Spring 2024 | Hundredth Series | math@sonoma.edu | math.sonoma.edu | (707)664-2368 | @ssumathandstats

THE MATHEMATICS & STATISTICS DEPARTMENT AT SONOMA STATE UNIVERSITY

presents a series of lectures and informal discussions

M*A*T*H COLLOQUIUM

WEDNESDAYS at 4:00 PM | In Person: DARWIN HALL 103 | Virtual: bit.ly/SP24_math_talks

"The book of nature is written in the language of mathematics." - Galileo

January 31

FIFTY YEARS OF M*A*T*H COLLOQUIA | Jean Bee Chan, Sonoma State University professor emerita

This semester marks the 100th Sonoma State Math Colloquium Series. Hear the story of some luminary speakers and their mathematical impact.

February 7

PHYSICS & MATHEMATICS: A LOVE STORY | Alexandra Miller, Sonoma State University

As a theoretical physicist, my work lies on the boundary between math and science. Indeed, some of my work is better described as applied mathematics than physics. In this talk, I will discuss how physicists use different types of math to describe the real world. Specifically, we will look at Differential Geometry in General Relativity, Linear Algebra in Quantum Mechanics, and Group Theory in Particle Physics and Conformal Field Theory.

February 14

THE COMPLEXITIES & DANGERS OF CHANGE OF SCALE | Rick Luttmann, Sonoma State University professor emeritus

Why do small animals and birds hibernate or fly south for the winter? Why do raindrops just get your head wet, but hailstones injure you? Why are our lungs and intestines so complex? Why do model railroaders face intractable difficulties in making their models look realistic? Why do animals huddle together for warmth when they don't generate more heat together than apart? Why are the Lilliputians (little people) and Brobdingnagians (giants) of Jonathan Swift's "Gulliver's Travels" impossible? Why do glaciers exist for thousands of years, but the ice cubes in your drink melt in under an hour? Why do large fires generate hurricane-force winds, sucking everything nearby into the flames? These, and many other similar questions, can be answered by considering the variation in the volume ratio to area as a function of scale.

February 21

USING EVOLUTIONARY GAME THEORY TO UNDERSTAND FOREST DIVERSITY | Robin Decker, University of Texas, Austin

Any forest has a diversity of plants that live together. Given that all plants compete for the same basic resources, such as light or water, one type of plant should evolve to capture all the resources and outcompete all the others. I will use a mathematical tool called evolutionary game theory to show how the best strategy for plants to acquire light depends on the strategies of other plants in the forest. Using this framework, I will show that competition for light can result in diverse plant species coexisting in the forest rather than producing a single winner.

February 28

THE JOY OF MATHEMATICAL RESEARCH, PROGRAMMING, AND MODELING! | Math 180 & Math 470 Students, Sonoma State University

As Sonoma State students progress through their math and statistics courses, they become more aware of the connections across coursework, the power of using technology effectively, and the variety of mathematics and statistics applications in their future lives. See some fantastic student projects that combine mathematical expertise with student creativity in a selection of our courses.

March 6

SELF-REFERENCE IN MATHEMATICS & GÖDEL'S INCOMPLETENESS THEOREMS | Tim Melvin, Santa Rosa Junior College

In 1931, in his Incompleteness Theorems, Kurt Gödel shocked the math community by showing that truth and proof are not the same, at least in many formal systems of arithmetic. During this talk, we will cover some of the history of formalism in mathematics that led to Gödel's results and how Gödel used self-reference in formal systems of arithmetic to create statements that are true but not provable within the system.

March 13

MATH UNDER PRESSURE! | Megan Taylor & Eric Muller, Exploratorium

Expose yourself to the math of pressure. This workshop will combine fun, hands-on activities, principles of algebra and geometry, and the basic science of gasses to solve some exciting engineering problems. We will figure out how much air force is on your body right now and determine the immense forces on vessels like planes, spacecraft, and submarines. These activities were created at the Exploratorium Teacher Institute in San Francisco.

