Mini-Focus

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Editor
Walden Freedman
Cal Poly Humboldt

Contributors: Edward Bradley, Ed Keppelmann, Gabriel Dorfsman-Hopkins

Jesús R. Oliver Wins Section Teaching Award

Jesús R. Oliver, of CSU East Bay, won the 2022 MAA Golden Section's Distinguished College or University Teaching of Mathematics Award. The award was presented at the 2022 Golden Section Meeting held at the Cal State Maritime Academy, on February 26, 2022. (See Jesús Oliver's complete award citation online.)

Dr. Jesús Oliver is an extraordinary teacher, mentor, and human being. His laser-like focus, energy and passion for supporting student success is incomparable. Dr. Oliver is a first-generation Latinx immigrant, a first-generation college student, and an English as a second language learner. After starting out at Moreno Valley Community College he transferred to UCLA where he earned his BS in Mathematics. A faculty mentor's encouragement helped him gain confidence and see his own potential, launching him on the path to a PhD from UC San Diego. At CSUEB, Dr. Oliver shares his story with his students and encourages them to

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Arauza Rivera Wins Section Award for New Teachers

Andrea Arauza Rivera was awarded the 2022 MAA Golden Section's Distinguished College or University New Teacher of Mathematics Award at the Section Meeting held at the Cal State Maritime Academy on February 26, 2022. Dr. Arauza Rivera is an extraordinary teacher, collaborator, mentor, and leader. She infuses her values of joy, community, justice and love skillfully and visibly into her teaching and all of her interactions with students and others in the university community.

Dr. Arauza Rivera was born in Guadalajara, Mexico and her family moved between Texas, Mexico, and Nevada before settling in California's Central Valley. She attended Modesto Junior College and then transferred to CSU Stanislaus where she earned her B.S. in Mathematics. In 2018, she completed a PhD in Mathematics at UC Riverside and then joined California State University, East Bay (CSUEB) as an Assistant Professor in Fall, 2018.

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Oliver: Teaching Award

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tell their own, including challenges and triumphs, in order to reveal and share their common humanity. This is a feature of his instructional approach, humanizing mathematics and illuminating the multiple ways in which students can find their own path and create their own success. Through active, inclusive, and engaging instruction, CSUEB math classes open doors and are designed to combat systemic and structural inequities. Dr. Oliver is an influential leader in all of these efforts. Dr. Oliver engages his students and inspires them to think deeply, critically and analytically. He uses student projects that incorporate peer feedback. This feedback process helps students better understand each other's projects and also helps them learn how to critically evaluate the work of others. He also works as a research mentor, training students to think deeply and engage with mathematics in new ways. Under Dr. Oliver's guidance these students have created joint publications, presented posters at national and regional math conferences, earned awards for outstanding research presentations, and been accepted into math PhD programs.

Dr. Oliver uses his skill and personal experience to create open and inclusive classroom spaces. An inclusive, collaborative and active classroom helps students remember what they learn and enhances their ability to transfer that knowledge to future major courses across the scientific disciplines. Finally, and most significantly, Dr. Oliver's commitment to active, inclusive, and engaged learning extends far beyond his own classroom. He was one of the originators of our Community of Practice model for STEM pathway classes which now regularly engages instructors and TAs in collaboration in order to better support students. The group developed a suite of active learning activities and guided notes and built a course coordination framework based on promoting and supporting active learning.

Jesús Oliver is an exemplary instructor and mathematical citizen. His work has impacted thousands of students as well as helping many of our instructors transform their pedagogy and deepening their own understanding of the subjects they teach. The Golden Section congratulates Jesús Oliver, an exceptionally effective and inspiring mathematics teacher!

Rivera: New Teachers Award

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Dr. Arauza Rivera sets the stage for all of her courses with materials that are beautiful, unique, thought provoking and inspiring. She uses language and imagery to bring important concepts to life. Her creativity gives students the space to see themselves in a new light as thinkers about and creators of new mathematical ideas through the exploration of puzzles vs. problems and engagement vs. participation.

Her ability to bring depth and context to all of her classes, from precalculus through undergraduate and graduate topics courses, is extraordinary. Another important component of Dr. Arauza Rivera's approach to teaching and learning is her use of innovative assessment strategies. Her approach allows students multiple ways and opportunities to demonstrate their understanding. Her work in this area is inspiring and influencing substantive change with the potential to transform the mathematics classroom and, indeed, the mathematics community.

Dr. Arauza Rivera has actively engaged students across all levels and majors in mathematics beyond the boundaries of the traditional classroom. She mentors freshman and sophomores in her project "Research for Undergraduates on the Mathematics of the Bay Area," funded by a MAA Tensor- SUMMA grant, and undergraduate and graduate math majors working on problems in fractal geometry funded by a PUMP-URG NSF Grant. These, and numerous other activities allow students to engage with mathematics in new ways and create transformative opportunities to learn and to forge new mathematical paths.

Dr. Arauza Rivera's commitment to students and to infusing her values of joy, community, justice and love in all that she does changes lives and open doors. Her generosity in creating and sharing her materials impacts other instructors at CSUEB and beyond. She thinks deeply about her work and holds the community in her heart as she lifts up our students to be their best selves. The Golden Section congratulates Andrea Arauza Rivera as an extraordinary, effective and inspiring new teacher.

Teaching Awards: Call for Nominations

2023 MAA Golden Section Distinguished College or University Teacher of Mathematics Award (General)
&
2023 MAA Golden Section Distinguished College or University New Teacher of 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, 2023

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

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

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!

Remembering Elaine Kasimatis (1952-2021)

by Edward Bradley, Sacramento State University

From the time Elaine arrived at Sacramento State, she radically transformed programs in the area of teacher preparation. Given that she had a rare combination of a Ph.D. in Mathematics and an M.A. in mathematics teaching, she had the background and depth of understanding to guide and implement an outstanding teacher preparation program that would ultimately influence a generation of mathematics teachers in the Sacramento area and beyond. Elaine started at Sacramento State in Fall 1986 and was immediately given the task of restructuring the course for students intending to become elementary school teachers. Under her expert guidance, the course evolved into an exposition of the very nature of mathematics. The course went to the essence of the subject by having students engage in a conjecture-proof method of mathematical thinking. By this method of learning, future school teachers were given a strong grounding in mathematics as well as strategies for presenting mathematical thinking. The course ultimately had a profound impact on the quality and training of future teachers in the Sacramento area. Since the new course was a radical departure from the previous way of thinking, she worked closely with other instructors to ensure that they understood the underlying philosophy and methods used in the course. A number of these instructors went on to fill positions in local community colleges and were able to take their knowledge and training with them. As for other community college instructors, Elaine devoted considerable time explaining her course and used articulation conferences to expound on the pedagogical changes involved. As a way of assisting beginning instructors in the department, Elaine introduced a course to support undergraduate and graduate students who had teaching roles across the university. Before the introduction of this course, student teachers were offered little advice and were essentially left to their own devices. The new course focused on observation of instruction as well as group discussion of strategies to deal with the challenges faced by beginning teachers. Perhaps the most significant contribution Elaine made to the department was the development of the blended Program. The aim of this program was to integrate the undergraduate mathematics subject matter with the teacher preparation study that was normally part of a credentialing program. She worked with two colleagues from the department to create the first such program in the state, and over the years it has been recognized as one of the finest such programs. In the 1990s Elaine and a colleague initiated a campus center to offer professional development for local K-12 teachers of mathematics. This was called the Math Project and its summer institutes for teachers aimed at improving mathematics instruction in the Sacramento area. The Math Project continues to be a major source of inspiration for local math teachers and provides professional development opportunities and on-going support for K-12 teachers in the Sacramento area. Elaine played a key role in the establishment of the College Preparatory Mathematics (CPM) program which was started in the late 1980's as a curriculum development and research project supported through the Eisenhower Math and Science Education State Grant Program. As one of the three original co-directors of this program, she helped create an innovative mathematics curriculum and teacher support program that is used throughout the country and the world. In 1999, CPM was designated by the U.S. Department of Education as one of three "Exemplary Mathematics Programs". It should be clear from her outstanding accomplishments that Elaine was a teacher's teacher. For her efforts in teacher education she was awarded the Deborah and Franklin Tepper Haimo Award for Distinguished College or University Teaching of Mathematics by the Mathematical Association of America in 2021. This award was truly a fitting tribute to a colleague who devoted her life to teaching. Her zeal, dedication, spontaneity and energy were always on display in the department and will be impossible to replace. She will be greatly missed by both her colleagues and her students.

