# Spring Meeting of The Southern California-Nevada Section of The Mathematical Association of America

# Program and Abstracts


April 13th, 2024

## Acknowledgements

The Southern California-Nevada Section of the MAA welcomes participants to our 2024 Spring Meeting. We would like to thank our invited speakers and our poster session presenters for their participation in the meeting. The Section thanks the Mathematics Department at the University of San Diego for their hospitality in hosting the meeting. We would like to especially thank Martha Romero, Perla Myers, and Amanda Ruiz, who handled the local arrangements for the meeting. We also extend a special thank you to Satyan Devadoss and the Fletcher Jones endowment which sponsored the refreshments.

Please recycle your name tags at the end of the conference using the boxes provided.

## Section Officers, 2023-2024

MAA Representative: Edray Goins
Section Chair: Shanna Dobson
Section Vice-Chair: Kim Ayers
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Las Vegas Liasion: Zhijian Wu
Web Page Editor: Karrolyne Fogel

Are you looking for a way to engage with and support our math community? Our officer positions rotate frequently. Each spring we elect a new Section Vice-Chair and 2nd Program Vice-Chair, who serve on the board for three years. Other upcoming openings are the MAA Representative (elected), and the appointed positions of Meeting Coordinator (Spring Meetings), Student Chapters Coordinator, and the Section NExT Liaison to support early career faculty. If you are interested in serving in any of the Section Officer positions, but especially one of these that will be open soon, please contact the Past Section Chair (Brian Katz).

# Schedule

Warren Auditorium is located in Mother Rosalie Hill Hall

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| 8:30-12:30pm | Registration | Mother Rosalie Hill Hall |
| 8:30-10:30 | Poster Presentation Check-In | Mother Rosalie Hill Hall |
| 9:00-9:15 | Welcome Remarks and Land Acknowledgement | Warren Auditorium |
| 9:15-10:15 | Invited Address<br>**Jamie Haddock**, Harvey Mudd College<br>*Randomized Kaczmarz Methods: Corruption, Consensus, and Concentration* | Warren Auditorium |
| 10:15-10:45 | Section Business Meeting | Warren Auditorium |
| 11:00-12:00 | Student Poster Session | Buddy Sala inside Mother Rosalie Hill Hall |
| 12:00-2:00 | Lunch Break | |
| 2:00-3:00 | Invited Address<br>**Alina Bucur**, UC San Diego<br>*Counting Number Fields* | Warren Auditorium |
| 3:00-3:30 | Break | |
| 3:30-4:30 | Invited Address<br>**Amelia Stone-Johnstone**, CSU Fullerton<br>*Fostering Positive Attitudes Toward Learning Mathematics: A Mission for the Corequisite Model* | Warren Auditorium |
| 4:30-4:45 | Closing Remarks | Warren Auditorium |

## Invited Addresses

**Alina Bucur**, UC San Diego
**Counting number fields**

Arithmetic statistics is the number theorists' way of organizing and making sense of infinite sets of data, a sort of infinite data science if you will. A guiding question in this field is counting number fields in families. We will discuss the history of this question and take a closer look at the story in the case of quadratic and quartic fields.

**Jamie Haddock**, Harvey Mudd College
**Randomized Kaczmarz Methods: Corruption, Consensus, and Concentration**

The Kaczmarz methods are a family of simple, deterministic or randomized, iterative methods which can be employed for solving consistent systems of linear equations of the form $Ax = b$, or related problems. These methods have gained popularity in recent times due to their amenability to large-scale data and distributed computing environments. This talk will focus on results in three areas, all related in some way to the Kaczmarz methods: iterative methods for adversarially corrupted systems of linear equations; analyzing the dynamics of simple models of consensus amongst interacting agents; and proving bounds on the concentration and variance of randomized iterative methods. This talk presents joint works with several collaborators.

Jamie leverages mathematical tools, such as those from probability, combinatorics, and convex geometry, on problems in data science and optimization, and has been active recently in topics like randomized numerical linear algebra, combinatorial methods for convex optimization, tensor decomposition for topic modeling, network consensus and ranking problems, and community detection on graphs and hypergraphs. She is especially interested in questions about complex and messy data, like that encountered in medical applications.

