M*A*T*H COLLOQUIUM

Wednesdays 4 p.m. • Darwin 103 • Coffee, Tea & Cookies @ 3:45

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

"The first thing to understand is that mathematics is an art." -Paul Lockhart

Jan 31 **A Brief Introduction to the Mathematics Behind Traffic Collision Investigation** — **Jason Yarnall, Sonoma State University alumnus**

Using controlled testing and evaluation of staged traffic collisions, mathematicians have developed industry standardized formulas for evaluating physical evidence left at the scene of a traffic collision. These formulas are used to determine not only the speed of the involved vehicles, but also the direction a vehicle was traveling. Some calculations include calculating speed of a vehicle based upon launch angle and point of impact for a vehicle or object that has flown through the air, determining how fast a vehicle was traveling based upon the tire skids left on the roadway, or how fast vehicles must have been traveling based upon their intrusion into another vehicle. We will explore a few calculations and tools that can show minimum speed of a vehicle and exact speed of vehicles or objects on the roadway as determined by the evidence collected at the scene.

Feb 7 **Three Impossible Constructions** — **Kristen Beck, St. Mary's College of California**

The geometry of ancient Greece, formalized by Euclid into the famous axiomatic system that we were first introduced to in grade school, began more than two-thousand years ago with a compass and straightedge. Using these tools and Euclid's first three axioms, the Greeks sought to develop constructions for various geometric objects. Three of the constructions which eluded them --- (1) squaring a circle, (2) trisecting an angle, and (3) doubling a cube --- were proven to be impossible several hundred years later, and only through the use of modern algebra. This talk will focus on these proofs of impossibility.

Feb 14 **Circus of Circles** — **Rick Luttmann, Sonoma State University**

This talk will highlight some interesting theorems regarding sets of circles in the plane, including (1) Descartes's Four-Circles Theorem, which in a simple formula connects the curvatures of four circles that are mutually tangent, and (2) Monge's Problem and the concept of the Radical Center (or Power Center) of three circles, which leads to the Spieker Point of a triangle as the Radical Center of its three excircles, an obscure "special point" of a triangle that has such wondrous properties it should be better known!

Feb 21 **Making Cultural Assets Count: Funds of Math Knowledge in a Yucatec Maya Community and Middle School** — **Felicia Darling, College Skills Department, Santa Rosa Junior College**

If you walk away with one idea from this presentation, let it be that students who say, "I am not good in math," or those who have historically underperformed on standardized tests, may actually be competent math learners and budding mathematicians. While national math scores are low in Yucatec Maya villages in México, this study illuminates a wealth of community math knowledge and a wide variety of innovative approaches to solving everyday problems. This talk is about my six-month ethnographic, mixed-methods study that explored problem-solving approaches in one Yucatec Maya community in México, and how these cultural assets could inform how we teach math, engineering, and maker space skills in the US.

Feb 28 **Habits of Graphing: "I just don't like that!"** — **Natalie Hobson, Sonoma State University**

Imagine a rider at a carnival going around a Ferris wheel at a constant speed. What is the graph of the rider's height and the total distance the rider traveled around the wheel? This may sound like a typical problem asked in a trigonometry class used to introduce students to sine and cosine functions. However, what ways of thinking about the graph are influenced by our image of the situation itself? What habits of graphing confuse us in accurately representing the quantities in the situation? In this talk, we explore certain habits of graphing that might constrain students from developing consistent understandings of relationships. We will play with a collection of animated tasks to see what habits of graphing we have formed and what we can learn from these habits in designing activities for students.

Mar 7 **Models, Models, Everywhere!** — **Fall 2017 Math 470 Students, Sonoma State University**

We all know and love differential equations, matrices, and regression analysis, but how do they apply to the world outside of the mathematics classroom? Get a glimpse at the variety of possibilities through projects by the Fall 2017 Mathematical and Statistical Modeling students.

Mar 14 **Inverted Chessboards and Kissing Circles: A Look at Inversive Geometry** — **Bruce Cohen, Lowell High School, San Francisco**

Geometric transformations of the plane (e.g. reflections, rotations, translations, and dilations) are studied in high school geometry classes. Rather than reflecting points (and sets of points) over a given line, what happens when we "reflect" them over a given circle? (This is Pi Day, so circles should pop up.) We will dive into the strange world of inversive geometry where points are "reflected over a circle." This session will include some active work in pairs. If you can, bring a screen that can be viewed by two people (e.g. a notebook computer or tablet).

Mar 21 **NO TALK — Spring Break**

Mar 28 **Current Trends in Acceleration Courses** — **Sonny Mohammadzadeh, City College of San Francisco**

Acceleration courses are designed to be shorter in length than traditional college courses so that students may advance to higher study or progress towards graduation more quickly. In this talk, we will consider how acceleration classes have evolved over time due to measured evidence of student persistence into upper-level coursework.

Apr 4 **Joy of Mathematica—Student Projects** — **Fall 2017 Math 180 Students, Sonoma State University**

You thought Mathematica could only take derivatives and integrate? Come see some amazing student projects from Nick Dowdall's Fall 2017 Mathematica class.

Apr 11 **Inversion in the Plane** — **Zvesdelina Stankova, University of California, Berkeley**

Everyone knows the Pythagorean Theorem, and some may even know that, roughly, it has as many proofs as there are math fans around the world. Yet, do you know what the most proof-abundant geometry theorem might be that is situated on the circle? And what might be its most profound yet super-clever proof that reduces it to a statement a 3rd grader would have no trouble accepting? In this talk, we will delve into the method of Inversion in the Plane, which will not only solve this particular problem, but will open up opportunities for attacking a whole array of geometry problems that would otherwise be close to impossible to solve. Inversion in the Plane was one of the very first topics I learned while training on the Bulgarian team for the International Math Olympiads, and even to this day, it is still one of my favorite math topics that has taught me to never assume any boundaries on human imagination. Standard geometry background, no calculus, and a certain amount of daring will be needed to engage in the talk.

Apr 18 **Modeling and Computational Simulations of Pulsating Soft Corals** — **Matea Alvarado, University of California, Merced**

Soft corals of the family Xeniidae are a subset of octocorals that actively pulse their tentacles. Evidence indicates that the pulsing helps facilitate photosynthesis and decreases photorespiration of the symbiotic algae that live on the corals. One way to investigate this complex behavior of pulsing is through mathematical modeling and numerical simulations. This presentation will be an overview of numerical methods for modeling the coral motion and the resulting fluid flow, and then we couple the resulting flow with advection and diffusion of a concentration, since these play a role in photosynthesis and photorespiration.

Apr 25 **An Introduction to Reaction-Diffusion Equations** — **Daniel Brinkman, San Jose State University**

Reaction-diffusion equations are a type of partial differential equation (PDE) often used to model how large numbers of particles (or agents) move and interact. We will begin with a light introduction to PDEs using ideas from Calculus 1 and introduce the concepts of diffusion and convection (or drift). We will then discuss several applications of such systems with a special focus on the semiconductor equations and their application to solar cells.

May 2 **Advanced Graphing Techniques and The Batman Equation** — **J. Matthew Register, American River College**

Analytic Geometry has come a long way since the days of Descartes, but many of the more advanced techniques are often left to the reader. In this talk, we'll explore some of the different coordinate systems and graphing techniques which may merit a little extra exploration, and then we'll discuss what happens when a graph you make goes viral on the internet. Bring your cape and cowl; we're exploring the Batman Equation.

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