Group Comps Talks

This coming Thursday, May 19, those math and math/stats majors who chose to pursue a Winter/Spring group comps project will present their findings in Olin 141. Take a look at what they'll be speaking about just below, then be sure to stop by and support them while they share what they've learned with the Math & Math/Stats Department! (You're likely to learn something new yourself as well!) Then stay afterwards for dinner catered by Bon Appetit.

**Title:** Elastic Curves  
**Speakers:** Sarah Nordin and Ben Russell  
**Time:** 3:30 p.m.  
**Abstract:** Like hair ties return to their original shape after being used, there are certain shapes that curves tend towards. How do we describe this idea mathematically, and what makes these end-state curves different from other curves? In this talk, we describe these elastic curves as minimizers of a quantity called the bending energy and find the planar elastica using the calculus of variations—a kind of infinite dimensional version of calculus.

**Title:** Improving 3D Models  
**Speakers:** Mikyla Carpenter, David Lembersky, Risako Owan, and Ming Zi  
**Time:** 4:30 p.m.  
**Abstract:** How exactly does 3D scanning work? What visual information isn't captured by a scan? Can that lost information be incorporated back into the scanned image, or even recreated? We partnered with Cyberoptics, a Minnesota based company, to explore the mathematics involved with 3D scanning and to improve the visual quality of the 3D models produced by their scanning technology. Our work has real world significance as the improved image will allow human operators to visually detect manufacturing flaws in circuit boards effectively. Come to our talk to learn about the mathematics behind one 3D scanning technique, Phase Profilometry, as well as strategies we developed to improve the scanned image. We will explore 3D point clouds, heightmaps, and so much more.

**Title:** Algebraic Properties of Voting Systems: How the Weighting Vector Trumps Your Vote  
**Speakers:** Jordan Cahn, John Eckert, Margalo Mullaney, and Dana Neidinger  
**Time:** 5:30 p.m.  
**Abstract:** How important is the system we use to count votes in an election? Could it be more important than the voters' preferences? Is there a way we can analyze the structure of a voting system mathematically? Using algebraic methods that only recently have been applied to voting theory, we will explore when voting systems meet certain desirable criteria. We will discuss which voting systems "behave well" under a ballot reversal.
Furthermore, we will examine when the outcome of an election is consistent with the outcomes of smaller groups in the electorate. Our results may surprise you -- many commonly-used voting systems fail to satisfy these conditions!

**Math Department Movie Excursion**

Next Friday, May 20th, the math department is traveling to watch a movie, and we'd like to invite you all to come! We will be traveling up to Edina to see *The Man Who Knew Infinity*, a biopic about Srinivasa Ramanujan. He was a mostly self-taught genius from a rural town in southern India who, with the help of English mathematician G.H. Hardy, managed to travel to Cambridge and make considerable contributions to the mathematics of his time. The film is based on an excellent biography of Ramanujan written by Robert Kanigel. It stars Dev Patel as Ramanujan and Jeremy Irons as G.H. Hardy.

Are you interested in coming with us? Keep your eyes peeled for a sign-up sheet on the CMC whiteboard! We'll be leaving close to 6:00 p.m. on Friday the 20th and returning to campus at around 10:30. Tickets to the theater will cost around $9/person. Contact Jordan Cahn (cahnj) if you have any questions about the trip.

**New Addition to the Reading Nook: New Horizons in Geometry**

You've taken calculus, sure. But what if there was a way to solve many of the problems typically addressed by calculus without using a single formula? As it turns out, you can! The newest addition to the book nook, *New Horizons in Geometry*, is authored by Tom Apostol and Mamikon Mnatsakanian. Using nothing but classical geometry, they explore both old and new results, with exercises provided for the intrepid reader.

You'll start your journey through the book by learning Mamikon's Sweeping-Tangent Theorem, an important piece of machinery that underpins much of the rest of the book. (It also has surprising applications in physics!) You'll see elegant proofs without words alongside their analytical components, which will help to ground your understanding of calculus in a second way. You'll also see some new descriptions of conics and gain exposure to many classical shapes in the field of geometry. This is a book very much designed for students with a knowledge of calculus or geometry. If you're interested in learning more about it, stop by the foyer of the Math & Math/Stats Department, where *New Horizons in Geometry* will be until it moves to its permanent home in the Book Nook (upstairs in the CMC).

**Hello from the Career Center!**

My name is Erin Chamlee and I am the Career Center liaison for mathematics and statistics majors. Before you leave for your summer break, I wanted to say hello and remind you of a couple of things. 1) The Career Center is OPEN ALL SUMMER and available for phone and/or Skype appointments! We can help prepare your application
documents, practice interviewing, connect with alumni and employers, and give you tools to solidify your future career goals. Just call the front desk at 507-222-4293 to schedule an appointment with me or another staff member. Click here for more information. 2) Many organizations hire for both jobs and internships in the fall term, with some deadlines occurring before you return to campus in September. With that in mind, I encourage you to take some time over the summer to prepare so you can hit the ground running in the fall. I look forward to working with you soon!
Job, Graduate & Internship Opportunities

Great Oaks Foundation: Full-Time Tutor Fellowship
As a member of the Great Oaks Tutor Corps, you will mentor and tutor middle and high school students at a Great Oaks Charter School for the duration of one school year (August 2016-June 2017). This is a service role with regular full-time hours Monday-Friday with some tutors participating in Saturday Academy as well. At Great Oaks, around half of our tutors are members of the AmeriCorps National Service Network which provides additional benefits. Applicants should hold a Bachelor’s Degree; applications will be accepted through July 2. Visit the Tunnel to learn more about the position and for a link to the online application.

Problems of the Week

Solutions to these problems are due by Tuesday, May 24 at noon.

1. Find the “volume” in n-dimensional space that is cut off from the region in which all coordinates are nonnegative by the hyperplane with equation

\[ x_1 + 2x_2 + 3x_3 + \cdots + nx_n = 1. \]

(For instance, for \( n = 2 \), this “volume” will be the area cut off from the first quadrant by the line \( x + 2y = 1 \); for \( n = 3 \), it will be the volume cut off from the first octant by the plane \( x + 2y + 3z = 1 \).)

2. Let \( \mathbf{a}, \mathbf{b}, \mathbf{c} \) be vectors in \( \mathbb{R}^3 \) with the property that for all \( \mathbf{v} \) in \( \mathbb{R}^3 \),

\[ \mathbf{a} \times (\mathbf{v} \times \mathbf{a}) + \mathbf{b} \times (\mathbf{v} \times \mathbf{b}) + \mathbf{c} \times (\mathbf{v} \times \mathbf{c}) = \mathbf{v}. \]

Show that the vectors \( \mathbf{a}, \mathbf{b}, \mathbf{c} \) form an orthogonal set (that is, they’re all at right angles to each other) and find all possibilities for the lengths (magnitudes) of \( \mathbf{a}, \mathbf{b}, \mathbf{c} \).

The good news is that a nice solution for the second problem posed April 15 arrived from Noah Scott Goldman, who should check with Sue Jandro in CMC 217 to pick up a B.B.O.P. item. The sad news is that no solutions have arrived for the problems posed April 29. How goes it, problem solvers?

- Mark Krusemeyer

If you're having trouble seeing the problems of the week, try enabling images for the message!