News from the Section

Compiled by Walden Freedman, Mini-Focus Editor

Editor's Note: News is included from institutions who replied before the deadline. This year, the call for news was made via MAA Connect with the Golden Section Digest sent by email. To avoid being left out next year, please look for the call for news each fall season.

CSU East Bay

The CSU East Bay math department welcomed Dr. Mikahl Banwarth-Kuhn in Fall 2022 as our newest assistant professor. Dr. Banwarth-Kuhn earned her Ph.D. in Mathematics at UC Riverside in June 2019. As a mathematical biologist, Dr. Banwarth-Kuhn's research combines tools from data science, mathematics, and computer science to develop data-driven, multi-scale models that can be used to study critical questions in biology and medicine.

CSU Fresno

Mario J. Bencomo joined the department as an Assistant Professor in Fall 2022. He was most recently a Pfeiffer Postdoctoral instructor at Rice University, in the Department of Computational Applied Mathematics and Operations Research (CMOR), where he received his Ph.D. in 2017. Dr. Bencomo also spent a year as a postdoctoral fellow at the Institute of Computational and Experimental Research in Mathematics (ICERM), affiliated with Brown University. His research interests include numerical methods for wave propagation problems, inverse problems, optimal control, and most recently with a focus on nonlinear conservation laws. Dr. Bencomo looks forward to teaching and developing applied math courses at Fresno State, as well as engaging with students and the CSU community in future research ventures.

Yaomingxin Lu joined the department as an Assistant Professor of Math Education in Fall 2021. Yao received her B.A. degree in mathematics from Skidmore College in 2014, M.S. in mathematics from the Ohio State University in 2016, and Ph.D. in mathematics education from Western Michigan University in 2021. She has been working with pre-service teachers, local schools, undergraduate and graduate students. With the research focus on students' learning, teachers' professional development and technology, Yao is really excited about bringing her knowledge to the Fresno State community and working with students with diverse backgrounds. Yao has lived in many different countries throughout her life, including China, Norway, Australia, and the United States. Within the U.S., she has lived in New York, Ohio, Michigan, and now California.

On Friday, November 18, 2022, the department celebrated its 8th annual Department of Mathematics Day (DMD). The event involved a Student Mini-Conference, Ignite Talks given by faculty, a social with board games, a Math Jeopardy competition, and a talent show. Students at various academic stages and mathematics faculty enjoyed this community-building event, and are looking forward to next year's event. More information can be found on the DMD website (bit.ly/fresnodmd).

The AMS Spring Western Sectional Meeting (#1187) will be held at CSU Fresno on May 6-7, 2023. The deadline for all abstract submissions is March 7th, 2023. More information about this AMS sectional and other upcoming sectional meetings can be found on the AMS website.

Cal Poly Humboldt

It's official! The university formerly known as Humboldt State University is now California State Polytechnic University, Humboldt, or Cal Poly Humboldt, (or even just Humboldt), for short. Cal Poly Humboldt is the third Cal Poly campus, and the only one in Northern California. In addition to a restructured math major, Humboldt is offering new B.S. degrees in Data Science, Software Engineering, and Mechanical Engineering.

The Fall 2022 Kieval Lecturer was Dr. Pamela E. Harris, University of Wisconsin, Milwaukee, who spoke on "How to Choose Your Own Mathematical Adventures".

Dr. Peter Goetz has a new publication, "Quantum Projective Planes as Certain Graded Twisted Tensor Products", joint work with Dr. Andrew Connor of Saint Mary's College of California, to appear soon in the Journal of Algebra.

Santa Clara University

After building our CS faculty for several cycles, we have turned our attention back to mathematics recruiting! We are grateful to welcome Shamil Asgarli as a new tenure-track Assistant Professor in mathematics, with broad expertise in algebraic geometry. Shamil comes to us from Brown University, via a

post-doc at his undergraduate institution, the University of British Columbia, during the pandemic. In the same round of hiring, we added Chi-Yun Hsu, who earned her PhD at Harvard and completed a post-doc at UCLA. Chi-Yun has deferred her arrival at SCU in favor of a research appointment in Lille, France.

We are delighted to announce that Nikki Meshkat received tenure and was promoted to Associate Professor. Katelyn Byington White was advanced to the rank of Renewable Term Lecturer. Our yield of acceptances of incoming students was again much, much higher than planned and we have been scrambling. Our Fall Quarter enrollment was over 3,250 students, counting lecture and lab registrations separately, as they are staffed independently. We're happy we're popular, but this had led to very full classrooms. New adjunct faculty include Honey Dhupar, Sumudu Khalubolila, and Preeti Mohindru.

In response to pandemic learning loss, we instituted a new Math Advance program to help entering students prepare for their Fall classes at SCU. Linda Burks and Josh Grice designed 3-week intensive online classes and a system to get students registered to take them. The two classes, one designed to prepare for calculus and the other for precalculus, were run on a trial basis with about 40 students in each section. We plan to scale this up for next summer.

We are currently searching for two tenure-track faculty members in CS and two lecturers in mathematics, so January and February will be quite busy for us. We will relax in March, with our Alexanderson Lecture on Monday, March 6, 2023: Bruce Sagan will speak about combinatorics, and we expect to live-stream the event for those unable to attend in person.

Our colloquium series is thriving under the guidance of Howard Levinson and Shamil Asgarli. If you have a great talk to offer, please contact them. Our public lecture series, Bay Area Mathematical Adventures (BAMA), offered jointly with SJSU continues to be online. Our fall speakers were our own Sara Krehbiel on "All the Ways to Color a Graph," Liz McMahon and Gary Gordon of Lafayette College talking about SET, and Jack Lee of the University of Washington telling us about the Curvature of Space. Since these will continue to be online for the spring, we invite people to sign up to receive announcements by sending an email to Frank Farris at ffarris@scu.edu.

MAA Congress Report

by Walden Freedman, Congressional Representative

The Congress of the MAA met in-person at MathFest in Philadelphia, PA on Wednesday, August 3, 2022, from 08:30 a.m. to 5:00 p.m. Here are some of the highlights, based on my personal notes and minutes of the congress meeting by Emily Hynds, Recorder.

