Morning Contributed Paper Session Abstracts

Abstracts are listed by session

Golden Eagle Ballroom (across bridge) (Mathematics Education I)

10:10-10:25 in Golden Eagle Ballroom (across bridge)
Presenter(s): Rasha Issa, University of California, Riverside
Title: *Examining Reflective Practices Among Mathematics Graduate Student Instructors Through Journaling and Community Discussions*
Abstract: Mathematics Graduate student (MGs) instructors play a vital role in undergraduate education, yet limited pedagogical preparation often leads them to default to traditional, survival-driven teaching practices. This qualitative study examines a low-stakes professional development model designed to cultivate teacher noticing and reflection among novice MGS primary instructors during a summer term. Grounded in Schon's theory of reflective practice and Mason's Discipline of Noticing, the model combined weekly "brief-but-vivid" journaling with peer-faculty community discussions. Analysis of post-program exit interviews demonstrates that writing objective classroom accounts heightened instructors' real-time classroom awareness. Group discussions introduced key pedagogical disturbances, such as re-evaluating unscripted board delivery and integrating dynamic visualization tools—that disrupted routine habits. The interplay between objective journaling and collective dialogue fostered vicarious learning, enabling instructors to translate critical reflections into prospective, student-centered instructional changes. We share actionable insights for structuring reflection-centered professional development for graduate instructors. *Math Education/Pedagogy*
Audience: *General audience (faculty, graduate students, and undergraduate instructors)*

10:30-10:45 in Golden Eagle Ballroom (across bridge)
Presenter(s): Omar Bello, California State University, Fullerton
Title: *"I feel marginalized in mathematics and tend to feel like an imposter, as if I should not be there": Exploring Factors Influencing Mathematical Identity Development*
Abstract: Students' mathematical learning is seen through performance-based measurements such as grades, coursework, and standardized tests. These measurements provide insight about mathematical achievement, yet offer a partial understanding of the experiences that shape students as doers of mathematics. This research study examines the mathematical autobiographies of 51 California State University, Fullerton students who participated in the Math Reflection Survey. We analyzed participants reflections on their K-12 mathematics experiences to identify themes related to the development of mathematical identities. Reported positive mathematical identities include classroom factors, sociopolitical factors, and familial factors. Reported negative mathematical identities include classroom factors, sociopolitical factors, personal factors, and systemic factors. These findings demonstrate that students' autobiographies provide an additional perspective for understanding mathematical identities that extend traditional measures of achievement and the values of centering students' lived experiences within mathematics education. *Math Education/Pedagogy*

10:50-11:05 in Golden Eagle Ballroom (across bridge)
Presenter(s): Luc Frost-Neto (UC Santa Barbara), Dani Barwin (Cal Poly Pomona)
Title: *Care in the College Mathematics Classroom: A Quantitative Exploration of Student Perceptions*
Abstract: Care in the classroom is widely linked to K-12 student engagement and success, yet student perceptions of care in college mathematics are far less studied. We surveyed students enrolled in mathematics at a large minority-serving institution about their experience receiving care in the classroom. Students largely agreed that care was a meaningful component of their mathematics classroom experience. One-way ANOVAs found little difference in affect and experiences with care across demographic groups, though gender and transfer status emerged as leads for further investigation. An exploratory factor analysis was used to better understand how students conceptualize care in the classroom. We frame such results as hypothesis-generating for a larger confirmatory study. This study provides preliminary evidence and groundwork for developing validated measures of care in undergraduate mathematics classrooms. *Math Education/Pedagogy*

