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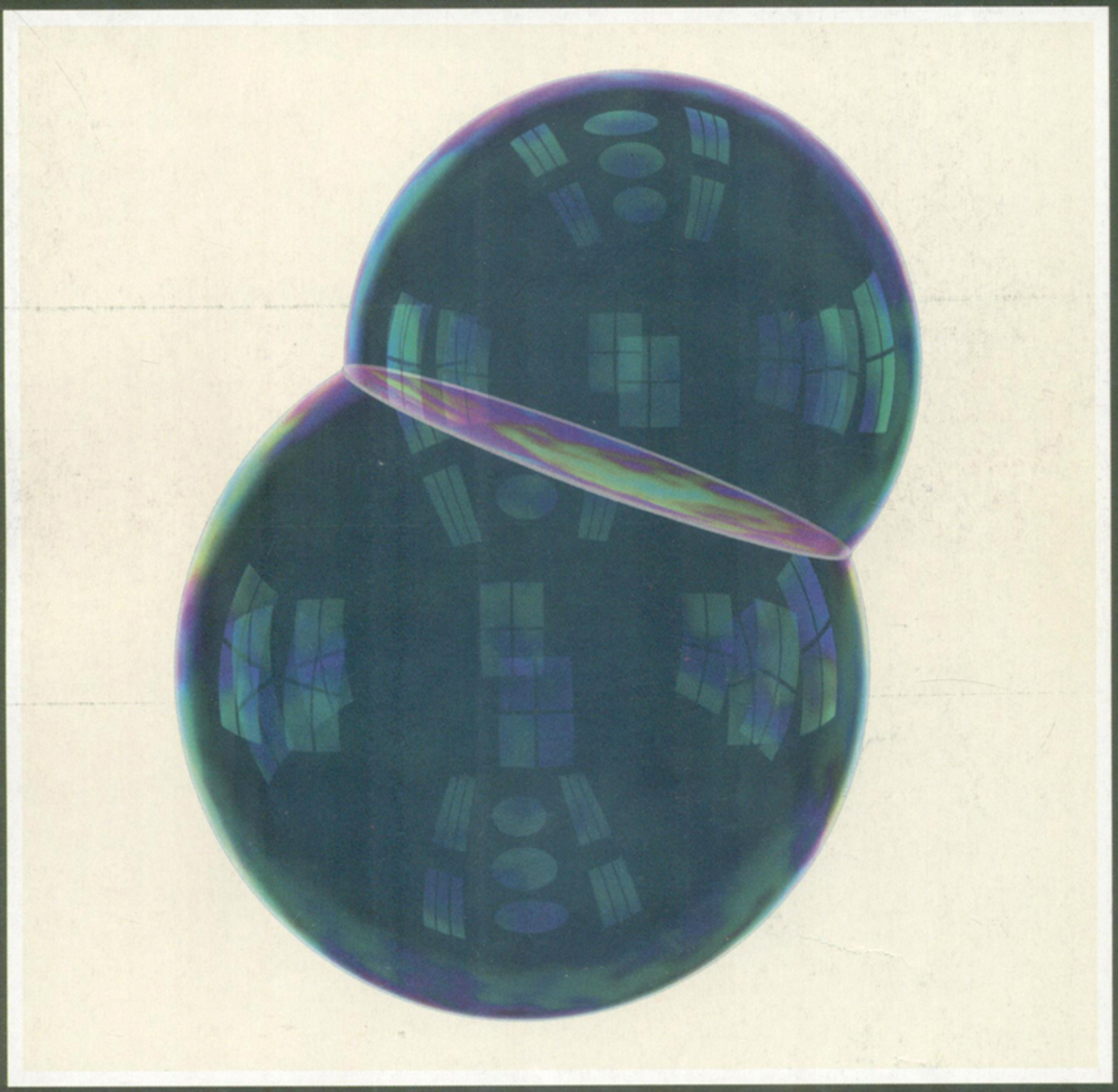
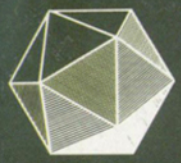
THE NEWSLETTER OF THE MATHEMATICAL ASSOCIATION OF AMERICA

FOCUS





INSIDE:

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Editor: Fernando Gouvêa, Colby College; fqgouvea@colby.edu

Managing Editor: Carol Baxter, MAA cbaxter@maa.org

Senior Writer: Harry Waldman, MAA hwaldman@maa.org

Please address advertising inquiries to: Carol Baxter, MAA; cbaxter@maa.org

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Letters to the editor should be addressed to Fernando Gouvêa, Colby College, Dept. of Mathematics, Waterville, ME 04901.