Presidential Update by MAA President Quinn

Among other things, President Quinn mentioned a joint policy statement with NCTM and the creation of the T. Christine Stevens award. There are plans for a by-laws refresh, extension of access for the Math Olypmiad, Olympiad training program and a new journal (Scatterplot) that will partner math, education, and data science.

Overview of MAA Programs

Dierdre Smeltzer, Senior Director of Programs at MAA and Kiera Edwards, Director of Programs and Grant Management, mentioned the many outreach initiatives that exist: Dolciani Mathematics Enrichment Grant (DMEG), Tensor SUMMA, Tensor Women & Mathematics, National Research Experience for Undergraduate Program (NREUP), Neff Outreach Initiative. Other exciting programs mentioned were Virtual Programming, Distinguished Lecture Series, Professional Development, including OPEN Math, StatPREP, and PIC Math.

2021 MAA Impact Report

Congress participants were asked to read the 2021 MAA Impact Report before the meeting; we were given an overview of the development and presentation of the report. It is a great resource for all MAA members.

MAA Strategic Plan

MAA Executive Director Michael Pearson gave a presentation on the MAA Strategic Plan. Some of the main themes were to create/provide resources to reduce the work of the sections, particularly with organizing meetings. Members expressed appreciation for the potential aids to sections, but also a desire to maintain flexibility and autonomy the section levels.

Congress Elections

The following individuals were elected to the indicated positions:

Vice Chair: Monika Kiss

Officer-at-Large: Russ Goodman

Reps-at Large for Interests of MMC: Alejandra Alvarado, Aris Winger

Elections Committee: Johanna Franklin, Kim Roth, Emille D. Lawrence

My tenure as congressional representative ends in June 2023. It has been an honor to serve the section in this way. I recommend such service as a way to promote mathematics and the Golden Section and get to know the workings of the MAA more deeply.

Report on the Section Meeting at Cal State Maritime, February 26, 2022

by Ed Keppelmann

While attendance by modern pre-2020 standards was quite small (just 27 students and 87 total) - one has to consider it a triumph that we could be back together with many MAA Golden Section enthusiasts and the locals of a wonderful and truly unique campus – California State Maritime.

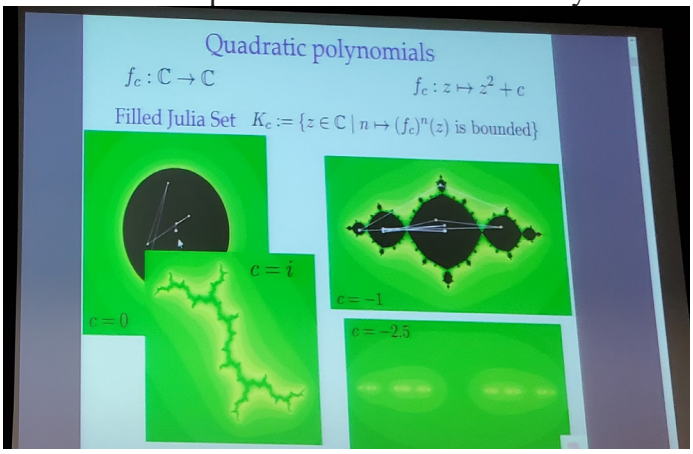
The day began with an inspiring high-energy talk from Talithia Williams of Harvey Mudd College. The title of her talk, *Power in Numbers*: *The Rebel Women in Mathematics* is the same as the title of her book available in both hardcover and e-reader versions. Here are just a view phrases from the nearly all 5-star ratings: "It is an extraordinary book… showing what happens when the human mind is unleashed. Perhaps women mathematicians will be the key to the future of all humans?...If Emmy Noether and Wang Zhenyi are examples from the past, the future seems unlimited…Wonderful photographs and illustrations…The book begins with the pioneers, then includes the code breakers and rocket scientists, and ends with modern mathematics… A must buy foran young woman or girl interested in mathematics." Talithia shared with us just a few personalities from her book: Winifred Edgerton Merrill was the first female in the USA to earn her PhD in 1886 from Columbia University. African-American Katherine G. Johnson, featured in the movie "Hidden Figures", devised the scheme that allowed NASA's Apollo 13 to use the moon as a gravity-powered slingshot to return the astronauts as quickly as possible to earth when the crew's oxygen supply was severely damaged. Eugenia Cheng is a modern mathematician working in Category Theory that has done an enormous amount to popularize mathematics and STEM.

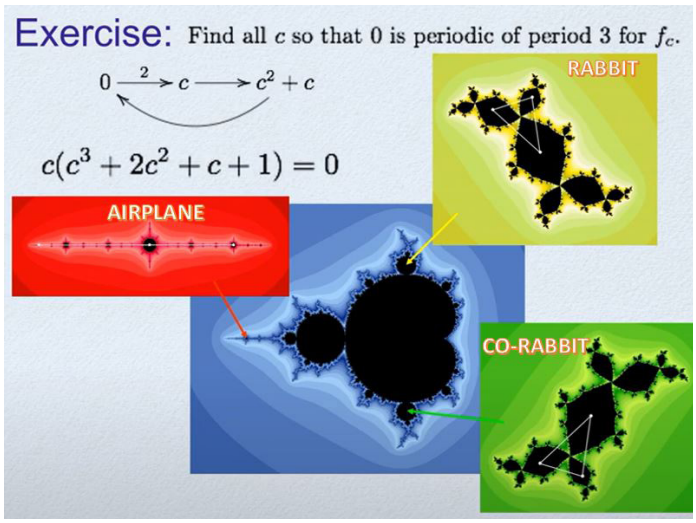
Talithia hosted the six-episode series NOVA Wonders on PBS which includes such episodes as "What are Animals Saying?" and "Can We Build a Brain?". Talithia also shared with us her own journey and what I found to be two essential lessons of her story: First, she was a well- rounded student (i.e., far from a nerd) in both middle and high school and while she enjoyed mathematics she wasn't by far at the top of her class. Second, with the right encouragement (for her it began with her high school teacher Mr. Dorn and continued to Dr. Etta Falconer at Spelman College and Drs. Lonne Lane and Claudia Alexander at NASA's Jet Propulsion Lab) she was continually able to visualize herself in increasingly higher-level successful STEM careers including a PhD in Statistics from Rice University, work with NASA and the NSA and of course her appointment as Associate Professor at Harvey Mudd College. The importance of great mentoring is nothing new to all of us who aspire to the great goals of the MAA but to see concrete examples is always inspiring and reinvigorating. We just wish all the world could know what we know and appreciate in this regard!

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 LONGTIME 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.

