MAA FOCUS

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WHAT'S INSIDE

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MAA FOCUS

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On the cover: Dramatically perched on the side of a ravine, James Stewart's Integral House in Toronto has quickly become an architectural landmark. The building's curves, surfaces, and innovative design reflect Stewart's work as a mathematician and as the author of the most widely used calculus textbooks in North America. Photograph by Ivars Peterson.

New MAA Officers Elected

Paul Zorn

Francis E. Su

Douglas E. Ensley

Conducted almost entirely online, the MAA's 2009 election was a success. A total of 3,076 votes were cast. The new officers begin their terms at the Joint Mathematics Meetings in January 2010.

Paul Zorn of St. Olaf College was chosen as President-Elect, a role he will play during 2010. In January 2011 he will become President of the Association for 2011–2012, after which he will serve one more year as Past President.

Francis E. Su of Harvey Mudd College was elected First Vice-President and Douglas E. Ensley of Shippensburg University was chosen as Second Vice-President. They will serve two-year terms beginning in 2010.

The MAA is grateful to all candidates who ran for office. They are dedicated members who have been willing to devote their time and effort to the Association. They help make the MAA what it is.

Barbara Faires Will Be MAA Secretary

The MAA Board of Governors has elected Barbara Faires of Westminster College for the important position of Secretary of the Association. Faires will serve as Secretary-Elect from April 2009 until the conclusion of the 2010 Joint Mathematics Meetings, at which time she will begin a five year term as MAA Secretary. She replaces Martha Siegel, who is stepping down after 14 years of distinguished service.

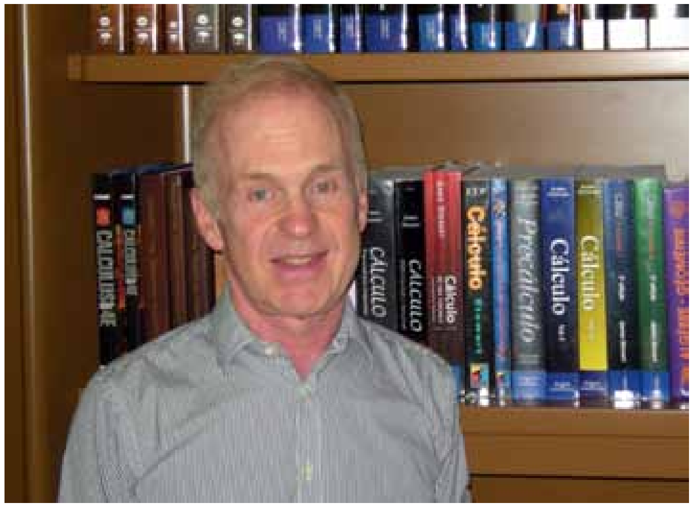
Faires has been active in MAA governance for a significant period of time, serving on the Board as a Governor, as a member of the finance and audit committees, and as First Vice-President. She has also been active in the Allegheny Mountain Section, where she chaired various committees and coordinated the Section NExT Program. Faires has published research articles on vector measures and related topics; she is currently investigating the history of functional analysis, especially the work of Banach. She has been on the faculty of Westminster College in Pennsylvania since the 1970s.

As Secretary of the Association, Faires will play a critical role in the life of the MAA. She will be responsible for all official correspondence, keep the seal of the Association, assist the President in matters of governance, and help run business meetings of the MAA, the Board of Governors, and the Executive Committee. She will be one of the five Officers of the MAA, and therefore a member of both the Board of Governors and the Executive Committee. The Secretary supervises all MAA elections, awards, and committees, prepares agendas and minutes, and represents the MAA as necessary.

James Stewart and the House That Calculus Built

By Ivars Peterson

The name James Stewart ought to be familiar to many thousands of calculus students and their instructors. In North America, Stewart's books outsell all other calculus textbooks combined.



Mathematician and author James Stewart stands in front of a selection of the many editions of his calculus textbooks.

Now, Stewart's name is also associated with his new home, a spectacular structure of graceful curves, wood, and glass that has put his Toronto neighborhood on the international architectural map. Named Integral House, the innovative building melds with the side of a wooded ravine. Its five floors encompass an airy performance space, where chamber groups have already performed to audiences of as many as 150 people.

A Canadian, Stewart grew up in Toronto. In high school, he was interested in all subjects, including languages, history, and English. He also played the violin and had a passion for music. Stewart's grade 11 math teacher at Earl Haig Collegiate, Ross Honsberger, sparked his interest in mathematics.

"He was not your typical math teacher," Stewart says. "He was always going off on digressions. In grade 11, he presented the proof on the board that the rational numbers are countable and that the real numbers aren't. I don't know what my fellow students thought, but I thought that was fascinating."

From the street, only two levels of the five-level house are visible, including a top floor sheathed in curved, frosted glass. After five years of construction, the $24 million house still isn't quite finished.

Unable to make up his mind about which direction to take, Stewart followed the advice of his high school guidance councilor to pursue science, and he went into the demanding mathematics, physics, and chemistry program at the University of Toronto. At the end of his second year, however, he came very close to switching from mathematics to music.

"In the end, I decided not to because I thought it would be better to be a mathematician whose hobby is music than a musician whose hobby is mathematics," Stewart says.

Interested in specializing in analysis, Stewart went to Stanford University for his master's degree. "At that time, virtually the entire math faculty at Stanford consisted of analysts," he says. "And there was the appeal of California weather."

Stewart came back to the University of Toronto to do his PhD with Lionel Cooper. Cooper, however, was slated to leave Toronto for a position at the University of London. "From the time I got the subject of my PhD thesis to the time I defended it was one year; I wanted to finish up before he left," Stewart says. "I never worked so hard in my life." He then followed Cooper to London to do two years of postdoctoral work.

While in London, Stewart came back to the serious study of the violin. "This pull between music and mathematics came into play again," Stewart says. "When I got my first job at McMaster University, in addition to playing chamber music, I was asked to become concertmaster of the McMaster Symphony. I also ended up playing for some years professionally in the Hamilton Philharmonic Orchestra."

Music wasn't Stewart's only serious pursuit. At McMaster, he had a full research program in harmonic analysis and supervised several PhD theses. He was also passionate about teaching. "I knew I loved teaching from the moment I stepped into a classroom," Stewart says.

Designed by the Toronto architectural duo of Brigitte Shim and Howard Sutcliffe, Integral House incorporates an airy space in which chamber groups and soloists can perform to audiences of as many as 150 people. Angled, wooden fins divide the curved glass walls into segments, giving viewers strikingly different perspectives on the wooded ravine outside as they move from place to place.

Stewart never considered writing a textbook until two of his calculus students suggested the idea, remarking that his notes on the blackboard were better than the textbook they were using. "It was their idea, and it changed my life," Stewart says.

Before he had a chance to start writing a calculus text, two Hamilton high school teachers asked Stewart to collaborate with them on a series of high school math books. "I found it to be a useful apprenticeship," Stewart says. "Together we wrote grades 10, 11, 12 textbooks that came to be used in a lot of high schools."

With a working knowledge of what students are supposed to know when they enter calculus, Stewart felt that he could start writing a calculus textbook. "I thought I could write one in three years," Stewart says. "Instead, it took me seven years — seven really, really intense years — while I continued with my teaching and research. With the writing, I spent 13 hours a day, 364 days a year at work during those seven years. Once I had started, I had to finish it."

When it was published in 1987, the resulting book sold fewer than 20,000 copies in its first year, but the numbers grew in each subsequent year. By 1992, in the second year of the second edition, Stewart's *Calculus* had become the best-selling calculus textbook. "I basically wrote the book to use in my own classes," Stewart says. "I had no idea it would catch on."

Stewart finds it difficult to pinpoint why his book and subsequent iterations have proved so successful. "I think one reason for the success is accuracy," Stewart says. "I'm a fanatic for accuracy. There can be no wrong answers." He also mentions the close attention that he pays to his students, and he remarks that in school he was as strong in English as he was in mathematics. "But mostly, it's a mystery to me," he concedes.

His publisher has kept him busy producing new editions and variants — an edition of *Calculus* in which transcendental functions are introduced near the begin-

Graceful curves define the stairways leading to the performance space and to lower levels, where Stewart has his office, a modest, art gallery, and a small swimming pool. Photograph by Ed Burtynsky. Courtesy of James Stewart.

ning; a version that helped bring calculus reform ideas into the mainstream; another aimed at engineering students that integrates vectors into the material from the start; and *Essential Calculus*, a somewhat condensed iteration.

"I haven't had a break since the first book," Stewart says. At present, he is preparing the seventh edition of his original *Calculus* book and collaborating on two other books: applied calculus for business and economics students and a "reform" college algebra book that is heavily data driven.

Stewart is also toying with the idea of eventually writing a book about mathematics and music, focused on the theme of why mathematicians tend to be musical. He has given talks on the topic to a variety of audiences, bringing his violin along to demonstrate analogies between form in music and structure in mathematics.

Although Stewart is now an emeritus professor at McMaster, he has continued to teach occasionally at the University of Toronto. He is particularly excited about introducing a course in problem solving, something he had done earlier at McMaster.

"When I was a graduate student at Stanford, I fell under the spell of George Pólya, who was retired but used to come in and give these problem-solving talks," Stewart says. "He had all of us — teachers and students alike—literally sitting on the edges of our seats with mathematical excitement, presenting data, asking us to make conjectures."

Nonetheless, writing is at the core of Stewart's working life, and it has proved lucrative for him. He has earned enough to help fund the James Stewart Mathematics Centre at McMaster, contribute to a variety of projects and causes, and, after renovating four homes during his earlier years, to dream of building a house of curves, wood, and glass, with all the little touches that he could wish for.

Now, Stewart has a spectacular house in which to think, write, entertain, and perform — the result of a project that evolved from a simple wish, even a kind of naiveté, into an innovative architectural wonder.

"I've set out to do two major things in my life, but I didn't think of them as major at the time," Stewart muses. "I just thought, 'My two students suggested that I write a calculus book; I think I'll write a calculus book.' Look what happened. And then I thought, 'It would be nice to build a brand-new house.' I naively went about interviewing architects, and look what happened." The complete interview with James Stewart is available online at www.maa.org/news/061809stewart.html.

Photographs by Ivars Peterson.

Even the door handles in Integral House have a custom curvature.

MAA to Probe Calculus I

By David M. Bressoud

I am pleased to announce that the MAA anticipates funding from the National Science Foundation to support a five-year study, *Characteristics of Successful Programs in College Calculus*, that will investigate the instruction of mainstream Calculus I courses in order to:

1. improve our understanding of the demographics of students who enroll in calculus,
2. measure the impact of the various characteristics of calculus classes that are believed to influence student success, and
3. conduct explanatory case studies of exemplary programs in order to identify why and how these programs succeed.

The principal and co-principal investigators for this project are myself, Marilyn Carlson, Michael Pearson, and Chris Rasmussen. To accomplish our goals, we will need help from and the cooperation of the mathematical community in the United States.

This project will be conducted in two phases. Phase I will entail a large-scale web-based survey to identify factors that are correlated with success in Calculus I. Phase II will identify eight highly successful calculus programs at various types of institutions. During fall term 2012, we will send teams to explore what is happening at these institutions and to conduct explanatory case studies for the purpose of understanding what it takes to create a successful program of calculus instruction. An important component of this project is the dissemination through publications, presentations, and workshops of the information gathered in both phases. The ultimate goal is to help math departments determine what use of resources will have the greatest impact on student performance and retention.

The Phase I survey will be conducted in the fall term of 2010. Late in spring 2010 we will use stratified random sampling to choose approximately 600 colleges and universities whose mainstream Calculus I classes will be surveyed. Both instructors and students will be asked to respond to the survey, both at the beginning and end of the term. We have begun to identify basic demographic questions as well as the variables for which we will need to control. These include type of institution, socio-economic status of students, reasons for studying calculus, year in college, and prior mathematical experience. We have also begun to specify the factors that may promote student success or, in the other direction, contribute to a decision to leave mathematics. Potential factors include class size, use of technology, instructor's status and number of years teaching, instructor's pedagogical content knowledge base, means of instruction including the mix of lecture and peer instruction or other active learning, and type and frequency of assessment including how homework is handled. Most of these are broad categories that will need to be refined. The intent of the Phase I study is not just to discover what is effective. We also want to learn whether there are practices that are commonly believed to be helpful but in fact do not correlate with improved performance.

This coming academic year will be spent deciding what we want to measure and how we will measure it, keeping in mind that this must be done within the constraints of web-based surveys of reasonable length. I ask for your help in identifying factors that we should measure and questions that will help us to measure them. A survey has been posted at http://www.maa.org/Surveys/TakeSurvey.aspx?SurveyID=86L1672.

Your suggestions will be very much appreciated. We are engaged in a literature review as preparation, and we also request that you list references to studies that you believe may be relevant to our work.

Additional information on this project can be found in my July *Launchings* column at http://www.maa.org/columns/launchings/launchings_07_09.html.

