

# Tangents

Fall 2006

News from the Department of Mathematical Sciences  
University of Massachusetts Lowell

## New Mathematics Faculty: James Propp

*We've asked the newest member of our faculty to introduce himself. In order to give you a feel for Jim's research in combinatorics, we have asked him to contribute the Tangents Problem for this issue.*

I obtained my Ph.D. in mathematics in 1987 at U.C. Berkeley, and after three years of postdoctoral work I taught at MIT for eight years. I was on the faculty of the University of Wisconsin for eight more years, before coming to Lowell this fall.

I shuttle back and forth between the areas of combinatorial theory and probability theory, with side-interests in dynamical systems, game theory, and computer science.

In combinatorics, I initiated the study of domino

tilings of regions I named Aztec diamonds. This work was mentioned at this year's International Congress of Mathematicians as a precursor to the work that won Andrei Okounkov a Fields Medal this past summer.

In probability theory, I may be best known for my work with David Wilson on "coupling from the past" — a method of simulating a random system for an infinite number of steps without having to do an infinite number of calculations.

My hobbies are singing, writing songs, playing and designing word-games and word-puzzles, writing stories for children, and parallel parking.

My wife, Sandi Gubin, has a Ph.D. in social psychology and works as a social science consultant. We were blessed with our first child—a boy named Adam Daniel Propp-Gubin—in October.



## 2006 Alumni Reception—A Great Success

### Hoping for a Repeat On April 20, 2007

The annual UML Mathematical Sciences Alumni Reception and Awards Ceremony was held on April 21, 2006. It was held at the Brewery Exchange, and it was a great success. We had a nice mix of alumni, students, parents and faculty.

Student awards were presented to

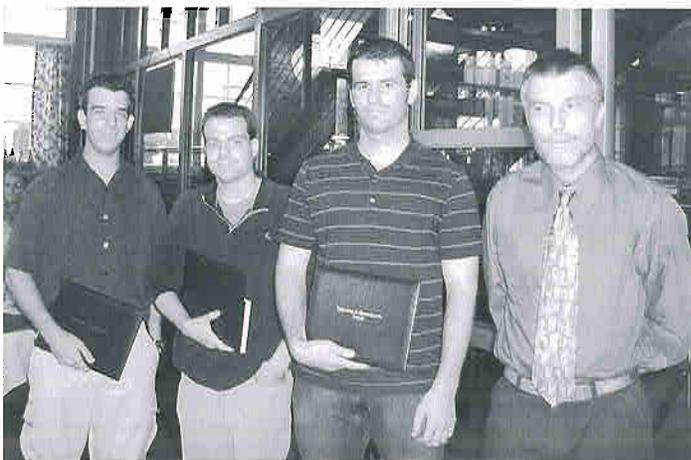
- Andrew Bawn: Mary Hall Prize
- Beth Christie, Tiffany Kot, Alex Levin, Jon McElroy, and Michael Williams: Outstanding Undergraduate Students
- Ryan Hill, Brian Intoccia, and Joshua Wladkowski: Arthur Zamanakos Scholarship

- Zbigniew Opolka, Margaret Mangiapane and Robert Peck: Outstanding Graduate Students
- Jason Percival: Bedell-Richardson Scholarship

The 2006 UML COMAP Modeling Team members whose submission was judged a very strong "Meritorious" were also recognized. They were Chris Evans (Physics), Ryan Hill (Math), and Brian Intoccia (Math)

For photos of the event, visit the UML Mathematical Sciences alumni web page at <http://www.uml.edu/Dept/Math/alumni.htm>.

We hope to have even more of you in attendance at the Brewery Exchange on Friday, April 20, 2007 for our next awards ceremony.



## The Mathematical Sciences Web Page

Have you visited Mathematical Sciences web page lately? The address is <http://www.uml.edu/dept/math>. You don't need to remember the address—just Google "uml math" and the first link should be ours.