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FOCUS

May/June 2000

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Inside

On the cover: A standard double bubble. Created by John Sullivan, University of Illinois at Urbana.

FOCUS Deadlines

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Georgia Benkart Named 2000–01 Pólya Lecturer

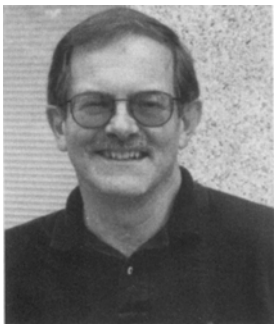
Georgia Benkart, new George Pólya Lecturer.

The MAA's Board of Governors has selected Georgia Benkart, of the University of Wisconsin, Madison, as the newest George Pólya Lecturer. She will serve for the academic years 2000–01 and 2001–02.

On a rotating basis, the MAA sections can invite any of the current Pólya lecturers to speak at a regional meeting. The award includes a stipend and covers the travel expenses involved in attending the section meetings. The scheduling of specific lectures is done by the Committee on Sections, which is chaired by David Stone.

Past Pólya lecturers were John Ewing, Patricia Rogers, Carl Pomerance, Robert Osserman, Underwood Dudley, Laszlo Babai, and Ronald Graham. Currently, two lecturers, Colin Adams (1998–99, 1999–00) and Joseph Gallian (1999–00, 2000–01), are visiting the Sections. ■

Thomas Rishel Named Associate Executive Director for Programs and Services



Thomas Rishel, new Associate Executive Director for MAA Member Services and Programs.

Thomas Rishel, from Cornell University, will become the MAA's Associate Executive Director for Member Services and Programs in July 2000.

Rishel holds a doctorate from the University of Pittsburgh and has published papers about c-spaces and Morita's M spaces. He has spent the last twenty years at Cornell University as the Director of Undergraduate Teaching and as Senior Lecturer in the department of mathematics.

Rishel's service to the MAA includes chairing its Task Force on Graduate Students and as a member of the MAA Task Force on Institutional Membership as well as a member of the AMS-MAA Joint Committee on Employment Opportunities. He is also the chair of the Selection Committee of the MAA Professors for the Future Program and is active in the Seaway Section.

Rishel is the author of *The Academic Job Search*, published by the AMS; *A Handbook for Mathematics Teaching Assistants: Preliminary Edition*, an MAA publication; and *Writing in the Teaching and Learning of Mathematics*, an MAA publication in the MAA Notes Series. ■

Proposed Fiscal 2001 Budget Calls for $2.8 Billion Increase in Science R & D

President Clinton's budget for Fiscal Year 2001, which he submitted to Congress in early February, includes a $2.8 billion increase for scientific research and development across all federal agencies and disciplines.

New funding is directed at the core programs of mathematical research at the National Science Foundation (NSF) and other government agencies. The NSF would benefit under the current budget proposal, with a requested increase in its budget of $675 million, or 17.3 percent. Mathematical programs at the Department of Energy (DOE) would also receive significant increases, while the request for the Department of Defense's basic research accounts would fare less well. The President's request will be evaluated by Congress over the next few months. See http://www.maa.org/features/budget00.html for an analysis of the proposed budget. ■

MAA Earmarks Funds for Student Activities

By Tina H. Straley

The MAA is earmarking all revenues generated by the MAA Visa Card to support student activities at the Section level. Since 1989, the Exxon Education Foundation has awarded the MAA annual grants to support a variety of student activities. These activities, which have included the MAA Student Lecture, Student Workshops, and special paper and poster sessions at national meetings, have increased student participation in MAA meetings and in mathematics in general. Unfortunately, the newly formed Exxon/Mobil Corporation has informed us that they are no longer able to support student activities, so MAA has been actively pursuing an alternative source of funding.

The MAA's activities and programs for students are an important part of the Association's service to the mathematical community. Our programs foster the development of tomorrow's mathematical pioneers and leaders. In order to continue to be able to fund these programs, the MAA has earmarked all revenue generated by the MAA credit card (backed by MBNA Bank) for use in student activities. I hope that you continue to support MAA's student activities by using your MAA credit card, or obtaining one if you don't already have one. For information on the MAA credit card call 1-800-847-7378. Promo code: E4CB. ■

Tina H. Straley is the Executive Director of the Mathematical Association of America.