March 27

MATHEMATICS IN NATIVE AMERICAN CULTURES | Leslie Banta, Mendocino College

What kind of mathematics do we see in Native American cultures? Number systems, cultural objects, and societal prevalence provide rich topics for exploration in a mathematics classroom that engage Native American (and other) students with the curriculum. The speaker will share her experience developing and teaching a liberal arts math course that honors and celebrates the mathematics and cultural knowledge that exist in Native American cultures.

April 3

WHAT IS AN ELLIPTIC CURVE? | Fabian Ramirez, UC Irvine

Assuming you are working over a field, F, of characteristic >3, an elliptic curve is the solution of an equation of the form $y^2 = x^3 + ax + b$ where a,b are in F with $4a^3 + 27b^2$ being nonzero and a specialized point at "infinity." In modern mathematics, elliptic curves are everywhere. "Semistable" elliptic curves played a fundamental role in Wile's proof of Fermat's Last Theorem. Similarly, Elliptic Curve Cryptography underlies the security of popular apps such as WhatsApp and Apple's iMessage. However, at first glance, it is not clear why a humble-looking cubic of the above form is so important, and a quick Google search is no help with elliptic curves often described as "projective nonsingular algebraic curves of genus one." Many of these words are meaningless without an entire graduate course in algebraic geometry. The goal of this talk is to create a bridge between the math often taught in a standard undergraduate program and the fascinating world of elliptic curves.

MATH FEST **April 10**

APPLICATION OF STATISTICAL TECHNIQUES & DATA GOVERNANCE IN THE TECH INDUSTRY | Melissa Depweg, Intuit Director - Data Governance

This session will use survival curves and Markov Chains to understand parts reliability and forecast parts demand. We will also review the importance of clean data and the growing significance of governance across Data, Analytics, and AI.

April 17

ARABIC MATHEMATICS | Sam Brannen, Sonoma State University

There exists a common misconception that the period spanning approximately 1000 years, from the conclusion of ancient Greek mathematics to the sixteenth century, witnessed minimal mathematical activity. The prevailing notion suggests that aside from specific Arabic translations of Greek texts, which preserved Europeans' knowledge during the European Renaissance's onset, little mathematical progress occurred. However, contrary to this belief, many concepts attributed to European mathematicians in the sixteenth, seventeenth, and eighteenth centuries had been developed by Arabic/Islamic mathematicians around four centuries earlier. This presentation will highlight some of the significant contributions made by Arabic/Islamic mathematicians from the late eighth century to roughly the mid-fifteenth century.

April 24

THE MAN & THE GENIUS: RAMANUJAN | Kruti Darji, Santa Rosa Junior College

This talk will present a brief biography of the legendary Mathematician of the twentieth century, Srinivasa Ramanujan: The Man and the Genius Who Knows Infinity. His contribution to Mathematics leads us to exciting problems to think about. In this talk, we will try to solve surprising results of infinite series from a notebook of Shrinivas Ramanujan.

May 1

SEPARATING HYPERPLANES & LAPSES OF SELF CONTROL: A GLIMPSE OF MATHEMATICAL METHODS IN BEHAVIORAL ECONOMICS | Dmitry Taubinsky, UC Berkeley

This talk will illustrate mathematical methods in behavioral economics, focusing on time-inconsistent preferences, one of the core concepts of behavioral economics. Time inconsistency leads people to neglect the more "patient" plans they make in advance by choosing alternatives that are more immediately gratifying in the present. This has motivated empirical designs attempting to document such choice revisions. We formally study the identification of time inconsistency in such designs, linking non-parametric rejection of time consistency to a class of separating hyperplanes between convex sets generated from the advanced and revised choices. For single-peaked preferences, the only data that rejects time-consistent expected utility maximization is when the revised ranking between a pair of alternatives is always the reverse of their initial "advance" ranking. We establish variations of this result under other assumptions. We end by discussing other strategies for identifying time inconsistency.