11:10-11:25 in Golden Eagle Ballroom (across bridge)
Presenter(s): Kathryn Tickle, Dani Barwin, Eric Wilcox, California Polytechnic University, Pomona
Other Author(s): Research advisor: Dr. Anne Cawley, Cal Poly Pomona
Title: *Mathematics Majors' Challenges of Merging Mathematics and Social Justice*
Abstract: Teaching mathematics for social justice (TMfSJ) encourages meaningful learning by connecting lessons to social injustices and students' lived experiences. In this study, we examined social justice mathematics lessons (SJMLs) created by 15 mathematics students. We analyzed the SJMLs and post-lesson reflections focusing on how students engaged with both mathematics and social justice (SJ) topics. Analysis shows varying ways that the students engaged the mathematics and SJ topics, with most lessons focused on statistics content. In their reflections, students reported that educating themselves on their SJ topic was time-consuming and difficult, and more than half of the students referenced choosing to cut down their SJ discussion to allow more time for mathematical activities. Through this study, we found that planning and executing SJMLs is an incredibly challenging task. *Math Education/Pedagogy*
Audience: Mathematics Education/Mathematics for Social Justice

San Gabriel Room 313
(Classical and Algebraic Geometry)

10:10-10:25 in San Gabriel Room 313
Presenter(s): Ruilin Zhu, Troy High School and Fullerton Math Circle
Title: *Seven Ways to Prove a Triangle Is Equilateral with Complex Numbers*
Abstract:
Abstract: In the complex plane, complex numbers correspond to their affixes, and this allows the use of vectors and their geometric properties. As a result, complex-number computation can be used to solve a wide range of geometry problems. This talk focuses on one such class: proving that a triangle is equilateral. I present seven complex-number criteria for equilaterality, some derived from geometric methods and others from purely algebraic reasoning. I then use a classical result, Napoleon's Theorem, as a worked example to demonstrate the application of some of these criteria. The complex-number approach is often direct and computational, offering a systematic alternative to the geometric intuition and creativity that challenging geometry problems can otherwise demand. *Algebra, Geometry*
Advisor: Dr. Bogdan Suceavă and Dr. Shoo Seto, California State University, Fullerton

10:30-10:45 in San Gabriel Room 313
Presenter(s): Gary Brookfield, Cal State LA
Title: *Efficient Construction of the Heptadecagon*
Abstract: In 1796, Gauss showed that the complex 17th roots of unity can be expressed as the roots of quadratic polynomials. Consequently, a regular 17-sided polygon (a regular heptadecagon) can be constructed using a straightedge and compass. The fact that expressing a single 17th root of unity requires the solution of four levels of quadratic equations, and that solving a quadratic equation geometrically requires drawing at least one circle means that any geometric method for constructing one vertex of a regular heptadecagon requires at least four circles. This talk shows that this optimal construction is possible, leading to an efficient construction of the entire heptadecagon. *Algebra, Geometry*

10:50-11:05 in San Gabriel Room 313
Presenter(s): Sehun Jeong, Claremont McKenna College
Other Author(s): Co-Author: Lenny Fukshansky, Claremont McKenna College
Title: *Integral quadratic forms and lattice angles*
Abstract: Let us consider angles between two vectors in the integer lattice $\mathbb{Z}^n$. Fixing one such possible angle and one integer vector x, is there always another integer vector y that makes this angle with x? Assuming that x makes a given angle with some vector, how can we find the shortest such vector y? What if we designate a forbidden set of vectors, what is the shortest y making a given angle with x outside of this forbidden set? It turns out that all of these questions can be reformulated in terms of a search for integer zeros of integral quadratic forms, a rich arithmetic theory. I will discuss this research direction and show results by several authors, then present my recent joint work with Lenny Fukshansky at Claremont McKenna College. *Algebra, Geometry, Number Theory*

Montebello Room 309
(Algebra and Number Theory)

10:10-10:25 in Montebello Room 309
Presenter(s): Roberto Hernandez, University of California
Title: *Models of Elliptic Curves with Maximal 2-adic Image Subject to a Rational 2-Isogeny*
Abstract: Let E be a non-CM elliptic curve defined over $\mathbb{Q}$. We present models of curves that have 2-adic image as large as possible, given the constraint that they have a rational 2-isogeny. These curves are known to be generic, and one of the aims of this article is to make that fact explicit. Our techniques make use of modular curves and their j-maps, as well as classification results on isogeny-graphs that have appeared in the literature recently. *Number Theory*

