Matthew Alexander
Youngstown State University, OH Xi
An Application of the Riemann Zeta Function

I will go through the solution to problem 1196 from the the Spring 2009 Pi Mu Epsilon Journal. The problem asks us to find $\sum_{\frac{a}{b}\in\mathbb{Q}^*} \frac{1}{(ab)^2}$ where

$$\mathbb{Q}^* = \{\frac{a}{b} \mid a, b \in \mathbb{Z}, a \neq 0, b > 0,$$

and $gcd(a, b) = 1\}$. The solution will include the notion of a multiplicative function, and a proof of an identity of the Riemann zeta function.

Elizabeth Bernat
University of Mary Washington, VA Zeta
Laplace's Equation: A Mathematical and Computational Analysis

We study mathematically and computationally Laplaces equation. The change of heat energy over a region can be modeled using the law of conservation of energy. The change in temperature for the region may be described by the heat equation. Laplaces equation is the steady-state heat equation which describes heat flow in equilibrium over a region if there are no sources of heat energy generated inside the region. Mathematically, we find an exact solution to Laplaces equation for different types of boundary conditions. This solution will enable us to estimate the heat flow over the region in various physical environments. Computationally, we use several finite difference schemes to find numerical solutions of Laplace's equation. Finally, we evaluate the performance of the scheme by comparing the exact solution with our numerical results.

Neil Biegalle
Grand Valley State University, MI Iota
The Extremality of Bernstein Polynomials

Extremal problems in the geometry of polynomials concern which polynomials possess certain maximal or minimal geometric properties. We seek to employ results related to polynomial root dragging and root motion to further understand such problems. Of special interest is our investigation into why Bernstein polynomials frequently arise as maximizers.

Adam Boseman
University of North Carolina at Greensboro, NC Epsilon
Zeros of $\zeta(z(c)) - c$ and $\eta(e(c)) - c$ for $c \in [0, 1)$

Let $\zeta(s)$ be the Riemann zeta function and $z_0 \in \mathbb{C} \setminus \mathbb{R}$ with $\zeta(z_0) = 0$. We investigate the implicit function $z : [0, 1) \to \mathbb{C}$ with $z(0) = z_0$ given by $\zeta(z(c)) - c = 0$ and give right bounds for the zeros of $\zeta(s) - 1$.

Wyatt Brege
Grand Valley State University, MI Iota
Symmetry Analysis of the Lane-Emden Equation

We will focus on Lie theory and how it can be used to find symmetries of the Lane-Emden equation. This equation has provided a simple, physical description of the density distribution in many a stellar structure. Symmetry results of the equation will be presented.

Alexander Byers Brummer
Oregon State University, OR Beta
Examples of 3×3 *Octonionic Hermitian Matrices with Non-Real Eigenvalues*

There is currently no known method for identifying 3×3 octonionic Hermitian matrices which admit non-real eigenvalues. We therefore seek to find simple solutions to the generalized characteristic equation presented by Dray, Janesky, and Manogue. We present results of our current work which includes re-deriving the generalized characteristic equation for 2×2 octonionic Hermitian matrices, finding a class of matrices whose eigenvectors may satisfy certain constraints on their components, and we present a possible method of using known solutions to the corresponding 2×2 problem to construct solutions to the 3×3 problem.

Cameron Byrum
University of Mississippi, MS Alpha
Robustness and Efficiency of the Theil-Sen Estimator in Simple and Multiple Regressions

The Least Squares method is the most common estimator, but is known to lack efficiency with non-normally distributed error terms and to lack robustness to outliers. The Theil-Sen estimator is based on medians and far more robust. We compare the robustness and efficiency of each in linear and multivariate models.

Kathryn Christian
University of Mary Washington, VA Zeta
Laplace's Equation: A Mathematical and Computational Analysis

We study mathematically and computationally Laplaces equation. The change of heat energy over a region can be modeled using the law of conservation of energy. The change in temperature for the region may be described by the heat equation. Laplaces equation is the steady-state heat equation which describes heat flow in equilibrium over a region if there are no sources of heat energy generated inside the region. Mathematically, we find an exact solution to Laplaces equation for different types of boundary conditions. This solution will enable us to estimate the heat flow over the region in various physical environments. Computationally, we use several finite difference schemes to find numerical solutions of Laplace's equation. Finally, we evaluate the performance of the scheme by comparing the exact solution with our numerical results.

Amanda Coughlin
Roanoke College, VA Delta
Statistical Analysis of PGA Golfers: Who's the Best Golfer?