**Amelia Stone-Johnstone**, CSU Fullerton
**Fostering Positive Attitudes Toward Learning Mathematics: A Mission for the Corequisite Model**

The corequisite model of academic support, sometimes referred to as concurrent learning experiences, is a method for providing students additional time to master prerequisite skills needed for their content course. This model has been adopted by many postsecondary institutions seeking ways to support their students while complying with state legislative requirements (e.g., California's AB-705, AB-1705, EO-1110) for reducing and/or eliminating pre-College level courses (i.e., developmental mathematics). While research has demonstrated the benefits for students in terms of course completion, the field is still learning about the impact of such courses on student affect. In this talk, I will discuss how the corequisite model can be leveraged to foster positive attitudes toward learning mathematics.

## Speaker Biographies

**Alina Bucur**, UC San Diego

Alina Bucur is an Associate Professor at the University of California at San Diego. She received her Ph.D. from Brown University in 2006 under the supervision of Jeffrey Hoffstein. After that, she held a position as a Moore Instructor at Massachusetts Institute of Technology (postdoc, 2006-2009) and had visiting positions at the Institute for Advanced Studies (2006-2007 and 2009-2010) and MSRI (2011). In 2018-2019 she was named a von Neumann fellow at the Institute for Advanced Study and in 2021 she became a fellow of the Association for Women in Mathematics. Her research interests lie in the area of arithmetic statistics. Bucur's work combines techniques from analytic number theory, probability, and arithmetic geometry and has been supported by two Simons Collaboration Grants and an NSF research grant.

**Jamie Haddock**, Harvey Mudd College

Jamie Haddock received her BS in Mathematics from Gonzaga University, and Ph.D. in Applied Mathematics from University of California, Davis, where she was advised by Prof. Jesus A. De Loera. After completing her degrees, Jamie joined UCLA for a three-year postdoctoral fellowship where she was mentored by Prof. Deanna Needell. She arrived at Harvey Mudd College in 2021 and is an Assistant Professor of Mathematics.

Jamie leverages mathematical tools, such as those from probability, combinatorics, and convex geometry, on problems in data science and optimization, and has been active recently in topics like randomized numerical linear algebra, combinatorial methods for convex optimization, tensor decomposition for topic modeling, network consensus and ranking problems, and community detection on graphs and hypergraphs. She is especially interested in questions about complex and messy data, like that encountered in medical applications.

**Amelia Stone-Johnstone**, CSU Fullerton

Amelia Stone-Johnstone is an Assistant Professor in the Mathematics Department at California State University, Fullerton. Her research is situated in the field of undergraduate mathematics education. Dr. Stone-Johnstone's work involves the development and assessment of academic support systems in introductory mathematics courses. In addition, her research and service include faculty professional development around equity-minded active learning.

## Poster Session Abstracts

**Presenter(s):** Ruilin Zhu, Troy High School
**Title:** *Applying the AM-GM Inequality: Writing and Solving a Type of Minimum Problems without Using Calculus*
**Abstract:** The AM-GM inequality is a powerful tool that can help us solve challenging algebra problems. While solving an equation problem from Gazeta Matematică (28550, No.3/2023), I discovered a creative and methodical approach to applying the AM-GM inequality. The approach involves splitting each term to a specific number of equal parts in order to cancel out the variable in the geometric means of all the terms when applying the AM-GM inequality. Using this approach, I was able to write and solve a whole class of problems that were previously considered solvable only by calculus. One such problem I wrote was accepted and published by Gazeta Matematică(S:L23.254, No.10/2023).
**Advisor:** Bogdan Suceavă
**Poster Area(s):** Algebra

**Presenter(s):** Karina Behera, Pomona College
**Title:** *On the Bures metric and quantum metric*
**Abstract:** In 2017, Farenick and Rahaman showed that the Bures metric is a metric on the density space of any unital C*-algebra given any trace, thus opening up this metric from quantum information theory to the world of C*-algebras. In our work, we have found a way to induce another metric on the density space using quantum metrics of Rieffel. Thus, we show some comparisons between the Bures metric and the induced quantum metric. Specifically, we have found certain finite-dimensional C*-algebras for which the Bures metric and the induced quantum metric are topologically equivalent but not equivalent as metrics (This is joint work with Konrad Aguilar and Tron Omland).
**Advisor:** Konrad Aguilar
**Poster Area(s):** Analysis