10:30-10:45 in Montebello Room 309
Presenter(s): Shahed Sharif, CSU San Marcos
Title: *A quantum algorithm for principalizaing quaternionic ideals*
Abstract: We extend an algorithm of Page (2014) to compute a generator of a principal ideal for a quaternion algebra defined over a number field. Our method makes use of a quantum computer to navigate Bruhat-Tits trees—that is, at each prime we work with a group action on an infinite graph, where the vertices of the graph classify localizations of ideals. This is work in progress, joint with A. Silverberg and J. Voight. *Algebra, Number Theory*

10:50-11:05 in Montebello Room 309
Presenter(s): Leo Friedman, Scott Gowdy, Peiting (Tim) Jiang, Pomona College
Title: *A bicategorical construction of Span$_2(\mathcal{C}, \mathcal{F})$*
Abstract: Span categories provide a framework to compose certain physical systems. Given a category with pullbacks $\mathcal{C}$, we can form a span category Span($\mathcal{C}$) whose objects are objects in $\mathcal{C}$ and morphisms are isomorphism classes of spans in $\mathcal{C}$. In 1967, J. Bénabou introduced bicategories and showed that one can construct a bicategory of spans from a category $\mathcal{C}$, that has pullbacks, denoted by Span$_2(\mathcal{C})$. If the category does not have pullbacks, we can bypass this obstruction using the following construction due to D. Weisbart and A.M. Yassine. Given categories $\mathcal{C}$ and $\mathcal{C}'$ and a functor $\mathcal{F}\colon \mathcal{C} \to \mathcal{C}'$, we can form a generalized span category Span$(\mathcal{C}, \mathcal{F})$ using $\mathcal{F}$-pullbacks instead of pullbacks and if $\mathcal{F}$ is span tight. We extend the construction of the generalized span category Span$(\mathcal{C}, \mathcal{F})$ to a bicategory Span$_2(\mathcal{C}, \mathcal{F})$. *Algebra, Category Theory*

11:10-11:25 in Montebello Room 309
Presenter(s): Fabian Ramreiz, University of California, Irvine
Title: *An Average Version of Artin's Primitive Root Conjecture for Elliptic Curves*
Abstract: Let E be an elliptic curve over $\mathbb{Q}$, and let $P \in E(\mathbb{Q})$ be a point of infinite order. For a prime p of good reduction, we say P is a primitive point modulo p if $E(\mathbb{F}_p) = \langle P \bmod p \rangle$. The Lang-Trotter primitive-point conjecture predicts the natural density of primes such that P is a primitive point, providing a natural elliptic curve analogue of Artin's primitive root conjecture. We prove an average version of this conjecture for the family of elliptic curves $y^2 + ay = x^3 + bx^2 + cx$ where $a, b, c \in \mathbb{Z}$ and $P = (0, 0)$. More precisely, if $A, B, C \geq x^{1+\epsilon}$, then the average, over $|a| \leq A, |b| \leq B, |c| \leq C$ of the number of primes $p \leq x$ for which $(0, 0)$ generates $E(\mathbb{F}_p)$ is asymptotic to $C_{EA}\frac{x}{\log x}$ where $C_{EA} = \prod\left(1 - \frac{\ell^3-\ell-1}{\ell^2(\ell^2-1)(\ell-1)}\right) = 0.44014739\ldots$. *Number Theory*

Los Angeles Room 308
(Analysis and Differential Equations)