Our second speaker was Dr. Sarah Koch from the University of Michigan speaking on *Complex Dynamics and Moduli Spaces*. A moduli space is just a set of plausible parameter values for a dynamical system, and these are important as she explained in one of her recent research grant proposals: "Dynamical systems are all around us: the motion of the planets, the weather, the stock market, the ecosystems in which we live. These systems depend on a variety of parameters, and as these parameters change, the corresponding system is affected. Understanding how dynamical systems change with different parameters is a complicated and delicate question which is not even completely understood in the simplest of mathematical models. One dynamical system that arises across different scientific fields is Newton's Method, an essential tool for solving equations that is employed by scientists in every field. There remain many fundamental questions surrounding this dynamical system (in one and several variables) that have yet to be understood." To get a brief glimpse of the precise details of Sarah's work let's briefly review the Mandelbrot set and maps on the complex plane of the form $f_c(z) = z^2 + c$. One way to describe the famous Mandelbrot set in the complex plane is that it consists of all values of c so that the orbit of zero (i.e., $0, c, c^2 + c, c^4 + 2c^3 + c^2 + c, \ldots$) is bounded. Sarah and her co-authors look at very specialized subsets of this set consisting of values of c so that 0 is a periodic point of f_c of period two or three or in fact for any finite value. The Julia set for any f_c is the set of points whose orbit is bounded under f_c. It is known that the set of all such c (for any finite period) has a closure which is the boundary of the Mandelbrot set. One can also arrange it so that although zero is not periodic, some iterate of zero is periodic in which case we say zero is pre-periodic. When $c = -1$, 0 has period two and the associated Julia set is called the Basilica. When $c = i$, the orbit of zero is $\{0, i, -1 + i, -i\}$ with the last two values forming a cycle of period 2. This Julia set is a Dendrite. Finally, for the three values of c where zero has period three, the Julia sets are the airplane (c-real), the rabbit and co-rabbit (the associated cs are conjugate).





After defining these quadratic maps and their associated Julia sets, Sarah turned her attention to rational maps formed as a quotient of two quadratic maps. With a rational map we have the possibility of a zero denominator, so we need to think of such maps as iterating on the Riemann sphere (i.e., the complex plane plus infinity) instead of just the complex plane. There is a fantastic technique whereby the structures of the Julia sets of the individual quadratic maps can lead to a so-called "mating" of their geometry which gives rise to an intermingling of their quadratic-based Julia sets as the new Julia set arising on the Riemann sphere from the quotient of two quadratic maps.

Dr. C. Allen Butler, who is the MAA Treasurer, was our next speaker, discussing *Bayes' Theorem–Making Rational Decisions in the Face of Uncertainty*. He could not be at the meeting in person, so the organizers were able to have Allen give his talk through Zoom. Taking advantage of our maritime location, Allen told us about the tragic story of the SS Central America, the so called "Ship of Gold", which sank in a hurricane about 200 miles off the coast of California in September 1857. In addition to nearly 600 passengers (only about 53 survived and three of those spent over a week in a life raft) the ship got its nickname since it was carrying tons of gold from the San Francisco Mint and other treasures from the California Gold Rush. This gold is estimated

THE MATHEMATICAL ASSOCIATION OF AMERICA – GOLDEN SECTION

Saturday, February 25, 2023, at Santa Rosa Junior College

All talks are held in Newman Auditorium; Lunch is in the Bertolini Student Center

For directions on how to get to the meeting see page 17 and/or the following link: SRJC webpage.

Time	Event	Presider
8:00-9:00	Registration/Refreshments; Foyer of Newman Auditorium	
9:00-9:05	Opening Welcome	SRJC President Dr. Chong Section Chair Mark Durst
9:10-10:00	Edray Goins, Pomona College Clocks, Parking Garages, and the Solvability of the Quintic	TBA
10:10-11:00	Anastasia Chavez, Saint Mary's College Matroids, Positroids, and Beyond!	TBA
11:00-12:00	Posters and Mathematical Art Exhibition in Emeritus Hall	
12:00-1:00	Lunch in Bertolini Student Center	
1:00-1:30	Teaching Awards/Business Meeting in Bertolini Student Center	Ed Keppelmann
1:45-2:35	Omayra Ortega, Sonoma State University Who are we Serving with our Scholarship: A Covid Model Case Study	TBA
2:40-2:50	Door Prizes	TBA
2:50-3:40	Anthony Varilly-Alvarado, Rice University Using geometry to repair data losses: dealing with hard-drive failures in large server clusters	TBA
3:50-4:40	**TBA**	TBA
4:40-5:00	Closing Remarks	Outgoing Chair Mark Durst Incoming Chair Max Sklar

Program Abstracts

Edray Goins, Pomona College, *Clocks, Parking Garages, and the Solvability of the Quintic: A Friendly Introduction to Monodromy*

Abstract: Imagine the hands on a clock. For every complete the minute hand makes, the seconds hand makes 60, while the hour hand only goes one twelfth of the way. We may think of the hour hand as generating a group such that when we "move" twelve times we get back to where we started. This is the elementary concept of a monodromy group. In this talk, we give a gentle introduction to a historical mathematical concept which relates calculus, linear algebra, differential equations, and group theory into one neat theory called "monodromy". We explore lots of real world applications, including why it's so easy to get lost in parking garages, and present some open problems in the field. We end with a discussion of how this is all related to solving polynomial equations, such as Abel's famous theorem on the insolubility of the quintic by radicals.

Anastasia Chavez, St. Mary's College of California, *Matroids, Positroids, and Beyond*!

Abstract: Matroids are a fundamental combinatorial object with connections to many areas of mathematics: algebraic geometry, cluster algebra, coding theory, polytopes, physics ... just to name a few. Introduced in the 1930's, Whitney defined matroids with the desire to abstract linear and graphical dependence. In fact, every graph is associated with a matroid (called graphical) and from every vector configuration arises a representable matroid (over some field F). It has been shown that most matroids are neither graphical or representable, making these two matroid properties rare and highly desired. A particularly well-behaved family of representable matroids, called positroids, was introduced by Postnikov and shown to have deep connections to the totally nonnegative Grassmannian and particle physics. Moreover, he described several combinatorial objects in bijection with positroids that compactly encodes matroidal data and have been shown to characterize many matroidal properties. With just a few definitions and examples revealing their connections to a variety of fields, you too can begin searching for the matroids living among us.

Omayra Ortega, Sonoma State University, *Who are we Serving with our Scholarship: A COVID Model Case Study*

Abstract: Academic institutions use the number of publications as a measure of competency. Why are publications in peer-reviewed journals one of the most important measures of success in our field? I will give examples of ways to use your research, regardless of the field, in service to your students, your institution, and your community using the example of recent student work in COVID modeling.

Anthony Varilly-Alvarado, Rice University, *Using geometry to repair data losses: dealing with hard-drive failures in large server clusters*

Abstract: Motivated by large-scale storage problems around data loss, a budding branch of coding theory has surfaced in the last decade or so, centered around locally recoverable codes. A code is a subset of a finite-dimensional vector space over a finite field, chosen carefully so that all its vectors are locally isolated, as if they were "repelling" each other. Each vector in a code is called a code word, because we can store information in a vector. Locally recoverable codes have the property that individual entries in a code word are functions of other entries in the same word. If an entry is accidentally erased, it can be recomputed, and hence a code word can be repaired. Geometry has a role to play in the design of codes with locality properties. I will explain how to use algebraic surfaces to both reinterpret constructions of optimal codes already found in the literature, and to find new locally recoverable codes, many of which are optimal, in the sense that code words do the best possible job at "repelling" each other. This is joint work with Cecília Salgado and Felipe Voloch.

