9:00 - 10:00 Registration and Breakfast

<div align="right">2nd floor hallway</div>

If you registered online, you should pick up your name tag at the registration table. If you still need to register, please do so at the same table.

Poster presenters should take their posters to room EnGeo 2202 for check in.

Be sure to come to the Prize Session at the end of the day; all presenters and volunteers will be awarded prizes!

10:00 - 10:10 Opening Remarks

<div align="right">auditorium 2301</div>

Join Dr. Sam Prins, Dean of the College of Science and Mathematics, Mathematics and Statistics Department Head, Dr. Ravi Shankar, and the conference organizers as we welcome you to SUMS 2022.

10:10 - 11:00 Opening Address

<div align="right">auditorium 2301</div>

Great Moments of the Riemann Zeta Function

Jennifer Beineke
Western New England University

Movies have great moments and sports have great moments, but mathematics has the greatest moments of all. In this talk, we will explore moments of the Riemann zeta function (also known as mean values), and we will revisit the momentous discovery of Hardy, Littlewood, and Ingham in the 1920s. We will also discuss memorable moments that today's number theorists have encountered as they work on open problems related to the Riemann Hypothesis.

SUMS 2022 TIMETABLE

When	What & Where			
9:00-10:00	Registration 2nd floor hallway			
10:00 - 10:10	Welcome Dr. Sam Prins & Dr. Ravi Shankar (JMU) 2301			
10:10 - 11:00	Opening Talk Dr. Jennifer Beineke (WNEU) 2301			
11:15 - 11:30	Parallel Session I			
	Job Panel 1202	E. Lawing 1204	J. Kim 1209	1210
11:35 - 11:50	Parallel Session II			
	Job Panel 1202	A. Introne 1204	K. Sellakumaran Latha 1209	A. Mas 1210
11:55 - 12:10	Parallel Session III			
	Grad Panel 1202	A. Singh 1204	M. Misterka 1209	M. Brant 1210
12:15-1:15	Lunch and Poster Session Hallway			
1:45-2:00	Parallel Session IV			
	Grad Panel 1202	E. Bakhtadze 1204	Z. Sodagartojgi 1209	S. Lowery 1210
2:05-2:20	Parallel Session V			
	REU Panel 1202	A. Gupta 1204	K. Skalaban 1209	H. Doherty 1210
2:25-2:40	Parallel Session VI			
	REU Panel 1202	L. Joyce 1204	A. Arulandu 1209	S. Guess 1210
2:45-3:10	Afternoon tea Hallway			
3:10 - 4:00	Closing Talk Dr. Ken Ono (UVA) 2301			
4:00-4:10	Prize session & Goodbye 2301			

1202 **Career & Industry Panel**
Breydon Horton, JMU University Career Center
Shane Daveler, NSWC Dahlgren
Reginald Ford, Engility Corp.
  What can you do with a math or a statistics degree? What kinds of companies and institutions value your talent? This panel of people has experience using mathematics and statistics outside of academia, so come ask them some questions!

1204 **What factors have the greatest effect on movie gross?**
Evan Lawing, James Madison University
  In the ever-changing movie industry, predicting the next blockbuster movie is the main goal of every production and distribution studio. There are many factors that can cause a movie to be a flop or a success. In this project, we will be analyzing how various factors can impact domestic gross.

1209 **On Lattice Paths and Weight Polynomials**
Jacob Kim, University of Alabama
  We study lattice paths related with the entries of a banded matrix that contains q superdiagonals and p subdiagonals. We take collections of lattice paths which have related weight polynomials $A_{[n,i,j]}$ from which we generate certain Laurent series. We find relations between the different Laurent series $A_{(i,j)}(z)$.

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1204 **Modeling Infection in a Population with Seasonal Births**
Ally Introne, William and Mary
   This research uses a Susceptible-Infected (SI) model to simulate seasonal births and the spread of infection in a population over time. We investigate how different factors such as predation, disease transmission, and mortality due to infection affect the population dynamics.

1209 **Prime Graphs of Groups with K3 or Cyclic Composition Factors**
Karthik Sellakumaran Latha, University of Maryland, College Park
   We study prime graphs of finite groups. The vertices of the prime graph are the prime divisors of the group order, and two vertices p and q are connected if there is an element of order pq in the group. We classify the prime graphs of groups whose composition factors have order with at most three prime divisors.

1210 **Nahm-like gradient flows in Lie algebras**
Andre Mas, James Madison University
   We analyze a parameterized family of Nahm-like gradient flows taking values in a Lie algebra. A non-trivial solution for a specific case of the flow is constructed. Through this construction, we discuss diagonal trajectories and zeros of the flow.