Have You Moved?

The MAA makes it easy to change your address. Please inform the MAA Service Center about your change of address by using the electronic combined membership list at MAA Online (http://www.maa.org) or call (800) 331-1622, fax (301) 206-9789, email maaservice@maa.org, or mail to MAA, P.O. Box 90973, Washington, DC 20090.

General Double Bubble Conjecture in R^3 Solved

By Joel Hass

In March 2000, the proof of the general double bubble conjecture in R^3 was announced by four mathematicians: Michael Hutchings of Stanford University, Frank Morgan of Williams College, and Manuel Ritoré and Antonio Ros of the University of Granada. Their proof completes a long history of work on the problem.

Since early farmers started to fence off fields and beer drinkers started to design clay tankards, people have pondered how to enclose as much as possible within a container. The Greeks dubbed these "isoperimetric" (same perimeter) problems. Zenodorus made the first known attempt to show that the circle is the shortest curve in the plane enclosing a given area, some unknown time between the days of Archimedes (250 BCE) and Pappus (350 CE). However, it was only in the nineteenth century that Weierstrass developed the analysis needed to provide a complete proof. The optimality of the round sphere in three-dimensional space is an even harder problem. In 1882 Schwarz obtained the first proof.

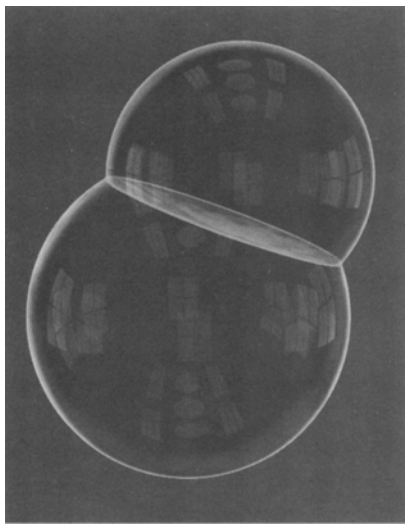


Figure 1: A standard double bubble

Experiments with blowing soap bubbles give rise not only to spheres, but also to more complicated conglomerations of bubbles. These can be foams with complicated geometries, but when only two components are enclosed the shape assumed is known as a "standard double bubble." This is made of pieces of three round spheres, meeting along a common circle at an angle of 120° as in Figure 1. The double bubble conjecture asserts that this shape is the most efficient one possible in enclosing two given volumes. More precisely, if V_1 and V_2 are two specified volumes, the conjecture is that the surface enclosing these volumes and having smallest possible area is a standard double bubble. The special case where $V_1=V_2$ was established earlier [HHS]. Hutchings, Morgan, Ritoré and Ros have now established the double bubble conjecture for all volumes.

Here is a sketch of the proof. The first issues that occur are existence and regularity. How do we know that any solution that is a reasonable type of surface exists? It's possible to pose similar problems with no solution. Even if a solution exists, is the optimal surface differentiable? The existence and regularity results are due to Fred Almgren and Jean Taylor see [AT]. Their work shows that there is an optimal bubble-like surface enclosing a given pair of volumes. This surface consists of smooth pieces having constant mean curvature, meeting along common curves at 120°, just like a soap film. (The same result holds for optimal shapes enclosing more than two volumes.) So what is this surface?

Each surface in this bubble has constant mean curvature, or constant average bending. This corresponds to a constant pressure difference between the two regions the surface separates. Constant mean curvature surfaces are very special, but far too general to classify. In a complicated soap froth, each piece of surface has constant mean curvature, and can be far more complicated than just a piece of a sphere. Fortunately, the surfaces used in constructing an optimal two region bubble are very special. White, Foisy and Hutchings applied symmetry arguments to show that the optimal double bubble is a surface of revolution—it is symmetric under rotation around an axis. The possible configurations now become tractable, and Hutchings established that there was a rather limited number of possible shapes for the cross-sections, some of which are shown in Figure 2. Some of the possible three-dimensional bubbles are shown in Figures 3 and 4. The bubble in Figure 3 is a torus bubble—one of its two regions is topologically a solid torus, like the inside of a tire tube. The bubble in Figure 4 has three components, two of which are solid tori. It appears at first that this latter bubble encloses more than two volumes. However it needs to be shown in the proof that the enclosed volumes are connected, and that an optimal bubble cannot contain a region divided into two non-connected pieces. The connectedness of each region is still un-