Additional speaker info: TBA

to be worth about $300 million in today's terms. The mathematical reason for the story was the powerful Bayesian search techniques that were used to locate the wreck nearly 130 years after the event. (For the full story see the book "The Ship of Gold in the Deep Blue Sea" by Gary Kinder.) Bayesian search techniques have also been used successfully to recover the wreck of the USS Scorpion and the flight recorder in the 2009 Air France Flight 447. It was unsuccessful in the case of Malaysian Airlines flight 370 which crashed in March of 2014 and was never recovered.

I would like to explain the Bayesian search method using a very simple example from my own experience – (but see Katie Howgate's blog for a more detailed example.) Bayes' Theorem, a famous probability result, has recently received a lot of attention for its use in artificial intelligence and algorithms like Bayesian searches. Bayes' Theorem is ideal in allowing someone who wishes to estimate probabilities and make predictions the option to update those probability estimates as new information becomes available. Let us recall that if A and E are events in a common probability space and $P(A|E) = \frac{P(A \cap E)}{P(E)}$ denotes the conditional probability of the event A given that the event E has already or definitely will occur, then Bayes' Theorem describes the key way to reverse this conditional probability using (this in fact is easily proved from the above definition) that:

$$P(E|A) = \frac{P(A|E)P(E)}{P(A)}$$

Let us consider the situation of Ed Keppelmann's lost wallet. It is nighttime and I wish to go online and make a purchase when I realize I do not have my wallet! After a quick look around the house and then moments of panic when I also search my car, etc., I construct the following table of estimated probabilities and conditional probabilities which, in this case involve just three possibilities for the wallet's location. (In the case of the lost ship, the ocean floor could be filled with a large grid of squares as possible locations and such probabilities):

EXPLANATION/LOCATION	PROBABILITY	IF THIS HAPPENED
S_1 Under the car seat	p_1 =0.35	q_1 =0.95
S_2 Fell out of my pocket or the car	p_2 =0.20	q_2 =0.15
S_3 Left at the store	P_3 =0.45	q_3 =0.80

These are all initial estimates of probabilities. The second column is the probability of each type of loss or misplacement and so the probabilities in this column must add to 1. The probabilities in the third column are conditioned on the possibilities that the given events did occur. In other words, I estimate that if my wallet is under my car seat, or perhaps lodged nicely between seats where no one's hand can fit, then there is a very good chance that a thorough search will yield success. (I haven't made this probability quite 1.00 since, among other reasons, my wallet is black and my carpet is dark and in my panic I might miss seeing it.) In the worst case scenario that my wallet fell out of my car or pocket, I will have to retrace all my steps – if I can even remember them all, I think you will agree that the chances are small that I will find it before someone else does. On the other hand, if I left it at the store – they know me (and alas yes, I have done this before!) and they are all good people so I think I should probably be OK. However, it is not like having to search my own car, so the chances of success are not quite as good.

If we let F denote the event that we find the wallet and that no other scenarios besides the disjoint S_1, S_2, and S_3 are possible, then the probability that I will actually find my wallet is

$$P(F) = P(F|S_1)P(S_1) + P(F|S_2)P(S_2) + P(F|S_3)P(S_3) = 0.7225$$

But of course, in order to be positive I *must* assume this will happen. The beauty of Bayes' Theorem is that I can now go from these estimates to calculations of $\frac{P(F|S_i)P(S_i)}{0.7375}$ for i = 1, 2, 3 which tell me the likelihood of finding my wallet in each of the given locations:

BEFORE FIRST LOOK

SCENARIO	LIKELIHOOD TO FIND HERE
S_1	0.4602
S_2	0.0415
S_3	0.4983

Thus, according to this calculation, I should start my search process by calling the store. I do that but, even though the lady on the line asks me some questions about my wallet and what it contains, she finally says, "No we don't have anything like that", so I say, "Thanks for checking, I appreciate it", and I hang up.

This means I can now update my table – a process in which each probability will change. We replace the probability of S_3 with the conditional probability that it is still there but wasn't found (we use primes to denote the complement of events)

$$P(S_3|F') = \frac{P(S_3)P(F'|S_3)}{P(S_3') + P(S_3)P(F'|S_3)} = \frac{(0.45)(0.8)}{(1-0.45) + (0.45)(0.8)} \approx 0.3956$$

So, the likelihood of a loss at the store has dropped.

We can also update the other two scenarios using (again with the original estimates):

$$NEW\ P(S_i) = \frac{P(S_i)}{P(S_i') + P(S_i)P(F'|S_1)} = \frac{p_i}{(1-p_i) + p_i(1-q_i)}, \qquad i = 1, 2$$

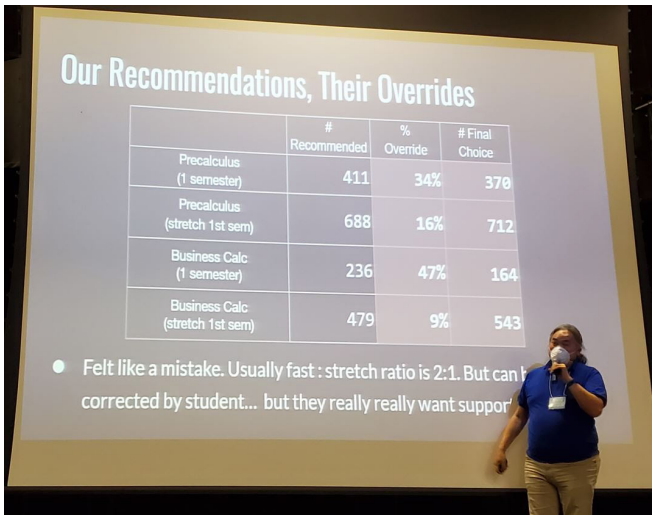
AFTER FIRST LOOK

SCENARIO	LIKELIHOOD TO FIND HERE
S_1	0.5243
S_2	0.2062
S_3	0.3956

Thus, the probability where I have already looked got revised down and the two other places where I haven't look have been revised upward. So, in general one can continue this process going to the next most likely spot after each new calculation. Once all the original p_i have been updated we can replace our original estimates with these new values and start another round.

Also, depending on certain technical details you can also consider changing the q values as well which makes a lot of sense since we would need to search in a more thorough way if we try somewhere twice. Of course, in the real world, other considerations may enter into the process as well such as the cost of shifting to another grid point far away or perhaps the chance that some of my q estimates might not remain fixed if I wait too long. For example, in my case I might want to do a quick drive back on my recent route to see if I easily see anything before too many people pass by those areas. However, these calculations show me that it is time to get out my super-powered flashlight and search my car from top to bottom. It's probably a good time to clean up in there as well!

The fourth main speaker of the day was Dr. Eric Hsu of San Francisco State University who took us through some modern thinking about math placement for incoming students. Traditionally, in what is quickly becoming the remote past, most incoming students without obviously stellar backgrounds like high AP test scores or great SAT/ACT performance or nearly perfect high school GPAs, were often required to take a mandatory placement exam to determine their first-year math course. While placement is often too biased against the chance of student failure, in too many cases these remedial courses carried no college credit and we now know that for far too many students these courses provided an unnecessary barrier to graduation. Because the contexts of these remedial courses were different than the actual courses they were supposedly preparing the students for, because they often involved material that was more than what was really needed, and finally because they had an element of abstraction which meant they didn't provide lasting competency, these courses were for some hard to pass and for others provided no practical preparation. In recent times this has forced many campuses to introduce stretch courses which take a standard first-semester college credit-earning curriculum like business calculus or elementary statistics and teach these over two semesters thus leaving lots of time for "just in time review." However, by still forcing these options onto students via mandatory placement exams has caused many problems at schools like SFSU. Placement tests are rarely studied for, and they don't measure student persistence and the motivation and resources students will have when they are earning college credit and mostly understand a concept except for a few minor misunderstandings that can, once identified, be easily rectified. In addition, traditional placement tests provide placement in a completely opaque manner.