1202 **Panel Session on Graduate School in Math, Stats and Math Ed**
Dr. Prabhashi Withana Gamage, James Madison University
Willam Nettles, University of Pittsburgh
 What is graduate school really like? How do you apply? What schools should you consider? How important is the GRE subject test? Find out from this panel!

1204 **Identifying Atrial Fibrillation with Stepping Windows**
Ari Singh, Early College at Guilford
Taran Puvvala, Ardrey Kell High School
Shravan Selvavel, Providence Day School
Satvik Vadlamudi, Green Level High School
 This project aimed to detect atrial fibrillation in near real-time using electrocardiogram readings and a stepping window method. Features for each window of heartbeats were calculated while factoring in the features of previous windows. We conclude that the stepping window method can detect AFib in near real-time.

1209 **A generalization of q-calculus using formal group laws**
Max Misterka, Homeschool, Harrisonburg, VA
 Q-calculus is a version of calculus where the derivative is replaced by the q-derivative, which is defined without using limits. It can be generalized using a type of formal power series called a formal group law. This new type of calculus has a power rule, a product rule, and analogs of many combinatorial identities.

1210 **Stability of Floating Objects at a Two-Fluid Interface**
Mark Brant, George Mason University
 This talk concentrates on the study of stability of floating objects through mathematical modeling in a two-fluid interface. This work is a continuation of previous work on the study of floating objects in water. We will show how one can computationally find these stable orientations.

POSTER SESSION: Students will be near their posters during lunch. Please stop by to see their excellent work! Poster judging will start by 12:30.

On Conjugacy Classes of Varying p-Regularity Level
Neelam Akula, University of Maryland

Vaccine Distribution in Heterogeneously Mixed Populations
Alvan Arulandu, Thomas Jefferson High School for Science and Technology

Estimate the Size of a Closed Population with Varying Heterogeneity Patterns
Kara Athey, James Madison University

The Benfordness of Bach
Darby Burgett, Washington and Lee University

Predicting the Jet Noise and Location of Jet Breakaway
Matthew Caulfield & Finn Otto, James Madison University

Lewis Carroll's Triangle Problem
Elizabeth Harvey, West Virginia Wesleyan College

Pylos Game Analysis
Sepand Jahrominejad & Hana Shaikh & Meba Tadesse, Montgomery College (MD)

A statistical analysis of the effect of vitamin D on cancer
Samuel Lowery, Slippery Rock University

A generalization of q-calculus using formal group laws
Max Misterka, Homeschool, Harrisonburg, VA

Modeling Acoustic Loads Generated by Rocket Propulsion Systems
Jack Nordstrom & Matt Smith, James Madison University

Use of Statistical Learning to Predict Imbalanced Data
Ty Nunley, James Madison University

Polynomial Projection Models for New COVID-19 Cases
Henna Parmar, James M. Bennett High School

Prime Graphs of Groups with K3 or Cyclic Composition Factors
Karthik Sellakumaran Latha, University of Maryland, College Park & Timothy Edwards, Gannon University

Identifying Atrial Fibrillation in Near Real Time With ML
Ari Singh, Early College at Guilford & Taran Puvvala,Ardrey Kell High School & Shravan Selvavel, Providence Day School & Satvik Vadlamudi, Green Level High School

1202 **Panel Session on Graduate School in Math, Stats and Math Ed**
Dr. Prabhashi Withana Gamage, James Madison University
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 What is graduate school really like? How do you apply? What schools should you consider? How important is the GRE subject test? Find out from this panel!

1204 **ODE Model for Glucose Tolerance Test and Its Limitations**
Elene Bakhtadze, Washington and Lee University
 Common method used to diagnose diabetes is the Glucose Tolerance Test. How do doctors make sense of the data? The answer is math models, first developed by Ackerman et al in the 1964. My goal is to show the expected GTT result and discuss the meaning of it, in addition to pointing out any limitations it might have.

1209 **eBay, online auctioning marketplace**
Zahra Sodagartojgi, James Madison University
 eBay, the world's most popular online auctioneer, has several leading characteristics in its bidding system. In this study, using a unique data set of iPhone 8 and higher models, with appropriate statistical methods, our goal is to identify the relationship between some of those factors and the final bidding price.

1210 **Coloring Intersection Points of Line Segments**
Samuel Lowery, Slippery Rock University
 The Erdös-Faber-Lovász conjecture is a famous problem about coloring the nodes of a network, formed in 1972. We consider a special case of the EFL conjecture, aimed at coloring the intersection points of a set of line segments with the minimum number of colors so that no points on the same segment have the same color.