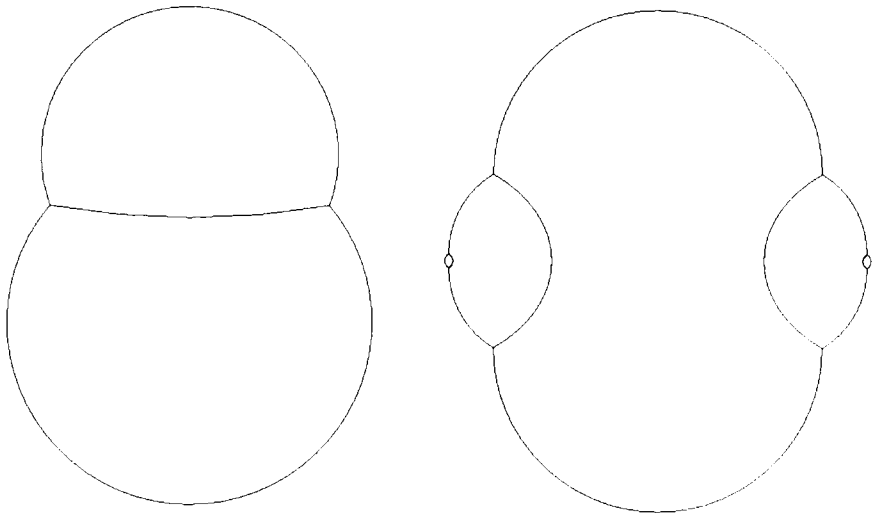


Figure 2: Some possible cross sections of optimal bubbles:

known for bubbles with more than two components, even in the plane.

An analysis due to Hutchings had shown that each region was connected when the volumes were equal. This led to a solution of the equal volume case in [HS] by a computational approach. The space of all possible optimal surfaces, each of which is a torus bubble, was described precisely. By a comparison to the standard double bubble, all the possible competitors were ruled out. Looking at unequal volumes, Hutchings, Morgan, Ritoré and Ros extended Hutchings's arguments to show that the larger volume is always connected and an instability argument to show that the smaller volume has at most two components. The resulting possibilities were more general than for equal volumes, but still tractable.

For each resulting possibility for an optimal bubble configuration, Hutchings, Morgan, Ritoré and Ros construct a deformation which preserves the volume enclosed in each region, but decreases the total surface area. In other words, they establish that the non-standard configurations are unstable; they aren't even optimal among nearby shapes. For soap bubble fans this has the disappointing consequence that we cannot expect to create one of the non-standard shapes with cleverly blown soap bubbles.

The tricky part of the proof is constructing the deformations. One way to deform a bubble is to rotate the entire thing, an operation that doesn't change its area or volume. What Hutchings, Morgan, Ritoré and Ros do is to rotate only portions of the bubble, pieces carefully chosen to blend smoothly into the rest of the bubble. A nice analogy is given by a great circle on the 2-sphere, like the equator, which is an example of an unstable geodesic. Rotating a great circle gives another great circle. But the rotation vector field, the derivative of this rotation, has zeros at two points. If we just rotate a half of the great circle lying between these two zeros, we still get a curve of the same length but create corners where we rotate. These can be smoothed off to shorten the curve. A length preserving deformation supported on a subset of a geodesic implies it is unstable. Similarly a deformation constructed on part of a non-standard double bubble shows that it is unstable.

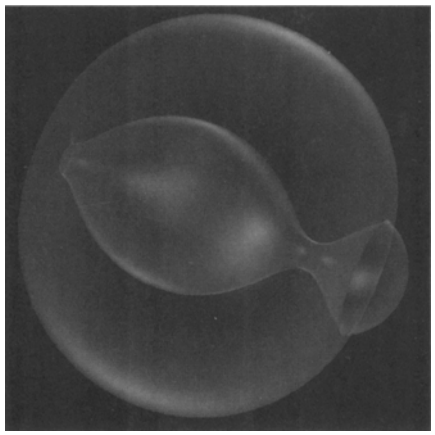


Figure 3: A two-component torus bubble

It is worth noting that a comparison of the general solution with the proof in the case of equal volumes indicates that a good mathematical idea is still worth a year of computer time.