Mathematics and the Arts: The Curriculum Foundations Workshop

By Hartmut Höft, Joanne Caniglia, John DeHoog, and Chris Hyndman

A Mathematics and the Arts workshop was held on November 1–4, 2007 as part of MAA's *Curriculum Foundations* Project. It was part of the Knotting Mathematics and Art Conference, hosted by The University of South Florida (USF), with additional sponsorship by Eastern Michigan University and a National Science Foundation grant awarded to USF. The workshop was an opportunity for conversations between mathematicians, artists, and art educators about the mathematical understanding needed by art students. Participants were asked four questions meant to generate foundational materials based heavily on the needs of art students, from which appropriate mathematics curricula can be constructed. The questions were: What are the common processes of exploration and problem solving? How can mathematicians address the needs of art students in mathematics classes? What is the expected level of mathematical understanding for art students? And finally, what are the points of intersection between art and mathematics? Each of the sections below records some of what we found out.

What Are the Common Processes of Exploration and Problem Solving?

Art educators and artists would prefer to deemphasize the linear nature of the content in some undergraduate mathematics courses required of art majors. They instead support mathematics courses that emphasize exploration in solving a problem or creating a design. Artists and mathematicians both agree that the problem solving/design process involves the collection of ideas through experiment and the development of skills. Both disciplines refine the problem solving/design process through tentative problem/design formulations. Artists cautioned against teaching this process using an algorithmic approach.

George Hart's creation, constructed and displayed during the workshop.

How Can Mathematicians Address the Needs of Art Students in Mathematics Classes?

Art educators talked about the importance of addressing students' fear of mathematics and their tendency to delay taking their mathematics course requirements. A fear of mathematics often makes art students see mathematics and art as separate entities, leading to this delay. For example, art students learn proportions and percentages in mathematics classes, yet do not seem able to use that knowledge when they are required to mix paints and create color combinations. Artists and art educators remarked that their best mathematics courses were the ones that encouraged experimentation and exploration — a playful approach to design.

What is the Expected Level of Mathematical Understanding for Art Students?

In terms of numerical skills, all participants agreed that proficiency in percentages, proportion, measurement, and unit conversions is essential. Necessary geometrical competencies include scaling, perspective, transformations, and symmetry. Artists stressed the importance of using essential art concepts (such as precision, accuracy, effects of scaling, spatial relationships, perspective, and visualization in two and three dimensions) in all mathematics courses, as a means of teaching appreciation and observation. Technology also plays an integral part in the development of an art student. Specifically, competency in the use of measurement tools (e.g., rulers, protractors, and computer programs such as *Geometers' Sketchpad*) is critical for subsequent art classes.

What Are the Points of Intersection Between Art and Mathematics?

Throughout the workshop, participants discussed points of intersection between art and mathematics in terms of content and process. Content-based interconnections include *patterns* — recognition of arrangements in nature; *transformations* — the realization of motion in space and time — and *symmetry* — the extraction of order in visually complex objects. Process-based interconnections include *constraints* — the comprehension of ratio, proportions, similarity, and transformation; and, *inspiration* — the process in solving problems and in design.

A conference such as Knotting Mathematics and Art generates excitement. Experiencing the interconnections between mathematics and art with artists, art educators, and mathematicians instilled a desire to renew the mathematics curriculum around the guiding principles of inspiration and creativity. Mathematicians should utilize inspiration as a central tool in the teaching of both art and mathematics and recognize the connections between creating art and solving mathematical problems. Alas, most mathematics courses required for non-mathematics majors currently center on business-science-technology-engineering problem sets, bypassing the aestheetic, the arts, and the humanities entirely.

Goals for renewing the mathematics curriculum were compatible between mathematicians and artists. All participants agreed on the importance of interdisciplinary courses, appropriate timing of mathematics courses in the art curriculum, hands-on activities that connect concepts with tools, and the fusion of creating art objects with numerical tools and physical topics. Artists and mathematicians agreed that basic mathematical tools and skills are a necessary foundation for art students, but an appreciation of the connection and interplay between mathematics and art also is critical. The works of artists shown at the workshop can illustrate the "mathematician within" the artist, just as the tools of mathematicians can provide inspiration and guidance to the student for artistic design. Renewal of mathematics courses in the spirit outlined during the workshop will help to make this interdependence between art and mathematics explicit in the curriculum.

Blosme 2, by Brent Collins. This geometrically coherent blossom ("blosme" is the Middle English spelling) is formed from helical paths and helicoidal surfaces. The result is a beautiful surface that looks as if it might have evolved naturally.

The final draft of the workshop report and other details about the workshop can be found at http://www.emich.edu/cas/maa.

Joanne Caniglia (Mathematics Education, Kent State University) and Hartmut Höft (Computer Science, Eastern Michigan University) co-chaired the workshop with Elaine Richards (Developmental Mathematics, Eastern Michigan University). John DeHoog and Chris Hyndman, both professors of art at Eastern Michigan University, were participants.

The Curriculum Foundations Workshop on Meteorology

By Bill Marion and Craig Clark

Unless your university has an undergraduate major in meteorology, you might not know that meteorology students complete at least as many mathematics courses as the engineering students do — Calculus I, II and III and differential equations. In order to get a better sense of the mathematical needs of these students, faculty from around the country who teach in meteorology programs were invited to participate in a two-day Curriculum Foundations II workshop which was held at Valparaiso University in Northwest Indiana in late February 2008. The meeting was hosted jointly by the Department of Mathematics and Computer Science and the Department of Geography and Meteorology. It took place in the new wing of a building dedicated to the meteorology program.

Two of the participants at the Curriculum Foundations Workshop: Bill Marion, Mathematics, Valparaiso University and Clint Rowe, Meteorology, University of Nebraska-Lincoln.

Fourteen meteorology faculty, representing 11 colleges and universities, attended the workshop. (Three other meteorologists who had originally planned to come were unable to because of bad weather conditions in various parts of the country.) Four mathematics faculty were present. Their roles were to help facilitate the conversation, to address questions about curricular issues and mathematics content, and to hear what the meteorologists had to say.

Prior to their arrival on campus, the participants took part in an electronic discussion about their expectations for the workshop. It quickly became clear that one of the major concerns of the meteorologists was the mathematical preparedness of their first-year majors. It appears that meteorology has become a very attractive program. Perhaps as a result, students come to the major with very disparate quantitative abilities. A substantial number of students struggle in the first two calculus courses and, as a result, many don't make it to the second year of their meteorology program. Thus, one of the main questions the meteorology faculty wanted to address when they arrived was what, if anything, can be done to remedy the situation.

A little bit of background might help. While incoming students *should* know that meteorology is a math-intensive major, many are not prepared for college-level calculus courses. Their mathematical preparation varies substantially. Most programs estimate that between 25% and 50% of their majors take Calculus I their first semester, with a much smaller number starting in Calculus II. The remaining students begin their math program in pre-calculus. As for meteorology courses, at least one largely qualitative survey course is typical. The meteorologists agreed that it would be beneficial for their students if they saw more calculus-based applications in this course or in some other meteorology course that might be offered early in the program, but it would be logistically challenging, given the varying mathematics placement of incoming students. Math-intensive courses such as the atmospheric dynamic meteorology sequence and atmospheric thermodynamics, are not typically taken by the students until their junior year. Thus, a sound mathematical preparation is what would benefit students most.

To tease out some specifics, the meteorologists were asked a couple of questions. "Are practical applications of mathematics more important than conceptual understanding?" Second, "What calculus topics should receive more emphasis?"

Though responses to the first question varied, the consensus was that both mattered. A majority felt that the conceptual aspects may be more important overall, since many of the meteorological applications can be taught in their upper-level courses. However, practical problem-solving skills are critical. Toward this end, it was suggested that more applied problems be included in the calculus sequence. While there are not many textbook examples related to the study of weather, there are many problems from related fields, such as physics, which could be assigned to hone students' skills. Another idea that gained some currency in the group was for mathematics and meteorology faculty to work together to develop some elementary calculus-based meteorological problems.

To address the second question, a list of topics covered in the calculus sequence was provided and the meteorologists were asked to rank their importance and to suggest the semester in which they should be covered. The primary change they recommended was that the standard vector content should be covered early, if not multiple times.

Other important calculus topics for the study of meteorology include derivatives, limits, integrals, Fourier transforms, and Taylor's Theorem. The group wasn't concerned that much about the remaining ordering, especially in the third semester. However, they did emphasize that it was essential for their students to be able to interpret mathematical concepts, such as function, limit, derivative, and definite integral, when the function to be analyzed is represented as discrete data points and via a graph rather than by a formula. On the whole, the consensus was that mathematicians should use whatever sequencing was most effective pedagogically. The crucial thing was that students be well prepared to handle the more quantitative meteorology courses that are offered in their junior and senior years.

Mainly anecdotal, yet fairly pervasive, evidence pointed to another issue: students have the greatest difficulty in the second semester calculus course. The poorest math students do not make it to Calculus II, but a significant number of students get adequate grades in Calculus I and subsequently struggle to pass Calculus II. The causes are not well-known. One of the mathematicians commented, however, that it is not unusual for the second-semester course to begin with applications of the integral and end with infinite series. In between, topics such as integration techniques, improper integrals, conic sections, parametric equations, and polar coordinates are covered. Such a hodgepodge of topics can make it challenging, even for the better prepared students, to assimilate and master the material. One of the meteorologists added that during the same semester meteorology students are taking calculus-based physics, making for a high workload.

So, where does this leave us in terms of the original question: What should we educators be doing in the first two years of college to prepare students interested in studying the weather? First, we should acknowledge that there are many students entering the field who are well-prepared. The real concern is with those whose mathematics background is weak. Some felt that there is not much that can be done, while others believed that we must do better. All agreed that these students' problem-solving skills need to be strengthened considerably, probably through a revised pre-calculus course or sequence. (The mathematicians responded that, indeed, there is a national effort to do just that.)

Other issues discussed were the use of technology, underrepresented groups entering the discipline, and preparedness for graduate study. The meteorology faculty stressed that their students should become familiar with a number of different software packages, one being Excel, and should develop some skill in programming, especially in FORTRAN. For the most part the meteorologists were satisfied with what their students were getting, although they were concerned that a typical first computer science course in object-oriented programming did not fit the bill — too much overhead for what their students really needed.

As for the underrepresentation of women and students of color, the good news is that the enrollment and graduation of women has increased substantially — in some programs it is approaching 50%. Unfortunately, the same cannot be said of minority students.

After graduation most students go on to careers in operational meteorology and broadcasting, while some go directly to graduate school. For the latter some exposure to linear algebra, numerical methods, Fourier

Curriculum Foundations is a project of CRAFTY, the MAA subcommittee dedicated to "Curriculum Renewal Across the First Two Years." Currently in Phase II, the project organizes workshops to consult faculty in other disciplines about the mathematics they would like their students to learn during their first two years in college. See the February/March 2009 issue of FOCUS for more information. In this issue, we publish reports on the workshops for the Arts (pages 8-9) and Meteorology (pages 10-12).

analysis, statistics, and partial differential equations is helpful.

In the end, the meteorology faculty emphasized that what is most important for their students to get out of the first two years of college-level mathematics is the ability to make sense of quantitative data and to apply confidently a variety of mathematical tools and concepts in a variety of settings. The mathematics faculty came away from the workshop with a clearer idea of how their courses affect other disciplines; in addition, offering the right set of upper-level math courses might lead to more students double-majoring.

The feedback from the meteorologists after the workshop ended was encouraging. It suggests that these types of conversations at the local level need to happen on a regular basis. At Valparaiso University, discussions with a number of departments are under way to restructure second semester calculus and to revise the first computer science course. The hope is to meet more broadly the needs of science, mathematics, engineering, and meteorology majors.

Bill Marion is Professor of Mathematics and Computer Science at Valparaiso University. He teaches both mathematics and computer science and is a member of the Curriculum Foundations II Steering Committee. Craig Clark is Assistant Professor of Geography and Meteorology at Valparaiso University and teaches courses in global climate change, data analysis and atmospheric thermodynamics.

Found Math

If there is a parallel universe in which smells are theorems, *100% Love* would be something like a proof of Riemann's conjecture.

Luca Turin, in *Perfumes: The Guide*

The Homework Self-Evaluation Challenge

By Lee Stemkoski

Every semester, one of my greatest hopes is that my students will internalize the philosophy "we learn math by doing math." I explain to my students that this is why I assign homework regularly, and why I count homework averages significantly towards final grades. I also want students to use homework as an opportunity to "self-assess," to determine the extent of their understanding and of what remains to be learned. Unfortunately, calculating grades and giving useful feedback on all this homework requires a lot of time. Most advice I've read on reducing time spent grading (such as assigning points on a 0–2 scale, spot-checking random exercises, or randomly determining if exercises will be collected at all) would not help students identify or learn from their mistakes. Most of all, it saddens me to see students glance at the grade on an assignment, ignore the written comments I have made, and file it away forever.

