Colloquium
Della Fenster
Mathematics: A Question of History
Abstract: Not too long ago, former Governor (and now Senator) of Virginia Mark Warner inquired, “What is the history of mathematics? Is it about the problems or the people who solve the problems?” Beginning with the former governor’s curiosities, this talk introduces the history of mathematics as a vibrant field that considers technical questions within a broad framework that includes issues related to biography, institutional settings, and political dynamics among others.
Thursday, February 19, 4-5 p.m. in CMC 206

Department Job for Spring
Do you enjoy working in and around the Mathematics and Computer Science Departments? You might be just the student that Sue Jandro is looking for. We are in need of an Office Assistant for Spring Term. The position is for eight hours per week and the chance to work with the friendliest departments on campus. If you are interested, stop by and see Sue Jandro in CMC 217 or email sjandro.

Prospective Majors Meeting
Are you a first- or second-year student considering a major in math? Join us for our annual “Who Wants to Be a Math Major?” event! Emcee (and Department Chair) Steve Kennedy will be giving information about the department and the major, and several faculty will talk about mathematical nuggets. Add in some pizza and some current math majors to talk with, and we’ve got a party.

Carleton to host Problemfest
The Seventeenth Annual Konhauser Problemfest will be held on Saturday, February 28. Teams of up to 3 people will be competing against teams from St. Olaf, Macalester, St. Thomas, and Gustavus Adolphus. The contest itself runs from 9 a.m. to noon with results announced in the early afternoon. If you are interested in participating you should contact Gail Nelson. If you have a team arranged, great. Otherwise, she will do her best to accommodate all interested parties. However, you need to contact her before Monday, February 23.

Women’s Math Conference!
The first weekend of February, four Carleton female math majors trekked to Nebraska for the Nebraska Conference for Undergraduate Women in Mathematics. Kiva Oken, Beatrice White, Becky Patrias, and Christina Knudson attended numerous student talks as well as a series of plenary speakers and panels on topics such as graduate school and careers in mathematics. This was an excellent opportunity to meet other undergraduates and establish contacts at graduate schools. Female math majors interested in attending next year’s conference should contact Kiva Oken (okenk).
Summer Teaching Opportunity

If you are looking for something to do this summer that will leave a lasting impression, here is an exciting opportunity for you. Each summer for over a dozen years, Carleton has sent a student to the San Antonio Pre-Freshman Engineering Program (PREP) to serve as a mentor for seven weeks. PREP consists of about 1300 middle- and high-school students from the greater San Antonio area. PREP stresses the development of abstract reasoning, problem solving skills, and their application. In particular, the program encourages the participation of women and minority students. About 70 college-student mentors work with college, secondary and elementary school faculty in this highly successful program.

Carleton pays for the travel expenses and a generous stipend for the seven weeks; PREP pays for room. The dates for this summer are June 15 to July 31. Carleton will send one student to serve as a mentor. Interested? Let Gail Nelson know as soon as possible.

More Summer Opportunities

The 2009 University of Nebraska IMMERSE program is looking for applicants. It is a program to help students transition into graduate study; any student who is beginning graduate school in the fall of 2009 is eligible. A stipend is provided, and the highlights of the program are intensive classes in Algebra and Analysis. Go to www.math.unl.edu/immerse for more.

The Center for Talented Youth (CTY) is looking for instructors and teaching assistants. If you want an interesting summer job with younger people, look into it at: cty.jhu.edu/summer/employment.

Spring Term Course Descriptions

Math 236: Intro to Mathematical Structures
Instructor: Deanna Haunsperger
Time: 2a
Prerequisite: Math 232 or instructor permission

The great architectural wonder that is mathematics cannot be built up without mathematical clay (logic, axiomatic systems, set theory, and algebraic structures) or without mathematical tools (techniques of proof and problem solving). You’ll get your hands dirty with these and more while building (or strengthening) your own mathematical foundation in preparation for the edifice of higher mathematics. Along the way we’ll have some fun asking and answering many questions about set theory and graph theory. For example, we’ll discover the shocking fact that not all infinite sets are the same size, and we’ll try to decide how many different crayons you need to color a map. (It turns out the answer is four. Of course, we don’t know which four; it’s a non-constructive proof.)

CS254: Automata and Computability
(or What Your Computer Can and Cannot Do)
Instructor: Josh Davis
Time: 2a
Prerequisite: CS201; CS202 or Math 236

An introduction to the theory of computation. We’ll talk about what problems you can and can’t solve with a computer that has a finite amount of memory; problems that you’d love to write a program to solve, but you can’t (because there just aren’t enough programs to go around); and self-reference and all the trouble it can cause. Partially computational, partially mathematical, and partially philosophical.
Math 315: Spatial Statistics  
**Instructor:** Laura Chihara  
**Time:** 4a  
**Prerequisites:** Math 275, or Math 215 and Calculus (familiarity with matrix algebra helpful but not required).