We should remark on some related results. A group of undergraduates working with Morgan in the Williams College SMALL REU program had proved the general double bubble conjecture in the plane in 1993 [ABFHZ]. In a remarkable achievement in the summer of 1999, undergraduates Ben Reichardt of Stanford, Yuan Lai of MIT, and Cory Heilmann and Anita Spielman of Williams College, working together in that summer's Williams REU, extended the general double bubble solution to R^4.

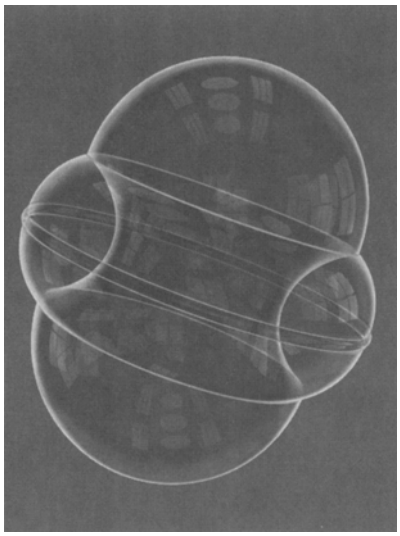


Figure 4: A three-component torus bubble

The proof of the double bubble conjecture joins recent breakthroughs such as [Weaire-Phelan] on the Kelvin Conjecture for partitioning R^3, [Hales1] on the Kepler conjecture regarding the best sphere packings, and [Hales2] on the optimality of the hexagonal packing of R^2. As a result, the study of optimal shapes has taken us to the point where the techniques have real connections in physical and biological applications. The coincidence of the mathematical solutions and nature's shapes show us that we are studying the right mathematical theories and equations. This has begun to be seen in exciting new studies of foams, crystal growth, and other complex structures.

References:

[ABFHZ] M. Alfaro, J. Brock, J. Foisy, N. Hodges and J. Zimba, The standard double soap bubble in R^2 uniquely minimizes perimeter, *Pac. J. Math.* 159 (1993), 47-59.

[AT] F.J. Almgren and J. Taylor, The geometry of soap films and soap bubbles, *Sci. Amer.* 235 (1976), 82-93.

[HHS] J. Hass, M. Hutchings and R. Schlafly, The Double Bubble Conjecture, *Electronic Research Announcements*, Amer. Math. Soc. 1 (1995), 98-102.

[Hales1] Hales, T. C., Sphere packings. I, *Discrete Comput. Geom.* 17 (1997), no. 1, 1-51.

[Hales2] Hales, T. C. , The Honeycomb Conjecture, *E-print math.*MG/9906042

[Weaire-Phelan] Weaire, D., Phelan, R., A counter-example to Kelvin's conjecture on minimal surfaces, *Philos. Mag.* Lett. 69 (1994), no. 2, 107-110. ■

Joel Hass teaches at UC Davis. He is one of the authors of the recently published book How to Ace Calculus, the Streetwise Guide *(see the review on MAA Online).*

Figures 1, 2, and 4 provided by John Sullivan, University of Illinois at Urbana.

Figure 3: provided by Joel Hass of UC Davis and Jim Hoffman of MSRI.

MAA Professional Development Workshops Summer 2000

Viewpoints: Mathematics and Art

EPADEL Summer Workshop–June 4–9, 2000; Franklin & Marshall College, Lancaster, PA Registration Fee: $325 (includes room and board)
Viewpoints is an intensive five-day workshop featuring classroom-tested activities and field trips which explore the connections between mathematics and art. Activities and materials from Viewpoints can be used collectively to form a full-semester course in Mathematics and Art (such as the ones taught by the facilitators), or as separate, independent modules to enhance and enliven courses ranging from elementary algebra and geometry to linear algebra, abstract algebra, and real analysis (as also done by the facilitators). Contact: Annalisa Crannell, a_crannell@acad.fandm. Web address: http://www.fandm.edu/Departments/Mathematics/m_frantz/viewpoints/Default.html.

