‘i. Her teaching often extends beyond the classroom through community engagement...(and) in using place-based knowledge to reform the quantitative reasoning curriculum.”

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Ariel Setniker Wins Section Award for New Teachers

Ariel Setniker, of California Maritime Academy, won the 2023 MAA Golden Section’s Distinguished College or University New Teacher of Mathematics Award. The award was presented at the 2023 Golden Section Meeting held at Santa Rosa Junior College, on February 25, 2023. See (Ariel Setniker’s complete award citation online.)

As an Assistant Professor at Cal Maritime, Dr. Ariel Setniker made key achievements in curriculum design and classroom instruction, transforming the learning experience for undergraduates. A senior colleague states “Dr. Setniker’s teaching effectiveness is truly remarkable. She brought to our campus much-needed pedagogical innovation in the instruction of mathematics and did this brilliantly.”

Dr. Setniker earned her doctorate in mathematics in 2019 from the University of Nebraska-Lincoln. Since joining

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Chyba: Teaching Award

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Dr. Chyba obtained her Ph.D. from the University of Bourgogne (Burgandy) in Dijon, France. She held research assistant positions at Harvard and Princeton and a visiting assistant professor position at UC Santa Cruz before joining UH Mānoa. Dr. Chyba has brought her skills as an applied mathematician to create engaging research opportunities for her students at the undergraduate and graduate levels. Her students have worked on projects spanning the sciences, including motion planning for underwater vehicles, medical imaging, analyzing microbiome data, and pandemic modeling.

Dr. Chyba has built opportunities for math students in a variety of ways. She was the PI on an NSF grant "SUPER-M: School and University Partnership for Educational Renewal in Mathematics" which trained 33 graduate students in science communication suitable for work with K-12 schools, which has led to ongoing outreach programs. A former student states "...her mentorship continuously helped me grow as a young scientist. I watched her communicate advanced mathematical concepts to the public with ease. She also placed high value on STEM outreach, trying to get students still in elementary and high school enthusiastic and curious about math…. Through this work, Dr. Chyba was a large part in my recognition of my own love for teaching.."

In addition to mentoring, Dr. Chyba's key achievements include the development of a university-wide program that trains undergraduates to aid in classroom active-learning activities, and the comprehensive redesign of the UH Mānoa department's Survey of Mathematics course, a large multi-section quantitative reasoning general education course. Dr. Chyba has been at the forefront of developing new, place-based quantitative reasoning material relevant to the Hawaiian Islands, e.g., the revitalization of Kahoʻolawe, hurricanes and other natural disasters, and climate change.

The Golden Section congratulates Dr. Monique Chyba, an exceptionally effective mathematics researcher, teacher, and educational leader.

Setniker: New Teachers Award

continued from previous page

Cal Maritime in 2019, Dr. Setniker has maintained research in pure mathematics and in mathematics education. This has allowed Dr. Setniker to engage students at different stages of their education, from redesigning gateway courses to leading undergraduate research projects.

Dr. Setniker led redesign of mathematics gateway courses, creation of student workbooks, and undergraduate teaching assistant mentoring. She developed new course offerings and adopted open-access free textbooks which she supplemented with her own materials, including course readiness activities, reading guides, worksheets, and in-class interactive activities.

Dr. Setniker's teaching impact is felt throughout the campus, and her colleagues university-wide hold her in high esteem. A colleague from another department notes "She works hard to make her classes particularly fun and engaging, inspires students to excel, and finds effective ways to engender student learning."

She has been highly involved in and now leads the campus-wide faculty development team, finding new ways to support her fellow faculty interested in learning and implementing new pedagogical methods.

Testimonies from students and colleagues all point to Dr. Setniker's unique skill at helping shift attitudes about mathematics towards more positive feelings and increasing self-confidence. This is accomplished through active learning strategies in the classroom, connecting with students so they feel supported in sharing their challenges, offering extra office hours, and providing one-on-one help. One student states "She would take the time to help me fully understand the material, no matter how long it took. With her level of dedication to my success, I am where I am today."

The Golden Section congratulates Ariel Setniker, an extraordinarily effective and inspiring new teacher!

Teaching Awards: Call for Nominations

2024 MAA Golden Section Distinguished Teacher of College or University Mathematics Award (General)
&
2024 MAA Golden Section Distinguished Beginning Teacher of College or University Mathematics Award

The MAA has two awards for distinguished college or university teaching of mathematics: the Deborah and Franklin Tepper Haimo Award (instituted in 1991) and, for beginning college or university teachers of mathematics, the Henry L. Alder Award (instituted in 2003). The recipient of the Golden Section Teaching Award (General) is nominated by the Section for the MAA Haimo Award. The recipient of the Golden Section New Teaching Award is nominated by the Section for the MAA Alder Award if the recipient holds a Ph.D. The Golden Section has a two-step nomination process that consists of (i) the initial nomination, and (ii) the full nomination. The initial nomination is very simple and requires the filling out of a one-page form together with a one-page summary that supports the nomination. After screening the initial nominations, the Teaching Awards Committee will invite the nominators of clearly competitive nominations to submit full nominations. Members of the Golden Section are encouraged to nominate their exceptional colleagues for the two Golden Section Distinguished Teaching Awards (New Teacher and General). The formal Call for Nominations and the Nomination Form files are available through the Golden Section webpage. These files describe the award and eligibility requirements. The initial nomination deadline is

May 31, 2024

Please direct questions to Elizabeth Gross, Teaching Awards Committee Chair, University of Hawai‘i at Mānoa

Previous General Teaching Award Winners

An asterisk precedes names of those who went on to win a national Haimo Award.