**Presenter(s):** Darren Okura, California State University, Fullerton; Los Alisos Intermediate School
**Title:** *An Identity Regarding the Subseries of the Maclaurin Expansion for the Exponential Function*
**Abstract:** In the poster, we prove an identity describing the closed form of the subseries of the Maclaurin expansion for the exponential function. We identify the subseries with a solution to an ODE and some ideas involving complex numbers.
**Advisor:** Dr. Shoo Seto and Dr. Bogdan Suceavă
**Poster Area(s):** Analysis

**Presenter(s):** Liwei Jia, Jacob Pan, Claremont High School
**Title:** *Meta-Analysis of Correlation between Possible Factors Affecting COVID-19 Mortality Rate*
**Abstract:** In this research project, we explored the many factors affecting pandemics. To conduct the meta-analysis, we collected and analyzed data from established sources including Johns Hopkins University, the World Health Organization, and the CIA organization. We performed correlation analysis using software to assess the relationship between these variables and their effects on COVID-19 death rates. Our findings show negative correlations for the following comparisons against the COVID-19 mortality Rate: Population Density, Hospital Beds (per thousand), and Physician numbers (per thousand). Furthermore, we obtain a strong negative trend for the number of COVID-19 World Daily New Deaths per Million vs the daily accumulative Vaccination Rate of the world population. The comparison against the Elderly Age Dependency Ratio, on the other hand, has a positive correlation. We used the coefficient of correlation (R) to determine the level of correlation between variables and the COVID-19 death rate.
**Advisor:** Xiaoyan Liu
**Poster Area(s):** Applied Mathematics

**Presenter(s):** Jingkang Xie, Xin Liu, Yubei Peng, Haoran Zheng, Claremont High School and Los Osos High School
**Title:** *The Ticking Time Bomb: An Analysis of the Growing US Debt Crisis*
**Abstract:** In summary, our team drew the blueprint of this real world based on the historical context, including government shutdown and debt ceiling debates. By deriving these models from these data and economic modeling, it indicated that the debt-to-GDP ratio of these 3 models will respectively reach an alarming level by the years 2156, 2088 and 2095. Approximately anticipated that ensuring long-term fiscal sustainability to eliminate the mounting debt burden is one of the urgent needs of policy makers. In order to tackle the debt crisis, we value the importance of bipartisan cooperation, public engagement, and bold leadership. According to the current situation from the United States, a practical solution will be to implement targeted spending cuts, revenue increases, and structural reforms urgently in order to promote sustainable economic growth and fiscal responsibility.
**Advisor:** Xiaoyan Liu
**Poster Area(s):** Applied Mathematics

**Presenter(s):** Lila Fowler, University of San Diego
**Title:** *Multifidelity Modeling for Rarefied Gas Kinetics Using POD and CFD*
**Abstract:** On this project we use multifidelity modeling methods to develop a more efficient model for fluid flow over a wedge. We study low density, supersonic air moving across a wedge and study its density across a spatial domain. There exist high fidelity (high accuracy, high computational time) models for this problem such as the Direct Simulation Monte Carlo (DSMC) method. We combine select DSMC data points in a data fit model using Proper Orthogonal Decomposition (POD) and independently developed a model using Computational Fluid Dynamics (CFD) techniques. We combine the POD and CFD models in an error correction term to produce an output model that runs orders of magnitude faster than DSMC while maintaining comparable accuracy. In this way, we demonstrate the efficacy of multifidelity methods for fluid flow problems.
**Advisor:**
**Poster Area(s):** Applied Mathematics, Interdisciplinary Topics

**Presenter(s):** Jingquan Shi, Xinyi Hu, Claremont High School and Los Osos High School
**Title:** *Prediction of Effect to the Rising Heat Waves in United States Using Mathematical Modeling*
**Abstract:** This paper pictures an overview of US heat waves trends in recent decades through mathematical modeling and predicts its effects on local communities in terms of human health along with a more thorough understanding in community-dwelling changes. This research utilizes mathematical modeling in least square fits to find heat waves frequency, duration, season and intensity in the past few decades from 1960 to 2020. As a result of this study, an accumulating pattern for heat waves frequency, duration and season was found. These discoveries support the existence of an increasing routine of heat waves, which negatively impacts human health along with a necessity for less CO2 emission to save architectures. This research has a great potential to be further explored and predicted with more quantitative data collection on US resident health reports and CO2 emission.
**Advisor:** Professor Xiaoyan Liu and Professor Liang Kong
**Poster Area(s):** Applied Mathematics, Interdisciplinary Topics