10:10-10:25 in Los Angeles Room 308
Presenter(s): Edgar Rojas, Cal Poly Pomona
Other Author(s): Research advisor: Dr. Fernando Lopez-Garcia
Title: *The Fefferman-Stein inequality on a bounded cuspidal domain.*
Abstract: This research focuses on the restricted sharp maximal function where we investigate its role in establishing local Fefferman–Stein inequalities. We show that the classical unweighted inequality fails on the cuspidal domain by demonstrating its implication of the improved Poincaré inequality, which does not hold in non-John domains. We then prove a weaker weighted version of the local Fefferman-Stein inequality on the cuspidal domain. Our approach relies on a decomposition of the domain, followed by localized analysis on each component and a local-to-global argument to piece together the global estimate. *Analysis Real Analysis*
Audience: Real Analysis, Functional Inequalities, Harmonic Analysis

10:30-10:45 in Los Angeles Room 308
Presenter(s): Ang Elyn P. Gumanoy, California State Polytechnic University, Pomona
Title: *Beyond Gaussianity: Mittag-Leffler Analysis and Generalized Scaling Operators*
Abstract: Gaussian analysis provides powerful tools for studying stochastic processes and generalized functions, but many phenomena particularly those involving fractional diffusion and anomalous behavior may require a non-Gaussian framework. Mittag-Leffler analysis provides a non-Gaussian infinite-dimensional framework in which the exponential function in the Gaussian characteristic function is replaced by a Mittag-Leffler function. In this talk, we provide an overview of Mittag-Leffler analysis and its associated Mittag-Leffler measure. We then discuss extensions of generalized Gauss kernels and scaling operators to this setting. We highlight their relationship through a generalized Wick-type formula. *Analysis*

10:50-11:05 in Los Angeles Room 308
Presenter(s): Adam M. Yassine, Pomona College
Title: *Compactness of the density space in the Bures metric topology and the non-unital case*
Abstract: Building off work of Farenick and Rahaman, we extend the definition of the density space and the Bures metric to the setting of non-unital C^*-algebras equipped with a faithful tracial state and prove that the Bures metric is also a metric in this case. Furthermore, we prove a Heine-Borel type theorem for C^*-algebras and the density space. In particular, we prove that for any C^*-algebra (unital or non-unital) equipped with a faithful tracial state, the density space equipped with the Bures metric topology is not compact if and only if the C^*-algebra is infinite dimensional. We also exhibit several examples of sequences that have no converging sequence in the unital and non-unital case including both commutative and noncommutative C^*-algebras. This is joint work with Konrad Aguilar, Karina Behera, Katrine von Bornemann Hjelmborg, Tron Omland, Gregory Wickham, and Nicole Wu. *Analysis*

11:10-11:25 in Los Angeles Room 308
Presenter(s): Jingfan Zheng, Pomona College
Title: *A Time-Map Description of the One-Dimensional (p, q)-Laplacian Fučik Spectrum*
Abstract: We study the one-dimensional Fučik-type problem

$$-\left(|u'|^{p-2}u' + |u'|^{q-2}u'\right)' = \lambda(u^+)^{p-1} - \mu(u^-)^{q-1}, \qquad u(0) = u(L) = 0,$$

where $1 < q < p$ and $\lambda, \mu \in \mathbb{R}$. Because the operator contains two different homogeneities, the usual scaling argument for the homogeneous p-Laplacian does not directly produce the Fučik branches. We show that every sign-changing solution must lie in the positive (λ, μ) quadrant and use a one-dimensional time-map method to characterize such solutions. If a solution has m positive nodal intervals and n negative nodal intervals, then all intervals share a common energy $E > 0$, and the parameters satisfy

$$2m\lambda^{-1/p}A(E) + 2n\mu^{-1/q}B(E) = L.$$

This yields a necessary-and-sufficient description of the corresponding spectral regions and gives formulas for their boundaries and asymptotes. *Analysis, Differential Equations*

Pasadena Room 307
(Graph Theory and Combinatorics)