While recently teaching Abstract Algebra, I attempted to address all of these issues simultaneously with the "Homework Self-Evaluation Challenge." For each assignment, I wrote and photocopied a detailed answer key, explaining how I would have graded and assigned partial credit for each exercise.

Students accepting the challenge for a particular assignment had the following responsibilities:

Photocopy their homework before class, hand in the photocopy, and keep the original.

Pick up an answer key and grade their assignment.

Before the next class, send me their grade via an e-mail with subject "Homework Grade" (or incur a significant grade penalty).

I informed students who accepted the challenge that throughout the semester I would be scanning the photocopied assignments to make sure that the grades they sent me were accurate. I also advised students to mark up their homework indicating where points were gained or lost, for the rare case of significant disagreement between our grades, necessitating a re-evaluation. Occasionally, students solved exercises in novel and unexpected ways, in which case I encouraged them to talk with me after class or during office hours if they felt they needed to discuss how to grade their solution. I graded non-photocopied homework (from students not accepting the challenge) using the aforementioned answer key.

Students accepting the challenge were awarded an additional ten points (out of 100) on each assignment they evaluated themselves. I explained that since homework exercises counted towards 33% of their final grades, accepting the challenge would often result in a "bump" in final letter grades (from a B to a B+, from a B+ to an A–, and so on). Furthermore, by retaining their current assignment, they could reference it during the next assignment if necessary. I also explained that the ability to evaluate work is an important skill not only for future teachers (the majority of Adelphi math majors), but for many careers. Whatever their motivation, 30 of my 35 Abstract Algebra students chose to accept the challenge on a regular basis. After first describing the challenge opportunity to them, it was easy to see their pleasure at the amount of trust I placed in them, and the pride they felt in becoming that much closer to self-sufficient learners. As a result, my students appeared to truly enjoy this activity.

I believe that the self-evaluation challenge helps students develop valuable skills, become more self-reliant and reflective, consider their solutions more fully, and view grades less as "externally assigned numbers" and more as a direct result of their own efforts.

In the past, I usually spent about 15 minutes sketching out a grading key for homework assignments so that my evaluations would be consistent. To make a grading key that is student-friendly requires about 15 additional minutes; about ten minutes are needed for photocopying grading keys and entering grades e-mailed by students.

Time spent: 40 minutes per assignment.

Time saved: In a class of 35 students, I typically spent two to three hours to grade each homework set, and so the time saved is around one to two hours per assignment, plus time saved from students with questions about how to correct mistakes and about why they received the grades they did.

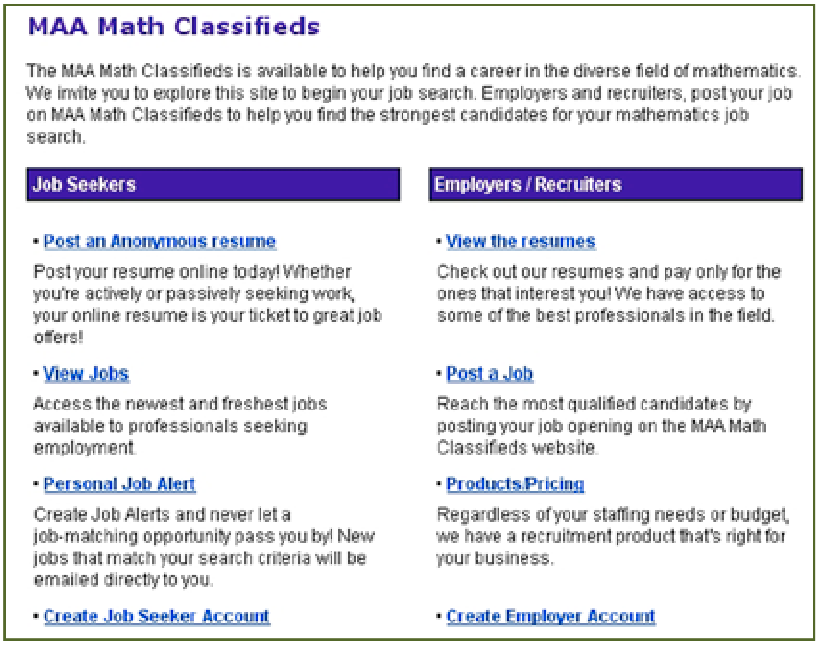
Lee Stemkoski received his PhD from Dartmouth College and is currently an Assistant Professor in the Department of Mathematics and Computer Science at Adelphi University. His interests include the History of Mathematics, Number Theory, and Mathematical Modeling.

What Can I Do with a Math Degree?

By Carla D. Martin

"What do people do with a math degree?" In today's business climate, we need to have answers beyond the usual "go to graduate school or teach." Some answers may be found at the MAA careers website at http://www.maa.org/careers and at a similar AMS website at http://www.ams.org/early-careers. Both contain profiles of mathematicians in bachelors-level positions. The books *101 Careers in Mathematics* by Andrew Sterrett and *She Does Math* by Marla Parker (both published by MAA) also feature profiles of mathematicians in industry.

As educators, we should be aware of non-academic careers in order to encourage more students who wouldn't otherwise pursue mathematics. I *was* this student — the one who almost didn't major in mathematics because of concerns about finding a job after college. To my surprise, there were several career choices available to me. During my stint between undergraduate and graduate school, I accepted a consulting job with IBM Global Business Services, where seemingly they couldn't hire enough people with math degrees. The quantitative reasoning skills that math majors possess are invaluable.



The MAA's employment website, Math Classifieds.

As a consultant, I took on many different projects all of which used my quantitative and logical reasoning skills. Here are just four examples — all of which involved undergraduate-level mathematics.

The Department of State needed to calculate the value of land owned and leased by the U.S. worldwide to prepare for their upcoming audit. Unfortunately, their data quality was poor due to outdated information and changing economies/currencies in many countries. We developed a model to estimate missing or invalid values and calculate the cost adjusted for inflation/deflation. Land values of developing countries with little to no data were estimated based on statistics for that country (mortality rate, GDP, literacy rate, etc.). The results and model were presented before Congress.

The National Highway Traffic and Safety Administration (NHTSA) noticed an increase in the number of single car accidents soon after antilock brakes (ABS) became standard on most cars. To understand this correlation, we performed a study on driver experiences with ABS and determined that the increase of single car accidents was attributed to driver error when the ABS engaged. The results were used by NHTSA to plan activities to increase the public's understanding of ABS.

A large fast food chain needed to forecast sales of their children's meals in order to determine individual store demand levels of the included toys. Individual stores need to keep toys available for the entire length of the promotion, while avoiding an oversupply at promotion conclusion. We developed an accurate predictor that determined the number of toys to be sent to each franchise based on toy popularity and region.

Data mining is ubiquitous. Supermarket shopper cards are one example where consumer purchasing histories are used for targeted coupon mailings. My particular project involved mining data from a large bank in order to target coupons in credit card statements. This was the most mathematical of the projects; we used nearest-neighbor models as well as neural network models.

After seeing these examples, it should be clear that math majors would be an asset on these projects. When the inevitable question comes up in class, it pays to be able to explain how mathematics is used in a real setting. Giving examples is very important, since they help students understand how mathematics fits into their major. It is especially crucial in non-major classes. I have seen students change their major to math after learning how mathematics is used.

For some of our majors, encouraging exploration of employment options may not be appropriate. However, there are many math majors (perhaps the majority at many schools) who are not on a secondary education track and are not planning on attending graduate school, at least not immediately after graduation. These majors and potential majors benefit greatly from a good answer to the question of what to do with a math degree.

The MAA's career site.

I will always have that distinct memory of sitting in my soon-to-be advisor's office as a sophomore in college. I loved mathematics and wanted to change my current chemistry major to mathematics. However, I did not want to change my major in return for losing career options. It was obvious to me I could get a job in chemistry, but it was not clear to me at all what I could do with a math degree. So it was me who asked this very question, "What can I do with a Math Degree?" Luckily, my advisor had a good answer. And here I am.

*Carla D. Martin (*carlam@math.jmu.edu*) is an Assistant Professor of Mathematics at James Madison University. She worked for four years as a consultant before returning to graduate school in applied mathematics. She has served on numerous panels on employment in mathematics and maintains contact with employers of mathematicians. Her profile appears on the MAA Career website and in* 101 Careers in Mathematics. *Her video and profile is also available on the Sloan Career Cornerstone website. She loves to find applications of mathematics in unexpected places and passes those on to her students whenever possible.*

Mathematicians Elected to the National Academy

On April 28, the National Academy of Sciences announced the election of 72 new members and 15 foreign associates. The list included several mathematical scientists: Sun-Yung Alice Chang (Mathematics, Princeton University), Percy A. Deift (Mathematics, Courant Institute), John E. Hopcroft (Computer Science, Cornell University), Thomas J. R. Hughes (Engineering, University of Texas at Austin), John W. Morgan (Mathematics, Columbia University), Christos C. Papadimitriou (Computer Science, University of California, Berkeley), Adrian Raftery (Statistics, University of Washington), Gilbert Strang (Mathematics, MIT), Cumrum Vafa (Physics, Harvard University), John D. Weeks (Physical Science and Technology, University of Maryland), and Wing H. Wong (Statistics, Stanford University). Our congratulations to all, with special congratulations to Hughes and Strang, who are members of the MAA.

AAAS Elects Fellows

The American Association for the Advancement of Science (AAAS) announced in April the election of 212 new AAAS Fellows and 19 Foreign Honorary Members. The new Fellows of the AAAS in Class I Section 1 (Mathematics) are Spencer Bloch (University of Chicago), Robert Fefferman (University of Chicago), Dorian Goldfeld (Columbia University), Stanley Osher (UCLA), Terence Tao (UCLA), Gunther Uhlmann (University of Washington), and Ruth Williams (UCSD). Our congratulations to all.

2009 USA Mathematical Olympiad Winners

By Steven R. Dunbar

This year, 12 outstanding high school students are winners of the 2009 USA Mathematical Olympiad (USAMO). They are the best of the more than 220,000 students who took part in a series of increasingly demanding contests put together by the Mathematical Association of America's Mathematics Competitions program, which culminated with the challenging USAMO exam. A total of 515 students took the USAMO on April 28–29, 2009 in their schools, and the results were scored by 23 mathematicians at the MAA Carriage House on May 8–10. The USAMO Problems and Solutions are available at the American Mathematics Competitions website. This was the 38th annual USAMO sponsored by the MAA.

The 2009 USAMO winners at the US Department of State. Pictured left to right are: Eric Larson, Qinxuan Pan, Delong Meng, Sergei Bernstein, Toan Phan, John Berman, David Rush, Robin Cheng, David Yang, Vlad Firoiu, and Wenyu Cao. Panupong Pasupat is not pictured. Photograph by Ryan Miller.

The winning students took part in awards festivities on June 8 at MAA headquarters in Washington, D.C., from 8 am until 12 pm. Later that evening there was further celebration at the U.S. Department of State, hosted by John Holdren, Director of the President's Office of Science and Technology Policy.

Each winner received the USAMO Medal, named in honor of Gerhard C. Arenstorff, twice a winner of the USA Mathematical Olympiad and also a member of the first USA team in the International Mathematical Olympiad. In addition, each winner received an "Einstein" savings bond as the Robert P. Balles USA Mathematical Olympiad Prize. Balles, a lifelong student of mathematics and former mathematics instructor, established this award to recognize and reward these high achieving students of mathematics.

In the days following the awards program the winners will take the rigorous team selection test to try to qualify for the United States team for the International Mathematical Olympiad (IMO), to be held in Bremen, Germany, July 10–22. That team will consist of the six students with the highest combined scores.

The 12 USAMO winners are:

John Berman: John graduated from John T. Hoggard High School in Wilmington, North Carolina and will be attending MIT in the fall with a primary interest in mathematics and physics. He was a recipient of a medal at the Romanian Masters of Mathematics Contest and he will attend the International Linguistics Olympiad this summer in Poland. His interests also include computer science, linguistics, philosophy, and history.

Sergei Bernstein: Sergei is a recent graduate of the Belmont High School in Belmont, Massachusetts and is planning to enroll at MIT. Sergei was a USAMO winner in 2007 and earlier this year was awarded a silver medal in the Romanian Masters of Mathematics Contest. Sergei placed fifth in the North American Computational Linguistics Olympiad and will represent the U.S. in the International Linguistics Olympiad in July. His interests include walking, meditating, music, and socializing.

Wenyu Cao: Wenyu is currently a 10th grader at the Phillips Academy and is very interested in attending MIT or Harvard. He was a semifinalist in the 2007 National MathCounts Competition and has been invited to the USA Invitational Computing Olympiad over the past two years. This year, he received a gold medal at the Romanian Masters of Mathematics Contest. His interests include table tennis, programming, and chess.