In other words, the student doesn't know why she/he isn't ready for the next course and so they don't know what they should work on most in order to get ready. Furthermore, when the Covid-19 pandemic hit, many students were unable to take standardized entrance exams and they fell behind in other technical ways that made them seem unprepared, whereas in a normal year they would have had no problems in becoming prepared. Given these issues, as director of placement, Dr. Hsu took the bold step of allowing students to self-place but only after having a "testing experience" which helped them to understand what college bearing courses would look like and having them reflect on their own aptitudes and habits when learning

mathematics. The initial fears that students would place themselves too high and fail in large numbers, thereby increasing campus rates of chaos, riots and jaywalking turned out to be amazingly unfounded. While the system certainly needs lots of tweaking and further study from all kinds of perspectives, Eric was proud to say that he has had many discussions with administrators and interested outside stakeholders that his fellow instructors are not seeing grossly under-prepared students and enrollment in the stretch courses is still quite solid. Stretch course enrollments are adjusting to proper equilibrium values as students use the advising tools and engage in responsible discourse with their peers to become responsible and impressive advocates for their own futures.

The final talk of the day by Emille Lawrence from the University of San Francisco was an eye-opening excursion across the ages and the planet. She (and many other prominent math historians) challenges the traditional doctrine that modern mathematics is predominately the result of contributions of the Western and European schools. As a graduate student at UW Madison, while serving as a TA for the late Richard Askey (a famous analyst), I heard two remarks that I will always remember – one of them was that he had checked over the calculus test we were about to give the students – it took him all of seven minutes to complete, so it should be about right for the students!–but, more importantly for this commentary that he was completely blown away by Ramanujan's so called Lost Notebook – some 130 pages of scratch work that Ramanujan produced in the last year of his life. I even remember him presenting some of this (although I was too much a novice to understand it very well). After Emille's talk I later found this quote from the highly regarded text "The Crest of the Peacock" by George Gheverghese Joseph (which is a great resource for this topic) by Richard Askey: "The work of that one year, while he was dying (and obviously in considerable pain a lot of the time, according to his wife), was the equivalent of a lifetime of work of a very great mathematician. What he accomplished was unbelievable. If it were in a novel, nobody would believe it." Ramanujan was very far from a mathematician trained in the western tradition and by the traditions of his heritage (or in his case traditions he essentially invented since his work was so groundbreaking) he did not prove things but rather merely stated results and (for him easy) implications. The fact that many very prominent western mathematicians have devoted entire careers to proving many of the results in that notebook is a huge testimony to their importance. As far as Emille's talk goes however, in which she entertained us with many fun and diverse examples (including some great examples from Africa and Oceania) thus showing the accessibility of this topic at all levels, this anecdote about Ramanujan is the very least of the evidence for many non-western roots to mathematics. The traditional view of Greek mathematics as the source of what we know was in fact not the beginning of the story since in reality the Greek-speaking mathematicians were influenced by mathematicians of Mesopotamia, Egypt, China, and the broader Hellenistic world. During the so-called Dark Ages of Western Europe (from about 476 CE to 1000 CE) when supposedly all technical advancements went dormant, there were enormous mathematical collaborations between Persia, Baghdad, India, China and others. Although ideas were extremely diverse in both approach and content across the non-western/European world at this time, the universal nature of mathematics made collaborations (while still no doubt very challenging) more feasible and promising than they were between different languages and alphabets with regard to subjects like philosophy and religion. As Emille remarked, and I heartily agree, it is very important that we continue to work to see that these ideas and many non-western examples work their way into math history and teacher education classes everywhere. As we teach in math circles – mathematical flourishing has and can continue by everyone everywhere.

Besides the talks, the day was also filled with other great activities like the art exhibit (discussed elsewhere) and poster presentations. I know my wife and I (and many others) also really enjoyed our tour of the Golden Bear – the school's ocean liner and research vessel. We heard about all the great senior and summer trips taken on that vessel to remote locations like the tip of south Africa or Hawai'i. The practical training received by CSU Maritime students in virtually all conceivable areas of ocean work from ship building and engine maintenance to work as captains and oceanographers of all types, (and not to mention their great business and global studies majors), while certainly essential for that kind of education, is very impressive, nonetheless.

We had these poster presentations:

Katarina Costa, **Amber Thompson**, and **Samantha Thompson** of the Truckee Meadows Community College High School in Reno, Nevada, presented *Low-Cost Technology Alternative for Diagnosing Scoliosis Utilizing Computerized Technologies*. Current means of diagnosing the curved spine that characterizes scoliosis and measuring the so-called Cobb Angle are not standardized and require lots of radiation exposure from X-rays.

These students have the goal of building a phone app that uses curve fitting techniques to make the needed measurements and calculations. Mentors: Dr. Cecilia Vigil, Dr. Kurt Ehlers, and Dr. Megan Lahti

Johnathon McCollum, **Gregory Mwamba**, and **Jesús Oliver** of CSU, East Bay presented *Blow-up of the Nonlinear Klein-Gordon Equation in General FLRW Spacetimes*. This partial differential equation is used to model the expansion of the universe. Their main result gives conditions under which the local solution blows up in finite time.

Yanru Chen, **Amber McNeill**, and **Jesús Oliver** of CSU East Bay looked at *How a Global Pandemic Changed Students' Perspectives in Undergraduate Mathematics Courses*. By considering student success and engagement data two semesters before the start of the Covid-19 pandemic of Spring 2020 and two semesters after this event, many insights and lessons are possible not only for CSU East Bay but for all striving departments of mathematics.

Brian Liu of Cal Poly, San Luis Obispo considered *Replicating the Stradivarius*. For nearly 250 years these violins have been considered the finest for their incredible sound quality. By examining the physics of the sound and thinking about violin construction from a modern point of view, it appears possible to counterfeit these instruments quite accurately.

Serina Cabrera of Sonoma State University considered a *SEARIV Model of Covid-19 for Sonoma State University*. This model using differential equations looks at the closed environment of students and instructors on the Sonoma State Campus. The effects of vaccinations and social distancing with both symptomatic and asymptomatic individuals is discussed.

Wendy Wang of Santa Clara University considered *America's Incapability in Paying Off National Debt*. When a country's growth in GDP exceeds the growth rate of its national debt the overall economic growth rate can be considered negative. This situation is modeled for the USA and may predict the date of a future recession.

Kevin Gong, **Owen Ouyang**, **Yisha Tang**, and **Andy Dai** of Woodson High School looked at Applying Mathematical Modeling on Analysis of Changing Factors of Global Climate Change. These students looked at current data on fossil fuel usage and worldwide carbon dioxide (CO2) emissions. Their regression models lead to very important predictions (in the absence of change) and recommendations for immediate action.