We statistically rate the golfers that participated in the 2008 PGA tournaments based on various aspects of the game including putting, chipping, driving, hitting out of the rough, and more. Using this, we determine which aspect is most important in winning and develop a formula to rate golfers overall performance.

Lisa Curll
Youngstown State University, OH Xi
Bacterial Resistance: When Selenite is Your Kryptonite

Heavy metal contamination is a serious environmental problem, forcing native organisms like bacteria to adapt resistance. What mechanisms do these cells use to attain survival? Given various growth conditions, a coupled system of differential equations models bacterial growth and reduction of toxic selenite to nontoxic selenium.

Scott Eddy
Youngstown State University, OH Xi
A Geometric Composition of Isometries

Results about isometries and their compositions, on the plane and in space, are efficiently obtained using matrices and complex variables. However, these same results can also be obtained geometrically, especially making use of reflections through lines and planes, a point of view which provides further insight into their behavior. In this talk, I will show how to use geometric tools to derive some of the basic results about isometries and their compositions.

Geoffrey Ehrman
The University of Akron, OH Nu
Collatz Structures in the Game Go on Graphs

Collatz maps generalize the $3n+1$ map of the famed $3n+1$, or Collatz, conjecture. Go is an ancient board game readily generalizable to play on an arbitrary graph. Collatz structures naturally arise in Go on complete graphs; their analysis leads to the solution of Go on several classes of graphs.

Thomas Eliot
Willamette University,
Voting Against a Candidate: A Novel System Using Negative Votes

This is a novel, non-simple voting system based on the idea of using negative votes to reduce the chances that a single candidate will win. This makes the winner much less likely to be disliked widely.

Terra Fox
Hope College
Evaluating Composite Bridge Decks

We will discuss our use of the Finite Element Method in the development of a nondestructive evaluation program for Fiber-Reinforced Polymer composite bridge decks.

Daniel Franz
Kenyon College, OH Pi
Solving the Pythagorean Formula Generalized to Polygonal Numbers

Finding when the sum of two squares is again a square is an old problem dating back thousands of years. What happens when other polygonal numbers are substituted for squares? The triangular case will be examined, and certain families of solutions will be presented for the general polygonal case.

Jennifer Garbett
Kenyon College, OH Pi
Metabolism, Microvilli, and the Manduca sexta Midgut: A Mathematical Model

Metabolism involves the use and storage of energy absorbed through food and for unknown reasons scales with body weight consistently across species. Manduca sexta, a type of caterpillar which grows to maturity in only 18 days and exhibits a 10,000-fold increase in weight, is an ideal organism for studying this scaling of metabolism. It has been suggested that the surface area of the caterpillars midgut may play a crucial role in metabolic scaling. I will present a model of the Manduca sexta midgut which reflects the contribution of microvilli (hair-like structures projecting into the midgut which significantly increase surface area) and folding of the midgut to its surface area. I will use this model to investigate changes in midgut surface area resulting from changes in size and density of microvilli over time and midgut section; I will also examine variations in surface area across sections of the midgut caused by differences in the folding pattern exhibited by each section.

Harold L. Gomes
City University of New York - Queens College, NY Alpha-Alpha
The Brain and Mathematical Modeling

The brain is a complex system with many variables that play important roles in computations/information processing. Here, we investigated the role of cell morphology on repetitive firings (voltage-impulses) of neurons. Using mathematical models, we analyzed electrophysiology of six morphological groups. Our results indicate that neuronal geometry can strongly influence electrophysiology.

Yasmeen Hussain
University of Utah
Coagulation: The Fifth Factor

Blood clotting is a complex system which can be modeled with differential equations. Using direct comparison to the results of biological research on Factor V, I have found that the controversial results found by clinical trials are largely unsupported by experiments on mathematical model of coagulation.

Masaki Ikeda
Western Oregon University, OR Delta
Random Juggling: Which State Happens the Most?

Juggling is well known as a very friendly entertainment. Suppose one keeps juggling RANDOMLY for a certain time. We will examine which of the situations of objects caught/thrown happens more likely than others by using Markov chains, as described in a paper by G. S. Warrington.

Tarah Jensen
Grand Valley State University, MI Iota
Extreme Curvature of Polynomials

Let P be a real polynomial of degree n. We are interested in the number of points of extreme curvature. Curvature is defined by $\kappa = \frac{P''}{(1+(P')^2)^(3/2)}$ and to find the points of extreme curvature we look at $\kappa' = 0$. We will discuss our progress in showing that the number of points of extreme curvature is at most $n-1$. This problem is reminiscent of the $P^2 + P'$ problem.