10:10-10:25 in Pasadena Room 307
Presenter(s): José Mijares-Palacios, California State University Los Angeles
Title: *On quantum Ramsey theory*
Abstract: Ramsey theory can be understood as an evolving framework to study colorings (or partitions) of mathematical structures admitting interest- ing monochromatic substructures (that is, substructures contained in one single class of the partition, satisfying a desired property). Many phenomena arising in different contexts can be studied within this framework and that is why Ram- sey theory has proved to be useful and very fruitful, with applications in several mathematical fields and other areas of science and technology. In this talk, after reviewing key results from classical Ramsey theory and its connections with in- formation theory, we will discuss recent "quantum" or noncommutative counter- parts to some of those results, including a generalized infinite quantum Ramsey theorem for operator systems that we proved recently (arXiv.2604.26894).

Operator Systems/Combinatorics (finite and infinite)/Ramsey Theory/Logic/Quantum Information
Audience: Combinatorics/Logic/Some functional analysis would be helpful

10:30-10:45 in Pasadena Room 307
Presenter(s): Sihan Tao, University High School
Title: *Asymptotic Lower Bounds of Diagonal Ramsey Numbers - Bonferroni Inequalities*
Abstract: In graph theory, diagonal Ramsey numbers $R(k, k)$ are the minimum number of vertices n ensuring a monochromatic k-clique in a two-colored complete graph K_n. Exact values remain unknown for $k > 4$, making asymptotic bounds a major research focus. Paul Erdős famously established an exponential lower bound by using a union bound to overestimate the probability of achieving a monochromatic clique in randomly colored graphs. We extend this probabilistic framework by using higher-order Bonferroni inequalities to achieve tighter probability overestimations. Specifically, we explicitly compute the third-order Bonferroni inequality and compute lower bounds of certain small diagonal Ramsey numbers. Based on our computational data, we hypothesize that higher-order Bonferroni inequality terms can be approximated with a Poisson paradigm. Using Poisson approximations and determining when event dependencies are negligible, we construct a heuristic argument asymptotically improving upon Erdős's bound by a constant factor of $2^{\frac{3}{4}}$. While slightly weaker than the current best-known bound, which beats Erdős by a factor of 2, our result surpasses other advanced bounds, demonstrating potential to match or exceed current bounds by further extending this Bonferroni framework. *Graph Theory/Combinatorics, Probability/Statistics*

10:50-11:05 in Pasadena Room 307
Presenter(s): Abdulrahman Sahmoud, California State University, Los Angeles
Title: *Exact Upper Quantum Turan Numbers*
Abstract: Operator systems are matrix spaces that provide a noncommutative analogue of graphs and arise naturally in quantum information theory. Weaver introduced quantum analogues of clique and Turan problems for operator systems. Writing $q = n - k - 1$, we prove the exact formula

$$T^{\uparrow}(n, n-q-1) = n^2 - q^2 - 4q - 1.$$

The proof translates the covering condition into an incidence variety of Hermitian matrices and q-dimensional subspaces. After passing to a smooth rank stratum, Sard's theorem supplies a regular point, and first- and second-order tangent calculations force the sharp dimension bound. In the equality case, the argument also gives a structural description of all extremal operator systems. *Graph Theory/Combinatorics, Quantum Information Theory / Operator Systems*

11:10-11:25 in Pasadena Room 307
Presenter(s): Kai Mawhinney, Harvey Mudd College
Title: *Connectivity and Diameter of Friends and Strangers Graphs*
Abstract: Friends and strangers graphs, denoted $\mathrm{FS}(X, Y)$, are constructed from graphs X and Y on n vertices. The vertices of $\mathrm{FS}(X, Y)$ are bijections from $V(X)$ to $V(Y)$, and two bijections f and g are adjacent if they differ by a transposition (ab) such that a and b are adjacent in X and $f(a)$ and $f(b)$ are adjacent in Y. We examine the connectivity and the diameter of $\mathrm{FS}(X, Y)$ based on the minimum degrees of X and Y, denoted $\delta(X)$ and $\delta(Y)$. We resolve a conjecture of Bangachev that if X and Y are connected graphs and $2\min\delta(X), \delta(Y) + 3\max\delta(X), \delta(Y) \geq 3n$, then $\mathrm{FS}(X, Y)$ is connected, and we show that this bound is sharp up to a convex hull. Under the same conditions on $\delta(X)$ and $\delta(Y)$, we show that the diameter of $\mathrm{FS}(X, Y)$ is $O(n^2/\min\{\delta(X), \delta(Y)\})$ and that this bound is sharp. *Graph Theory/Combinatorics*
Audience: General audience, familiarity with graphs and permutations is helpful