1992 G. D. Chakerian, UC Davis
1993 *Paul R. Halmos, Santa Clara Univ.
1994 Jane Day, San José State University
1995 *Edward M. Landesman, UC Santa Cruz
1996 G. Thomas Sallee, UC Davis
1997 Jean J. Pedersen, Santa Clara University
1998 Donald C. Pfaff, University of Nevada, Reno
1999 *Leonard F. Klosinski, Santa Clara University
2000 *Evelyn Silvia, UC Davis
2001 Wade Ellis, Jr., West Valley College
2002 *Paul Zeitz, University of San Francisco
2003 Peter Tannenbaum, Fresno State
2004 *Gerald L. Alexanderson, Santa Clara Univ.
2005 Russell Merris, Cal State East Bay
2006 Tatiana Shubin, San José State University
2007 William Fisher, Chico State University
2008 John B. Thoo, Yuba College
2009 *Allan J. Rossman, Cal Poly San Luis Obispo
2010 Dennis Smolarski, Santa Clara University
2011 Joseph Conrad, Solano Community College
2012 *Matthias Beck, San Francisco State Univ.
2013 Steven Blasberg, West Valley College
2014 Duane Kouba, UC Davis
2015 Michelle Manes, Univ. of Hawai‘i at Mānoa
2016 Serkan Hoşten, San Francisco State Univ.
2017 Jesús De Loera, UC Davis
2018 Frank Farris, Santa Clara University
2019 *Federico Ardila, San Francisco State Univ.
2020 *Elaine Kasimatis, Sacramento State Univ.
2021 Nicolette Meshkat, Santa Clara University
2022 Jesús R. Oliver, CSU East Bay
2023 Monique Chyba, Univ. of Hawai‘i at Mānoa

Previous New Teaching Award Winners

An asterisk precedes names of those who went on to win a national Alder Award.

2016 Martha Shott, Sonoma State University
2018 Elizabeth Gross, Univ. of Hawai‘i at Mānoa
2019 Jordan Schettler, San José State University
2020 *Kimberly Seashore, San Francisco State Uni.
2021 Alison Lynch, CSU Monterey Bay
2022 Andrea Arauza Rivera, CSU East Bay
2023 Ariel Setniker, Cal Maritime Academy

Interested in hosting the section meeting or serving in a leadership role?
Please contact one of the officers listed on the cover for more information.
We want you!

Diane Resek: Logician and Mathematics Educator

By family and friends of Diane Resek

Diane Resek, a brilliant contributor to mathematics education, passed away on March 19, 2023, at age 82 in her home in Berkeley. Diane and her brother Roger were born in Milwaukee's Whitefish Bay neighborhood, to J. Verne and Johanna Danziger Resek. She was schooled there, then earned a BA in philosophy from Wellesley College in 1962. Diane undertook graduate study in mathematical logic at UC Berkeley and was awarded a PhD in 1974 for her research on cylindrical algebras under supervision of Leon Henkin.

Diane worked in novel ways with students and teachers, developing innovative curricula to make mathematics more meaningful and accessible. Alongside her graduate study, she developed courses for preschool and elementary school teachers and wrote scripts for educational mathematics films. From 1975 to 2005 she served on the faculty at San Francisco State University (SFSU), first as lecturer then advancing to Professor of Mathematics. She created the SFSU course Math without Fear and with colleagues constructed and published an entirely new high-school curriculum, the Interactive Mathematics Program. Diane published numerous articles and books that continue to influence mathematics instruction today. She worked diligently to attract more girls and women to mathematics and science, designing a Math for Girls course at the Lawrence Hall of Science in Berkeley and supporting Expanding Your Horizons conferences in the Bay Area. In December 2023, Diane posthumously received the California Mathematics Council's Edward Begle Award, as her far-reaching work continues to influence teachers and students.

Throughout her career, Diane maintained currency in logic by teaching occasional courses, co-authoring a 1991 paper refining her PhD research, regularly attending the Berkeley Logic Colloquium, and referring to logical ideas in teaching elementary mathematics.

Diane traveled extensively throughout her life, broadcasting her work and snorkeling the seven seas. She was also deeply involved in various causes outside academia, including Food Not Bombs, Ashby Village, and the Berkeley Path Wanderers. Diane was a center of social activities for those and a beloved member of her community, regularly surrounded by dozens of loving neighbors, friends, and fellow volunteers.

Diane had strong opinions and felt free to scold vehemently even close friends when we disagreed with her. But generosity, warmth, and humor pervaded her interactions. We mourn her deeply.

In Memory of Rick Scott, Santa Clara University

By Frank Farris

Rick Scott, a beloved member of the Department of Mathematics and Computer Science at Santa Clara University, died peacefully at home on Wednesday, April 12th, 2023. We join with all those who loved and cared for Rick to remember the gift of his generous life.

Rick graduated from SCU in 1988. He proceeded on to graduate studies in mathematics at MIT. From there, his work under Bob McPherson led him to post-doctoral positions at the Institute for Advanced Studies in Princeton, and The Ohio State University. He returned to his native California and joined the faculty at SCU in 1997. Rick quickly rose through the ranks to achieve the distinction of Professor in 2011. In 2014, Rick received a prestigious Simons Faculty Collaboration Grant of $35,000 to support his numerous collaborations with colleagues around the world. He supervised numerous student research projects and was widely admired for his excellent teaching.

Rick's deep love of mathematics and music was widely shared among family and friends. He enjoyed playing cards, camping, and fishing. His sharp wit, easy humor, and generosity will be profoundly missed.

Rick is survived by his wife, Norine, and two daughters, Audrey and Emily. Predeceased by his sister Linda ('90), Rick is also survived by his parents, Stan and Carol, his brother Terry, his sister Nancy ('92), and several nieces and nephews. Rick's family has requested that commemorative gifts be directed to the department's Alexanderson-Pennello Fund to support an annual Rick Scott Memorial Scholar. These students will carry out research in the field of mathematics that Rick loved so much. To donate, start at https://mysantaclara.scu.edu/givenow, select Other, and enter "Alexanderson-Pennello Fund" in the box provided. Please designate your gift in honor of Rick Scott.

Editor's Note

No news items were received this year. For this reason, the "News From the Section" portion of this year's newsletter is absent. The call for news items was made twice via MAA Connect with the Golden Section Digest sent by email. If you have feedback on this process or questions or concerns, please contact the editor directly.

MAA Congress Report

by Yue Lei, Congressional Representative

The Congress of the MAA met in-person at MathFest in Tampa, FL on Wednesday, August 2, 2023, from 08:30 a.m. to 3:35 p.m. Here are some of the highlights, based on my personal notes and minutes of the congress meeting by Linda McGuire, EPaDel Section Representative, who was standing in for Emily Hynds, MAA Congress Recorder.