Have you lost your past issues of *Tangents*? Go to the alumni section of the UML Math web page links to back issues.

**L**et me begin by welcoming Professor James Propp who joins the faculty this fall. Jim has been on the faculty at The University of Wisconsin at Madison for the past eight years and during that time he held visiting positions at Brandeis University, Harvard University, Olin College and MIT. There is more on Jim elsewhere in this issue of *Tangents*. The arrival of Jim increases our number to 27 from a low of 22 in 2002. With the new expertise in the department we have begun to offer courses which have not run for years, and in some cases, decades.

Last semester the department entered one team in the annual Mathematical Contest in Modeling presented by Consortium for Mathematics and its Applications. We are very proud with this year's team—Chris Evans, Ryan Hill and Brian Intoccia—who were awarded a Meritorious ranking for their project on an optimal algorithm for watering a large field. You can view a copy of their report at <http://faculty.uml.edu/jgrahameagle/mcm2006.doc>.



James Graham-Eagle

The Alumni/Awards dinner in April was a big success with some forty faculty, students and alumni present. Certificates and books were handed out to our outstanding students and scholarship winners. Of special note were the Arthur S. Zamanakos Scholarship winners Ryan Hill, Brian Intoccia, and Joshua Wladkowski; the Richardson-Bedell Scholarship went to Jason Percival;

and the Mary Hall Award to Andrew Bawn. The Outstanding Graduate Student Award went to Robert Peck. This annual event has grown considerably in recent years and I encourage you to come next year and enjoy a nice meal in pleasant company.

Those who remember Barbara Regan will be saddened to hear that she passed away last semester after a brief illness. Barbara retired in 2002 and she was the department's last dedicated secretary—since that time the university has been moving toward the "service center" concept in which pools of secretaries are shared by several departments.

We were also saddened to learn that Professor Andrew Ouellette, passed away in September. Andy retired from Mathematical Sciences in the mid-80's after a long career at Lowell Tech and ULowell.

If you have news which you think others would enjoy hearing please let us know—we would be glad to include it in future issues of this newsletter. And I would again like to thank Ken Levasseur for overseeing the production of this newsletter.

*Kiwi*

## The Tangents Problem

A convex  $n$ -gon is divided into  $n-2$  triangles by  $n-3$  non-crossing diagonals. Suppose each of the  $n$  vertices is incident with an odd number of triangles. Show that  $n$  must be a multiple of 3.

Up to four correct solutions from among all that are submitted by February 1, 2007 will earn a "Math Challenge" T-shirt. You can submit your solution online to [mathematics@uml.edu](mailto:mathematics@uml.edu).

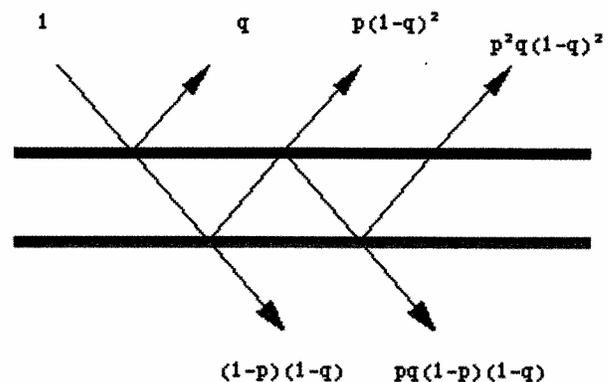
### Solution to the Spring 2006 Tangents Problem

The Spring 2006 problem was:

An insulated window consists of two parallel panes of glass with a small spacing between them. Suppose that each pane reflects a fraction  $p$  of the incoming light and transmits the remaining light. (a) Considering all reflections of light between the panes, what fraction of the incoming light is ultimately transmitted by the window? (b) What fraction of the light is transmitted if a third identical pane is added behind the first two?