Partnerships: Engineering and Mathematics

June 5–10: Rensselaer Polytechnic Institute, Troy, NY. Application Deadline: May 1, 2000
Participants will study materials developed by NSF Mathematical Sciences and their Applications Across the Curriculum program, and work in interdisciplinary teams to adapt and develop materials for use at their home institution. Topics come from all levels of the undergraduate curriculum in mathematics and engineering using storyboarding and technological delivery. Applications for the workshop are accepted from teams of two to four, which must include one mathematics and one engineering faculty. This is a workshop of the MAA Partnerships Project in interdisciplinary mathematics and is sponsored by a grant from the National Science Foundation. Please contact: Maureen Callanan, (FAX) 202.483.5450, mcallana@maa.org Web address: http://www.maa.org/pfdev/engpartnership.html.

Teaching Dynamical Systems Across the Curriculum

Rocky Mountain Section Short Course–June 5–9, 2000: Fort Lewis College, Durango, CO
The short course, presented by Professor Robert Devaney, will focus on methods by which ideas from dynamical systems theory may be included in various parts of the undergraduate curriculum. These topics provide an ideal opportunity to give students (particularly lower division students) a glimpse of modern ideas in mathematics in a setting that is germane to the course at hand. Please contact: Annette Cooper at 970.247.7232, Cooper_a@fortlewis.edu.

Teaching Statistics: Data, Concepts, Activities

Allegheny Mountain Section Short Course–June 19–23, 2000: Allegheny College, Meadville, PA
This short course, presented by Professor Allan Rossman, aims to help instructors teach introductory statistics in accordance with the recommendations of a joint ASA/MAA committee: emphasizing statistical thinking with more data and concepts, less theory and fewer recipes. Participants will engage in hands-on investigations of statistical concepts and methods that can be adopted for immediate use with students. Many of these activities will make use of Minitab statistical software. These activities include such topics as data collection, exploratory data analysis, randomness, and statistical inference. Sessions will also be devoted to discussing resources for teaching statistics and to issues of assessing students' learning of statistics. Registration Fee: $170; Room and Board: $140 Contact: Steve Bowser, 814.332.5348, sbowser@pellns.alleg.edu. Web address: http://webpub.alleg.edu/employee/s/sbowser/ssc00Adv.htm.

In Search of Newton

Northeastern Section Short Course–June 25–30, 2000: University of New Hampshire, Durham, NH

This short course will focus on the combined calculus and physics curriculum at University of New Hampshire. Participants will study updates and changes to both the calculus and physics curriculum, and will examine class materials and the studio format of instruction. Contact: Kelly Black, kelly.black@unh.edu Web address: http://www.math.unh.edu/~black/newton/pre-registration.html.

Proofs and Conjectures: The Story of the Alternating Sign Matrix Conjecture

Ohio Section Short Course–June 28–30: Cedarville College, Cedarville, OH
Discrete mathematics is now a regular part of the undergraduate mathematics curriculum at most colleges. Too often, the adjective "discrete" also applies to the individual topics which seem to bear little relationship to each other. They lack a sense of historical development. The stories and connections are missing. This short course, presented by Professor David Bressoud of Macalester College, provides a chance to share some favorite stories. They interweave in often surprising ways and each lead, in some fashion, to the story of the alternating sign matrix conjecture. There will also be a lot of hands-on work, with opportunities to explore the algorithms and patterns that arise. Registration Fee: $100. Please contact: James Sellers at 937.766.7695, sellersj@cedarville.edu. Web Address: http://www.cedarville.edu/dept/sm/jas/maashort/shcourse.htm.

Partnerships: Life Sciences and Mathematics

July 17–22: Carroll College, Helena, MT
Application Deadline: May 1, 2000
Participants will study materials developed by NSF Mathematical Sciences and their Applications Across the Curriculum program, and work in interdisciplinary teams to adapt and develop materials for use at their home institution. Topics come from all levels of the undergraduate curriculum in mathematics and population growth, the environment, human physiology, animal population, and more. Applications for the workshop are accepted from teams of two to four, which must include one mathematics and one life sciences faculty. This is a workshop of the MAA Partnerships Project in interdisciplinary mathematics and is sponsored by a grant from the National Science Foundation. Please contact: Maureen Callanan, by (FAX) 202.483.5450, or mcallana@maa.org. Web address: http://www.maa.org/pfdev engpartnership.html.

Have You Met Everybody...?

By Nora Franzova

"That place is a maze. It is so hard to find your way around," commented my friend when I told her that I was going to the Marriott off of Connecticut Avenue for the Joint Mathematics Meeting. "She was right," I kept thinking as I stood in the middle of a huge lobby trying to figure out a bijective map between the room assignments and the names appearing on the signs.