**Presenter(s):** Colin McGrane, San Diego State University
**Title:** *Listening to Student Experiences in Support Courses: Confidence and Sense of Belonging in Undergraduate Mathematics*
**Abstract:** Studying student identities and their unique experiences in undergraduate mathematics education serves as a fundamental aspect of understanding how mathematics departments can best serve the most at-risk populations of students who are often harmed by inequities present in student success rates in undergraduate mathematics courses. This study focuses on the experiences of 61 students enrolled in support courses for Precalculus and Calculus I, where they engage in frequent Supplemental Instruction (SI) sessions and an online course run by the university Math Equity Coordinator. Using a mixed-methods approach consisting of interviews and a survey, I examine the impact of these supports on students' sense of belonging and confidence in mathematics. Preliminary results from survey analysis show that students in the support course report higher levels of belonging and confidence in mathematics. Additionally, quotes from student interviews highlight the importance of instructor mentorship in enhancing students' confidence and sense of belonging.
**Advisor:** Chris Rasmussen
**Poster Area(s):** Education/Pedagogy

**Presenter(s):** Ruo Ning (Nancy) Qiu, San Diego State University
**Title:** *A Case Study: Comparing Instruments in Chemistry Education and Mathematics Education with Coding Scheme*
**Abstract:** This poster showcases a coding scheme designed to extract information about instruments (e.g., surveys, questionnaires, etc.) used in chemistry education literature and how the coding scheme applies to a case study in mathematics education literature. The original coding scheme is employed in the CHemistry Instrument Review and Assessment Library (CHIRAL) project. Coded instruments, panel-reviewed by experts to aid consumers in making data-informed decisions, are available in the database (at chiral.chemedx.org) for other researchers to search and reuse, thereby promoting sustainability within the field. By comparing the coding process applied to an instrument in another discipline (mathematics, in this case), this study verifies the applicability and transferability of the coding scheme originally designed for chemistry instruments. This case study also initializes forming a robust framework for coding instruments to summarize their characteristics like validity, reliability, and demographics in education journals of other disciplines, as an extendable direction of the CHIRAL project.
**Advisor:** Regis Komperda
**Poster Area(s):** Education/Pedagogy

**Presenter(s):** Blue Taylor and Mariah Moschetti, San Diego State University (SDSU)
**Title:** *Exploring Graduate TAs' Perspectives on Equity in Professional Development*
**Abstract:** STEM education needs to be more equitable, as evidenced by the low persistence of minoritized students. Despite efforts to improve outcomes, challenges persist, often attributed to student experiences in gateway mathematics courses like precalculus and calculus. Mathematics Graduate teaching assistants (MGTAs) are pivotal in addressing this issue to support undergraduate STEM students. However, MGTAs only sometimes receive training in student-centered and equitable teaching practices, highlighting the need for MGTA professional development (PD). This poster focuses on an early activity as part of an MGTA PD course focused on engaged learning, inclusive teaching, and equity. We used Gutiérrez's (2009) four dimensions to analyze their reflections on the activity to see how it prompted them to think of equity. Our analysis revealed prevalent themes of access and achievement and emergent themes of empathy and a growth mindset, emphasizing the potential impact and ongoing need for MGTA PD focused on equity and inclusion.
**Advisor:** Prof. Mary Pilgrim
**Poster Area(s):** Education/Pedagogy, Equity and Inclusion

**Presenter(s):** Brinley Poulsen Stringer, San Diego State University
**Title:** *The Impacts of a Near-Peer Mentor Program Across a Mathematics Department*
**Abstract:** Many interventions are being implemented and studied to help combat barriers into STEM fields that contribute to high attrition and low persistence rates. One such intervention is near-peer mentor (NPM) programs, which utilize undergraduate students as academic supports for fellow undergraduate students. While studies have found that NPM programs contribute towards improved outcomes for students and other positive impacts, there is a gap in the literature studying how NPM programs make such differences. To fill this gap, my dissertation study used qualitative methods to investigate how an NPM program impacts the classes, and more broadly the mathematics department, at a private liberal arts university. From analysis of observational and interview data, this poster outlines main findings of the study. One major impact of the program was the NPM's ability to help students feel more comfortable and seek out additional support resources. One major challenge of the program was fragmented communication structures, and one suggested improvement was increased professional development for both instructors and NPMs.
**Advisor:** Mary E. Pilgrim
**Poster Area(s):** Education/Pedagogy, Interdisciplinary Topics