Alhambra Room 305
(Statistics, Data, and Information)

10:10-10:25 in Alhambra Room 305
Talk withdrawn

10:30-10:45 in Alhambra Room 305
Presenter(s): Ji Y. Son, California State University, Los Angeles
Title: *Measuring Statistical Thinking with the Data Investigation Assessment*
Abstract: If the goal of teaching statistics is to develop statistical thinking, how should we assess it? Most statistics assessments use independent, multiple-choice items that capture isolated concepts but not how students coordinate them for a purpose such as a data investigation. We developed the Data Investigation Assessment (DIA), a performance assessment in which students use a Jupyter notebook to explore a research question with an unfamiliar dataset (e.g., are longer passwords stronger using 192 leaked passwords). Students must coordinate competencies identified in the GAISE College Report (variables, representations, modeling, computation, and communication) as they explore data, build models, and draw conclusions. Across 16 introductory statistics sections (N = 319), students demonstrated proficiency on approximately two-thirds of DIA tasks. Performance depended on which competencies had to be coordinated; for example, students were more successful coordinating modeling with computation than with communication. We also found that students' perceived competence increased substantially and became better aligned with demonstrated performance after instruction. Together, these findings position DIA as a step toward more authentic assessment of students' statistical thinking.

Data Science, Math Education/Pedagogy, Probability/Statistics, Statistics

10:50-11:05 in Alhambra Room 305
Presenter(s): Alejandra Castillo, Pomona College
Title: *Statistical Stopping Rules for Randomized Iterative Regression Solvers*
Abstract: We investigate statistical stopping rules for randomized iterative methods applied to linear regression, with a focus on variants of the randomized Kaczmarz method. In the presence of observation noise, increased numerical accuracy need not improve coefficient estimation or prediction. We examine stopping criteria based on prediction error and residual information and compare them with conventional numerical convergence criteria. Our work considers simulation settings with varying sample sizes, noise levels, and condition numbers of the design matrix. In particular, we assess coefficient estimation error, prediction error, and computational cost, including the cost of evaluating the stopping criteria. The aim is to identify settings in which statistically motivated stopping can reduce computation while preserving or improving estimation and prediction accuracy. This is joint work with Sophia Shalz. *Probability/Statistics, Applied Mathematics*
Audience: Linear algebra and introductory statistics

11:10-11:25 in Alhambra Room 305
Presenter(s): Anthony Valencia, California State University Dominguez Hills
Title: *Entropy in Binary Linear Probability Models*
Abstract:
Abstract: Higher-order entropy compares the entropies of all subcollections of a collection of random variables. We study binary linear models in which each random variable has the form

$$X = a \cdot U = \bigoplus_{i=1}^{d} a_i U_i, \qquad 0 \neq a \in \mathbb{F}_2^d$$

where U is a random vector in $\mathbb{F}_2^d$ with the uniform distribution. In this setting, the entropy of any subcollection equals the rank of the matrix whose rows are the corresponding coefficient vectors. Cube entropy therefore reduces to an alternating sum of matrix ranks. We give a complete classification for three variables: the cube entropy is -1 bit when all three variables are equal, $+1$ bit when their coefficient vectors are distinct and satisfy the parity relation $a_1 + a_2 + a_3 = 0$, and 0 in every other case. For $n \geq 4$, we are investigating the connection between the entropy of the n-cube associated with $A \cdot U$ and the Crapo's beta invariant of the vector matroid of A. *Graph Theory/Combinatorics, Information Theory & Linear Algebra*