Jennifer Jordan
Goucher College, MD Theta
Follow the Food Feeding Function: A Biomathematical Study of Gastric Emptying

As this is a joint undergraduate research project, our research will be presented in two sessions. Ariel Kramer will present in the MAA Student Paper Sessions, and Jennifer Jordan will present in the Pi Mu Epsilon Student Paper Sessions. Through an examination of the mechanisms driving gastric motility, absorption, and transit, and using differential equations, we created a compartmental model of the digestion system. Specifically, we seek to understand the process of gastric emptying by modeling the interactions between ingested solids, liquids, and chyme. To make the model accurate biologically, we introduced randomness into the system; additionally, the nonlinearity and number of the parameters in the model make finding analytical solutions impractical. Thus, we created numerical simulations of the model. As this research is at the crossroads of biology and mathematics, both quantitative and qualitative analyses of the simulations will be discussed.

Lindsey Kingsland
Concordia University, CA Pi
A Mathematical Model of Chagas Disease

I will present a mathematical model for Chagas disease, a vector-borne parasitic disease that affects mammals, including humans, in Central and South America. I will discuss the steady state solutions of the model and the effects of insecticide spraying and the recovery rate of the vectors when spraying is stopped.

Josh Koslosky
Duquesne University
Image Denoising Via Feature-Based Sparse and Redundant Dictionaries

In recent years the computer vision community has demonstrated that sparse and redundant representations of image patches can be used to denoise images. These representations can be formed using dictionaries that are either fixed (e.g. Discrete Cosine Transform) or learned from the noisy data itself. Finding the best patch representation leads to a constrained optimization problem, which depending on its formulation can be nonconvex. Elad and Aharon propose such a model which learns the dictionary from the noisy data, which they solve using Orthogonal Matching Pursuit and K-SVD (a modification of the Singular Value Decomposition inspired by K-means). In this talk we propose a modification of their algorithm in which dictionaries can be tailored to denoise smooth regions, textured regions, and edges separately. In particular, we discuss several approaches for segmenting an image based on these different geometric properties, and how dictionaries tailored to these properties can improve both the image representation and denoising.

Nicholas Krzywonos
Grand Valley State University, MI Iota
Generalizing Rook Polynomials to Three and Higher Dimensions

A rook polynomial counts the placements of non-attacking rooks on a board. In this talk, we describe generalizations of rook polynomials to "boards" in three and higher dimensions, and the properties of rook polynomials in three dimensions. We also provide results on rook polynomials of generalizations of well-known two-dimensional boards, including the rectangular and triangular boards, and boards of the probléme des rencontres.

Justin Laufman
Youngstown State University, OH Xi
"Really" Counterintuitive

In earlier centuries, the real line was thought to be easy to understand. However when mathematicians really started to study it, some very surprising results started to appear. One of the results discovered was that the set of rational numbers could be covered by a collection of open intervals the sum of whose lengths could be arbitrarily small–this despite the fact that the rationals are dense. In addition to this, Ëmile Borel discovered a function defined on $[0, 1]$ whose definition defies our intuition. In this talk, we will present some of these counterintuitive results.

Michael Lind
Rensselaer Polytechnic Institute, NY Kappa
Infection Dynamics on a Scale-Free Network

We model the spread of an infection in a population connected through a scale-free network. The population consists of those susceptible (S), those infected (I), and those who have temporary immunity (R). We have investigated what characteristics of the network result in the long-term survival of the virus. Interesting phenomenon are found, including synchronization of the three-states as well as the requirements necessary for the virus to get a foothold in the population.

Mark Lucas
Roanoke College, VA Delta
Exploring the Fibonacci Sequence Using Combinatorics

In Proofs That Count, Art Benjamin introduces a new, combinatorial method for exploring the ubiquitous Fibonacci sequence using a board of length n, squares, and dominoes. This talk will explore proofs of known Fibonacci identities using this new combinatorial approach, including an original proof that combines combinatorial and classical techniques.

Jason Lutz
St. Johns University, MN Delta
An Analog for a Basis in Finite Groups

In linear algebra, a basis of a vector space is a linearly independent spanning set. Here, we will discuss some cases when we can find an analog for a basis in a finite group. This talk is suitable for anyone with a background in undergraduate algebra.

