Fall 2012 77th 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

Aug 29 **The Hairy Ball Theorem** — **Ken Hoover, California State University Stanislaus**

Having a bad hair day? Maybe algebraic topology is to blame. Of course, with enough effort and hair-care product it is possible to comb your hair so that it flows in a continuous pattern and no hairs are sticking up, but now imagine that your head is detached from your body and is covered entirely in hair. Could you still get the same results? Not if L.E.J. Brouwer has anything to say about it. In his 1921 paper *On Illustration of Manifolds*, Brouwer proved the Hairy Ball Theorem, which states that there exists no continuous nowhere vanishing vector field on the surface of an even dimensional sphere. We will examine this theorem and its implications from personal grooming to meteorology.

Sept 5 **Conics in the Hyperbolic Plane Intrinsic to the Collineation Group** — **John Sarli, California State University San Bernadino**

Jacob Steiner (1796-1863) defined a conic in the projective plane as the locus of intersections of a pencil of lines with their images under a collineation. This definition is intrinsic: It requires no structure beyond the plane itself. Further, it generalizes to any planar geometry defined by its points, lines and corresponding group of collineations. We will begin by reviewing the classification of the conics in the Euclidean plane according to this intrinsic construction. Then, using an inversive model we will classify the conics in the hyperbolic plane in terms of invariants of the collineations that afford them, and provide metric characterizations for each congruence class. This intrinsic classification displays a natural duality among congruence classes induced by split inversion, an involution based on complementary angles of parallelism relative to the focal axis of each conic.

Sept 12 **Linear Algebra Blasts Off into Orbit** — **Jim Foster, Santa Clara University**

The speaker will present interesting applications of Linear Algebra used in the design, launch, and operation of earth satellites. These applications are drawn from his 25 years in the aerospace industry and 10 years of teaching Linear Algebra. The applications are not found in Linear Algebra textbooks or classes. Results used from Linear Algebra will be motivated so they are understandable by students who have not had a course in this subject.

Sept 19 **An Introduction to Spherical Geometry and Some of its Application** — **Marshall Whittlesey, California State University San Marcos**

Spherical geometry is the study of geometric objects on the surface of a ball in 3-Dimensional space. A century ago, this was a significant part of mathematics curriculum in high schools and colleges. In fact the study of problems in spherical geometry was central to the historical development of trigonometry. However, few people learn about it today except as short part of a topics class in college geometry. Typical kinds of issues that arise are similar to those in plane geometry: properties of triangles, congruence, areas, and relations between sides and angles. In this talk I will survey some of the main theorems of spherical geometry and its curious applications in navigation, astronomy, and crystallography.

Sept 26 **Sunshades Fold Oddly** — **Thomas Mattman, California State University Chico**

Using some basic topological observations, I'll argue that automobile sunshades must fold in an odd way. I'll develop all the math we need during the talk; don't be afraid of big words like 'topological.' The talk is based on a paper of Feist and Naimi.

Oct 3 **Math Bistro** — **Bill Barnier, Sonoma State University**

The menu includes mathematical appetizers for the hungry mind and main dishes from Chefs Euclid, Euler, and others. Our Math Bistro specializes in small portions with cool side dishes.

Oct 10 **The Effect of WalMart on Wages and Employment in California** — **Steven Cuellar, Economics Department, Sonoma State University**

This paper analyzes WalMart's effects on wages and employment in California. We use a data set consisting of cross sectional data taken from the Current Population Survey on individuals pooled over time from 1986 to 2004 to examine the wage and employment effects of WalMart's entry into California in 1991. We also introduce a new measure of WalMart's effects that accounts for the distance of WalMart to the affected workers and allows for cross regional spill-over effects. We use a fixed effects model and correct for endogeneity of WalMart's decision to enter into a region by using instrumental variable regression.

Oct 17 **Puzzles Make Math Less Puzzling, Or Why Money Has 2 Serial Numbers** — **Stuart D. Moskowitz, Humboldt State University**

If a mechanical puzzle is difficult to solve, the problem solver needs to try multiple strategies until a solution is found. This is exactly the skill we want for our students. Vanishing area puzzles make an excellent addition to almost any mathematics course. The puzzles are easy to make, but difficult to figure out, yet they can be explained with concepts from beginning algebra. The variety of designs appeals to everyone from third graders and elementary teachers, to college students and faculty. Even counterfeiters have made use of this type of puzzle. We will use a hands-on approach to explore and explain how it works, as well as take a historical tour of how they have been used and collected for 500 years.

Oct 24 **Conway's Topographs** — **Martin Weissman, University of California Santa Cruz**

In the 1990s, John Conway discovered a remarkable visual tool for understanding binary quadratic forms. Using his "topography," we can prove some otherwise difficult theorems of Gauss and Siegel, solve Pell's equation, and compute class numbers, all by drawing pictures. Topographs require nothing more than addition and subtraction of integers -- no background with quadratic forms is required.

Oct 31 **Fermat's Last Theorem** — **Nick Franceschine, Sonoma State University**

Once considered the most difficult problem in mathematics, the remarkable result known as Fermat's Last Theorem defied the efforts of generations of gifted mathematicians. We will explore the rich history of this theorem, from its ancient origins to the solution that was finally found in 1994. And - an even more difficult challenge will be presented.

Nov 7 **"The End of the World as We Know It"** — **Dan Munton, Santa Rosa Junior College**

The Mayan Calendar has generated much interest, especially as we approach the end of the thirteenth Bak'tun. In this lecture we will discuss the mathematics used by the Maya, their different calendar systems (Tzolk'in, Haab, Long Count and other systems) and how they interconnect. We will examine the calendar from mathematical, historical and cultural perspectives, and propose an answer to the question: Is there cause for concern, or should we party like it's 12.19.19.17.19?

Nov 14 **The SVD: A Superhero in the Fight Against Monstrous Data** — **Jeff Haag, Humboldt State University**

Disguised as a simple result from elementary linear algebra, the SVD, (Singular Value Decomposition), can be called upon to help bring peace and order to difficult problems in any field, from physics to political science. It is effective in facial recognition problems, social network analysis, and signal processing. It was recently used to improve recommendation systems and earn a $1,000,000 reward. In this talk I will reveal the humble true identity of the SVD and point out some of its heroic accomplishments.

Nov 21 **No Talk– Thanksgiving Break**

Nov 28 **Japanese Temple Geometry** — **Sam Brannen, Sonoma State University**

From the early seventeenth century until a little past the mid-nineteenth century, Japan was mostly closed to foreign influence. In the absence of warfare, gentlemen cultivated skills in medicine, poetry, the tea ceremony, music, arithmetic and calculation, reading and writing. Many poets and mathematicians traveled throughout the country, visiting temples and friends and sharing their art and knowledge. A custom arose of hanging wooden tablets with mathematical problems under the roofs of shrines and temples. Some may have been a challenge to others, while others may have been offerings to gods. This talk will present an introduction to Japanese Temple Geometry and will present some of the most interesting problems found on the wooden tablets.

SONOMA STATE UNIVERSITY

DEPARTMENT OF MATHEMATICS AND STATISTICS

❖ Phone: (707) 664-2368 ❖ Fax: (707) 664-3535 ❖ www.sonoma.edu/math ❖

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