Boardroom South Room 303B (Applied Mathematics)

10:10-10:25 in Boardroom South Room 303B
Presenter(s): Carly Haggard, Westmont College
Title: *Efficient Path Continuation for PDE-Constrained Inverse Problems*
Abstract: Inverse problems work backwards: given a mathematical model and state data, we aim to reconstruct structure in the model that is not directly observable. We consider physical systems constrained by partial differential equations (PDEs) that include uncertain auxiliary parameters. The standard approach involves solving the inverse problem independently at each perturbation of the auxiliary parameters. However, this strategy is computationally expensive since it ignores previous computations, and it becomes prohibitively so in the case of multiple perturbations due to the increasing number of required PDE solves. We develop efficient methods for solving inverse problems under multiple perturbations of the auxiliary parameters. We employ a predictor–corrector framework with pseudo-time continuation, which uses sensitivity information to continuously track the solution across the auxiliary parameter space. We combine pseudo-time continuation with a minimum spanning tree (MST) over the sample of perturbations. Numerical experiments indicate that this method reduces the number of PDE solves by up to a factor of three compared to the standard approach. *Applied Math, Differential Equations*

10:30-10:45 in Boardroom South Room 303B
Presenter(s): Elysa Tan, Pomona College
Title: *From Linear to Piecewise Linear: Solving Two-Point BVPs via the Prüfer Transformation*
Abstract: Boundary value problems of the form $-u'' = g(x, u)$ on (a, b), with $u(a) = u(b) = 0$, always admit the trivial solution when $g(x, 0) = 0$. We investigate the parameter values for which these problems admit nontrivial solutions. We study two cases: the linear eigenvalue problem $-u'' = \lambda w(x)u$ with positive weight function $w(x)$, and the piecewise linear problem $-u'' = \mu u^+ - \nu u^-$, whose set of admissible pairs (μ, ν) is the Fučík spectrum. We use the Prüfer transformation, which writes solutions of the associated initial value problem in polar form, $u = r \sin\theta$ and $u' = r\cos\theta$. Because both nonlinearities are positively homogeneous, the equation for the Prüfer angle θ decouples from the amplitude r, and the boundary conditions reduce to the requirement that $\theta(b)$ be a multiple of π. A shooting argument on the parameters recovers the eigenvalues and eigenfunctions in the linear case and the curves of the Fučík spectrum in the piecewise linear case. *Differential Equations*

10:50-11:05 in Boardroom South Room 303B
Presenter(s): Christina Duron, Pepperdine University
Title: *Epidemic Thresholds on Adaptive Networks with Noncompliance*
Abstract: Classical compartmental epidemiological models often rely on well-mixed mean-field assumptions. However, human behavior during public health crises is inherently dynamic, with many susceptible individuals modifying social contacts in response to local infection threats. We propose an epidemiological model incorporating adaptive human behavior over an Erdős–Rényi network, where individuals remove contacts once infected neighbors reach or exceed a threshold h. By combining next-generation matrix linearizations at the disease-free equilibrium with local exposure threshold probabilities, we formulate an effective basic reproduction number, R_0^{eff}, as a probabilistic expectation framework bridging static network dynamics with adaptive edge deletion. Numerical simulations validate R_0^{eff} across low and high infectivity regimes (with relative error $< 1.53\%$) and reveal an approximate transition from an adaptive to a static regime. Finally, we model a targeted 25 *Applied Math*