Jim Manning
University of South Carolina,
Stochastic Modeling in Actuarial and Financial Mathematics

Recent economic and financial events and uncertainties reflect the fact that we live in a stochastic and ever-riskier world, and that mathematical, financial, and analytical skills are critical for identifying, quantifying, understanding, and managing the impact of those risks. This presentation explores mathematical applications in an area of finance.

Kaylin McCue
Mount Union College, OH Omicron
An Investigation on Triangle Centers

Within a triangle, there are an endless number of possibilities. This investigation explores the triangle centers that form Eulers Line, the Nine Point Circle, and ultimately the necessary and sufficient conditions which make the Euler Line of a triangle parallel to one of the sides of that triangle.

Brandon McMillen
Mount Union College, OH Omicron
Chinese Remainder Theorem and the Faro Shuffles

How does an ancient Chinese theorem relate to shuffling an ordinary deck of cards? Come see how the Chinese Remainder Theorem and a special shuffle can be used to perform a card trick.

Killian Meehan
SUNY Potsdam, NY Phi
Intrinsically Linked Signed Graphs in Projective Space

Define real projective space, $\mathbb{R}P^3$, as the region obtained from the closed 3-ball D^3 by identifying the anitpodal points of ∂D^3. We examine signed graphs that contain a non-trivial link in every embedding in $\mathbb{R}P^3$. We call such signed graphs intrinsically linked. A graph is signed if each of its edges is labeled positive or negative. When we embed a signed graph in in $\mathbb{R}P^3$, negative edges cross the boundary (i.e., the line at infinity) an odd number of times. We discuss some examples of signed graphs embedded in $\mathbb{R}P^3$ and discuss our attempt to fully characterize the set of minor-minimal (simplest) intrinsically linked signed graphs that are disconnected or have connectivity 1.

Leanne Merrill
SUNY Potsdam, NY Phi
Intrinsically Linked Signed Graphs in Projective Space

Define real projective space, $\mathbb{R}P^3$, as the region obtained from the closed 3-ball D^3 by identifying the anitpodal points of ∂D^3. We examine signed graphs that contain a non-trivial link in every embedding in $\mathbb{R}P^3$. We call such signed graphs intrinsically linked. A graph is signed if each of its edges is labeled positive or negative. When we embed a signed graph in in $\mathbb{R}P^3$, negative edges cross the boundary (i.e., the line at infinity) an odd number of times. We discuss several examples of intrinsically linked signed graphs with high connectivity. We further discuss our attempt to fully characterize the complete set of minor-minimal intrinsically linked signed graphs.

Josh Mike
Youngstown State University, OH Xi
Mathematical Modeling of Senktide Response in Pyramidal Neurons

Senktide is a drug that increases firing activity in prefrontal cortex layer V pyramidal neurons. In order to investigate this response, we developed a biophysically based model incorporating the multiple currents effecting the firing activity of these neurons. The model is based on the literature and consists of a system differential equations. This model was compared to our experimental data in order to determine the currents sensitive to senktide. Additionally, the model was analyzed using dynamical systems techniques to determine the mechanisms of the senktide response.

Kathleen Miller
St. Norbert College, WI Delta
Genome Exploration

Due to high-throughput genomics, massive amounts of data on DNA protein structure and protein sequences are becoming rapidly available - at a faster rate than we can keep up! This data is only as useful as long as it is interpreted. Based on summer laboratory research in bioinformatics, we explore a biological question using statistical and computational models to create algorithms. These algorithms allow for comparison between databases allowing for further interpretation and exploration within genomes.

Dania Morales
Western Oregon University, OR Delta
Summer in Minnesota

n this talk, we will discuss the mathematical findings based on the 2009 Summer Mathematics Program for Undergraduate Women at Carleton College in Minnesota.

Kristi Mraz
Youngstown State University, OH Xi
Using Differential Equations to Model Selenium Metabolism in Bacteria

Selenite resistant bacteria removes excess selenium, which is toxic, by reducing it to the elemental form, which is non-toxic. The principle goal is to understand the mechanisms that allow the bacteria to survive when exposed to highly toxic levels of selenite. Using a system of differential equations that model concentrations, we can see how these bacterial cells metabolize selenite. We hypothesize that a selenite resistant strain, S. Maltophilia O2, may use a reduction mechanism during both log and stationary phase.