Presidential Update by MAA President Hortensia Soto

After giving a brief overview of her recent and future activities as MAA president, including addressing concerns regarding the decision to hold MathFest 2023 in Tampa, President Soto solicited and addressed questions from meeting attendees. She noted that MAA tries to offer a variety of meeting structures to reflect the principles of active learning. She emphasized that the MAA cultivates safe and welcoming professional environments and prioritizes being respectful of people and opinions that included showing respect for those who cannot or have chosen not to be at those meetings.

Other Updates

The MAA 2022 Impact Report (https://2022report.maa.org/) was publicly launched on Friday, July 28, 2023. Congress participants were encouraged to reference and share this report and to use these materials at section meetings, as it reflects the data which the MAA relies on to make policy decisions. it is also a document that students will find valuable to explore, especially if they are interested in getting involved with the MAA.

MAA Treasurer C. Allen Butler remarked that the MAA fared better fiscally in 2022 than in 2021. There are still lingering effects from the Covid-19 era. For example, participation in AMC competition is still down.

MAA Director of Meetings and Member Relations Cheryl Adams reported that the MAA is moving toward a rollout phase of the new Fonteva management database and indicated that they hope to complete a full rollout by the end of the year.

Senior Director of Programs at MAA Deirdre Smeltzer highlighted an overview of 13 grant-funded MAA programs across three categories: curriculum resources, outreach initiatives, and professional development.

MAA Strategic Plan

MAA Executive Director Michael Pearson, Congress

Chair Edray Goins, and President Hortensia Soto led a session on MAA Strategic Plan. They outlined the status of planning process, the changing landscape of higher education, the new set of questions that the organization faces, and the themes of greatest interest that emerged from the MAA member survey. The congress participants were then divided into teams and brainstormed for ideas of concrete actions.

Task Force on Minority/Marginalized Representatives

Minority/Marginalized Representatives Alejandra Alvarado and Aris Winger led a lively discussion on the purposes, roles, and duties of the minority/marginalized representatives. Congress Chair Edray Goins wrapped up the discussion by encouraging section representatives to reach out more to marginalized groups and to listen to their comments and concerns.

Changes to MAA Bylaws & Congress Bylaws and Congress Elections

Past MAA President Jenny Quinn provided context for the changes and outlined the proposed changes for consideration. Congress members were afforded time to read and converse in small groups about proposed edits. A discussion ensued and participants raised comments and questions. There was a motion to approve the proposed changes with the understanding that certain language will be edited before the changes go for votes by the full MAA membership. The motion passed.

MAA Congress Vice Chair Monika Kiss presented the Congress election ballot and offered a special thank you to the elections committee.

Closing Activity and Remarks

Congress participants generated and voted for ideas that they would love to see the MAA do. Congress Chair Edray Goins brought the meeting to a close by noting that "This is a really special experience." He appreciated that many were confused on how to view having MathFest in Florida and acknowledged fears that many had for the safety of members of our community. He expressed the hope that the organization will be richer for the discussions and actions this situation has brought about.

Report on the Section Meeting at Santa Rosa Junior College, February 25, 2023

by Ed Keppelmann

With spectacular weather and hospitality that was beyond compare, I think everyone had a great time at this meeting at Santa Rosa Junior College. I consider myself particularly fortunate to have been there – my wife Jackie and I left Reno at about noon on Friday but after trying all sorts of routes to get over the mountains (the roads were closed after we had gone south for many hours and so we turned around and came back!), it wasn't until nearly 10 pm that night when I had all but given up trying to cross Donner Summit and was about to head back to Reno when one final try proved successful and CalTrans said we could proceed! Consequently, we were a bit late the following morning, so I apologize that not everything started on time.

Dr. Edray Goins from Pomona College, Chair of the MAA Congress, spoke to us about A Friendly Introduction to Monodromy. His basic motivating examples included the hour, minute, and seconds hands of a clock which can be represented by $f(t) = ie^{-2\pi int}$ where for the minute, second, and hour hands we have, respectively, $n = 1$, 60, and 1/12. Note here that the multiplier i and negative exponent gets us a clock which runs (as the name implies is necessary) clockwise and can be viewed here: https://www.youtube.com/watch?v=70xzQcQTlgU. Another example is the layered covering space type aspect of a parking garage as shown here: https://www.3dcadbrowser.com/3d-model/garage-parking-four-level. Edray jokes about why it is so easy to lose your car in such places – every floor looks the same!

Intuitively explained, monodromy is the notion that in certain situations, both discrete and continuous, there are functions into structures whose outputs lead to a kind of semi or actual periodicity in which most features are the same except for notions of quantities like winding numbers and levels. This concept, which is a part of group theory, differential equations, and topology just to name a few of the subjects that play a role, has some important applications in the solutions of polynomial equations.

We are probably all familiar with the well-known quadratic formula and why it often gives answers with a plus or minus form like the solutions of

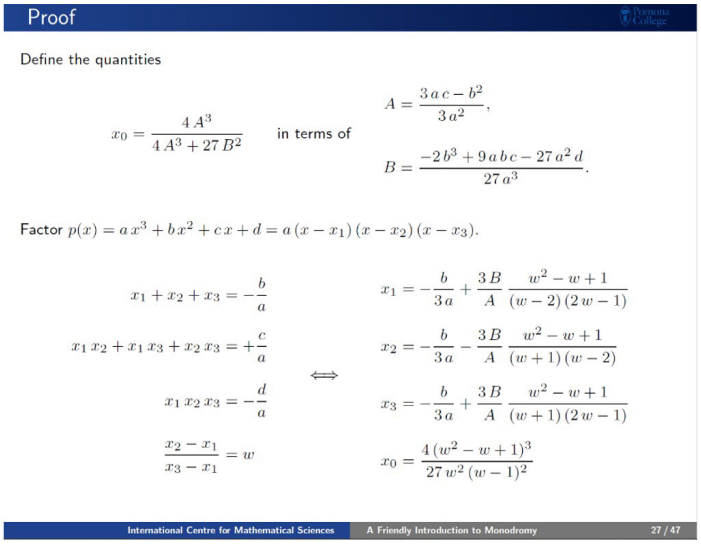
$$x^2 - 44848x + 502833753 = 0$$

which are

$$x = 22424 \pm \sqrt{2023}.$$

(How about that for the past and future of the Golden section!?) A deeper look shows that there is actually an analytic function whose local inverse at a certain value arising from the discriminant of the equation gives a monodromy function which swaps the two roots. This notion generalizes to higher degree polynomials.