Robin Cheng: Robin attends Pinetree Secondary School in British Columbia, Canada. He's thinking about attending The University of Waterloo in Canada but has two choices in the USA; MIT and Caltech. In 2008, Robin was on the Canadian IOI team to Egypt and received a bronze medal and will again be on the team this year in Bulgaria. His interests include table tennis, badminton, programming, and all kinds of music.

Vlad Firoiu: Vlad is a junior at the Westford Academy in Westford, Massachusetts and is thinking seriously about attending MIT. He placed second at ARML in 2008. He is also a former number one tennis player in New England. Besides mathematics and tennis, his interests include computer programming, and table tennis.

Eric Larson: Eric, a graduate of South Eugene High School in Eugene, Oregon, will be attending Harvard this fall. He placed first in both the Intel Science Talent Search and the Intel International Science and Engineering Fair in 2009. He also placed second in the Siemens Math, Science, and Technology competition in 2008, and received a silver medal in the International Mathematical Olympiad in 2007. Playing Bach fugues is a passion for Eric as he has been a gold medalist in the Oregon Junior Bach Festival for the past five years.

Delong Meng: Delong graduated from Baton Rouge Magnet School and will be attending MIT in 2009 where he will study mathematics. Delong was also a USAMO finalist in 2008. In high school he was active in student government and in his church. In his spare time, Delong likes to play basketball, ping-pong, and go.

Qinxuan Pan: In 2008, Qinxuan won numerous math awards including ARML Individual 1st place and University of Maryland Math Competition 1st place. In Spring 2009, he represented the USA at the Romanian Masters in Mathematics and won a silver medal. Qinxuan's other hobby is classical music. He won first place in the Music Teacher National Association Senior Division in Maryland last fall. Besides math and music, Qinxuan also loves soccer, movies, and computer games. Qinxuan is going to attend MIT this fall.

Panupong Pasupat: Panupong is a native of Thailand, and he is very interested in attending MIT. Participating in the International Mathematical Olympiad has earned him two silvers and one gold in 2005, 2006, and 2007. He was also a gold winner in the IOI in 2008 and won the top individual first place in the Harvard-MIT Math Tournament.

MAA President David Bressoud pins a medal on Vlad Firoiu at the USAMO Awards Ceremony held at the U.S. Department of State. Photograph by Ryan Miller.

Toan Phan: Toan attends the Taft School in Watertown, Connecticut and he is a two time individual winner of the New England Math League and he was one of six representing the U.S. at the Romanian Masters in Mathematics. His interests include playing soccer, computer games, and playing the piano.

David Rush: David is a graduate of the Phillips Exeter Academy and will be attending MIT this fall. While at Phillips Exeter Academy, he was awarded superior achievement prizes in European history and accelerated German, the Hoar Prize for distinction in American history, and the Morgan Prize for distinction in advanced mathematics. As a representative of the United States at the 2009 Romanian Master of Mathematics, he earned a bronze medal. His interest over the past year has been being the president of the student government.

David Yang: David is the youngest winner at 12 years-old, and he is home schooled in Walnut, California. He placed second in this year's national MathCounts. His interests include computer programming, chess, reading, and go.

Steve Dunbar is the MAA Director of Competitions.

NSF Institutes Create Post-Doctoral Jobs

On May 11, the seven mathematical sciences research institutes funded by the National Science Foundation (see the sidebar) announced that they would be creating 45 new one-year and two-year positions for young mathematical scientists. These positions will combine research and other activities, from teaching at local community colleges to working in industry.

The new initiative is a reaction to the impact of the economic downturn on academia. There have been many hiring freezes and cancelled job searches across the country. For the mathematical sciences, this has resulted in the loss of almost 400 positions for recent PhDs. As a result, many recent graduates, even from top programs, were facing unemployment. The NSF, through the seven Mathematics Institutes, has responded, albeit in a small way, by creating these new postdoctoral fellowships.

The positions were created and advertised rapidly. One month after the first meeting of the institute directors, 750 applications had been received for the 45 available positions. "The timing was perfect," said Eddie Herman, one of the newly hired mathematicians. "Most academic positions are decided by the middle of March, so the Institutes began advertising at exactly the time when many of us were losing hope of finding a research position and were ready to look for other jobs."

Each of the institutes has taken a different approach to these fellowships. Post-docs at the American Institute of Mathematics (AIM), for example, will help to fill a desperate need for math instructors by teaching at De Anza Community College in Cupertino, California, and at San Francisco State University. "I have more than 1000 students on a waiting list for math classes, and no faculty to teach them," said Jerry Rosenberg, Dean of Physical Sciences, Mathematics, and Engineering at De Anza. Thanks to this initiative, approximately 250 of those students will be able to take a math class from one of the new post-docs at AIM. Their teaching duties will be in addition to the research they will do under the direction of Stanford University faculty.

Through the Institute for Mathematics and its Applications (IMA) in Minneapolis, Mustafa Tural, who trained in statistics and operations research at the University of North Carolina, will intern at Telcordia Technologies in Piscataway, N.J. He will apply his knowledge to the development of statistical learning methods for creating more efficient algorithms and protocols for communication networks. Prashant Athavale, a post-doc from the Institute of Pure and Applied Mathematics (IPAM) will collaborate with scientists at Placental Analytics, a company that studies the effect of placenta structure on fetal development. The placenta can be used to track fetal development, faithfully retaining information about possible prenatal problems and as a predictor of adult health risks. Athavale will apply his training in image processing to study irregularities of placenta structure and develop models of placental vascular branching.

Among the ten Postdoctoral NSF Fellowships awarded through the Mathematical Sciences Research Institute (MSRI) is Sikimeti Ma'u, originally from Tonga and now a permanent U.S. resident. Sikimeti will pursue research in

The Mathematics Institutes

AIM
American Institute of Mathematics
http://aimath.org

IAS
Institute for Advanced Study
http://www.math.ias.edu

IMA
Institute for Mathematics and its Applications
http://www.ima.umn.edu

IPAM
Institute for Pure and Applied Mathematics
http://www.ipam.ucla.edu

MBI
Mathematical Biosciences Institute
http://mbi.osu.edu

MSRI
Mathematical Sciences Research Institute
http://www.msri.org

SAMSI
Statistical and Applied Mathematical Sciences Institute
http://www.samsi.info

geometry and topology as a Postdoctoral Fellow at MSRI in 2009–10, then her NSF Fellowship award will take her to Barnard, which has an historic legacy as a college for women, to be mentored by the distinguished topologist Dusa McDuff.

At the Statistical and Applied Mathematical Sciences Institute (SAMSI), the new postdoctoral fellows will be joining the existing postdoctoral program, as this ensures that the fellows will become involved in highly interdisciplinary research, a potential key for their future employment. For those interested in an eventual academic position, the appointments will involve teaching at one of the partner universities of SAMSI (Duke University, North Carolina State University, and the University of North Carolina at Chapel Hill).

Jean-Philippe Lessard, currently at Rutgers, has been selected by the School of Mathematics at the Institute for Advanced Study (IAS) for an appointment at Rutgers beginning in September of 2009. Lessard is developing new techniques to deal with large amounts of data using Morse Homology, an abstract and notoriously difficult-to-calculate notion of algebraic topology. His goal is to make it computable.

Julia Chifman, a postdoc at the Mathematical Biosciences Institute (MBI), will be exploring the genetic relationship between species. The evolutionary history of a group of organisms can be illustrated through graphs called phylogenetic trees. Julia will use her training in algebraic methods to work on the mathematical structure of these trees.

For more information on the NSF Mathematics Institutes and their new program, visit http://www.mathinstitutes.org and the web sites of the individual institutes.

Highlights from the 2008 Putnam Competition

By Joseph A. Gallian

The 69th annual Putnam competition, held in December 2008, had 405 teams and 3627 participants from 545 institutions. The number of institutions was a record high, but the number of individual participants was down 126 from the record high in 2007. The four top ranked teams — Harvard, Princeton, MIT and Stanford — were the same as in 2007. Princeton finished second behind Harvard for the eighth time since 1985. Harvard finished first for the 27th time and placed in the top five for the 54th time.

The top fives scores on the 120 point exam ranged from 117 to 101. The score of 117 is the third highest since 1967. A score of 22 was enough to rank in the top 500. The median score was 1. MIT had five out the top 16 finishers and an amazing 48 out the top 189. In keeping with recent trends, four of the top five finishers and eight of the top 16 finishers had previously won Gold medals at the International Mathematics Olympiad.

Sophomores Brian Lawrence of Caltech and Arnav Tripathy of Harvard were repeat Putnam Fellows (top five finishers) from 2007, while junior Yufei Zhao from MIT matched his top five finish of 2006. Freshman Seok Hyeong Lee from Stanford and sophomore Bohua Zhan from MIT were the other two Putnam Fellows. The Elizabeth Lowell Putnam Prize went to Viktoriya Krakovna of the University of Toronto.

Harvard increased its total number of Putnam Fellows in the 69 competitions to 97. MIT, which has the second highest number of Putnam Fellows over the years, increased its total to 49. Harvard received an award of $25,000 for finishing first while each Putnam Fellow received $2,500.

A comprehensive up-to-date history of the Putnam competition is available at http://www.d.umn.edu/~jgallian/putnam06.pdf.

2009 Section Award Winners

Pacific Northwest

Thomas Dick
Oregon State University

North Central

Danrun Huang
St. Cloud State University

Southern California-Nevada

Curtis D. Bennett
Loyola Marymount University

Rocky Mountain

Richard Grassl
University of Northern Colorado

for Distinguished Teaching

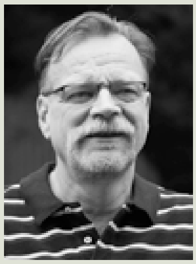
Wisconsin

Jennifer Earles Szydlik
University of Wisconsin Oshkosh

Michigan

Lisa DeMeyer
Central Michigan University

Allegheny



George Bradley
Duquesne University

Seaway

Christopher Leary
State University of New York at Geneseo

Northeastern

Solomon Friedberg
Boston College

New Jersey

Tom Osler
Rowan University

Missouri

James Guffey
Truman State University

EPADEL

Barry Tesman
Dickinson College

Md-Dc-Va

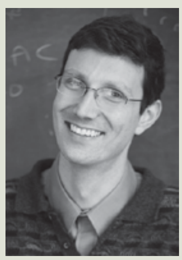
Lawrence Washington
University of Maryland, College Park

Kentucky

Christine Shannon
Centre College

David Shannon
Transylvania University

Southeastern



Hugh Nelson Howards
Wake Forest University

Florida

Margie Hale
Stetson University

Winners not pictured:

Indiana
Jeffrey Watt
Indiana University-Purdue University Indianapolis

Intermountain
Nicholas Jacob Korevaar
University of Utah

Louisisana-Mississippi
Victor P. Schneider
The University of Louisiana at Lafayette

Metro-New York
Dan Ismailescu
Hofstra University

Northern California, Nevada, Hawaii
Allan Rossman
California Polytechnic State University

Oklahoma-Arkansas
David J. Wright
Oklahoma State University

Southwestern
Joanne Peeples
El Paso Community College

Texas
John Davis
Baylor University

Is Elementary Education a Concern of MAA Members?

By Patricia Clark Kenschaft

Last year in a "nice" white suburban town a fifth grade teacher was observed drilling her students in adding fractions by adding across the numerators and then adding across the denominators. Is this teacher an outlier? I fear not. Some years ago I went to a fifth grade class in one of New Jersey's wealthiest districts. "Where is one-third on the number line?" I began. All those friendly white faces fell to the floor, so I repeated the question. "Near three?" the teacher guessed. She is one of the highest paid fifth grade teachers in the country.

You can read about my adventures during seven years of helping elementary schools teachers mathematically in "Racial Equity Requires Teaching Elementary School Teachers More Mathematics" (*Notices of the AMS*, February 2005, also online at http://www.ams.org/notices/200502/fea-kenschaft.pdf). I was inspired by the teachers' eagerness to learn and their ability to do so, but distressed at their lack of mathematical knowledge. The teachers had emerged from a flawed system.

Too often elementary school teachers teach incorrect "mathematics" and also communicate to their students that mathematics is too difficult for ordinary mortals. "If my teacher doesn't understand this, I can't either." Such intellectual and emotional damage is so devastating that even a teacher who is mathematically competent will find it very difficult to undo. High school teachers and remedial college faculty must overcome much more than lack of knowledge.

It seems to me that the critical path toward improving our entire math education system is helping pre-service elementary school teachers *before* they damage children. Mathematicians may have some reluctance to teach these courses, based partly (justifiably) on the difficulty of doing so, but also (less justifiably) on the perceived lack of intellectual challenge.

One memorable semester, I taught three first grades each Wednesday morning, introductory calculus each Wednesday afternoon, and abstract algebra each Wednesday evening to graduate students. One evening I found myself saying, "When we were discussing this topic this morning in first grade…" The class roared in laughter, but I continued. The fundamental topics of abstract algebra *are* presented in first grade! Furthermore, the pedagogical approaches that reached the children were useful for graduate students. After the final exam that semester, the graduate students stood around and one said, "I think we learned a lot more this semester because you were also teaching first grade!"