A solution was submitted by Tom Lumenello, LTI '64, who will receive a Math Challenge T-shirt. Tom included the comment "Thank you for presenting a problem that transported me back several years to a time when I worked on light piping problems for Polaroid Corporation." Also shedding light on the problem with a correct solution was Brendon Putin, who is a student of Andy Miller (LTI B.S. 1966 and M.S. 1972) at Berkshire Community College. Brendon will also get a T-Shirt.

First consider the general problem of two panes with different fractions of reflection. Assume that the top pane reflects some fraction  $q$  of light and the bottom reflects a fraction  $p$ . If one unit of light is directed downward, some of the fractions of light escaping the system in either the upward or downward directions are shown. If we add all the light that is transmitted downward, the sum is a geometric series with initial term  $(1-p)(1-q)$  and ratio  $pq$ . The sum of this series is  $(1-p)(1-q)/(1-pq)$ .



Now to answer part (a), set  $q$  equal to  $p$  and the fraction of transmission simplifies to  $(1-p)/(1+p)$ . Therefore, the fraction that is reflected is  $2p/(1+p)$ . To answer (b), think of the two top panes as one with fraction of reflection  $q = 2p/(1+p)$ . Simplifying the general result with this value of  $q$  yields a transmission fraction of  $(1-p)/(2p+1)$  and  $3p/(2p+1)$  reflected.

# The Calculus Gallery: Masterpieces from Newton to Lebesgue

by William Dunham  
Princeton University Press,  
236 pp., \$29.95

REVIEWED BY GUNTRAM  
MUELLER

**W**hen reviewing a book of non-fiction, it is customary for the reviewer to begin by laying out a general background of the subject, to go on to citing the ideas and particularities of the book under review, to present some points of critique, and possibly, lastly, to slip in whether the reviewer actually liked the book.

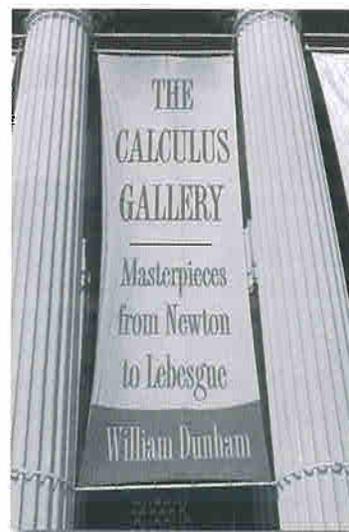
Here's my review: I love this book! What a pleasure to read the story of calculus, to see the form it happened to take according to the specific ideas of certain individuals, nestled within the logical envelope of the set of all possible calculuses. This

story is told through the presentation of certain gems of thought, fragments of the actual writing of 13 of the major contributors from Newton to Lebesgue, via two Bernoullis, Euler, Cauchy, Riemann, Weierstrass, and Cantor, among others, which make up the contents of the "gallery" in the title.

The Leitmotiv, the motif that recurs throughout this composition, is the forced evolution of the basic notions of limit, function, and integral, with each new version being a response to a problem with the previous one. The author includes some wonderful quotes, such as from Bishop Berkeley from 1734, attacking mathematicians for using a looseness of logic that would be utterly unacceptable in a school of divinity! He has a point. In defining the derivative,

infinitesimals were used, remarkable creatures of the mind that are sometimes zero, sometimes not, that he lampooned as "ghosts of departed quantities."

The author leads the reader through some difficult spots with an air of confidence and competence, but with a gentleness that pauses for breath (although Prof. Enrique Gonzalez of UML did point out some historical inaccuracies). The author includes two "interludes" that allow the reader to take stock of what has been done, and to assess the issues and mysteries still to be explored. The level of difficulty? Well, it does take a good measure of mathematical maturity, and an



interest in ideas for their own sake. In addition, some knowledge of real analysis is certainly desirable, as well as a springy style of reading that allows you to skip ahead when you get bogged down. Fortunately, the author provides the reader with lots of re-entry points for exactly that purpose.

