Fall 2008 **69th Series**

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 Erdös

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Sep 3 **Taking Symbols Seriously** — Brigitte Lahme, Sonoma State University

Current algebra teaching often emphasizes the idea of a function from multiple viewpoints. In this talk we will focus on the symbolic aspect of algebra, discussing what it means for students to acquire symbolic literacy. We will highlight the algebraic concepts that are essential for procedural fluency and for success in college. Common misconceptions about functions, expressions, equations, and equivalence will give us a window into student thinking. We will look at questions that probe student understanding and at examples that demonstrate why algebra has earned such a large role in the school curriculum.

Sep 10 **Flatland Video**

Flatland: The Movie is an animated film inspired by Edwin A. Abbott's classic novel, Flatland. Set in a world of only two dimensions inhabited by sentient geometrical shapes, the story follows Arthur Square and his ever-curious granddaughter Hex. When a mysterious visitor arrives from Spaceland, Arthur and Hex must come to terms with the truth of the third dimension, risking dire consequences from the evil Circles that have ruled Flatland for a thousand years *[Pizza after talk]*

Sep 17 **Zoology of Convex Bodies** — Ellen Veomett, CSU, East Bay

In this talk, we will study the fascinating creatures called convex bodies, who live in the wilderness which we call vector spaces. As we wander, we will come across the "dragon" of the lot: the cone of positive semidefinite quadratic forms. We will study this creature's form, which can be well understood by anyone with a knowledge of functions and matrices. We will explore some of the seemingly magical powers of this dragon, including a counterexample to Borsuk's conjecture.

Sept 24 **Is there a Function that Generates Prime Numbers?** — Margaret Owens, Chico State Univeristy

Of course there is! Consider the constant function $f(x) = 17$. Hmmm ... do you suppose we can do better than this? Perhaps you already know examples of non-constant polynomial functions that take on prime values for long sequences of consecutive integers. Are there non-constant (and non-annoying!) functions that generate only prime values? Is there a formula for the n^{th} prime? We will explore these and other questions, including the question of what we really mean by an "answer" to our question.

Oct 1 **Partial Computation of Extremely Large Numbers** — Bala Ravikumar, Sonoma State University

Numbers like 2^2^1000 are so large that even if every elementary particle in the universe is used to store one of its digits, it is still not possible to store the number. We address the problem of computing some of the specified digits of such numbers. Some interesting mathematical issues related to such computations will be discussed in this talk. *[Pizza after talk]*

Oct 8 **Visible Numbers** — Raphael Patton, Saint Mary's College

Greek mathematicians seem to have avoided algebra. Why? Not because they weren't modern enough! We will work through some examples of how ancient mathematics dealt with the amazing heronian triangles.

Oct 15 **Pythagorean Triples** — Bill Barnier, Sonoma State University

Any three integers that are equal to the lengths of the sides of a right triangle constitute a Pythagorean triple; the most well-known are (3, 4, 5) and (5, 12, 13). This talk will demonstrate some easily accessible but surprising facts regarding these triples. For example, 5 is always a factor of one of the integers. Why?

Oct 22 (note change) **Where in the world am I?** — Bill Poe, Sonoma State University

Three solutions to the GPS signal produce increasing degrees of accuracy and precision from meters to millimeters. This presentation will focus on the application of these solutions in archaeological research conducted in Central and South America over the last decade.

Oct 29 (note change) **What Does a Statistician Do at Chevron?** — Jim Rutherford Chevron Oronite Company

The talk will begin with a general description of the global statistics function at Chevron. Two examples of projects will be discussed. Chevron joined with ACTransit, Sasol, and Cummins to test cleaner fuels in an urban transit system. Statistics are used in design, monitoring, and analyses from this project that is nearing completion. Sometimes, statistical theory and closed form mathematical equations are not readily available to address complex analytical issues. Simulation can provide a solution if conceived and executed properly. *[Pizza after talk]*

Nov 5 **Secure E-Mail: PGP, Hashes and Digital Signatures** — Michael King, Joseph Muller and Dylan Field, Sonoma State University

Do you ever wonder how the messages you send over the internet are secure? Speakers will give a brief introduction to cryptography using RSA; an overview of PGP and how it is used to secure communication over the internet; and an overview of hash functions (with MD5 algorithm as an example) used for password protection and message integrity. This is a student project from the Fall 2007 Math 485 class (Introduction to Cryptography). *[Pizza after talk]*

Nov 12 **How Many Colors Do I Need To Tell My Keys Apart?** — Cora Neal, Sonoma State University

Do you have several similar looking keys? Have you ever fumbled to find the right key to open your door? Have you ever thought about buying those colorful key identifiers but been too lazy or cheap to do it? This talk will begin by determining the miminum number of different colors you would need to tell your keys apart on a circular keyring. This number, which depends on the number of keys you have, is called the distinguishing chromatic number. Together we will use graph theory to determine the distinguishing chromatic number of a variety of more complex structures. This will be a very interactive talk so come ready to participate.

Nov 19 **Synchrony and the Brain: Phase-Locking in Neuronal Networks** — Tim Lewis, UC Davis

Synchronous oscillatory behavior is a hallmark of electrical activity in neuronal networks. Its presence has been correlated with many higher brain functions, including attention, learning, and memory. Mathematical modeling and analysis is playing an important role in uncovering the mechanisms of synchrony of neuronal networks. The speaker will provide a brief introduction to neuronal networks and discuss a mathematical framework for understanding the mechanisms underlying synchrony.

Nov 26 **No Talk: Thanksgiving Holiday**

Dec 3 **Three-dimensional thrust wedge deformation** — Matty Mookerjee, Sonoma State University

It is a long-standing observation that thrust fault traces have arcuate shapes suggesting that thrust faults are, in general, non-planar. Three-dimensional complexities in thrust surface geometry give rise to three-dimensional variations in the displacement field and therefore the incremental and finite strain distribution. The kinematics of a salient-recess pair along the Moine thrust zone, Northwest Scotland, are examined to gain an understanding of how three-dimensional thrust surface geometry effects the strain distribution within thrust zones. A mathematical model was developed to more fully understand the kinematics of thrust sheets moving over non-planar thrust fault surfaces.

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