I eventually was able to teach pre-service elementary school teachers. Grappling with basic mathematical concepts with adults who don't love math is very different from exploring them either with first graders or with graduate students. But they too can be enticed to reexamine concepts that they had been taught were "stupid questions." I used Thomas Parker and Scott Baldridge, *Elementary Mathematics for Teachers* (Sefton-Ash Publishing, 2003, see http://www. singaporemath.com), a text accompanied by five Singapore children's texts, and was quite smitten. There may be other fine teacher-preparation programs, but I know there is at least one.

Some teachers have told me that they are ordered by their superiors, "Teach only one method! More than one confuses the children." It is hard to estimate the mathematical damage done by this widespread admonition. When elementary "mathematics education" consists of inculcating children with algorithmic skills, never to be questioned or varied, what does that do to citizens' ability to think mathematically?

Another pernicious aspect of elementary mathematics education is key words. One widely used test-prep program advocates, "When you see 'each,' multiply." Administrators claim that such drilling improves test scores. One Montclair State University student intending to become an elementary school teacher insisted that because American small trucks had an average gas mileage of 20 mpg in 1999 and sedans had an average of 28 mpg, altogether they must have an average of 48 mpg. She was a pleasant person who knew she was outvoted, but no matter how many of her classmates tried to explain why the average must be between 20 and 28, she clearly felt betrayed. "'Altogether' means 'add,'" she kept saying, incredulous that she had been taught wrong all these years.

Persuading college students to abandon key words has been more challenging for me than leading them to enjoy mental math. One actually said, "How else are you supposed to learn?"

Pre-service and in-service teachers *can* learn to think, even after decades of faulty teaching and administrative admonitions. Furthermore, they *want* to learn — in my experience, without exception. Once, after exploring the multiplication algorithm using base ten blocks, a teacher became angry: "*Why* wasn't I taught this before? I've been a third grade teacher for thirty years, and I could have been *such* a better teacher if someone had let me in on this secret thirty years ago! "

Most memorable, perhaps, was a whole day that I spent with 28 Newark third grade teachers, two each from 14 schools. I changed the (math) subject every 40 minutes, and I've never had a more rapt class. After the first break they came to me with a question on a standardized third grade test "that none of us can answer. Can you?" I could and did. It was a combinatorics problem, reasonable for third graders but much harder after you have been taught never to *think* in a math context.

The Conference Board of the Mathematical Sciences (CBMS), an organization composed of 16 mathematical organizations, released *The Mathematical Education of Teachers* in 2000. It recommends that future elementary school teachers take four courses in mathematics: (1) number and operations, (2) geometry and measurement, (3) data analysis, statistics, and probability, and (4) algebra and functions. States are not hastening to adopt the CBMS standards as requirements for certifying teachers, and institutions of higher education are even less eager to mandate requirements above the states'.

Wouldn't it be great if American children emerged from elementary school either knowing algebra or ready to learn it? Children in some countries do. As I signed in at January's Joint Mathematics Meetings, I noticed "Romania" on the nametag of the woman checking me in. I confirmed she had put her native country after her first name.

"Did you take calculus in eighth grade?" I asked, motivated by reports from two other Romanian immigrant desk clerks I'd met in the past two years.

"No, we had integral in ninth grade."

"But you had differential calculus in eighth grade?"

She nodded.

I don't want to suggest that we should model our education program on that of any other country, but wouldn't it be nice if college math professors could teach only calculus and up? One prerequisite for this pleasant possibility is that our elementary school teachers learn the mathematics we want them to teach.

Members of the MAA are pivotal in remedying this situation, both politically in getting appropriate state requirements and professionally in providing willing, competent teaching. What can you do to help?

Pat Kenschaft is Professor Emerita of Mathematics at Montclair State University and now teaches mathematics to pre-service elementary school teachers at Bloomfield College, also in New Jersey. She can be reached at: kenschaft@pegasus.montclair.edu.

We are deeply grateful for the generosity of the following individuals, who have made a bequest to the Mathematical Association of America.

Every bequest is a powerful expression of loyalty, their lifetime involvement, and their faith in the future of the MAA. We remember each of them fondly and with deep personal and professional respect.

Richard A. Good
Member since 1944

M. Gweneth Humphreys
Member since 1935

Marcia P. Sward
Member since 1969

As Massachusetts Goes, So Goes the Nation?

By Donna Beers

As 2008 wound to a close, the 2007 *Trends in International Mathematics and Science Study (TIMSS)* scores were released. There was good news for Massachusetts: Its fourth and eighth grade test-takers outperformed their peers nationwide; further, the state's fourth graders ranked third internationally, while its eighth graders ranked sixth. On the other hand, news stories in mid-May revealed that some 75% of aspiring elementary school teachers in Massachusetts failed their mathematics tests.

What tests? During the 1990s, Massachusetts, along with Texas and Maryland, led the way in standards-based reform. Now the Bay State has embarked on a new era of reform, one calling for tougher mathematics licensure requirements for elementary school teachers, including a separately scored mathematics subtest. The new licensure requirements are an attempt to respond to concerns about the mathematical preparation of teachers, but they raise questions of their own.

The National Context

For the past three years, people have worried about the mathematical preparation of teachers, driven by workforce needs, national security needs, and the mediocre performance of American students on national and international mathematics tests. For example, the National Council of Teacher Quality (NCTQ) surveyed 77 education programs. In a final report, strikingly titled *No Common Denominator: The Preparation of Elementary Teachers in Mathematics by America's Education Schools* (June, 2008), the NCTQ concludes there are no common standards in mathematics, either for admissions to or for graduation from education programs, and no common mathematics coursework is required of students.

With the goal of building teachers' deep conceptual understanding of the mathematics they will be teaching, the NCTQ recommends that teacher preparation programs follow a 3/1 framework: three mathematics courses covering the four "critical areas: numbers and operations, algebra, geometry and measurement, and data analysis and probability," and one closely aligned methods course. Echoing the *Final Report of the National Advisory Panel for Mathematics* (March, 2008), the NCTQ report urges that algebra receive greater attention: "A deeper understanding of elementary mathematics, with more attention given to the foundations of algebra, must be the new "common denominator" of our preparation programs for elementary teachers."

The NCTQ's 3/1 course framework for pre-service elementary teachers parallels the new mathematics curriculum recommended by the Massachusetts Department of Education. The NCTQ also advises that "States need to develop strong course standards and adopt wholly new assessments… to test for these standards. … A unique stand-alone test of elementary mathematics is the only practical way to ensure that the state's expectations are met. Only one state, Massachusetts, is on the road to creating a regulatory framework that accomplishes these goals, goals that should be shared by the entire nation."

Standards-based Reform in Massachusetts

The 1989 publication of the NCTM's *Standards for School Mathematics* sparked a standards-based reform movement in all 50 states. For Massachusetts, this reform began under a cloud: the Supreme Judicial Court ruled that the state was violating its constitutional mandate "to provide every child with an adequate education." Until 1993, school funding was based on property taxes; plaintiffs successfully claimed that poor school districts were disadvantaged. The Massachusetts Business Alliance, made up of business, education, and civic leaders, reacted by proposing a comprehensive blueprint for educational reform, including standards for core school subjects, common assessments tied to the standards, and, very significantly, a landmark method of school funding that would provide a minimum funding level for all school districts. This plan was enacted in the 1993 Educational Reform Act.

By the end of the nineties, Massachusetts, with Texas and Maryland, earned recognition as a model of standards-based reform. Massachusetts stood out for the high quality of its common assessments, the Massachusetts Comprehensive Assessment System (MCAS). Quoting Achieve's 2002 report, *Three Paths, One Destination: Standards-Based Reform in Maryland,* *Massachusetts, and Texas*: "Our results showed that the state has developed high-quality standards and high-quality tests, and there is tight alignment between the two …[W]e found MCAS to be among the best tests Achieve has reviewed in the United States."

Since 2000, state workforce needs have been a huge impetus for strengthening mathematics and science education in Massachusetts. Two companion organizations, Mass Insight Corporation and Mass Insight Education, have mobilized policy-makers and leaders from business and higher education to develop strategies for growing the state's economy and its leadership in the global economy, and to strengthen student achievement, respectively. In 2005 Mass Insight Corporation initiated *Global Massachusetts 2015*, a multi-year agenda for making Massachusetts "a world leader in R & D," e.g., in life sciences/medicine.

At the same time, Mass Insight Education reported a narrowing pipeline of students into STEM majors and careers. In its 2005 report, *World Class: The Massachusetts Agenda to Meet the International Challenge for Math- and Science-Educated Students*, it concluded: "Teachers' weak content knowledge is at the heart of our national math and science problems, universally among elementary teachers but also to a disturbing degree — especially in urban areas — among middle school and secondary teachers." To combat this problem, Mass Insight Education launched an ambitious framework for reform, "The Great Schools Campaign," which aspires to provide Massachusetts students with a world-class education in mathematics and science.

The *World Class* report recommended "three high-leverage steps" to strengthen teacher preparation: (1) "Raise pre-service math and science course requirements for elementary school teacher candidates." (2) "Require aspiring elementary school teachers to pass MTEL math and science tests, just as they have to pass a reading test today." (3) "Provide intensive content training and coaching in math to current teachers in grades 3-8 at a scale that matches the need. Follow that math priority with an equivalent commitment to science training and coaching." The new Massachusetts mathematics licensure requirements emerged against this back drop.

New Licensure Requirements in Mathematics

In July 2007 the Massachusetts Department of Education (DOE) issued *Guidelines for the Mathematical Preparation of Elementary Teachers*, which delineated new licensure requirements in mathematics for elementary teachers. Noting the "front line" role played by elementary school teachers in preparing children for advanced study of mathematics and for STEM careers, the *Guidelines* states that the goal of the new licensure requirements is to "strengthen the mathematical preparation of teachers at the elementary level," and to articulate "…the scope and depth of mathematical knowledge — both skills and understanding — that are expected of elementary teachers and that will be assessed on the [state licensure] test."

Through December 2008, candidates for elementary teaching licenses were required to pass three Massachusetts Tests for Educator Licensure (MTEL): "General Curriculum," "Communication and Literacy Skills," and "Foundations of Reading." The General Curriculum Test covered Language Arts, History/Social Science, Science, Child Development, and Mathematics. Of this test's 86 questions, 18 were on mathematics. To pass the General Curriculum Test, candidates only had to obtain an overall passing score across the five subjects. As of March, 2009, the General Curriculum MTEL Test includes a separately scored subtest of 45 mathematics

Guidelines for the Mathematical Preparation of Elementary Teachers

2. Mathematics.

Basic principles and concepts important for teaching elementary school mathematics in the following areas:

Number and operations
Functions and algebra.
Geometry and measurement.
Statistics and probability.

Candidates shall demonstrate that they possess both fundamental computation skills and comprehensive, in-depth understanding of K–8 mathematics. They must demonstrate not only that they know *how to do* elementary mathematics, but that they *understand* and can explain to students, in multiple ways, *why it makes sense…*

[Massachusetts Department of Education, July 2007, p. 1]

questions which candidates must pass to obtain licensure. See the sidebar on page 25 for the topics covered in the subtest.

The *Guidelines*, written for mathematics faculty as well as for licensure candidates and the coordinators and faculty of teacher preparation programs, recommend 9 to 12 semester-hours of coursework to cover the four strands of elementary school mathematics according to the following weights: Number and operations (45%); Functions and algebra (25%); Geometry and measurement (20%); and Statistics and probability (10%). The mathematics courses taken by candidates shall be "taught by mathematics faculty, potentially in partnership with education faculty," and "these should be taken after any necessary remedial courses and either integrated with or taken prior to math methods courses." The *Guidelines* provide sample course syllabi as well as suggestions for textbooks.

The Recent Test Results

On May 19, 2009, the *Boston Globe* headline read: "Aspiring teachers fall short on math — nearly 75 percent fail revamped section of state licensing test." So we learned the results of the mathematics subtest for the Massachusetts state licensure exam for elementary teachers, administered for the first time in March, 2009. Moving beyond the drama of the headline, we observe that Massachusetts is in a transitional stage: Undergraduates who were the first to take the test were likely rising juniors when the DOE Guidelines were released in July, 2007, so the 9 to 12 credit hours of mathematics recommended by the DOE may not have been available to them. Moreover, mathematics departments in Massachusetts schools and universities are still revising their curricula to meet the needs of preservice elementary teachers.

For now, several questions need to be answered: What assistance do mathematics faculty need to revise their existing courses for elementary school teacher candidates? What assistance do mathematics departments need to win administrative support for adding new mathematics courses, given current economic constraints? What assistance do teacher candidates need to help them prepare to re-take the test? For those graduate education programs that currently do not require their students to take a mathematics course, how will they determine what mathematics their students need and how will they deliver it?