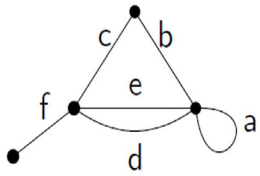
In this regard it was quite breathtaking to see the general formula for the solution of the cubic equation where you can almost see a similar monodromy:



Probably most readers have heard of or know about the unsolvability of the quintic. If you were like me, and although maybe once you knew better but years spent in other mathematical pursuits brought on a naïve view of this notion, I failed to appreciate the finer detail here that we don't mean completely unsolvable but just unsolvable using radicals. That there may actually be a different kind of general formula arising out of this notion of monodromy which Dr. Goins and his REU participants are working on was quite breathtaking and extremely intriguing!

After the first talk we had our annual business meeting (which due to newly adopted language at the national level should not be confused with our executive committee meetings each April and October). With unanimous approval, Max Sklar from Mission College was named our new vice chair. Max is the son of David Sklar – a longtime supporter and member of the section. In fact, David was one of our few Golden Long-Time Leaper Doubles who registered for both the Feb 29, 2020, meeting at Mills College as well as the February 29, 1992, meeting at UOP. Because David served the rotation as a former chair, vice chair, and program chair, we might indeed be headed to a history-making situation three years from now when Max finishes his service, and we have our first father-son duo as former executive committee members.

Dr. Anastasia Chavez is a great local hero having started her career at Santa Rosa Junior college and now being a very successful professor at St Mary's college of California. She gave a very interesting and wonderful talk titled Matroids, Positroids, and Beyond! Matroids are a wonderful construct that generalize a great deal of mathematics – especially in graph theory and linear algebra. After hearing her talk I sort of think the following (or something like it) should be in every linear algebra course!



$$A = \begin{array}{c} \begin{matrix} a & b & c & d & e & f \end{matrix} \\ \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 \end{bmatrix} \end{array}$$

EDGE	a	b	c	d	e	f
COST	51	49	91	40	18	43

The column space of the matrix A has rank 3 and in fact there are five subsets of of the six columns which form a basis for the column space – namely

$$\mathcal{B} = \{\{b,c,f\},\{b,d,f\},\{b,e,f\},\{c,d,f\},\{c,e,f\}\}.$$

Any other subset of three of the columns of A will be linearly dependent as will any subcollection of four or more columns. This is mimicked in the graph on the left where the notions of independence/dependence and basis also exist. For if in the graph if we choose any subset of the edges listed in $\mathcal{B}$, we will get a maximal spanning tree (i.e., a graph with no loops). If we choose any other subset of three edges not listed in $\mathcal{B}$ or any subset of edges of size four then there will be a loop in the resulting subgraph. This is an example of an underlying matroid of rank 3 which is both representable (as a matrix) and graphic. In general then a matroid consists of a set with a collection $\mathcal{B}$ of subsets of a certain fixed size that act as bases by showing you what the maximally independent sets are. These have the following property (which is automatic if we use linear algebra): Given any two elements (i.e., subsets) A, B

$\in \mathcal{B}$, if you pick any a$\in$ A, there will be some b $\in$ B, so that if you replace a with b in A , (i.e., form the set $(A - \{a\}) \cup \{b\}$), this will be an element of $\mathcal{B}$. In other words, any independent set of size 2 can always be completed to be a basis.

In one of many possible applications this basis creating feature of matroids means that these objects are excellent for solving combinatorial problems like the Traveling Salesman Problem. The general traveling salesman problem involves a connected graph with n cities. Each edge of the graph has a cost associated to traveling along that edge – some sort of travel cost. The salesman needs to find a path that goes through all the cities and minimizes the cost. In general, the only way to find such a minimal path is by trial and error which, when there are even a modest number of cities leads to a combinatorial explosion. However, in the case of a matroid the greedy algorithm is always a solution. To illustrate we have assigned random weights to the edges of the graph above:

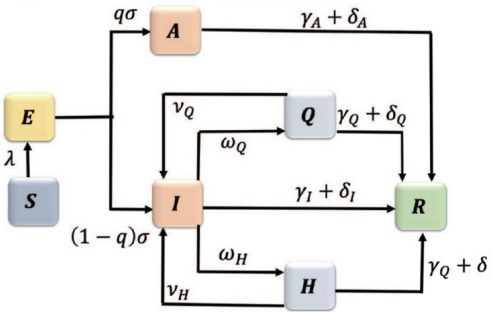
The greedy algorithm works by making, at each step, the best local choice provided no dependency is introduced. This means we can turn locally optimal choices into globally optimal ones. To illustrate here in this example, we start by picking the cheapest edge e. The next cheapest edge is d. However, $\{e, d\}$ has a loop and so we cannot accept d. The third cheapest edge is f. Since $\{e, f\}$ has no loops we now have an independent set of size 2. The fourth cheapest edge is b and in fact one can check (in this case) that $\{b, e, f\}$ links all the nodes with a minimal cost of 49 + 18 + 43 = 110.

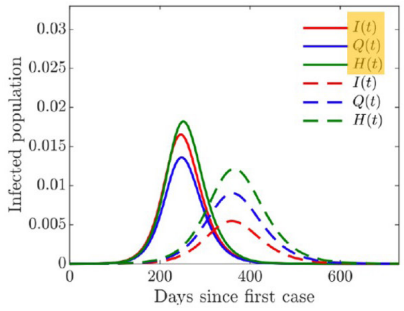
Our next speaker Omayra Ortega of Sonoma State University presented an inspiring and impassioned talk about different kinds of greatness in mathematics. In particular, Omayra believes that the publish-or-perish mandates faced by most professors are not always in the best service of our students. These can and should be changed and there is really no need for institutions and departments to sacrifice the true spirit of their missions.

With an incredible record of summer research mentorships (and the obtaining of the many grants and successful collaborations needed to foster these) for undergraduates and graduate students at all levels both within and outside of mathematics, Omayra is certainly a great mathematician in the way she truly lives out this message of reform. She related work on a variety of summer projects which included the following. In the summer of 2019 with support from the Association for Women in Mathematics (AWM), Women in Math Biology (WIMB), and the Institute for Pure and Applied Mathematics (IPAM), she worked with students on the modeling of Malaria transmission in Botswana and Zimbabwe. In 2020, she took advantage of the pandemic to work with students on her campus to model the transmission of COVID-19. As shown below, the model her students created is quite extensive and realistic.