Rating: \*\*\*\*  
(of a possible 4)

## Suggested Reading: *Actuaries and the Law of the Jungle*

**M**ichelle (Pollister) Weatherbee, FSA, MAAA, suggested that we reprint an article titled "Actuaries and the Law of the Jungle" by Eynshteyn Averbukh that recently appeared in *Contingencies*, a publication of the American Academy of Actuaries. It

was a bit too long for this issue, but with permission from *Contingencies* we've made it available online at <http://www.uml.edu/Dept/Math/alumni.htm>. Michelle graduated from UMass Lowell with a B. S. in mathematics in 1992 and she is currently working as an actuary for John Hancock Financial Services.

### What Are You Up To?

Want to keep your classmates up to date on what you're doing and where you are? Take a few moments to tell us where you are, and whatever else you might like to share. We'll add it to the UML Math Alumni page, <http://www.uml.edu/dept/math/alumni.htm>.

We can be contacted by mail at Department of Mathematical Sciences, North Campus, UMass Lowell, Lowell MA 01854. Telephone: (978) 934-2410. Email: [mathematics@uml.edu](mailto:mathematics@uml.edu)

You might also wish to contact our Office of Alumni Relations, Southwick Hall 250, UML North, Lowell, MA 01854-3629. Toll free telephone: (877) UML-ALUM. Email: [Alumni\\_Office@uml.edu](mailto:Alumni_Office@uml.edu)

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## This Year in Mathematics Mod 100

**R**ecent years mod 100 have welcomed important mathematical logicians into the world. In 1806 Augustus De Morgan was born to English colonists in India. He was known as an early reformer in the development of a rigorous approach to mathematical logic, and the “de Morgan laws” are now included among the basic principles of formal logic. De Morgan was allegedly proud of having been 43 years old in the year  $43^2 = 1849$ . Perhaps he would also appreciate the mod 100 numerology of his birthdate and chosen specialty, for his work in logic was arguably both finished and rendered impossible to finish by Kurt Gödel, born in 1906. Other prominent mathematicians born in 1906 include Max Zorn (another logician!), the algebraic geometer André Weil, William Feller, who wrote an enormously influential text on probability, and Olga Taussky-Todd, a pioneer in abstract algebra.

This year 2006 the International Congress of Mathematicians held its quadrennial meeting in Madrid. A highlight of each Congress is the awarding of the Fields Medal for outstanding mathematical achievement, sometimes considered the equivalent of a “Nobel prize” for mathematicians. This year the award went to four mathematicians: Andrei Okounkov, Grigori Perelman, Terence Tao, and Wendelin Werner. Perelman declined to accept the award, a first in the history of this prize. Indeed, controversy swirls around Perelman’s solution to century old Poincaré conjecture, perhaps all the more so because of million dollar Millennium Prize offered by the Clay Institute for the solution to this fundamental problem in geometric topology.



Kurt Gödel



Augustus De Morgan

*Sources and interesting further reading:*

1. The MacTutor History of Mathematics archive, <http://www-history.mcs.st-and.ac.uk/~history/>
2. Millennium Prize Problems, [www.claymath.org/millennium/](http://www.claymath.org/millennium/)
3. The Fields Medal, <http://www.mathunion.org/Prizes/Fields/index.html>
4. Sylvia Nasar and David Gruber, “Manifold Destiny”, *The New Yorker*, August 28, 2006, [www.newyorker.com/fact/content/articles/060828fa\\_fact2](http://www.newyorker.com/fact/content/articles/060828fa_fact2)

## Thanks for the Contributions!

**O**ur thanks to all who have contributed to the Department of Mathematical Sciences over the past few years. Your generosity has allowed us to make purchases, award scholarships, and engage in activities that would otherwise have been impossible.

Many of you have responded generously to UML phonathon and other fundraising contacts. These requests can benefit the Department of Mathematical Sciences directly if you specify that you wish to have your gift directed to Mathematics. Otherwise it will provide valuable assistance to the University at the College level.

*Tangents*  
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