Michael O'Connor
United States Air Force Academy, CO Gamma
A Model for Solar Flux and Atmospheric Density Prediction

Satellites are expensive investments and protecting them requires accurate orbital prediction. Impeding prediction is the lack of a robust atmospheric drag model. This project will model solar flux, a driving factor, and correlate flux with density. Fast Fourier transforms and sinusoids will be addressed, and Kalman filters will be discussed.

Bette Putnam
Unversity of Mississippi, MS Alpha
On Generalized Mersenne and Fermat Primes

The classical Mersenne and Fermat primes are, respectively, primes of the form $2^k - 1$ and $2^k + 1$. As of September 2008, there are forty-six Mersenne primes known. Fermat primes, of the form $2^k + 1$, seem to be more rare as only five are known to be prime. My work involves generalized Mersenne and Fermat primes. Using Mathematica, I have found tens of thousands of both generalized Mersenne and generalized Fermat primes. It is my hope that these generalizations will prove to be interesting for both theoretical and computational investigation.

Jon Rogers
Southwestern University, TX Pi
Reconstructing Sparse Signals from Random and Incomplete Frequency Samples

Compressive sensing advances a method for simultaneous signal acquisition and compression by exploiting the sparsity of natural signals. A random frequency sample obtained using the Bernoulli model can be used to reconstruct a much larger signal with a very high probability by solving a convex optimization problem.

Stephanie Schauer
St. Norbert College, WI Delta
Generating Sudoku Puzzles

A (solved) Sudoku puzzle can be viewed as a function $f : (Z_3)^4 \to Z_9$ with certain near one-to-one properties. In this case, for fixed a and b, $f(x, y, a, b)$, $f(a, x, y, b)$, and $f(a, b, x, y)$ are injective functions of (x, y). Functions of the form $f(x, y, z, w) = g(x, y) + h(z, w) \bmod 9$ were studied. This form produces filled Sudoku puzzles if and only if two criteria are satisfied. An unsolved puzzle gives you some of the values of f; you need to find the rest. Sudoku puzzles were generated using this function.

Henry Schreiner
Angelo State University, TX Zeta
Edge Effects in the Use of Wavelets for Partial Image Reconstruction

When reconstructing a portion of an image from its wavelet transform, problems often arise near the edges. We compare the effectiveness of several different remedies, including matrix completion methods and the use of bi-orthogonal filter banks.

Kian Shenfield
Rhode Island College, RI Beta
Irreducible Elements in $\mathbb{Z}_n$

This paper observes patterns in different rings of integers modulo n, focusing on irreducibility. By looking at different specific rings where n is composite, we can find general relationships between the factors of n, the set of units in n, and equivalence classes under the relation of mutual divisibility.

Ilan Shomorony
Worcester Polytechnic Institute, MA Alpha
Authentication Schemes based on Physically Unclonable Functions

We present different hardware authentication schemes based on Physically Unclonable Functions. We analyze the concepts of a secure sketch from an information-theoretic perspective. Then we propose and analyze a new cryptographic protocol for PUF authentication based upon polynomial interpolation using Sudan's list-decoding algorithm.

Carson Sievert
St. Johns University, MN Delta
A Mathematical Perspective on Voting

The 2000 presidential election is an example of how voting procedures can yield disputed outcomes. Voting theorists say the phenomenon known as the "spoilers effect" helped Bush win the decisive swing-state. Limiting the possibility of adverse results such as this from occurring in three and four candidate elections is addressed.

Mario Sracic
Youngstown State University, OH Xi
Concerning the Volume and Surface Area of Hyperspheres in $\mathbb{R}^n$

The volume of a sphere of radius R in $\mathbb{R}^3$ is $V_3(R) = \frac{4}{3}\pi R^3$ and the surface area of this sphere is

$$SA_3(R) = 4\pi R^2 = D_R\, V_3(R).$$

We consider whether it is true that for all positive integers n, the derivative of the volume of a hypersphere in $\mathbb{R}^n$ with respect to its radius gives its surface are. While doing so we discover an interesting inconsistency in standard calculus.

Sarah Stern
Southwestern University, TX Pi
Labelings of Directed Graphs

Graph labeling has been widely researched over the last 50 years. Recently graceful and magic labelings for directed graphs have been defined and studied. This talk will focus on some new labelings of directed graphs. Definitions and examples will be given.