Variable	Description
$S(t)$	Proportion of susceptible individuals
$E(t)$	Proportion of exposed individuals
$A(t)$	Proportion of asymptomatically infected individuals
$I(t)$	Proportion of symptomatically infected individuals
$Q(t)$	Proportion of quarantined individuals
$H(t)$	Proportion of hospitalized individuals
$R(t)$	Proportion of removed individuals

Parameter	Description
β	Infection rate
η_A, η_Q, η_H	Modification parameters for asymptomatic, quarantined, and hospitalized infection rates
q	Proportion of exposed developing asymptomatic infections
σ	Disease progression rate from the exposed to infectious
$\gamma_I, \gamma_A, \gamma_Q, \gamma_H$	Recovery rates of symptomatic, asymptomatic, quarantined, and hospitalized individuals
ω_Q, ω_H	Quarantine and hospitalization rates
ν_Q	Quarantine violation rate
ν_H	Hospital discharge rate
$\delta_I, \delta_A, \delta_Q, \delta_H$	Death rates of symptomatic, asymptomatic, quarantined, and hospitalized individuals





As Omayra notes, these mentorships foster increased expertise by, in this case, Biology students in their own field as well as an appreciation for mathematics. The experiences create a rich community of shared values which teaches resilience when solving problems and promotes deep and careful consideration of future career options. In an excerpt from A Poem: Bob Moses 1932-2021 by Alice Walker we have the following beautiful words of wisdom: “The world is filled many vineyards in which to labor. Look deeply in the valley in which your talent and spirit have found rest and energy. Flow with that offering.” In this same spirit, Francis Su offered these words which Omayra shared: “Maybe the way for you to see yourself in mathematics is not for me to convince you that math is great or that math does lots of wonderful things, but for me to show you that math is intimately tied to being human.”

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THE MATHEMATICAL ASSOCIATION OF AMERICA – GOLDEN SECTION

Saturday, February 24, 2024, at UC Santa Cruz

All talks and lunch are held in Stevenson Event Center

To register, go to: sites.google.com/view/golden-section-2024

Registration: $25 (regular) or $10 (student/retired/unemployed) Lunch: $15

See page 15 for directions on how to get to the meeting

The schedule below is tentative. Please see the online version for the latest information.

Time	Event	Presider
8:30-9:30	Registration/Refreshments in Stevenson Event Center	
9:30-9:45	Opening Welcome	TBA TBA
9:45-10:35	Haydee Lindo, Harvey Mudd College	TBA
10:35-10:55	Section Business Meeting (all are welcome)	TBA
10:55-11:45	Frank Sottile, Texas A & M University	
11:45-12:30	Lunch	
12:30-1:15	Poster Session and Mathematical Art Exhibition	TBA
1:15-1:35	Teaching Awards	TBA
1:35-2:25	Adriana Salerno, Bates College	TBA
2:35-3:25	Stephen DeBacker, University of Michigan	TBA
3:45-4:35	**Della Dumbaugh, University of Richmond**	TBA
4:35-4:40	Closing Remarks	Outgoing Chair Max Sklar Incoming Chair TBA

Program Abstracts

Haydee Lindo, Harvey Mudd College

Title Introduction to trace ideals and centers of endomorphism rings

Abstract: In many branches of mathematics, the full set of "functions" between two objects exhibits remarkable structure; it often forms a group and in some special cases it forms a ring. In this talk, we will discuss this phenomenon in Commutative Algebra. In particular, we will talk about the endomorphism ring formed by the homomorphisms from a module to itself by first looking at commuting square matrices with real entries. The well-known trace map on matrices can be generalized to a map on any module over a commutative ring. The image of such a map is a trace ideal. I'll introduce the trace ideal and explain its role in the question "What properties of a module does its endomorphism ring detect?"

Frank Sottile, Texas A&M University

Title Galois groups in Enumerative Geometry

Abstract: In 1870 Jordan explained how Galois theory can be applied to problems from enumerative geometry, with the group encoding intrinsic structure of the problem. Earlier Hermite showed the equivalence of Galois groups with geometric monodromy groups, and in 1979 Harris initiated the modern study of Galois groups of enumerative problems. He posited that a Galois group should be `as large as possible' in that it will be the largest group preserving internal symmetry in the geometric problem. I will describe this background and discuss some work of many to compute, study, and use Galois groups of geometric problems, including those that arise in applications of algebraic geometry.

Adriana Salerno, Bates University

The Mathematics of Secrets

Abstract: Information permeates our lives. We send texts, shop online, pay bills, type emails, and store pictures and medical data in "the cloud". Hidden from view is the mathematics needed to make information transfer efficient and secure. This talk will give an overview of the history and the evolution of coding (turning information into numbers) and encryption (securing the information), from ancient times to the modern era, and we will look at how mathematics is the key to it all.

Stephen DeBacker, University of Michigan

Making Connections Across Algebra, Analysis, and Geometry

Abstract: In the fall of 1988 Paul Halmos hired me, then a 19-year-old undergraduate, to do a bit of research. He was writing the paper "Has Progress in Mathematics Slowed Down?" (Monthly, 1990) in which he identifies 22 mathematical concepts, explosions, and developments that had occurred during the first 75 years of the MAA's existence. My specific task was to find and report on every article in the Monthly where these 22 subjects had appeared. It was an eye-opening experience for me: almost nothing that I had learned as an undergraduate was among the 22 subjects. Why had I not been exposed to more of these subjects, at least in passing? I think there are many good reasons, including the fact that there is quite a bit of pre-1915 mathematics that is beautiful, valid, and useful in essential ways. However, I think that some of the fault also lies with how many (most?) math instructors silo their teaching: calculus is about calculus, algebra is about algebra, analysis is about analysis...and so it is unnatural for teachers to discuss mathematical ideas that fall outside the subject matter of the class. I will discuss an example where I try to break this approach to teaching in my introductory analysis courses.

