

Tangents

Spring 2007

News from the Department of Mathematical Sciences
University of Massachusetts Lowell

My Life and Times at UMass Lowell

BY GUNTRAM MUELLER

I received my Ph.D. in 1971 from the University of Notre Dame, with a thesis in the Theory of Functions of

Several Complex Variables. Prof. Dan Klain has googled that my doctoral great-grandfather was David Hilbert—hey! I joined the UML faculty in 1982, following the merger (a.k.a. murder) of Boston State College with UMass Boston. The day they closed BSC, I called Prof. Al Doerr, the Mathematics chair at UML, and presented my credentials. His response: Can you start tomorrow? He does have such a way with words!

I first shared an office with Prof. Tom Kudzma: now there's a political odd couple. But his cheeriness and lively sense of the absurd saved us, and we had a great time. Once, with uncontrollable glee, he showed me a letter, on departmental letterhead paper, from the University of Mississippi.

I taught various courses at various times: I taught Lebesgue Integration left-handedly when I broke my wrist, but mostly I focused on Calculus for Scientists and Engineers. I enjoyed it very



Guntram Mueller

much. I had many excellent students. One of them was a student from Lowell High School, Dan Klain (yes, that one), whose questions took us into Real Analysis, Complex Analysis, Riemann Surfaces, Number Theory, Logic. What a pleasure!

But in the course of the '80s and '90s, increasing numbers of freshman students showed up underprepared (nice word) for the calculus course. Was it the "constructivist math" that the students had in high school? Or the "new math" that their teachers had gotten in their high schools? Or in their grade schools? Could

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Pi Mu Epsilon Revival at UML

If you were a student here in the late 1970's or 1980's, you may remember participating in events sponsored by the UMass Lowell chapter of Pi Mu Epsilon, the Honorary National Mathematics Society. PME was founded in 1914 at Syracuse University and currently has over 300 chapters at colleges and universities throughout the United States. Its purpose is to promote scholarly activity in mathematics among students.

The chapter at UMass Lowell (the Massachusetts Delta chapter) was established in 1978 by Professors Al Doerr and Virginia Taylor. Prof. Taylor served as PME faculty advisor until her

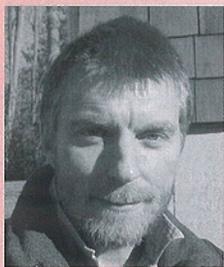
retirement in 1996, after which the chapter became inactive. Thanks to the efforts of senior math major Michael Williams, there is renewed interest in PME on campus. Our chapter was recently reactivated by PME Council member Brigitte Servatius, Professor of Mathematical Sciences at Worcester Polytechnic Institute, who inducted eleven new student members and gave a talk on "A beautiful mind and hyper-perfect numbers." Despite being interrupted by a fire alarm caused by a burst pipe, everyone enjoyed the ceremony. For a photo of the inductees, go to http://faculty.uml.edu/spennell/PME/UML_Pi_Mu_Epsilon.htm



UMass Lowell Pi Mu Epsilon induction ceremony on January 26, 2007. Back row from left: Jacob Kushkuley, Jason Percival, Ryan Beaven. Middle row: Mia Parviainen, Ryan Hill, Michael Williams, Tiffany Kot, Joshua Wladkowski, Prof. Brigitte Servatius (WPI), Ryan Masson. Front row: Steve Pennell, Paul Tishue. Inducted but unable to attend: Brendon Staruk.

My current term as chair ends this semester and I do not plan on seeking re-election so I would like to take this time to thank the faculty for their help and support over the last five or so years. The department has seen a lot of change during that time—the retirement of six faculty, seven new faculty, displacement to a different building, and a major overhaul of the undergraduate mathematics major and corresponding increase in the number of majors.

I would particularly like to thank Shelley Rasmussen for taking the big job of undergraduate coordinator, Charlie Byrne for doing the same for the graduate program, Steve Pennell for chairing the Personnel Committee and overseeing the Senior Seminar, Ken Levasseur for producing this newsletter and maintaining the department web site, Ron Brent for agreeing to teach the large Calculus I lectures, Marvin Stick for coordinating the management courses, Ann Marie Hurley and Al Doerr for maintaining our excellent relationship with the Division of Continuing Studies and



James Graham-Eagle

Cooperate Education (Continuing Education), Dan Klain for agreeing to chair the hiring committee, Raj Prasad for chairing the Personnel Committee and being the Scholarships Committee and Sasha Kheifets for volunteering to do all the jobs which no one else would do.

This is the last semester at UML for Guntram Mueller who has decided to retire after 25 years with the department. While here Guntram worked tirelessly to improve the lot of students in the freshmen mathematics courses. He organized Mass MAJIC to help students know what mathematics courses they should complete in high school in order to have the best chance of success in their chosen college major; Math Challenge, a Jeopardy style competition for local high schools; and coauthored (with Ron Brent) the Just-In-Time and Just-Enough series of textbooks to help students with the high school to college transition. He will be missed.

The department recently reactivated its Chapter of the Pi Mu Epsilon Honor Society. Thanks to Steve Pennell and congratulations to the students selected for this award. You can read more about the induction ceremony inside this newsletter.

This is a great department to work with—everyone is friendly and helpful and several students have told me they have switched to mathematics because of the atmosphere here. I consider this the best endorsement of what we do. I look forward to contributing to the department in other ways and trust that my successor as chair will be given the same level of support as I was.

The Tangents Problem

This problem was suggested by Ravi Montenegro (<http://www.ravimontenegro.com/>).

