M*A*T*H COLLOQUIUM

Spring 2019 90th Series

Sonoma State University Department of Mathematics and Statistics
presents a series of informal talks open to the public

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

Every Wednesday at 4:00pm in Darwin 103.
Coffee, Tea & Cookies at 3:45pm in Darwin 103.

Phone: (707) 664-2368 www.sonoma.edu/math

Series supported by Instructionally-Related Activities Funds

January 30

Why Math? **Benjamin Woodford, Stanford University**

The fast-paced nature of technology today means change is the reality for both life and career choices. We will ask if a mathematics focused education is right for you when facing the uncertain landscape after college, what you might expect as a mathematics student, and who can be successful in the field. Spoiler alert: the issues may not be what you think. I will share stories from the classroom, research, and media. Illustrating various perspectives to set you up for answering the question yourself: "why math?"

February 6

Moving Beyond Popsicle Sticks **Juan Gonzalez, Santa Rosa Middle School**

We need to work to re-humanize our math classrooms. Student stories can engage diverse learners in math content in authentic and relevant ways. We will explore tasks and strategies for eliciting, engaging and capitalizing on student ideas, starting by valuing and creating space for student voice through their own stories.

February 13

A Likelihood Approach to Estimating Kinetic Parameters of Prion Dynamics from Propagon Recovery Experiments in Yeast
Fabian Santiago, University of California Merced

Prion proteins cause a variety of fatal neurodegenerative diseases in mammals but are harmless to yeast, making it an ideal model organism for these diseases. Determining kinetic parameters of prion replication in yeast is complicated because the number of aggregates in an individual cell depends on both the dynamics of the aggregates and cellular proliferation. We present a structured population model describing the distribution and replication of yeast prions in an actively dividing population of cells. We then consider three models of intracellular prion aggregate dynamics and develop a likelihood approach for estimating kinetic rates under these models.

February 20

SQUIRREL! **Peter Fritz Baker, Stillwater Sciences**

Pure and applied mathematics have always been deeply intertwined: practical problems motivate research into theory, and theoretical work finds unexpected applications to practical problems. I will talk about a purely mathematical puzzle I came across while considering a practical issue in population biology, and the fun I had working out the solution instead of doing real biology.

February 27

The Joy of Modeling and Mathematica! **Math 180 & Math 470, Sonoma State University**

Modeling without clay or glue? The *joy* of Mathematica? We'll see both. Come see amazing student projects from Martha Shott's Mathematical and Statistical Modeling course and Nick Dowdall's Mathematical Programming course. Learn about applications of matrices, differential equations, regression, and programming logic to natural systems, puzzles, and more!

March 6

Sophie Germain: Bridging Art and Algebra **Natalie Hobson, Sonoma State University**

It was Germain who once said, "Algebra is but written geometry and geometry is but figured algebra." Germain is most notable for her work writing equations to model the effects of vibrations on the smallest of particles. Her work is visible in our tallest buildings and longest bridges. This 18th century mathematician was forced to work under a male pseudonym but persisted through societal challenges and mathematical mistakes to make the most spectacular of discoveries. In this talk, we will explore the life and work of this unshakable mathematician.

March 13

Florence Nightingale: One of the Founders of Statistics **Susan Herring, Sonoma State University**

You probably know Florence Nightingale as the founder of modern nursing, but did you know she is also considered one of the founders of statistics? This talk with discuss how Florence Nightingale used statistics to demonstrate the need for healthcare reform in 19th century. By using mathematics and statistics, she was able to improve and standardize healthcare.

March 20

NO TALK—Spring Break

March 27

Forecast and Control Population Outbreaks Using Empirical Dynamic Modeling
Bethany Johnson, University of California, Santa Cruz

Population outbreaks of pests are ubiquitous in complex ecological systems, and they often have detrimental impacts on the surrounding environment and economy. These adverse impacts have motivated nearly one hundred years of effort to forecast and mitigate pest outbreaks. Researchers tend to rely on parametric approaches to aid in outbreak predictions, but these approaches have a lot of room for improvement. I will introduce a data-driven, nonparametric method called Empirical Dynamic Modeling (EDM) and show how it is useful in the ecological context of pest management.

April 3

Polyhedra Doing Calculus **Federico Ardila, San Francisco State University**

I will introduce you to two beautiful polyhedra, and show you that they know how to perform two interesting calculus computations.

April 10

Counting Pseudo Progressions **Drew Horton, Keith Rhodewalt, Ry Ulmer Strack, Sonoma State University**

Arithmetic progressions are simply sequences of numbers in which each consecutive term differs by the same constant. If we allow for more than one constant difference between consecutive terms then the progression is called a Pseudo progression. We will explore how to determine the number of valid pseudo progressions given the size of the set on which the progressions exists and the number of allowed differences between consecutive terms.

April 17

Mathematics of Origami Hexagons **Sayonita Ghosh Hajra, California State University, Sacramento**

This talk will explore Origami Hexagons, commonly known as Hexaflexagons. A hexaflexagon is a hexagonal paper polygon, constructed from paper strips consisting of multiple triangles. It has six triangles on one face and reveals a new face with six triangles when it is flexed from the center. These shapes have interesting mathematical features. In this talk, we will discuss the history and mathematics of hexaflexagons. We will also build some of these flexagons.

April 24

MATH FEST: Connections and Reconnections: A Link Between Mathematics, Physics and DNA
Mariel Vazquez, Department of Mathematics and Department of Microbiology & Molecular Genetics, UC Davis

What do the deformations of a smoke ring have in common with the way DNA recombines? They are both examples of reconnection events, which are common in biology and in physics. We model reconnection using mathematical tools from the field of topology. We also use computer simulations and visualization. These methods yield a better understanding of the action of recombination enzymes on DNA and help explain the striking similarities between reconnection processes at many different scales.

May 1

Ellipses, Matrices, and More **Jean Chan, Sonoma State University Emerita**

This elementary talk will explore how ellipses are central to some results about 2 by 2 matrices, plane geometric figures, and functions.

Talks may change: Please confirm with the Department of Mathematics and Statistics