Della Dumbaugh, University of Richmond

Every Paper Tells a Story: Reflections on the Monthly

Abstract: Over its 130-year history, the American Mathematical Monthly has not only featured a wide array of mathematics on its pages but also a host of other insights related to the discipline. From Nobel prize winning ideas to careers inspired by a local drugstore to mathematical menus created by students, this talk showcases the riches of the Monthly and what we can learn about the profession. This talk also includes tips for publishing in the journal today.

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Our next speaker was Anthony Várilly-Alvarado from Rice University. This is where we learned some philosophy behind coding theory and its important applications to the massive amounts of data now stored and analyzed all over the Internet. In Ancient Times (like when I was a child), we used very simple schemes like attaching a parity bit to a sequence of ones and zeros to detect errors. The parity bit would be set to 1 or 0 depending on the number of 1s (odd or even) in the intended base-two word. This way if the parity of the bit doesn't agree with the parity of the word received then we know there is an error and we can request retransmission. This was obviously very primitive in many ways. First, we could only detect the errors and not correct them and second, if an even number of errors were made (e.g., six wrongs make a right) then we would never notice any problem. Later on, schemes were used to create parity digits that looked at different sets of digits or that used weighted sums to make parity calculations. These multiple pieces of information could sometimes be used to essentially triangulate and correct errors. Today's schemes go way beyond these simple ideas.

In today's technological world codes are used which have all sorts of wonderful features. Not only can we detect and correct errors in individual entries by making computations in r other entries (a feature called r-locality) but we can also determine an intended message by using a certain minimum distance d between code words. Anthony motivated this notion of minimum distance for us in a very clever way as follows using the English language. If you just look at all possible symbol arrangements there are 26^{10} possible ten letter words. Of course, most of these are nonsense like ygfetodskg. In fact, only about 37,000 of the approximately 140 trillion possible ten letter words are actually in the dictionary. Humans are usually very good at detecting intended meaning when they, for example, receive a text. However this will not always be the case! Do you know what the following says? (try it and check the end of this subsection of the article for the answer!)

Color_ess gree_ _deas sle_p fu_ious_y

For a computer of course the work must be systematic. By defining an obvious sort of Euclidean distance between 10 letter words based on say the square root of the sum of squares of the number and size of changes (by going up or down consecutively in the alphabet) that we must make in each letter to go from one word to another, the basic plan would be to find some maximum distance that any word would be from an acceptable word. We can then assume that whatever we receive must have been intended to be the actual word that is closest to our given word. In actual coding theory the acceptable code words are vectors in some finite dimensional space that are systematically spaced using the fact that they are a linear subspace or the solution to some algebraic equation. We want the minimum distance d between code words to be as large as possible given the amount of information we have to encode, the dimension of our vector space, and the number of actual legal code words. Then we can hopefully nearly cover the possible word space with disjoint Euclidean disks of radius d. When we receive a word in one of those disks we interpret this to be the actual acceptable word at the center of that disk. If we receive a word not in any disk then this is considered too garbled to understand and we ask for a retransmission.

Anthony works on all these schemes to find all sorts of theoretical and actual (i.e. codes actually created) bounds on the minimum distance d (which we maximize), the locality r (which we minimize) and the dimension (minimize) and number of code words (maximize). The more possible code words the more meaning or information we can transmit per code word.

In the case of ten letter words in English the situation is not at all optimal. Take, for example, the words adjunction and abjunction. The first word can have many contexts but generally refers to a combining that has taken place without overlap between two similar objects. The second word is synonymous with abstriction and is a technical biology term that refers to the creation of spores by a certain type of technical procedure. The Euclidean distance between these words is only two units (i.e., go down two letters from d to b). This means that if we want to have uniform-sized disjoint disks in ten-letter word space whose centers are all valid English words, then we have to use disks of size 2 at the most (maybe only $d = 1$ will work!). This means that a vast portion of the ten-word space will be uncovered by these disks. Hence most nonsense words received could not be corrected.

The actual phrase missing letters is "Colorless green ideas sleep furiously." Don't feel bad if you couldn't

get this! It was a quote from Avram Noam Chomsky (a famous American linguist) who argued that it is well formed but meaningless. After all, how can something colorless be green and how can sleep (which is restful) be done furiously? This is coding theory on another level where we go beyond words to sentences and their grammar (which is fine here) and syntax (which is a mess). Noam presented the idea in his 1957 book Syntactic Structures where his search for a full syntax of meaning wasn't intended as a way to have computers correct errors, but rather as a means to compare and contrast different languages.

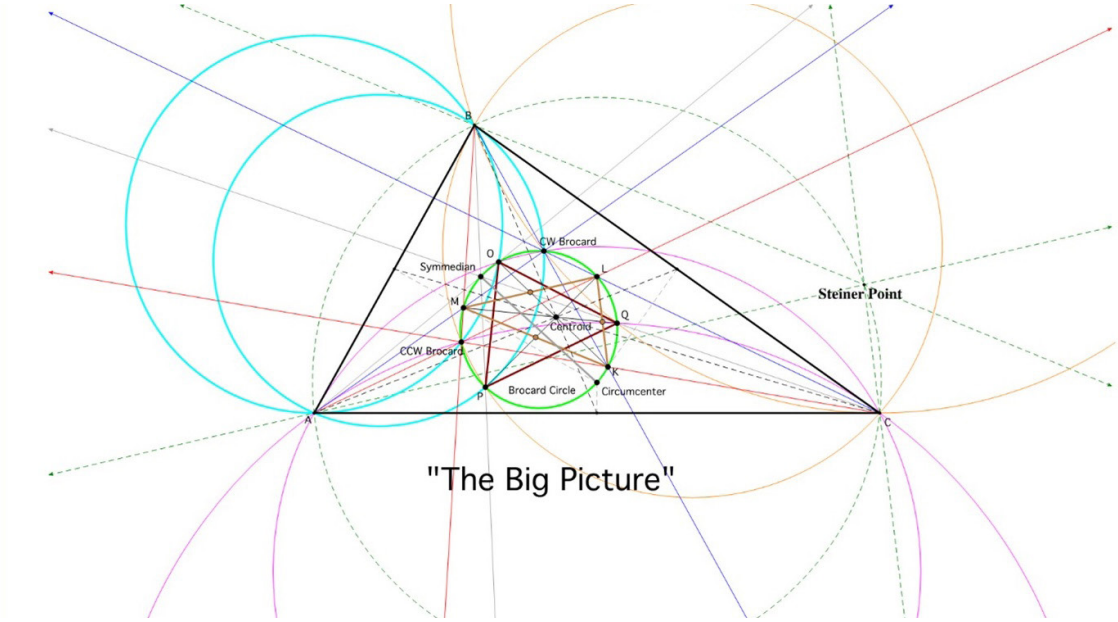
Our last speaker was actually an essentially last minute (i.e., in the last few weeks) addition to the program. We originally though that MAA monthly editor Della Dumbaugh would be joining us (we will see here in 2024 instead) so when that didn't work out Emeritus Professor Rick Luttman from Sonoma State University stepped in brilliantly to tell us all about the Brocard Miracles.