1202 **Panel Session on REUs and Summer Programs**
Dr. David Duncan, James Madison University
Dr. Sat Gupta, UNC Greensboro
Samuel Lowery, Slippery Rock University
 Want to learn more about Research Experience for Undergraduates programs and other summer opportunities in mathematics? Come ask this panel your questions!

1204 **Utilizing Entropy and Volatility to Help Classify AFIB**
Arnav Gupta, Ravenscroft School
Luke Ni, Chapel Hill High School
Siddhant Borkar, Research Triangle High School
Shriyans Sapkal, Green Level High School
 Atrial Fibrillation (AFIB) is a common heart condition characterized by an irregularity in the R-peaks This project seeks to provide ML models that can help in the detection of AFIB using RR-intervals in electrocardiograms using entropy and volatility. Sample Entropy was proven to be a strong indicator of AFIB.

1209 **Is kids' breakfast cereal part of a balanced diet?**
Zachary Skalaban, James Madison University
 Is kids cereal a part of a balanced diet? To answer this question, we took a stratified sample of 105 cereals to analyze the sugar content through statistical methods. Based on our findings, we offer guidance on cereal consumption following the maximum recommended daily sugar intake for kids (25 grams)

1210 **Monoid of Graph Determinants Under a Join Operation**
Hope Doherty, Georgia Gwinnett College
 The determinant of adjacency matrices of graphs n-joined together behave predictably. This predictability gives way to a homomorphism to the integer matrices under a sandwich operation whose image is the focus of this talk. We will also discuss interesting cases such as chains of complete graphs and cyclic graphs.

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1204 **Probabilistic Analysis of Entropy Stabilized Oxides using DFT and Machine Learning**
Lily Joyce, James Madison University
   Entropy Stabilized Oxides (ESOs) are a novel class of materials. We use Density Functional Theory (DFT) for gathering statistics from the microstates representing the local environments of these materials. DFT can be computationally expensive, so we use Machine Learning algorithms to filter ESOs for more in-depth study using more accurate DFT.

1209 **Vaccine Distribution in Heterogeneously Mixed Populations**
Alvan Arulandu, Thomas Jefferson High School for Science and Technology
   Using mathematical epidemiological models and physics-informed neural networks, our approach uses data to predict the compartmental dynamics of heterogeneously-mixed subgroups exhibiting different activity levels. We also estimate disease parameters to calculate an optimal vaccine distribution plan for the population.

1210 **The error term in the prime number theorem**
Spencer Guess, UNC Asheville
   Let $\psi(x)$ denote Chebyshev's function and $R(x) = \psi(x) - x$. For $R(x)$, Jurkat proved general Ω-results that imply key Ω-results due to Hardy and Littlewood. We study the average of $R(x)$ over long intervals. In addition, we use Ingham's and Selberg's methods to improve on Jurkat's results and recover Littlewood's Theorem.

2:45 - 3:10 Afternoon tea
<div align="right">2nd floor hallway</div>

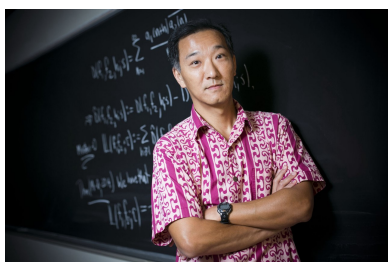Please join us for tea and coffee in the EnGeo foyer. This is your last chance to enter the candy contest!

3:10 - 4:00 Closing Address
<div align="right">auditorium 2301</div>

Why does Ramanujan, The Man Who Knew Infinity, matter?

Ken Ono
University of Virginia

Dr. Ono is an associate producer of the Hollywood film "The Man Who Knew Infinity" starring Dev Patel and Jeremy Irons about Srinivasa Ramanujan, a self-trained two-time college dropout who left behind three notebooks filled with equations that mathematicians are still trying to figure out today. Ramanujan claimed that his ideas came to him as visions from an Indian goddess. This lecture is about why Ramanujan matters. The answers to this question extend far beyond the world of equations and formulas. Dr. Ono—who specializes in number theory, especially in integer partitions, modular forms, moonshine, and the fields of interest to Srinivasa Ramanujan—will share several clips from the film in the lecture, and will tell stories about the production and promotion of the film.

4:00 - 4:10 Prize Session & Conference closing
<div align="right">auditorium 2301</div>

Please join us in the prize session the auditorium. Speaker awards, poster competition winners, and the candy contest winner will be announced!