

M * A * T * H COLLOQUIUM

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

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

"Mathematics is the process of turning coffee into theorems" Paul Erdős

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- Feb 4 **Mathematics of X-ray Tomography** *Charles Hamaker, St. Mary's College*
 Medical CT-scanners use x-ray data to produce the internal density profile of a 2 dimensional slice of the body. Mathematically this is equivalent to reconstructing a real-valued function on the plane from its integrals over lines in that plane. This talk will examine the mathematical algorithms developed to solve the reconstruction problem (as well as explaining the critical role played by the Beatles in the development of the scanners).
- Feb 11 **Iterated Triangle Partitions** *Ronald Graham, UC San Diego*
 For a given triangle there are many points associated with the triangle that lie in its interior; examples include the incenter (which can be found by the intersection of the angle bisectors) and the centroid (which can be found by the intersection of the medians). Using this point, one can naturally subdivide the triangle into six "daughter" triangles. We can then repeat the same process on each of the six daughter triangles, and then repeat it on each of 36 resulting triangles, and so on. A natural question is to ask what the typical nth generation daughter triangle looks like after some large number of steps. In this talk we examine this problem for both the incenter and the centroid and show that they have very different behavior as n gets large. We will also look at this process for a number of other lesser known points, such as the Gergonne point and the Lemoine point.
- Feb 18 **Student Projects From Math 180** *Bill Barnier, Sonoma State University*
 Selected students, including Alex Connor, Brian Lund, Juan Murillo, and Lindsay Rizzo, from the Fall 2008 Math 180 class will present their projects. The medium is *Mathematica*® and the content includes games, gambling, and math.
- Feb 25 **What an Actuary Actually Does** *Nick Franceschine, North Bay Pensions*
 Actuaries are business professionals who attempt to forecast the financial consequences of future events. How much should an insurance policy cost? When an employer promises lifetime medical benefits to somebody who retires, what is that promise worth? Just what IS a tontine anyway, and why are they illegal? One of the world's most elite professions will be on display as our speaker opens the "black box" to show you how actuarial mathematics actually works.
- Mar 4 **CLiCS: Categorical Logic in Computer Science -- where do we stand now?** *Valeria de Paiva, Palo Alto Research Center*
 This talk is about Categorical Logic, a branch of Category Theory, a newer subfield of Algebra, established in the late forties/early fifties by Eilenberg and MacLane. One of its most exciting applications is to theoretical computer science and I plan to discuss it, from a very personal perspective.
- Mar 11 **Why Certain Integrals Are "Impossible"** *Pete Goetz, CSU Humbolt*
 As every elementary calculus student quickly learns, integration is an art. In fact, some integrals seem very hard to solve in elementary terms. In this talk I will explain why certain integrals are "impossible." The proofs rely on a 19th century theorem due to Liouville, and can be phrased in the language of differential Galois theory.
- Mar 18 **Student Projects from Math 467** *Cora Neal, Sonoma State University*
 Two different groups of students will be presenting findings from statistical consulting projects. Kristen Roland and Amanda Frazier will be sharing their experience of working with SSU financial aid data to help to determine how limited funds should be distributed. Patrick Midgley and Anna Espitalier will explain how their statistical analysis helped cheese makers at Cowgirl Creamery. These presentations will give you a glimpse of how much fun you could have if you choose to pursue a major or minor in statistics at SSU.
- Mar 25 **A Bijection On Core Partitions** *Brant Jones, UC Davis*
 Core partitions are combinatorial objects that appear naturally in the modular representation theory of the symmetric group and the geometry of the affine Grassmannian. At the level of Coxeter groups, cores index minimal length coset representatives for the parabolic quotient of the affine symmetric group by the finite symmetric group. In this talk we give several new interpretations of a bijection between cores that was used recently by Berg and Vazirani, including a geometric description in terms of a root lattice. We also show that the bijection has a natural description in terms of another correspondence due to Lapointe and Morse.
- Apr 1 **Projective Geometry from Pappus to Pieri** *Elena Marchisotto, CSU Northridge*
 A theorem of the great mathematician, Pappus of Alexandria (circa 290-350), makes a beautiful connection between algebra and geometry. If we start with a geometric structure and impose certain postulates and theorems to determine an algebraic structure of an abstract coordinate set, we can prove that Pappus' theorem is necessary and sufficient for commutativity of multiplication there. This result is familiar to many mathematicians thanks to various texts and articles. This talk will focus on the significance of Pappus theorem to projective geometry in ways that that are perhaps not so well known, and will include original research findings on the mathematics of Mario Pieri (1860-1913).
- Apr 8 **Gold Rush! - Discovering the Golden Ratio** *John Martin, Santa Rosa Junior College*
 Over the years many people have ascribed mystical properties to the number known as the golden ratio. Recently, several authors have taken the opposite view. In this talk, we will explore some of the legend and lore surrounding this number as well as the mathematics behind it.
- Apr 22 **Randomized Response, The Power of Simulation, and the Simulation of Power** *Scott Nickleach, Sonoma State University*
 Would you tell the truth if asked a sensitive question such as, "Have you ever cheated on a significant other?" In this talk, we'll examine a technique for estimating the proportion of people who have cheated, and also the proportion of people who lie about it. We'll also incorporate simulations into the results using the statistical software package, R.
- Apr 29 **Mathematics, Energy, and Climate Change** *Math Fest* *Juan Meza, Lawrence Berkeley National Laboratory*
 Our use of energy and the resulting effects on the world's climate are tightly interwoven. Global warming effects are already having a clear and visible impact at many levels, including melting polar ice caps, hurricanes and other extreme events. Not surprisingly, the efficient use of all of our energy sources as well as the search for new sources of renewable energy has received increased attention. In this talk, I will discuss the connections between mathematics, the development of new and efficient energy sources and methods for analyzing the effects of climate change.
- May 6 **Use of the Gradient Vector in Constructing a Solar Electric System** *Chad Griffith, Former Sonoma State Student*
 Ever wonder when you may use your mathematics in the professional world? We will discuss mathematical applications used by a project manager in the solar industry highlighting specific examples of Calculus, algebra, geometry, and financial mathematics in the job place.
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DEPARTMENT OF MATHEMATICS AND STATISTICS

❖ phone: (707) 664.2368 ❖ fax: (707) 664.3535 ❖ www.sonoma.edu/math ❖