Spatial statistics is concerned with analyzing data that has a spatial component: Is the high number of cancer deaths in this part of the city statistically significant, or could it be due to chance? Based on radon measurements taken at 100 fixed locations, can we estimate the amount of radon at unsampled locations? In this course, we will learn some basic approaches for analyzing spatial data. We will consider spatial point processes, geostatistical data and lattice (areal) data. We will make heavy use of statistical software (S+ and R).

Math 333: Combinatorial Theory  
**Instructor:** Mark Krusemeyer  
**Time:** 5a  
**Prerequisite:** Math 236 or instructor permission

Does Valentine’s Day stress you out, because you’re not sure how you should count the ways? Maybe you’re not even sure, in situations where your intuition is not to be trusted, whether there are any ways. And given that there are, in fact, ways, which way is the best one?

Questions of this sort also come up at other times of year, in contexts ranging from pure mathematics to the routing of garbage trucks, the study of communication networks, the matching of medical students to residencies, and the design of statistical experiments. Among the methods used to get answers are counting techniques, often involving binomial coefficients and/or generating functions (we get to have all the fun of infinite series without any of the bother about convergence!), proof techniques involving ideas such as the pigeonhole principle, and optimization techniques involving recursive algorithms. All sorts of interesting things will come up as we venture into this material, so do join us!

Math 341: Fourier Series  
**Instructor:** Sam Patterson  
**Time:** 3a  
**Prerequisite:** Math 241

Fourier Series and Integrals and their applications to linear boundary value problems of mathematical physics - most notably the diffusion equation, Laplace’s equation, the wave equation, and Schroedinger’s equation. Topics include separation of variables, orthogonal sets of functions, Sturm-Liouville Theory, Legendre and other orthogonal polynomials, and Bessel functions.

Math 342: Abstract Algebra I  
**Instructor:** Jack Goldfeather  
**Time:** 1a  
**Prerequisite:** Math 236 or instructor permission

The fact that the solution to the equation $AX=B$ can often be found by multiplying both sides by the inverse of $A$, regardless of whether $A$ is a real number or a 1000 by 1000 matrix, reveals something about the power and elegance of abstract algebraic structures. In this course we will start with some simple algebraic notions like addition and multiplication, and develop the algebraic structures (groups, rings, and fields) that permeate much of modern mathematics. As time permits, we will examine the role of abstract algebra in crystallographic symmetry, coding theory, and the proof of the impossibility of angle trisection by straight edge and compass. This course is strongly recommended for students considering graduate work in mathematics.
Math 349: Methods of Teaching Mathematics  
Instructor: Deanna Haunsperger with Melissa Schwartau  
Time: 2,3c  
Prerequisite: Junior or senior standing and permission of the instructor

How is mathematics taught? You’ve certainly seen mathematics taught, and if you’re a tutor or have a friend in a lower-level math class you’ve probably done some teaching. What’s the best way to teach? Is there a best way to teach? How do students learn mathematics? How do you write a lesson plan? What’s important when you’re in front of a classroom? Through [many] readings and some observations and some practice, we’ll discuss (and you’ll develop your own answers to) these questions and more.

PROBLEMS OF THE WEEK

1. In the kingdom of Miserly, banknotes of high denominations (up to 1000 misers) exist, but they are never in circulation, because the inhabitants hoard them. Thus the banks have taken to paying out cash in 1-miser and 2-miser bills only. However, as an experiment, some 3-miser bills have now been printed, in hopes of eventually relieving the back strain caused by carrying around large piles of ones and twos.

   a) If there is an unlimited supply of 1-miser and 2-miser bills but there is a limit of one 3-miser bill per customer, in how many ways can a bank teller honor a check for \( n \) misers? (The order in which the bills are paid out doesn’t matter; for example, if \( n = 12 \), the payments 2, 2, 2, 1, 2, 1, 1, 1 and 2, 1, 1, 2, 2, 2, 1, 1 are considered the same, but 2, 2, 3, 2, 1, 1, 1 is different.)

   b) After a few days, the experiment seems to be successful, and the limit is relaxed to three 3-miser bills per customer. How does this change the answer from part a)?

2. Let \( y = f(x) \) be a polynomial of degree \( d > 1 \). For various points \( P \) in the plane, consider the points \( Q \) on the graph of the polynomial such that the tangent line at \( Q \) to the graph passes through \( P \).

   a) Show that if \( d \) is odd, then for every point \( P \) there will be at least one such point \( Q \) (that is, there is at least one tangent line to the graph that passes through \( P \)).

   b) Suppose \( d \) is fixed (not necessarily odd) but we allow any polynomial of degree \( d \) and any point \( P \) in the plane. What is the largest number of points \( Q \) that is possible? Show why your answer is correct (and in particular, why you can indeed get that number of different points \( Q \)).

A solution to the first problem from January 30 arrived from Ryan Smith and Bjorn Linder. Bjorn also solved the first problem from last week, and he should stop by CMC 217 to collect a “C” block or another item from the B.B.O.P. There was another serious attempt on that problem, but unfortunately it contained a minor oversight, which led to a major change in the answer.

- Mark Krusemeyer