Mathematical Art Exhibition

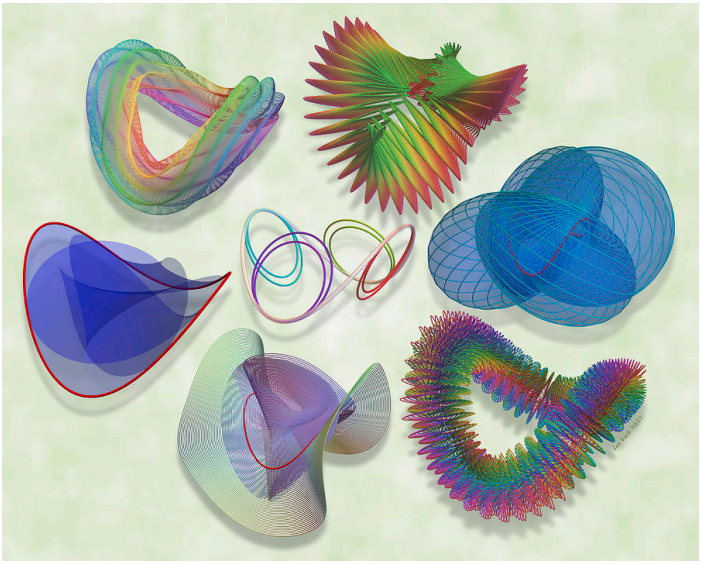
by Gabriel Dorfsman-Hopkins, images by the artists

In the lobby of California Maritime Academy's Simulation Building, nestled against a backdrop of models of merchant marine ships and barges, six mathematical artists gathered to showcase their work.

The pieces spanned various mathematical disciplines including complex dynamics, number theory, geometry, topology, and more. We also saw the use of various types of media, including prints on canvas and metal, computer animations, and 3D printed sculptures.

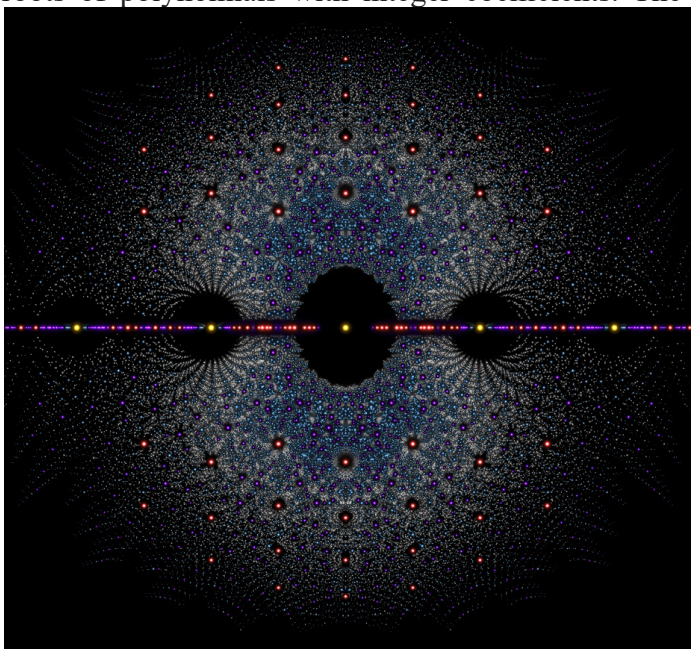
The artshow served as a successful outlet for interdisciplinary exchange of ideas and techniques, and some of the pieces from the artshow were even discussed during the keynote lectures at the conference. In what follows we will briefly highlight the artists and their contributions.

Dan Bach ontributed three peices to the show. Seven Stylin' Saddles (below) showcases different mathematical adornments of the saddle curve, Space-Filling



Circles is a 3D model exploring ways to cover geometric objects with families of circles, and Goldbach Prime Bars visualizes data supporting Goldbach's famous conjecture that every even number greater than 2 is the sum of two primes. Learn more at Dan's website: https://www.dansmath.com

Gabriel Dorfsman-Hopkins contributed a collection of canvas prints of algebraic starscapes (below), a joint project with **Shuchang Xu**. Algebraic starscapes are plots of complex numbers that arise as roots of polynomials with integer coefficients. The



mysterious patterns that arise bring together mathematicians and digital artists to create beautiful art and explore the mysteries arising in number theory. You can learn more at www.gabrieldorfsmanhopkins.com.

Frank Farris' artwork is titled The Temple of the Zonohedra: Balcony View, and investigates possibilities for coloring specimens from this wide class of rotationally-symmetric polyhedra. Polar zonohedra are

specified by a degree of rotational symmetry and an angle of inclination, and several different parameters are explored as the different features in the temple. More of Frank's work can be seen at his webpage: webpages.scu.edu/ftp/ffarris/

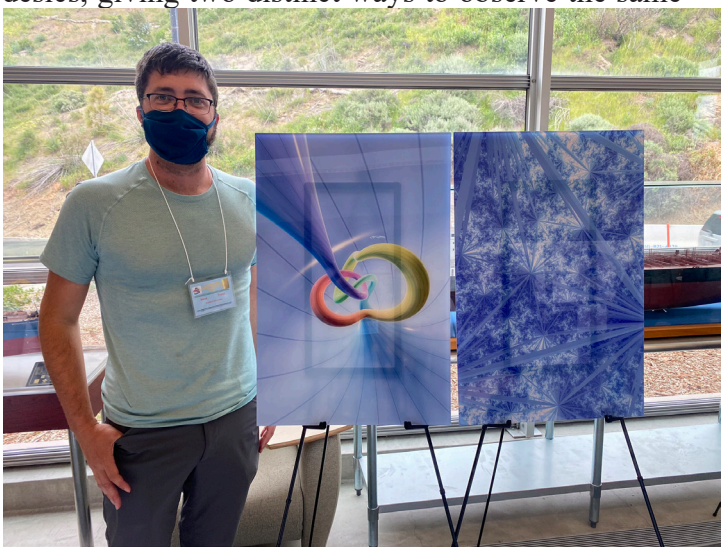
Sean Gonzales showcased several works (above), including still images and one animation. Mandleblob used domain coloring to color the composition a random finite Blaschke product with a Mandelbrot indicator function, while the animation Newton in Motion is a visualization of Newton's method for root approximation in the complex plane. The animation shows where different initial values converge as one of the roots rotates around the origin. Gonzales is

an arithmetic geometer and artist, and you can learn more about his work at: https://seangonzales.com/

Carlo Sequin brought a collection of 3D printed sculptures (above), including Star Cinders which depicts soap-film surfaces on symmetrical tangles of torus knots. Sequin's work spans many disciplines, and

can be explored at his website: people.eecs.berkeley.edu/~sequin

Steve J. Trettel brought two very different looking images of the same non-Euclidean 3-manifold (pictured above). One follows the hyperbolic geodesics in the knot complement, while the other provides an image of the knot complement using Euclidean geodesics, giving two distinct ways to observe the same



phenomenon. Trettel's interdisciplinary work spans number theory and geometry, and he has recently adopted the media of immersive virtual reality to explore non-Euclidean geometry. You can learn more at his website: https://stevejtrettel.site/.