**Presenter(s):** Carlos Alejandro de Alba, San Diego State University
**Title:** *Analyzing Integer Multiplication Strategies and Strategy Adoption*
**Abstract:** We examined how students compared and adopted strategies for novel tasks. Students responded to ten integer multiplication problems that assessed their pre-instructional understanding. Seven reflection questions were designed to expose students to potentially new solution strategies. Student responses and explanations were categorized into four major dimensions: Focusing, Judging, Comparing, and Adopting with statements or occurrences sorted into subcodes within each dimension. We use results from one student to exemplify the major elements of the adoption process. We observed that students have some level of intuition about negative numbers and are more than willing to attempt to reason through integer multiplication after some exposure to strategies. If teachers can attend to a student's focus, judgment, and comparisons, they may be able to scaffold the adoption process and the path to robust understanding.
**Advisor:** Dr. Lisa Lamb
**Poster Area(s):** Education/Pedagogy, Student Reasoning

**Presenter(s):** Devin Frost, CSU Channel Islands
**Title:** *Study of a Surface of Rotation*
**Abstract:** We study $S$, the surface of rotation created by rotating $y = (x-1)(x-2)(x-3)$ around the $y$-axis in $R^3$. We show its properties including the fundamental forms and curvature. We find that $S$ has a genus of $1/2$, and prove that it has one singular point. We find that the fundamental forms are all in terms of $u$, and theorize as to why. We analyze 4 curves on the surface, including finding and proving that one is a geodesic.
**Advisor:** Ivona Grzegorczyk
**Poster Area(s):** Geometry, Analysis

**Presenter(s):** Heydar Amanov, CSU Channel Islands
**Title:** *The Pseudosphere*
**Abstract:** The *pseudosphere* $\mathcal{P}$, sometimes called the *tractroid*, is a surface of revolution generated by the *tractrix* that has constant negative Gaussian curvature. That is, given the principal curvatures $\kappa_1$, $\kappa_2$, we have $\kappa_1\kappa_2 < 0$ for any point. The theory of constant negative Gaussian curvatures deals with surfaces that follow Lobachevskian geometry. Its mathematical importance comes from its ability to demonstrate negative curvature geometrically, with additional applications of the pseudosphere being shown in fields like physics. In this paper, we show parametric equations of the pseudosphere $\mathcal{P}$ in $\mathbb{R}^3$, define and analyze curves on the surface, and deal with its other properties, such as the corresponding equation for its geodesics and its Christoffel symbols. We then conclude with a more generalised theory of pseudo-spherical surfaces, that is, surfaces with constant negative curvature.
**Advisor:** Ivona Grzegorczyk
**Poster Area(s):** Geometry, Topology

**Presenter(s):** Cyrus Young, University of California, Irvine
**Title:** *New Results on Rainbow Cliques and Colorful Turán Problems*
**Abstract:** Given an edge-colored graph $G$, we denote the number of colors as $c(G)$, and the number of edges as $e(G)$. An edge-colored graph is rainbow if no two edges share the same color. A proper $mK_3$ is a vertex disjoint union of $m$ rainbow triangles. Rainbow problems have been studied extensively in the context of anti-Ramsey theory, and more recently, in the context of Turán problems. B. Li. et al. found that a graph must contain a rainbow triangle if $e(G)+c(G) \geq \binom{n}{2}+n$. L. Li. and X. Li. conjectured a lower bound on $e(G) + c(G)$ such that $G$ must contain a proper $mK_3$. In this paper, we provide a construction that disproves the conjecture. We also introduce a result that guarantees the existence of $m$ vertex disjoint rainbow $K_k$ subgraphs in general host graphs, and a sharp result on the existence of proper $mK_3$ in complete graphs.
**Advisor:** Dr. Juergen Kritschgau
**Poster Area(s):** Graph Theory/Combinatorics