11:10-11:25 in Boardroom South Room 303B
Presenter(s): Maria van der Walt, Westmont College
Title: *Ensemble Learning for Blood Glucose Prediction*
Abstract: Reliable blood glucose prediction is an important aspect of diabetes management. There are numerous existing methods for blood glucose prediction using various methodologies, ranging from classical least-squares type methods to machine learning. In this project, we investigate the idea of combining several existing methods in ensemble learning models to improve prediction performance. Specifically, we demonstrate that combining empirical mode decomposition, Tikhonov regulariztaion and neural networks improve prediction performance as compared to using these methodologies by themselves. *Applied Math, Data Science*

Boardroom North Room 303A (Geometry and Geometric Analysis)

10:10-10:25 in Boardroom North Room 303A
Presenter(s): Henry Wilkinson, Cal Poly Pomona
Title: *Rethinking Binormal Vectors. A Simpler Approach to the Frenet Frame*
Abstract: Finding the tangent, normal, and binormal vectors of a space curve is often presented as a sequence of multiple normalization steps. Although this traditional procedure is mathematically correct, it can create unnecessary algebra and confusion for students learning the geometric relationships among the three vectors. This talk presents a direct formula for finding the unit binormal vector,

$$\mathbf{B}(t) = \frac{\mathbf{r}'(t) \times \mathbf{r}''(t)}{\|\mathbf{r}'(t) \times \mathbf{r}''(t)\|},$$

whenever $\mathbf{r}'(t) \times \mathbf{r}''(t) \neq \mathbf{0}$. I will compare this formula with the traditional procedure used in calculus textbooks by Stewart, Thomas, and Regawski. The goal is not to replace the geometric meaning of the Frenet frame, but to show how a more direct computational method can make the tangent, normal, and binormal vectors easier to learn and understand. By reducing unnecessary algebraic steps, this approach may lead to less confusion, fewer computational errors, and a clearer understanding of the geometry of space curves. *Education/Pedagogy; Geometry*
Audience: Multivariable Calculus students and instructors

10:30-10:45 in Boardroom North Room 303A
Presenter(s): Marshall A. Whittlesey, California State University San Marcos
Title: *A proof of the Euler area formula for a triangle in spherical geometry using quaternions*
Abstract: Unlike Euclidean geometry, the easiest formula for the area of a triangle in spherical geometry depends on the angles of the spherical triangle. There are, however, several formulas for the area in terms of the sides of the spherical triangle. The Euler formula is one of these. We present an unusual proof of it which involves using quaternions. This technique using quaternions to prove theorems in spherical geometry is featured in the speaker's book "Spherical Geometry and its Applications," with CRC Press. *Geometry*

10:50-11:05 in Boardroom North Room 303A
Presenter(s): Russell W. Howell, Westmont College
Title: *Resources in Complex Analysis: A Website, An Open Source Text, Gemini Notebook, and a Cool REU Problem*
Abstract: For a variety of reasons many students are not able participate in an REU experience away from their home institutions. This talk begins by introducing a website that has accessible explorations for undergraduate students in complex analysis that can be pursued during the standard academic year, or as a local summer REU experience. It also has links to an open source text (in HTML and PDF formats). We then explore how this text can be used with Gemini Notebook, and discuss an unsolved question in the REU website section that emerged from a local REU project whose results recently appeared in the American Mathematical *Monthly. Complex Analysis, AI, and Student Research*
Audience: General, with some exposure to "imaginary number" arithmetic.

11:10-11:25 in Boardroom North Room 303A
Presenter(s): Jonathan Delgado, University of California, Irvine
Title: *ϵ-Regularity and Compactness for the Cone Yang-Mills Functional*
Abstract: We introduce the cone Yang-Mills functional: a Yang-Mills-Higgs-type functional where the Higgs field interacts with the curvature through a closed 2-form representing a geometric structure of interest, e.g. a symplectic form or Ricci form. This framework allows us to incorporate the additional geometric data directly into a gauge-invariant functional, with the goal of constructing moduli spaces sensitive to the geometry. We prove a monotonicity formula, ϵ-regularity, and a compactness theorem in the sense of Nakajima as a first step towards studying these moduli spaces. *Geometry*