Suppose x and y are two integers with $1 < x < y$ and $x + y \leq 100$. Jill knows their sum $x + y$ and Paul knows their product xy . The following conversation now takes place:

- Paul: I do not know the two numbers.
- Jill: I knew that already.
- Paul: Now I know the two numbers.
- Jill: Now I know them also.

What are the numbers? Hint: Every even number from 4 to 100 can be written as the sum of two primes (this is a special case of the Goldbach Conjecture).

Up to four correct solutions from among all that are submitted by September 1, 2007 will earn the solver "Math Challenge" T-shirt. You may submit your solution to mathematics@uml.edu or mail it to Ken Levasseur, Department of Mathematical Sciences, North Campus/Olney Hall, UMass Lowell, Lowell MA 01854.

Solution to the Fall 2006 problem

We haven't received a solution to the Fall 2006 Tangents Problem. The new deadline will be September 1, 2007

Thanks for the Contributions!

Our 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.

James Graham-Eagle, Chair

Writers: Ken Levasseur,
Raj Prasad, Ann Marie Hurley,
Dan Klain, Guntram Mueller,
Marv Stick and Alex Olsen

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This Year in Mathematics Mod 100

and introduced the arithmetic totient function ϕ using it to generalize the Little Fermat Theorem to composite moduli. Euler's solution to the Bridges of Königsberg problem began the field of graph theory, and his work related to the vertex-edge-face counting formula for convex polyhedra,

$$V - E + F = 2,$$

led to the modern Euler characteristic formula and the beginnings of algebraic topology.

The list of Euler's discoveries and accomplishments is so voluminous that it has become traditional to name many theorems for the second mathematicians to discover them after Euler— else every other major theorem would be named for Euler! As Laplace famously noted, Euler was “the Master of us all.”

References and Further Reading

1. W. Dunham. *Euler: Master of Us All*, Mathematical Association of America, Washington, D.C., 1999.
2. L. Euler. *Introduction to Analysis of the Infinite: Book I* (translated by J. Blanton), Springer Verlag, New York, 1988.
3. L. Euler. *Introduction to Analysis of the Infinite: Book II* (translated by J. Blanton), Springer Verlag, New York, 1989.
4. L. Euler. *Foundations of Differential Calculus* (translated by J. Blanton), Springer Verlag, New York, 2000.
5. J. Havil. *Gamma: Exploring Euler's Constant*, Princeton University Press, 2003.
6. *The Euler Archive*, <http://www.math.dartmouth.edu/~euler/>

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someone please write some theses to sort this out? In any event, to address this situation, some colleagues, Professors Bernie Shapiro, Al Doerr, Ron Brent, Marv Stick, and I, took up a suggestion of Prof. Charlie Byrne's, and in 1993 organized Mass MAJIC, a program that tested and advised high school Juniors, so they could use their Senior year to better prepare for college. (This year, the state administration is finally taking up this idea [*Boston Globe* 2/16/07].) I also co-authored, with Prof. Ron Brent, several books to help students in their transition to college math, the Just-in-Time and Just-Enough series at Addison-Wesley. The most fun was the annual Math Challenge, a contest for high school students in the Gym, a sort of mathematics team competition with tumblers and cheerleaders and the “wave,” with all disputes settled by the Supremes: Professors Steve Pennell, Ken Levasseur, and Kiwi. Sample question:

How many times do you need to fold a .01 cm thick piece of paper so that the thickness of the paper reaches from here to the moon, 400,000 km away? (Answer: 42)

So what will I do in my retirement? Sleep in (yes!), fix up my cabin by the stream in Maine (yes, we have running water), and I hope to raise a big bunch of money for solar cookers for the women of Darfur (yes, you'll be hearing from me).

So all the best to all of my dear friends at UMass Lowell. I loved my time here, and I'm keen on what's to come!

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. You can also get recent issue on iTunes!

<http://www.uml.edu/dept/math>

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

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

This Year in Mathematics Mod 100

This year we celebrate the 300th anniversary of Leonhard Euler, born on April 15, 1707. One of the greatest mathematicians in human history, Euler was also the most prolific. Indeed, at late as 1936, Euler's handwritten manuscripts still had not been completely catalogued, and it could be argued that Euler was still effectively publishing mathematical work over 150 years after his death in 1783.

E. T. Bell referred to Euler as *Analysis Incarnate*, although his work has had influence on every branch of mathematics. He discovered the significance of the number $e = 2.718281828\dots$ and used it to produce the formula:

$$e^{i\theta} = \cos \theta + i \sin \theta,$$



revolutionizing, and to many eyes finally legitimizing, the theory of complex variables. His methods for manipulating infinite series also led to the Euler product formula,

$$\sum_{n=1}^{\infty} \frac{1}{n} = \prod_{\text{primes } p} \frac{1}{1 - \frac{1}{p}},$$

relating the harmonic series to the distribution of primes. He also discovered that

$$\sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6},$$

and that the infinite series

$$\sum_{\text{primes } p} \frac{1}{p} = \frac{1}{2} + \frac{1}{3} + \frac{1}{5} + \frac{1}{7} + \frac{1}{11} + \frac{1}{13} + \frac{1}{17} + \dots$$

diverges, providing yet another proof that there are infinitely many prime numbers. These novel applications of power series initiated the development of modern analytic number theory, and,

in particular, the study of what came to be known as the Riemann zeta function. Euler's work in analysis also led to approximation methods for solving differential equations and to development of the calculus of variations.

Euler's work has had a tremendous impact on classical number theory. He completed the classification of even perfect numbers (begun by Euclid centuries earlier), discovered his criterion for quadratic residues, conjectured the Law of Quadratic Reciprocity (later proved by Gauss),

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 Department of Mathematical Sciences
University of Massachusetts Lowell
 Olney Hall
 UML North
 Lowell, MA 01854

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