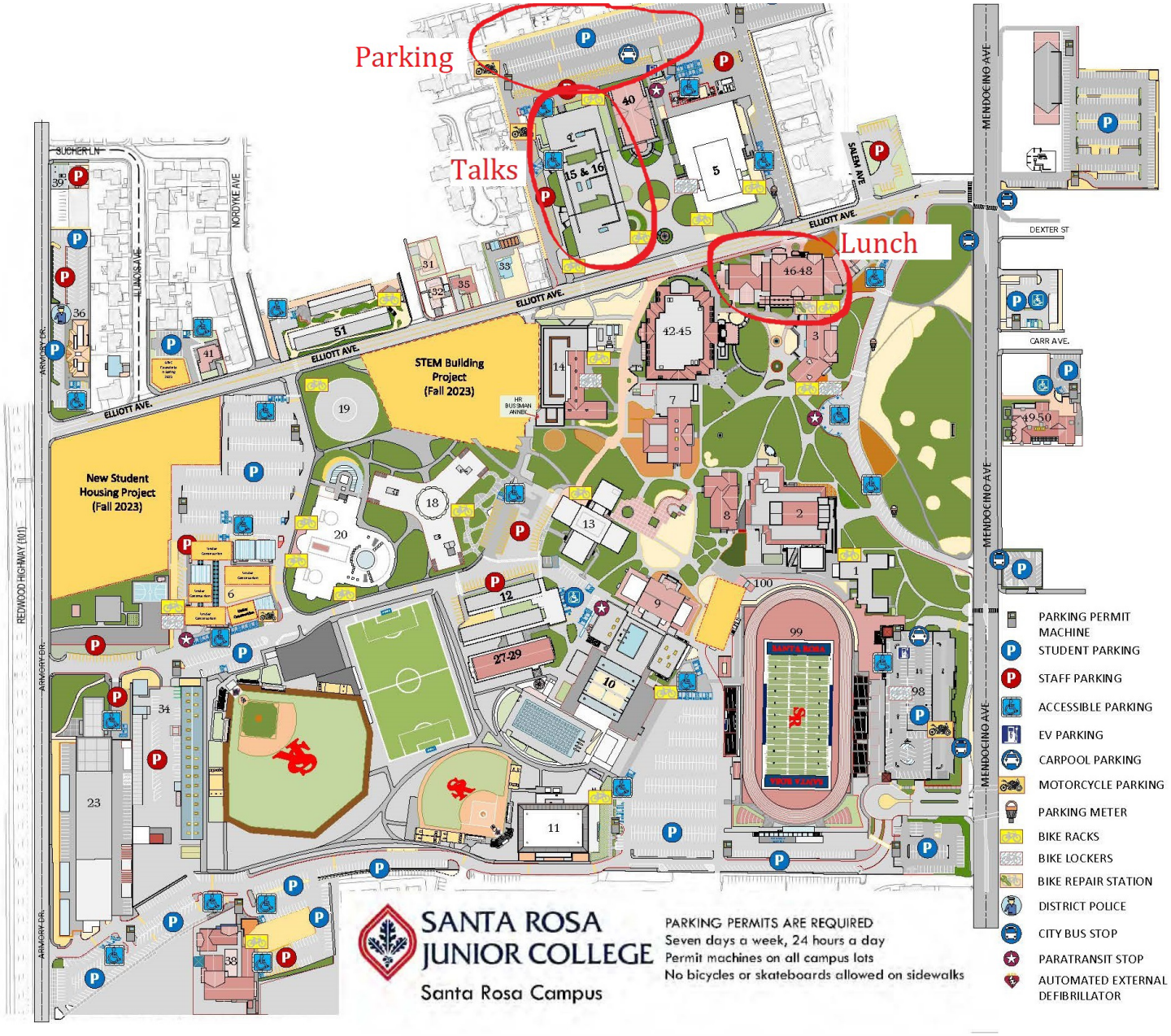
Call for Mathematical Art Works

The exhibition will take place at the meeting at Santa Rosa Junior College. The exhibition organizers are Katy Franz and Jeffrey Ventrella. During the period from 11:00 a.m. to 12:00 noon, 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 4, 2023

To submit a piece for consideration in the Mathematical Art Exhibition, fill out the Google Form by Saturday, February 4, 2023. 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. Meanwhile, here are two more images from the previous exhibition at Cal Maritime Academy!

Frank Farris and his work *The Temple of the Zonohedra*: *Balcony View*



How to Get to the Meeting at Santa Rosa Junior College

From the North

Travel south on Hwy 101. Exit at Steele Lane turnoff. At stoplight, make left turn onto Steele Lane. Proceed east-bound on Steele Lane to Mendocino Ave. Turn right on Mendocino Ave.
At intersection of Pacific Avenue and Bear Cub Way, turn right onto Bear Cub Way.

From the South

Travel north on Hwy 101. Exit at College Avenue turnoff. At stoplight, make right turn onto College Avenue. Proceed east-bound on College Avenue to Mendocino Ave. Turn left on Mendocino Ave.
At intersection of Pacific Avenue and Bear Cub Way, turn left onto Bear Cub Way.

Covid-19 Policy at Santa Rosa Junior College

Anyone who is not fully vaccinated must wear a mask and take a Covid-19 test within the week prior to entering campus. Those who are fully vaccinated are not required to wear a mask, but mask wearing is highly recommended.

Call for Student Posters

Who, When and Where

All undergraduate and graduate math students, on Saturday, February 25, 2023, at the annual meeting of the MAA Golden Section at Santa Rosa Junior College in Santa Rosa, 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.

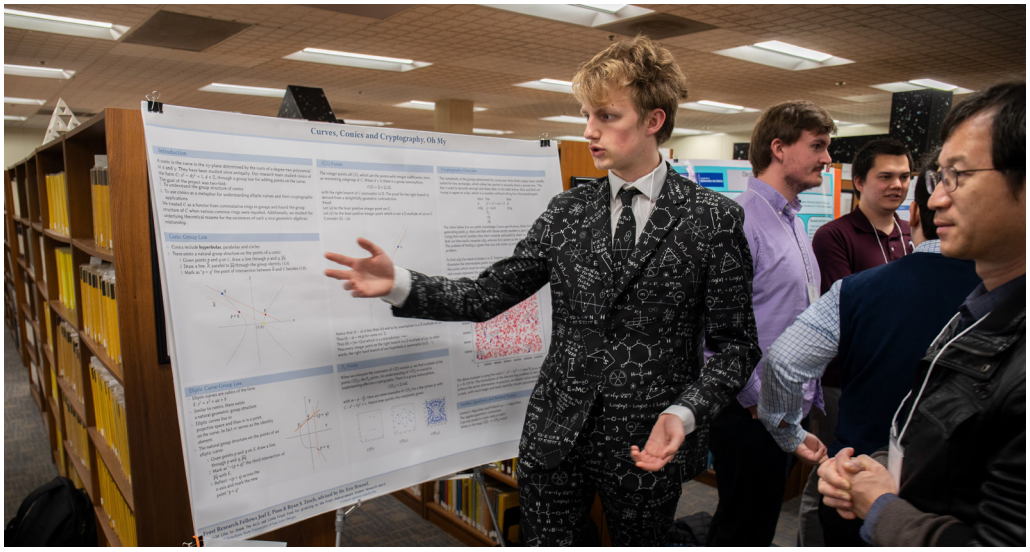
Why

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 MAA members) a **free book**.

How

To submit an abstract scan the QR code above or visit the webpage for the meeting. 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 POSTER

Deadline to submit an abstract: Saturday, February 19, 2023



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