Angela Urban
Youngstown State University, OH Xi
Groups and Counting

Some of the first groups studied were the permutation groups S_n for various n. These groups S_n, often called symmetric groups, permute the elements of the set of numbers $\{1, 2, 3, \ldots, n\}$. That is, the group S_n acts on the set of numbers $\{1, 2, 3, \ldots, n\}$. It was realized that not only do the groups S_n act on sets, but all groups act on sets. All groups permute the elements of various sets. Shortly after this, a mathematician from London, William Burnside, discovered a formula which gives the number of orbits a group has on a set under such an action. Putting the two ideas together, groups acting onsets and a formula for the number of orbits of such an action, it was quickly difficult to count in the usual or conventional way. In this paper we let certain groups act on certain sets in order to count certain objects.

Corey Vorland
St. Norbert College, WI Delta
Modeling Diatom Growth in Trout Lake, Part 2

Aulacoseira is a freshwater diatom which forms string-like colonies. Aulacoseiras growth is determined by a complex, interconnected relationship between mixing and light availability in the lake. Mixing, generated by turbulent convection, alters the location of Aulacoseira within the depth of the lake, consequently altering its ability to obtain light for growth. Aulacoseiras abundance and colony size have been measured at varying depths in Trout Lake in Northern Wisconsin. In previous work, we built a mathematical model which accounted for growth and sinking of the diatom. However, sinking was only qualitatively included. In this work, the model takes a more quantitative approach to including the diatoms sinking velocity which is not well known in the biological community. This work is in collaboration with Stephanie Schauer, an undergraduate student at St. Norbert College.

Sean Watson
Southwestern University, TX Pi
The Structures of Series and Sum Ranges in Banach Spaces

The famous Riemann theorem states that a conditionally convergent series in $\mathbb{R}$ can be rearranged to converge to any real number. In a finite dimensional Banach space (a space complete with respect to its norm), an analogue of the Riemann theorem, the Levy-Steinitz theorem, will be presented. An introduction to the infinite-dimensional case, examples of when the analogy breaks down, and ongoing research into understanding when the Levy-Steinitz theorem holds will also be discussed.

Alyssia Weaver
Mount Union College, OH Omicron
Tuning an Instrument Like a Mathematician

Are mathematics and music really related? In my presentation, I will be exploring how the set of musical notes form a group in abstract algebra, which can be further divided into subgroups and cosets. In addition, I will be discussing how mathematics can be used to tune instruments.

Allison Wiland
Youngstown State University, OH Xi
Sylow's Theorem

Ludvig Sylow was a Norwegian mathematician that lived from 1832 to 1918. After studying at Christiana University, he was unable to find a position at a university and so he became a high school teacher in the town of Frederiskshald. He continued to study mathematics and began giving lectures at Christina University. He eventually wrote a paper, *Theoremes sur les groupes de substitutiones*, in which he generalized Cauchy's theorem. Today this generalization is called Sylow's theorem. Using Sylow's Theorem one can classify groups of given orders determine certain properties of groups only based on their orders. In fact, Sylow's theorem is so fundamental that nearly every result in finite group theory since uses Sylows's theorem.

Veronica Wills
Southeastern Louisiana University, LA Delta
A Study of the Solutions to the Family of Differential Equations $f'(x) = \frac{1}{(fofo...of)(x)}$

We will study the differential equation $f'(x) = \frac{1}{(fofo...of)(x)}$where there are n copies of f in the denominator. We begin by finding explicit solutions to our differential equation for $n = 1$ and $n = 2$ We then show that solutions exist for all n. We end by discussing the convergence/divergence of the sequence of solutions.

Moriah Wright
Youngstown State University, OH Xi
Mathematical Modeling of Cardiac Myocytes

Life-threatening cardiac arrhythmias are caused by irregular firing (electrical) activity in cardiac myocytes, muscle cells. Long QT Syndrome is one such condition that increases susceptibility to arrhythmias in which cells have longer action potential durations and EADs (Early After Depolarizations), abnormal increases in membrane potential during the plateau phase of the action potential. We investigate the mechanisms for arrhythmogenic activity by applying dynamical systems techniques and bifurcation analysis to a biophysically based mathematical model of cardiac action potentials that accounts for the numerous types of currents involved as well as calcium dynamics.

Sandi Xhumari
Grand Valley State University, MI Iota
On Applications of Generating Functions

A lot of problems turn into Recurrence Relations, where the next term depends on the previous ones. For example, every term in the Fibonacci sequence is defined as the sum of the two previous terms, which is a Recurrence Relation. One of the most powerful tools to solve Recurrence Relations is Generating Functions. In this presentation, I will introduce you to Generating Functions and apply them to some specific problems. Next time you are faced with a Recurrence Relation, you will have a brand new secret weapon up your sleeve!