Pierre René Jean Baptiste Henri Brocard (1845-1922) was born in northeastern France. Brocard fought in the Franco-Prussian war of 1870 and spent ten years in Prussian prison. He was always a mathematical hobbyist and in 1881 he presented his paper (translated from French) Studies on a New Circle in the plane of a triangle to the French Academy for the Advancement of Science.

The story begins with an arbitrary but ordinary triangle ΔABC. Let us consider the angle bisectors and the medians at each vertex. If you reflect each median across its corresponding angle bisector you will get three lines that meet at the so-called symmedian point of the triangle. Take the line segment from the circumcenter of the triangle to the symmedian point and you have the diameter of what is called the Brocard circle. Now form three lines by going from the circumcenter perpendicular to each side of the triangle. Each of these three lines meets the Brocard circle in a single point. These three points together give the Brocard triangle which is circumscribed by the Brocard circle. Returning to the original triangle there is a line through each vertex which is parallel with a side of the Brocard triangle. These three lines then meet at the Steiner point. The resulting miracles (an abbreviated list is below) seem like a gift from heaven!

Of all circumscribing ellipses for ΔABC, the one of minimum area will meet the circumscribing circle at the three vertices of ΔABC and the Steiner point.

- The line segments used to find the Steiner point will meet the Brocard circle in three separate points. These points from the vertices of the Brocard triangle which is similar to ΔABC and is circumscribed by the Brocard circle.
- Consider the angles a,b,c at the respective vertices A,B,C of ΔABC. The Brocard angle α is defined by $\cot(\alpha) = \cot(a) + \cot(b) + \cot(c)$. Take the three rays formed from the sides of ΔABC and rotate them clockwise by α. These will intersect on the Brocard circle at a so-called Brocard point X. Similarly, take the three rays formed from the sides of ΔABC and rotate them clockwise by α. These will intersect on the Brocard circle at another so-called Brocard point Y. Then X, Y, and the symmedian point form a second Brocard triangle circumscribed by the Brocard circle and



also similar to $\triangle ABC$.

- A so-called set of three rose circles can be formed from each vertex of $\triangle ABC$ by forming the circle that is tangent to a different side of the triangle there. These Rose circles will all intersect at one of the Brocard points.
- A second set of Rose circles can be formed from each side and vertex of $\triangle ABC$. For each side take the perpendicular bisector of that side along with the perpendicular from another side through one of the vertices that make up that side. These pair of lines will meet at the center of this second rose circle. These three Rose circles will all intersect at the other Brocard point on the Brocard circle.
- Triangle $\triangle ABC$ and the two Brocard triangles all have the same centroid.

Rick summed it up nicely when he closed with the following!

If geometry were a novel, the writer would be criticized for making the plot so simplistic – so many coincidences, so many story lines brought improbably together. Yet in the real world of mathematical truth – as opposed to the fictional world created in the imaginations of novelists – such amazing collisions are common, and are the objects of our continuing awe.

The day was a success for these fine poster presenters and their advisors:

Edric Dabu and **Sienna Unter** of Santa Clara University (Advisor: Dr. Tamsen McGinley) presented *Determining Highest Weight Matrices in a Crystal of Type An*–1. After encoding the node relationships of a crystal graph as a matrix, these students show how certain geometric and algebraic actions correspond with operations on this matrix and give some insight into their structure.

Elijah Guptil, **Gregory Leathrum**, and **Daniel Sebo** of Cal Poly San Luis Obispo (Advisor: Dr. Sean Watson) presented *One Hundred and One Arabian Carpets*. They used Lapidus's Fractal Zeta function to analyze the complex dimensions of the components of 100 different modifications of the Sierpiński Carpet Fractal construction.

Pablo Curiel of CSU Chico (Advisor: Dr. Thomas Mattman) presented *Mathematical Modeling of Honybee Colonies Infested with Mites and Virus*. Using a model developed by Dr. Vardayani Ratti, Pablo did sensitivity analysis on the parameters of that 5 by 5 system of differential equations. The rates at which adults emerge from their pupa along with birth and death rates (especially of foragers), how frequently foragers are recruited, and the temperature of the colony are critical determinants of the model.

Connor Albright of Sonoma State University (Advisor: Dr. Kate Lorenzen of Linfield University) presented *Modifying Kemeny's Constant*, joint work with Ari Pomerance of Macalaster College, Abigail Nix of Middlebury College, and Kim Hadaway and Joel Jeffries of Iowa State. Kemeny's constant is the expected number of steps in a random walk on a graph G needed to get between two vertices. The students used this constant to examine the graph associated to the popular game Candyland. They also did a general eigenvalue analysis to modifications of the Candyland graph.

Matt Pablo and **Xinliang Philong** of CSU Chico (Advisor: Dr. Thomas Mattman) presented *The Graph of Minimal Cap Number 2*. The Kuratowski theorem classifies all planar graphs as those which do not contain K5 or K3 subgraphs. A graph is called apex if at most one vertex can be removed so that it becomes planar. These students are doing great work helping to provide a long list of subgraphs L whose presence in a graph make it not apex.

Andrea Barnett (presenter), Anthony Macias, Ely Schoenfield, Marco Ocampo, and Medardo Perez of CSU Chico (Advisor Dr. Thomas Mattman) presented *The Most Efficient Way to Contain a Virus With Limited Vaccinations*. By using existing models of COVID-19 infection these students determined the best place to locate vaccinations within a graph of connected individuals.

Jorge Reyes of the University of Nevada Las Vegas (advisor Dr. Monika Neda) presented *An Introduction to Differential Equations and SIR Epidemiological Modeling*. The SIR (Susceptible, Infected, Recovered) differential equations model technique was used to look at both COVID and Monkeypox viruses. Results were presented for a variety of parameter values.