President Obama has promised 40,000 Teacher Service Scholarships to be used, in part, to recruit high quality mathematics and science degree graduates into the teaching profession. With the nation awakening to the importance of what we do, the present moment offers mathematics departments the opportunity to increase the number of mathematics majors, enrich departmental offerings, and strengthen collaboration with education programs on teacher preparation.

Polynomia, Maxiministan, and the Calculusian Republic

A Review by Debbie Gochenaur

Uncommon Mathematical Excursions: Polynomia and Related Realms, by Dan Kalman. MAA, 2009. Hardcover, 296 pages, \$61.95 (\$49.95 to MAA members).

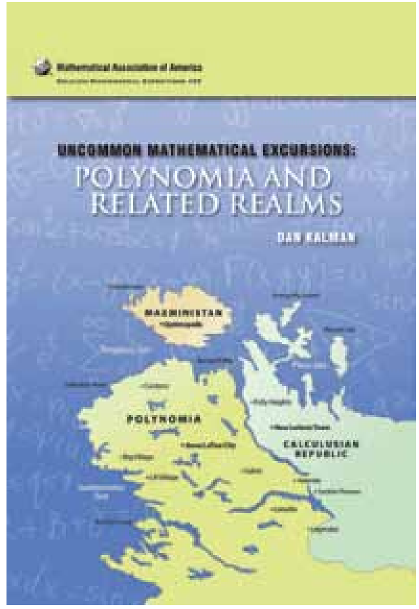
Offering an assortment of topics in the algebra, geometry, and calculus curricula, this book is intended as enrichment for those familiar with these topics at the upper-secondary or introductory college math level. The book is geared to teachers who have taught this material enough times to be thoroughly comfortable with it, but advanced students and scientists and mathematicians in general, may also find things here that will interest them.

The book is divided into three parts — *The Province of Polynomia*, *Maxiministan*, and *The Calculusian Republic*. Kalman ensures that the reader can make connections to familiar topics. He works to help the reader make extensions and perhaps understand more clearly the depth of mathematics in these seemingly elementary topics.

Uncommon Mathematical Excursions is not meant to be a textbook — it is a journey linking new ideas to familiar ones. Some topics are meant to be lingered over: in the Province of Polynomia, solving polynomial equations, including alternate solutions for cubics and quartics together with the historical reference for when each was discovered; in Maxministan, the hallway problem which deals with moving a ladder horizontally around a corner, leading to envelopes, an extension, and a discussion of duality; in the Calculusian Republic, envelopes, including boundary points, intersections and asymptotes.

Other sections are meant to be quick day jaunts into a variety of topics, each self-contained. They include palindromials, Marden's Theorem, borders on string art (where boundaries appear to be smooth curves but are in reality polygonal paths), and isoperimetric duality. While some topics may be familiar to the reader, everyone is sure to find something interesting.

The book includes descriptions of the concepts, setting them in historical context, and a variety of examples with some proofs. For example, the discussion on solutions for quartics begins with Descartes' 1637 factoring of the quartic into two quadratics. After some algebraic manipulation, one gets a sixth degree polynomial that is a cubic in u^2, which can be solved using methods that Kalman has discussed in previous sections. Kalman moves on to Euler's 1770 solution to the quartic, linking it to Euler's work on the cubic. Beginning by assuming that x is the sum of the square roots of r, s, and t, x is squared, simplified, and then squared again. Equating coefficients and substituting enables Euler to rewrite this system so that you finally find that the original r, s, and t are the roots of a cubic polynomial. After giving a third algebraic approach to solving quartics, Kalman moves on to explain the connections between solving quartics and cubics as well as Lagrange's frustrated but foundational struggle to extend this work to quintics.



There are sidebars throughout the book, including one on Lagrange and Vandermonde with a brief mention of their work with polynomial equations as well as giving a broader picture of their contributions, placing Lagrange as the greatest mathematician between Euler's and Gauss's generations. Every chapter ends with a brief history of the topics covered, with references and additional print sources if the reader wishes to explore further.

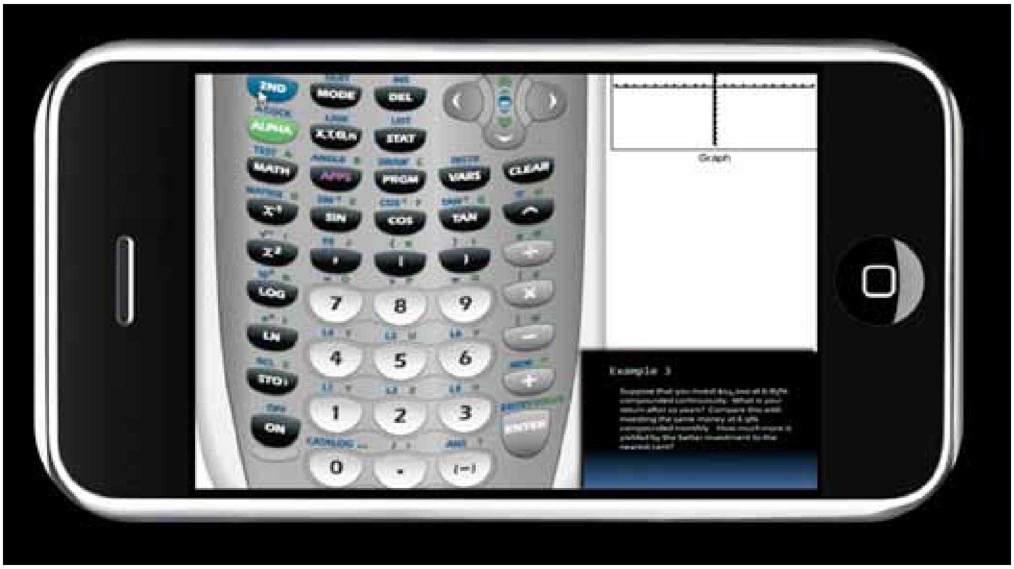
This book would make great summer reading or provide a good source for individual or group project assignments. The metaphor of traveling and exploring the back country of mathematics is used well. Kalman's sense of humor and adventure comes through from cover to cover while he takes you on the roads less traveled making connections to the mathematics you love.

Debbie Gochenaur is Assistant Professor of Mathematics at Elizabethtown College. Her interests lie in math learning disabilities and encouraging underrepresented minorities in STEM. *This is a lightly edited version of a review that first appeared in MAA Reviews on May 28, 2009. For more reviews, visit* http://www.maa.org/maareviews/.

What I Learned from… Catching iPhone Fever

By John Ehrke

In the fall of 2008, Abilene Christian University distributed Apple iPhones and iPod Touches to each of its 964 incoming freshmen. The campus was abuzz with the anticipation of the innovation these devices offered. I found it hard to imagine any device, even one as heralded as the iPhone, could make a meaningful difference in how my students experienced mathematics at the undergraduate level. “What could the iPhone possibly have to offer students in mathematics?”



One of the TI-84 emulator podcasts running on an iPhone.

Not one to summarily dismiss the iPhone’s promise, I observed the first semester impact of the device on campus. By semester’s end, I witnessed a campus that had fully embraced the idea of mobile learning. Soon, words like podcast and app became standard in conversation. I must admit my interest was piqued, and so I vowed to find a way to integrate these devices into my normal classroom routine.

With the spring semester approaching, I decided the best course of action was to begin with the university general education mathematics course. If events progressed well, I would extend the experience to majors. In preparation for the semester I jotted down a list of things I hoped to accomplish. My goals included increasing student engagement during class and keeping students engaged once they left class. Admittedly, I had more on the checklist than this, but past experience had taught me that if I could accomplish these goals, then the devices would have proven their worth.

The first day of classes finally arrived. I strode confidently into the classroom, iPhone in tow, and began the class by detailing the multitude of ways in which students could use their devices to access course materials, interact with other students, and contact their professor via a cleverly designed mobile web portal (courtesy of the IT folks on campus). I was even able to take attendance with the device while students located their course syllabus.

Everything seemed to be running smoothly, so I concluded the course introduction with an interactive poll of key items discussed in the syllabus. The experience was like laying carpet. Some of the students didn’t have devices (which I expected even though the class was predominantly freshmen). Some students did not have the app loaded on their phone (we used the free *ResponseWare* app from Turning Technologies). Some of the students couldn’t figure out how to submit their responses. Needless to say, my hopes for a seamless integration of student and device were unrealized, but I was undeterred.

We continued on with intermittent hiccups for the next few weeks, but as the semester progressed I became increasingly efficient in moving my students from lecture content to online content, to interactive polling, and back again. Midway through the semester, I had successfully managed to engage my students in actively experiencing mathematics in the classroom.

But how well was I succeeding in engaging them outside the classroom? My plan of attack for delivering content outside the classroom was quite simple: give students the confidence to do mathematics on their own, at their own pace. I tackled this in two ways.

Since the course relied heavily on the use of the TI-83 and TI-84 calculators, I developed a series of screen casts using *TI-SmartView*, a TI-84 emulator, to guide students through many of the various financial and statistical applications we used in class. By narrating the screen casts, I afforded students the convenience of being able to access their professor's instructions on a wide range of calculator questions with a certain level of comfort and familiarity, anytime, anywhere.

Course lecture content consisted primarily of LaTeX and Power Point slides. These slides were offered to students exactly as they appeared in class, with one addendum. Where appropriate, audio or video annotations to the discussions held in class were directly embedded into the slides in the exact context they were encountered in class. This afforded the students the opportunity to review class material in its original context as opposed to simply just videotaping class.

In the span of a few months, the course had undergone a complete transformation. I anxiously awaited the course feedback to see if things had gone as well as I had thought and for the most part student responses were extremely favorable. One student said, "I loved the videos! It made understanding and working through the problems much easier so that I could move into the homework at a quicker pace because sometimes it takes me a while to recall exactly where we left off in class," and another added, "It's always nice to be able to hit pause."

So what did I learn from taking the mobile learning plunge? I learned that the iPhone (or any mobile device for that matter) will not make students suddenly proficient in operations involving fractions. It will not provide clarity to students struggling with expected value or enable a student to successfully prepare a loan amortization schedule.

The power of mobile learning is rooted in its familiarity, in its ability to take an anxiety-riddled subject like mathematics and intertwine it with the tweets and blogs to which our students have become accustomed. It is for this reason I changed the way I teach mathematics and will continue to explore the untapped potential of these devices in the future.

John Ehrke is an Assistant Professor of Mathematics at Abilene Christian University in Abilene, Texas. He can be reached at john.ehrke@math.acu.edu.

Found Math

When the going gets tough, the tough get their math books out. Many of the diehard optimists on Wall Street have been beaten to a pulp by now, but those still standing have fallen back on a nifty bit of calculus. The second derivative, they say, is turning positive. That means that although the economy is spiraling down, it is doing so more slowly.

"Reasons to be cheerful, Part 2," *The Economist,* February 21–27, 2009

(Thanks to Sommer Gentry, United States Naval Academy)

Are You Experiencing Problems with the MAA Website?

If you have had difficulties placing orders or logging in to the MAA website, we apologize for any inconvenience that these problems may have caused. We are in the midst of a major association software conversion and have encountered a number of unforeseen complications. We are working to resolve these issues as quickly as possible. Please bear with us; we value your membership, your support, and your business with the MAA. If you are having any of these problems, please contact our customer service representatives at 1-800-331-1622, 9AM-5PM EDT, for prompt personal assistance with all of your needs.

The Oklahoma/Arkansas MAA Undergraduate Competitions

By Michael Scott McClendon

It sometimes feels next to impossible to generate excitement about mathematics amongst a group of undergraduates majoring in, say, biology. It can be almost as difficult to generate excitement amongst a group of mathematics majors. But it can be done. The Oklahoma/Arkansas section of the MAA just completed a first yearly undergraduate mathematics competitions. We were overrun by students eager to participate. We had 14 teams competing, 30 students competing in an integration bee and 20 students presenting research papers.

This competition really began when a student activities committee was formed: me, Fred Worth of Henderson State University, and Kathy Pinzon of the University of Arkansas at Fort Smith. It was early in the fall semester when I sat down at my computer and about one week later had a six-page proposal written of what I envisioned a great competition would entail. I sent it to Fred and Kathy, who were both excited about it. Kathy saw to it that the section governance saw the proposal. The total cost to the section was projected to be under $600. The actual cost this year was roughly $575. This includes three $75 awards, $300 for food and $50 for incidentals. But we collected about $150 in registration fees, so the cost to our section was really about $425.

The first, and major, part of the proposal was an undergraduate team competition. The universities in our section were allowed to send one or more teams of two or three students. Allowing teams of two made it possible for smaller universities to participate; in the end, seven of the teams had two students and another seven had three.

After I was fairly confident how the competition would run, I obtained a list of every institution of higher learning in Oklahoma and in Arkansas. I went to their web pages and hunted down the phone numbers to the chairs of their mathematics departments and I called every single one of them, telling all of the chairs about the competition coming up in Weatherford, Oklahoma.