**Presenter(s):** Samuel Barrier, Pepperdine University
**Title:** *Supersymmetric systems, binary arithmetic, and computers.*
**Abstract:** Studying supersymmetric equations can be difficult. One way that can make things more simple is by using existing techniques of representing equations with graphs. These graphs are known as Adinkras. Finding Adinkras becomes increasingly more difficult as the equations grow in size. To address this we have tried to apply computational methods to generating Adinkras. This was done by using binary numbers and modular arithmetic to generate the different components of Adinkras. This will allow for the generation of Adinkras that would be too difficult to do by hand. By doing this we hope to better understand the structures these equations produce beyond the limits of computation by hand. Currently the program is limited by the information lost by representing the data structures with binary. In the future we hope to advance the study of adinkras using computers and find new structures to categorize.
**Advisor:** Kevin Iga
**Poster Area(s):** Graph Theory/Combinatorics, Physics

**Presenter(s):** Emma Chen and Erline Casey Choon Fat Cheung, Arcadia High School
**Title:** *Investigation on Patterns of Homelessness in the United States*
**Abstract:** This study analyzes the patterns of homelessness in the United States from 2015 to 2023, with a specific focus on the aspect of race and ethnicity. The trends discovered in this study would help us better understand how certain races and ethnicities are most impacted by homelessness and provide the most suitable solutions to reduce the homeless populations.
**Advisor:** Xiaoyan Liu
**Poster Area(s):** Probability/Statistics, Analysis

**Presenter(s):** Yidan Wang, Chenzhang Zhao, University of California, Irvine
**Title:** *Community detection with Bethe-Hessian*
**Abstract:** Community detection is a fundamental problem in network analysis with many methods proposed to estimate and distinguish the communities within a network. Some previous methods, such as spectral clustering with the adjacency matrix and the non-backtracking matrix, have shown to achieve certain level of success in recovering the community and estimating the number of communities. We studied the community detection problem in a Stochastic Block Model with a spectral method based on a different operator called the Bethe-Hessian matrix. This is a hermitian matrix which is a weighted combination of the adjacency matrix and the degree matrix. It also has a deep connection to the Ihara-Bass formula and the non-backtracking operator. We empirically showed this operator could achieve better error rate when the graph has bounded expected degree. We conjectured that using the spectral information of the non-backtracking matrix, we can control the locations of the informative eigenvalues the Bethe-Hessian matrix. We also demonstrate that there exists a strong correlation between the informative eigenvector of the non-backtracking matrix and the Bethe-Hessian matrix, which potentially lead to more computationally efficient algorithms for community detection.
**Advisor:** Yizhe Zhu
**Poster Area(s):** Probability/Statistics, Applied Mathematics

**Presenter(s):** Joseph Martin, Cal State University Channel Islands
**Title:** *From Data to Diapers: Applying Machine Learning to Address Insecurity in Ventura County*
**Abstract:** In the United States, obtaining diapers for underserved families is an urgent social problem to solve, as most families are "living diaper to diaper." In this study, we utilize geographic information systems and unsupervised machine learning techniques to determine an optimal location for a diaper distribution center in Ventura County. We applied a k-means clustering algorithm to publicly-available data obtained from the United States Census Bureau on the population of infants and families living at or below 200% of the federal poverty level. Potential locations were identified with data-weighted tract centroids of the generated clusters. Viability of these locations was assessed according to proximity to major bus routes and population of families in need within a 30 minute walking distance. Our findings highlight potential areas for increasing diaper access for underserved families in south Oxnard, CA.
**Advisor:** Dr. Isaac Quintanilla Salinas
**Poster Area(s):** Probability/Statistics, Interdisciplinary Topics

**Presenter(s):** Hongyi Ou, Pasadena City College
**Title:** *The Solution of the 84th William Lowell Putnam Mathematical Competition 2023 Session A, Question A2*
**Abstract:** The question is as such: Let n be an even positive integer. Let p be a monic, real polynomial of degree $2n$; that is to say, $p(x) = x^{2n} + a_{2n-1} * x^{2n-1} + ... + a_1x + a_0$ for some real coefficients $a_0, \ldots, a_{2n-1}$. Suppose that $p(1/k) = k^2$ for all integers $k$ such that $1 \leq |k| \leq n$. Find all other real numbers $x$ for which $p(1/x) = x^2$.
**Advisor:**
**Poster Area(s):** Putnam Exam

**Presenter(s):** Caleb McCrillis, USD
**Title:** *Developing Semi Rigid Knots*
**Abstract:** A semi rigid knot can loosely be described as a knot with one or more arcs which cannot be deformed. We are working on the development of a mathematical way to describe semi-rigid knots and elementary deformations of knots with rigid segments.
**Advisor:**
**Poster Area(s):** Topology