Yiming Wang of Texas A & M, **Wenyi Ouyang** of Shenzhen College of International Education, **Else Yaxuan**, and **Elsa Yang** of Milburn High School in New Jersey (Advisor: Professor Xiaoyan Lium, University of Laverne) presented *Investigating the Cor-*

relations Between COVID-19 Death and Vaccination Rates of US States. These students found a very strong positive correlation between COVID death rates per capita and the elderly dependency ratio and the lack of availability of physicians.

With 120 in attendance and 34 students, both numbers were almost 38% higher than in 2022. As for my trip back to Reno, that was, like our trip down, also long and arduous. We used back roads to Cool, California (yes, a real place, population 4,100) and then on to Pilot Hill, California (where they brag they're "way beyond Cool"). Then almost all the way around Lake Tahoe and a long route through Gardnerville and Carson City, Nevada. It was a February to remember for sure.

Mathematical Art Exhibition at SRJC

In lieu of a report on the exhibition at Santa Rosa Junior College, we offer some images from the exhibition to inspire and delight!

Call for Mathematical Art Works

The exhibition will take place at the meeting at UC Santa Cruz. The exhibition organizers are Katy Franz and Jeffrey Ventrella. During the period from 12:30 p.m. to 1:15 p.m., artists are expected to be present to discuss their works with meeting participants. If you know anyone who produces art with a strong mathematical theme or content, please encourage them to submit their piece for consideration in the exhibition. Artists are expected to register for and attend the meeting.

Deadline to submit mathematical art works: Saturday, February 3, 2024

To submit a piece for consideration in the Mathematical Art Exhibition, fill out the Google Form https://forms.gle/FRYfQ6pq6knXo3LR8 by Saturday, February 3, 2024.

Artists can upload their images there along with brief descriptions of the pieces and a biography. Each artist can submit up to three pieces for consideration.

How to Get to the Meeting at UC Santa Cruz

From Southern and Central California

Take Highway 101 north to Highway 156 west to Highway 1 north. Follow Highway 1 north to Santa Cruz.

From Northern California

Take Interstate 5 south to Interstate 80 west to Interstate 680 south which becomes Interstate 280 north, then take Highway 17 south to Santa Cruz, then Highway 1 north.

From San Francisco Airport

Take Highway 101 south to Highway 85 south, to Highway 17 south to Santa Cruz, then Highway 1 north.

From the Santa Cruz Metro Station

Take any "UCSC" bus to get to the university.

Once in Santa Cruz on Highway 1 north, continue as it becomes Mission Street through town. Turn right on Bay Street and follow it to the campus entrance.

Click https://taps.ucsc.edu/pdf/parking-map.pdf for a more detailed campus map.

Call for Student Posters

Who, When and Where

All undergraduate and graduate math students, on Saturday, February 24, 2024, at the annual meeting of the MAA Golden Section at UC Santa Cruz in Santa Cruz, CA.

What

Poster presentations of research, new approaches to old problems, solutions to problems from mathematics journals, results of class projects or mathematical modeling contests, historical investigations in pure and applied mathematics, mathematical topics outside the standard curriculum, or mathematical investigations arising from internship experiences.

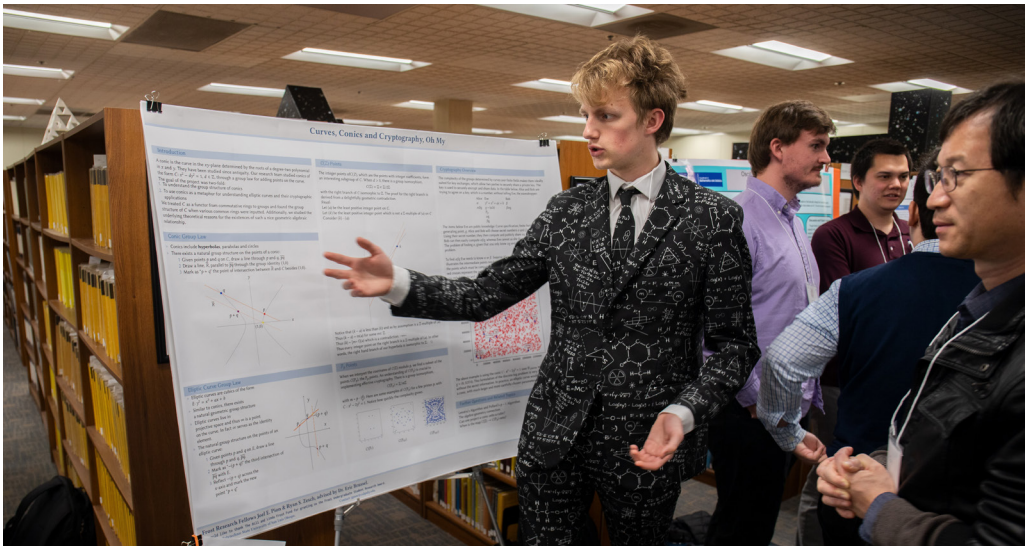
Why

The meeting provides a great opportunity to learn about interesting and entertaining areas of mathematics, as well as to network with other students and professors. Student presenters receive **complimentary registration** and **Saturday luncheon**, plus a **free one-year membership to the MAA** or (for those who are already members) a **free book**.

How

To submit an abstract go to https://forms.gle/tE7NJBWntHKQ3dSSA. Applicants must have a faculty or industry sponsor who has some knowledge of the work to be presented, an email address, possibly through a mentor, where they can be contacted. All posters should be typeset, illustrated, displayed in landscape orientation, and measure roughly 36 inches × 48 inches. Posters will be on display throughout the meeting, including during a scheduled poster session. If you have any questions (for example, whether your idea is appropriate for presentation or what size font to use on your poster), contact Professor Edward Keppelmann (email link), College of Science, University of Nevada, Reno, Reno, NV 89557, Office 775-784-4445 Email: keppelma “at” unr.edu, please use subject line GOLDEN 2024 POSTERS.

Deadline to submit an abstract: Saturday, February 17, 2024



Curves, Conics and Cryptography, Oh My
Joel E. Pion (coauthor) pictured at the 2019 AIM meeting