The last minute details were worked out about a week before the actual competition. My colleague Charles Cooper and I met with section chair Gerry East and professor emeritus Stewart Burchett at Southwestern Oklahoma State University (SWOSU) in Weatherford. We arranged the room so that each team would have a table and so that there was plenty of seating around the periphery for faculty mentors to sit and watch the competition.

The team competition was a *Jeopardy* style competition. Teams were given 75 seconds to solve each question. We used clickers: the team that clicked first and provided the correct solution would then select the next question from the grid of questions displayed on an overhead projector. If the team got a correct answer, they would get the number of points that was listed on the grid. If they clicked their clicker and got the wrong answer then they lost one point. If a team did not click their clicker at all then they they received 0 points. A colleague of mine at UCO, Larry Lucas,

SERIOUS CALCULUS 1	SINE LIMITS 1	ALGEBRA 1	HISTORY 1	MISC. 1	LIN ALGEBRA 1
SERIOUS CALCULUS 2	SINE LIMITS 2	ALGEBRA 2	HISTORY 2	MISC. 2	LIN ALGEBRA 2
SERIOUS CALCULUS 3	SINE LIMITS 3	ALGEBRA 3	HISTORY 3	MISC. 3	LIN ALGEBRA 3
SERIOUS CALCULUS 4	SINE LIMITS 4	ALGEBRA 4	HISTORY 4	MISC. 4	LIN ALGEBRA 4
SERIOUS CALCULUS 5	SINE LIMITS 5	ALGEBRA 5	HISTORY 5	MISC. 5	LIN ALGEBRA 5

The Jeopardy-style grid of question topics. Created by Michael Scott McClendon.

handled the clickers.

A team would click their clicker and work out their answer and hand it either to Fred Worth or to John Diamantopoulos from Northeastern State University or occasionally to Bill Sticka from SWOSU. Both John and Bill volunteered to help out and their efforts proved to be invaluable. We decided to ask questions with short answers plus a scant few multiple choice questions.

Students in action at the Team Competition, with interested faculty in the background. Photograph by Charles Cooper.

Immediately after time was called for each question, I would show a PowerPoint slide that had the solution to the question worked out. It was always amusing to hear all of the sighs, all the half-chuckle, half-groans and the small yelps of elation as the students realized they had either missed or correctly answered the questions. The 50 minutes just flew by.

As we had 14 teams, we randomly selected seven of them to compete from 6:00 pm to 7:00 pm, seven to compete from 7:00 pm to 8:00 pm, and then the two teams from each hour with the highest score were to compete in the final round from 8:00 pm until 9:00 pm. While this makes for a long evening we made sure to have plenty of pizza and soda available.

During the competition, Charles Cooper took a fantastic collection of photographs. I made sure that I had a picture taken with the winning team from the University of Oklahoma, and the two undergraduate students on this team, Logan Maingi and Ruozhou Liao.

The integration bee was set to begin at 9:00 pm after everybody was finished with the team competition. A lot of the students enrolled in the team competition were also enrolled in the individual competition. I believe the winning integral was $\int \frac{\cot x}{1+\sin x}\,dx$. An Oklahoma State University student, Markus Vasquez, won the integration bee tournament.

On the following Friday afternoon, we had the undergraduate papers session. I worked with our section Secretary Lee Turner (Southern Nazarene University) to help divide up the submitted papers and abstracts into various topical categories. (Without all the support that I got from Lee, absolutely none of this could have taken place.) This year, the categories we chose were "Differential Equations," "Applied Mathematics," "Graph Theory" and "General Undergraduate Papers." There would be at least two judges for each category. However, we could not award first place winners in the Presentation Competition because right in the middle of the student paper presentations, the sectional meeting was cancelled due to a major snowstorm that had just barreled down out of the north.

Now that the competition is over, I reflect back upon it and wonder how it could have been any better. Everybody was in great spirits; every single one of the students that I talked to said pretty much the same thing — they had a great time. Both John and Fred brought humor and jollity to the event that wonderfully lightened up the atmosphere.

If anybody would like a copy of all of the questions that we used in the team competition or if you would like a copy of the proposal that Kathy ran by our governance that was approved and implemented into a successful mathematics competition, just email me at mmcclendon@uco.edu. If there is currently no such competition in your section, this might be close to a good place from which to begin. Any such program would be fantastic for your undergraduates' excellence in mathematics. Let the excitement begin!

Scott McClendon received his PhD in mathematics from the University of Louisiana in Lafayette in 2000. He is now a professor in the Department of Mathematics and Statistics at the University of Central Oklahoma. His research interests are typically geometrical in nature. He likes to spin classical music LPs and rock and roll LPs with his wife Ginger.

Letters

More on Late Homework

I would like to respond and contribute to the February/March 2009 Teaching Time Savers article by Amy Myers. Myers' "List of Grievances and Special Requests" sounds intriguing despite me having a concern over the fairness implications of having students grading their own homework papers. I also wondered if having students grade their own late papers truly saves time, as one might expect that the professor should look over the student-graded papers anyway. Nonetheless, an interesting idea!

Here is my method for accommodating late homework: I allot each of my students two "Late Homework Freebies" for a course. They each get two times during the semester where they can turn in an assignment late, for any reason whatsoever and I will accept it and grade it with no penalty. Past that, any late homework receives no credit. My reasoning for this is that more than two late homeworks constitutes a pattern that should have consequences. I do give a fluffy late homework deadline of "within a few days of the due date" and that has been effective in preventing homework from Chapter 1 showing up the day of the final exam! I also tell my students I truly do not need to know the reason for the lateness unless they feel compelled to share it. Overall, this policy has worked quite well and I would certainly recommend it to others struggling with this issue of late homework.

Russ Goodman
Central College

Attacking the Problem, Not the Symptoms

For some years, now, the symptoms have been evident — more and more kids have arrived at their freshman year in college armed with one or more high school credits in "Calculus," have floundered in their first college math course and have vowed never to take math again. There have been sessions at recent conferences (David Bressoud's excellent presentation at the "Math is More" conference last Fall and several at the Joint Meeting in January, among others) that have documented this with charts and graphs and have given rise to despair and a lot discussion about what to do — but not a lot of realistic thinking about why this is happening.

Instead, many university departments are reacting to the symptom by rethinking their lower-level calculus courses, deferring some of calculus's big ideas (like limits) and offering a greatly increased support system. To accompany texts with titles like "Calculus with Early Transcendentals," publishers are now offering texts with titles like "Calculus with Precalculus." There are efforts afoot to offer high school teachers better grounding in calculus, to offer more high school students opportunities to take their classes at a college and to encourage college professors to teach in a high school course. All of this activity is admirable but I suggest that it misses the point — that it is addressing the symptoms, not the problem.

I suggest that many of the kids who have made it though a high school calculus course, have done so at the expense of a solid algebra background and their difficulties aren't so much with calculus as they are with algebra. This is happening because increasing numbers of kids are being pushed into the study of algebra while they are still concrete thinkers and are pushing symbols around cluelessly because they're not ready to think abstractly.

These are not stupid kids, they're just appropriately young kids who, a year or two later, would find that algebra actually can be understood, not just "done." These kids are being rushed through an algebra program as fast as possible without being given the time to explore interesting ideas (Dan Teague talked about this at his "Math is More" session) so that they can get to calculus in high school. What has come out at the end of high school too often recently, is a kid with only the most tenuous grasp of algebra and who hasn't had much fun taking math but who is sporting the trophy of a credit in calculus.

There certainly are kids — I suspect 15% or 20% of the kids I've taught over many years — for whom early and accelerated algebra is exciting and accessible and for whom high school calculus is a wonderful adventure. These are the kids who have always thrived mathematically when they hit college. It's the kids who make up the high school calculus surge that I'm concerned about and many of them become the mathematically walking wounded.

So the question becomes, why this rush to calculus? I suggest that the answer is that university admissions people use calculus as an easy flag — that kids and their families are told that "we" (the university) "like to see calculus on the transcript" — or something like this. The fact that rushing to calculus may not be pedagogically healthy for most kids plays second fiddle to the exigencies of making the admissions process easier. Such a message is irresistible to parents and to school administrators but the "we" in this message isn't the math faculty. It's the admissions staff. As chair of a high school math department, for years I struggled with parents who wanted their children to accelerate inappropriately so that they could "get to calculus" so that they could "get into a good college."

I've never taught at the university level, so I'm not up on university politics. But I strongly believe that if University Math faculties really want to address the problem of underprepared and discouraged students, they need to start a discussion with their admissions staff. They need to bring in the kind of data that David Bressoud has collected. They need to convince their admissions colleagues that rushing to calculus can be destructive and that a much better "flag" would be a strong algebra background. Such a message to parents and administrators might begin bring back some common sense to the business of preparing kids to be strong, enthusiastic calculus students.

Joan Reinthaler
Mathematics Department
Sidwell Friends School (Ret.)

Correction

In our story on Sylvia Bozeman's award (MAA FOCUS, April/May 2009, page 3), we wrote "Since Bozeman became chair of the mathematics department at Spelman, some twenty students have completed their PhDs there." The sentence should have read "Since Bozeman became chair of the mathematics department at Spelman, some twenty students who graduated from Spelman have completed PhDs in mathematics or mathematics education." Spelman College does not offer doctoral degrees. We regret the error.

Small Increase in 2010 Dues Announced

The MAA Board of Governors approved a modest increase in member dues in January at the Joint Mathematics Meetings. The increase of approximately 2.5% will take effect in 2010 for most members, though for some academic-year based members, it will be implemented starting in September 2009.

It should be noted that there will be no dues increase for undergraduate student members. In addition, this increase does not apply to members who recently joined the MAA, since they receive introductory rate pricing during their first few years of membership.

SIGMAA dues will also be increasing by $2 each. Members who add SIGMAA memberships will pay $12 in the future.

MAA dues were last increased in the 2008 membership year. No increases were made in 2009.

Former MAA President Leonard Gillman Dies (1917–2009)

Former MAA President Leonard Gillman (born January 8, 1917) died April 7, 2009 at his home in Austin, Texas. He was elected Treasurer of the MAA in 1973 and held that office until he was elected President. He served as President-Elect in 1986, as President in 1987–1988, and as Past President in 1989. All told, he served on the Board of Governors for 23 years, from 1973 to 1995. As Treasurer, he was known for his meticulous care of the MAA's finances and investments and for his innovative presentations of the Treasurer's Reports. Near the end of his term, he became an advocate for conducting MAA's national elections by "approval voting." This was adopted by the Board of Governors, though too late to affect Len who was the last President elected under the old rules.

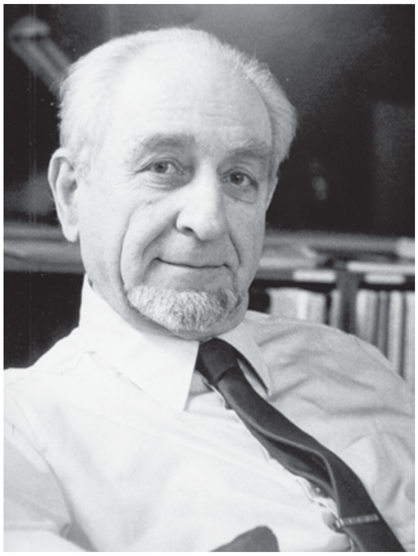
As MAA President, Len was a strong supporter of the new Committee on Minority Participation. He served on this committee for several years, beginning with its inception in 1989. Also, as President, Len was approached by Dr. Charles Y. Hu, a geographer, and his wife Yueh-Gin Gung, a librarian, who wanted to provide long-lasting support of mathematics but didn't know how. He steered them to the MAA's Award for Distinguished Service to Mathematics, which they then endowed in perpetuity. It is now known as The Gung Hu Award for Distinguished Service to Mathematics. It was rather fitting that Gillman himself was awarded the Gung Hu Award in 1999. See the citation in the February 1999 *American Mathematical Monthly*, page 97.

Gillman was born in Cleveland in 1917 and at age five moved to Pittsburgh, where he started piano lessons. After moving to New York in 1926, he began intensive training as a pianist. In 1933, upon graduation from high school, young Gillman won a fellowship to the Juilliard School of Music, from which he received a diploma in piano in 1938. Throughout his life, Gillman was an accomplished classical pianist and frequently performed in public, including four performances at the Joint Mathematics Meetings, two of them with a cellist, Louis Rowen, and two with the flautist and well-known mathematician, William Browder. Though he denied being a singer, he conducted 1900 mathematicians singing "Happy Birthday Dear American Mathematical Society" on the AMS's 100th birthday at the Atlanta Joint Mathematics Meetings in January 1988.

In 1942, Gillman received a B.S. in mathematics from Columbia University, a master's a year later, and in 1953 a PhD in mathematics from Columbia. He was at Tufts College 1943–1945 and M.I.T. 1945–1952, and served as a Naval operations analyst.

In 1952 he accepted a position at Purdue University and did research in general topology in collaboration with Melvin Henricksen, Meyer Jerison and others. Much of their research culminated in the classic book *Rings of Continuous Functions,* also known as "Gillman and Jerison." The book is very carefully written, and Len was especially proud of the complete index. He once commented that it was a copy of the text in alphabetical order.

In 1960 Gillman became chairman of the department of mathematics at the University of Rochester and played a key role in recruiting Arthur H. Stone and his wife Dorothy Maharam, W. Wistar Comfort and future MAA President Kenneth A. Ross. Among his students were Doris Schattschneider and the current MAA Secretary, Martha Siegel.



"Many of you may remember his *Rings of Continuous Functions,* written with Meyer Jerison, and his wonderful piano performances at the Joint Meetings," Martha Siegel said. "Those of us who were his students learned not only mathematics but also how to write (often painfully!) mathematics. Even with homework, he was a stickler for style and grammar. He was an excellent mentor to many of us in the MAA, and this is a great personal loss for me."

While at Rochester, Gillman became involved in activities of the MAA, starting with CUPM (Committee on the Undergraduate Program in Mathematics). In 1969 Gillman went to the University of Texas, where he served as chair of the mathematics department for four years. He remained on the faculty until his retirement in 1987.

In addition to "Gillman and Jerison," Gillman co-authored with Robert H. McDowell a rather successful book titled *Calculus.* He also wrote the invaluable guide *Writing Mathematics Well: A Manual for Authors,* published in 1987 by the MAA. An article, *An Axiomatic Approach to the Integral,* was published in the *American Mathematical Monthly* in 1993 and received the MAA's Lester R. Ford Award in 1994.

MAA Receives $24,000 Bequest from the Estate of M. Gweneth Humphreys

Mathematician M. Gweneth Humphreys (1911-2006) has left $24,000 from her estate for unrestricted use by the Association.

A member of the MAA for more than 70 years, Humphreys attended annual meetings and served on the Committee on Mathematical Personnel and Education (1956) and on the Committee on the Undergraduate Program in Mathematics (1965-67).

A native of British Columbia, Humphreys graduated from the University of British Columbia in 1932. After receiving her master's degree in 1933 from Smith College, she earned a PhD in mathematics in 1935 from the University of Chicago under the direction of Leonard E. Dickson (1874-1954). Her dissertation was titled "On the Waring Problem with Polynomial Summands," and it was published in the *Duke Mathematical Journal* (vol. 1, no. 3).

In the period 1920-35, the University of Chicago had a total of 26 women PhD's in mathematics, including Humphreys, Mina Rees (1931), Frances Baker (1932), Anna Newton (1933), and Marie Litzinger (1934).

Humphreys taught for 13 years at H. Sophie Newcomb Memorial College (New Orleans), the women's college associated with Tulane University. In 1949, she joined the mathematics faculty of Randolph-Macon Woman's College (Lynchburg, Virginia), now named Randolph College. Humphreys retired from Randolph-Macon in 1980, having been chairman of its mathematics department for 29 years.

Carol Wood, class of 1966, said, at Humphreys' retirement, that she "has impressed me profoundly with her brilliance and capacity for hard work, I still stand in utter awe of both.... I am deeply grateful for the careful training and kind example she gave, both of which have been critical in my own pursuit of this great passion we share for mathematics."

MAA Contributed Paper Sessions
San Francisco Joint Mathematics Meeting, January 13 –16, 2010

The MAA Committee on Contributed Paper Sessions solicits contributed papers pertinent to the sessions listed below. Contributed Paper Session organizers generally limit presentations to 15 minutes. Each session room is equipped with a computer projector, an overhead projector, and a screen. Please note that the dates and times scheduled for these sessions remain tentative.

Improving a Second Course in Statistics
Nancy Boynton, SUNY Fredonia, Patricia Humphrey, Georgia Southern University, and Michael Posner, Villanova University
Wednesday morning

My Most Successful Math Club Activity
Jacqueline Jensen, Sam Houston State University, Deanna Haunsperger, Carlton College, and Robert W. Vallin, Slippery Rock University and MAA
Wednesday morning

The MAA SUMMA Program Turns 20 – A Retrospective
William Hawkins, MAA and the University of the District of Columbia, Efraim Armendariz, University of Texas at Austin, Camille McKayle, University of the Virgin Islands, and Robert Megginson, University of Michigan
Wednesday morning

Experiences that Enrich the Education of Mathematics Majors
Suzanne Lenhart, University of Tennessee, Steven Schlicker, Grand Valley State University, J. Douglas Faires, Youngstown State University, and Michael Dorff, Brigham Young University
Wednesday afternoon

Preparing K-12 Teachers to Teach Algebra
Elizabeth Burroughs, Montana State University, Angie Hodge, North Dakota State University, and William McCallum, University of Arizona
Wednesday afternoon

The Scholarship of Teaching and Learning in Undergraduate Mathematics
Edwin Herman, and Nathan Wodarz, University of Wisconsin-Stevens Point
Wednesday afternoon

Engaging Students with Classroom Voting
Derek Bruff, Vanderbilt University, Kien Lim, University of Texas at El Paso, and Kelly Cline, Carroll College
Thursday morning

Mathematics Experiences in Business, Industry and Government
Phil Gustafson, Mesa State College, and Michael Monticino, University of North Texas
Thursday morning

Using Computer Algebra Systems in the Calculus Sequence
Bill Marion, Valparaiso University
Thursday morning

Developmental Mathematics Education: Helping Under-Prepared Students Transition to College-Level Mathematics
Kimberly Presser and J. Winston Crawley, Shippensburg University
Thursday afternoon

How Assessment Results Changed Our Program
Dick Jardine, Keene State College, and Barbara Edwards, Oregon State University
Thursday afternoon

Online Homework – Innovation and Assessment
Michael E. Gage, Arnold K. Pizer, and Vicki Roth, University of Rochester
Thursday afternoon

Wavelets in Undergraduate Education
Caroline Haddad, SUNY Geneseo, Catherine Beneteau, University of South Florida, David Ruch, Metropolitan State College of Denver, Patrick Van Fleet, University of St. Thomas
Thursday afternoon

Mathematics Courses for the Liberal Arts Student
Reva Kasman, Salem State College
Friday morning

Mathematics, Equity, Diversity, and Social Justice
Patricia Hale, California State Polytechnic University Pomona, Shandy Hauk, University of Northern Colorado, and

Dave Kung, St. Mary's College, Maryland.
Friday morning

Quantitative Reasoning and the Environment
Maura Mast, University of Massachusetts Boston, Karen Bolinger, Clarion University, and Cinnamon Hillyard, University of Washington Bothell
Friday morning

Undergraduate Mathematical Biology
Timothy D. Comar, Benedictine University, and Raina Robeva, Sweet Briar College
Friday morning

Philosophy of Mathematics for Working Mathematicians
Bonnie Gold, Monmouth University, and
Carl Behrens, Alexandria, Virginia
Friday afternoon

Publishing Mathematics on the Web
Thomas E. Leathrum, Jacksonville State University, William F. Hammond, The University at Albany, and
Kyle Siegrist, University of Alabama in Huntsville
Friday afternoon

Research on the Teaching and Learning of Undergraduate Mathematics
Keith Weber, Rutgers University, Stacy Brown, Pitzer College, Natasha Speer, University of Maine, and Karen Marrongelle, Portland State University
Friday afternoon

Innovative and Effective Ways to Teach Linear Algebra
David Strong, Pepperdine University, Gil Strang, Massachusetts Institute of Technology, and David C. Lay, University of Maryland
Saturday morning

Mathematical Texts: Famous, Infamous and Influential
Fernando Q. Gouvêa, Colby College, and
Amy Shell-Gellasch, Pacific Lutheran University
Saturday morning

Mathematics and Sports
Howard Penn, U.S. Naval Academy
Saturday morning

Mathlets for Teaching and Learning Mathematics
Joe Yanik, Emporia State University, Thomas E. Leathrum, Jacksonville State University, and David Strong, Pepperdine University
Saturday afternoon

The Arts and Mathematics
Douglas E. Norton, Villanova University
Saturday afternoon

Visualization in Mathematics
Sarah J Greenwald, Appalachian State University and
Walter Whiteley, York University
Saturday afternoon

General Contributed Paper Session
Eric Marland, Appalachia State University, and
Dan Curtin, Northern Kentucky University
Wednesday, Thursday, Friday and Saturday morning and afternoon

For complete descriptions of each session and additional information on the Contributed Paper Sessions please visit the MAA online at http://www.maa.org/meetings/jmm.html.

MAA FOCUS Deadlines (new schedule)

	Oct/Nov	Dec/Jan	Feb/Mar
Editorial Copy	August 15	October 14	January 5
Display Ads	August 29	October 27	January 16
Employment Ads	August 15	October 14	January 5

Meetings Calendar

Fall 2009 Section Meetings

EPADEL
November 7, 2009
University of Sciences of Philadelphia

Iowa
October 9-10, 2009
University of Northern Iowa

MD-DC-VA
November 13-14, 2009
Goucher College

New Jersey
November 7, 2009
College of St. Elizabeth

North Central
October 23-24, 2009
University of North Dakota

Northeastern
Western New England College

Ohio
October 30-31, 2009
Kenyon College

Seaway
October 23-24, 2009
SUNY-Fredonia

2010 National Meetings

Joint Mathematics Meetings
January 13-16, 2010
San Francisco, CA

MathFest 2010
August 5-7, 2010
Pittsburgh, PA

Additional information on section meetings can be found at: www.maa.org/Sections/schedule.html. For more information on national meetings go to: www.maa.org/meetings/national_meetings.html.

Undergraduate Conference in Oklahoma

The University of Central Oklahoma will host an undergraduate workshop on knot theory with lecturer Colin Adams the weekend of October 2-3, 2009. The workshop is funded by the NSF and limited travel funds are available to deter the expenses of participants. Women, minorities, and persons with disabilities are especially encouraged to participate and to apply for support. For more information, see www.math.uco.edu/nsfworkshop/knots.html or contact Charlotte Simmons at cksimmons@uco.edu.

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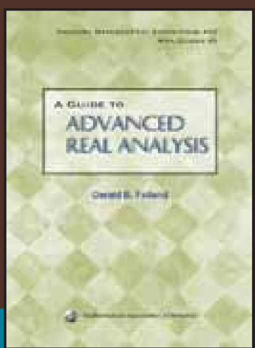

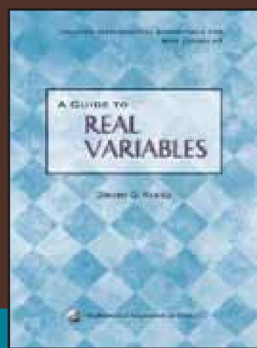

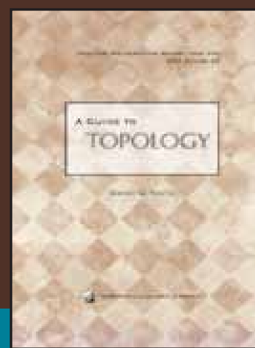

The MAA Guides are perfect for graduate students preparing for qualifying exams, or for faculty who would like an overview of the subject.

A Guide to Advanced Real Analysis by Gerald B. Folland

This book is an outline of the core material in the standard graduate-level real analysis course. It is intended as a resource for students in such a course, as well as others who wish to learn or review the subject. On the abstract level, it covers the theory of measure and integration and the basics of point set topology, functional analysis, and the most important types of function spaces. On the more concrete level, it also deals with the applications of these general theories to analysis on Euclidean space: the Lebesgue integral, Hausdorff measure, convolutions, Fourier series and transforms, and distributions.

Catalog Code: DOL-37/FC, 120 pp., Hardbound, 2009, ISBN 978-0-88385-343-6
List: $49.95 MAA Member: $39.95

A Guide to Real Variables by Steven G. Krantz

The purpose of A Guide to Real Variables is to provide an aid and conceptual support for the student studying for the qualifying exam in real analysis. Beginning with the foundations of the subject, the text moves rapidly, but thoroughly through basic topics like completeness, convergence, sequences, series, compactness, topology and the like. This book concentrates on concepts, results, examples, and illustrative figures. The reader may use this text alongside a more traditional tome that provides all the details.

Catalog Code: DOL-38/FC, 164 pp., Hardbound, 2009, ISBN 978-0-88385-344-3
List: $49.95 MAA Member: $39.95

A Guide to Topology by Steven G. Krantz

An introduction to the subject of basic topology that covers point-set topology, Moore-Smith convergence, and function spaces. It contains many examples and illustrations. The book treats continuity, compactness, the separation axioms, connectedness, completeness, the relative topology, the quotient topology, the product topology, and all the other fundamental ideas of the subject.

Catalog Code: DOL-40/FC, 120. pp., Hardbound, 2009, ISBN 978-0-88385-346-7
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