My goal at this year's meeting was to gather all available information that would somehow help me in developing an online math course for our college. I successfully made it to the Delaware Suite bright and early Wednesday morning to listen to "Innovative Uses of the World Wide Web in Teaching Mathematics." Unfortunately, the computers did not find their way so successfully and ended up in the Maryland Suite, so the first couple of talks had to be a little less computer based and more jovial. Hardship brings people together, and by 10 am, everybody in the room was in good spirits and full of enthusiasm for each was holding a huge list of useful web links and some JavaScript tricks. Once the computers were finally working, the group had a live interactive lecture on graphing derivatives from the University of Keele in Great Britain, proving that the whole world can be one classroom.

At noon the Exhibits and Book Sales opened and the real mingling started. For starters, I picked up a new brain at the Thinkwell booth. It was blue in color and mostly usable as a stress ball. Then, I made some soapy bubbles at Zometool, while looking for the shortest paths. However my primary interest was to investigate the possible and impossible ways of typing and posting math problems, quizzes and discussions on the web. I found answers to my questions at the booths of MathType and Math (Internet Math Consortium). Both have taken up the endeavor of enabling our students to type some math formulas without having to learn intricate cryptography. Math representatives were very persuasive, and are even willing to come to a school and customize to one's needs.

Of course publishers also approached this issue and I was able to pick up some "new age," reform/internet textbooks that have some parts of the book available only over the internet. And let's not forget the TI corner, and their new TI-Interactive program, which I was hoping to see. It was not available at noon on Wednesday, but later everything was working well and the "TI green shirts" were busy as always. Wednesday was the first day for those interested in downloading the Beta version of TI-Interactive and start testing it.

There were MAA books, *Math Horizons* t-shirts and many other booths worth visiting and mentioning, but hunger kicked in, so I ventured out. We all know that the worst thing about conferences is that one has to eat in a hotel. This one was a great exception. Walking a hundred yards to Connecticut Avenue in Washington DC means walking a hundred yards to the cuisine of the world. On one side of the street are places with Thai and Indian food, and on the other bagel shops, Baskin Robbins, and McDonalds. One of the tired cashiers at McDonalds asked me on Saturday, "When is this conference ending?" right after yelling into the crowd that there would be a 10-minute wait for Big Macs. No one listened to him. There were curvatures to be discussed, job interviews to be analyzed, and web addresses to be exchanged.

Since one always gets great pleasure from a good lecture I tried to visit at least some invited talks. "I am a MAA speaker, so I will be friendly" announced Ronald Graham in his opening speech for his invited talk on "Combinatorics at the Crossroads," to the laughter of a crowded ballroom on Wednesday afternoon. And he was. Soon afterwards I had to leave to teach my first class of the spring semester. But I returned to see more math and more friends, to make dates for lunch meetings that I did not keep, to attend coffee meetings that lasted more than an hour, to talk to graduates from my grad school, and to talk to people I talk to only once a year, at this conference.

Friday evening I visited the Isolated Teachers of Statistics annual meeting, where they discussed becoming a SIGMAA (Special Interest Group under MAA). I was hoping for a little more stats and less bylaws, but I guess my timing was wrong.

The undergraduate students' research poster session was very impressive and even more impressive was how many of us walked over to the Omni (it was very cold outside) to see the session. The students were absolutely wonderful, excited about their work, and I was glad to breathe in some of their enthusiasm. (Unfortunately the room was so small that very soon only the enthusiasm was left to breathe.)

On Saturday at 8 am I was ready to listen to "Philosophies in Mathematics Education." The session covered calculator use, computer use, and their role in enforcing understanding instead of symbol pushing. And there I found the answer to all my problems. I found someone who would not mind doing my work for me for free—http://www.math.temple.edu/~cow. Want to make students do their homework, but don't want to grade it? Try COW (Calculus on the Web). I assume by now everyone has contacted Dan Reich at Temple University and he (and his colleagues) will soon reconsider their offer of software and server for free, but I sure hope to still get in. Since then I have played with COW. I still need to compare it to similar systems available, but at this point it has met and exceeded my expectations (including the name).

Very soon I realized that even though it is possible to walk in and out of different sessions, the experience is best experienced when I sit through an entire session. Then I become part of a group that has a goal, an interest, whether it is control theory, quantum computation or the need of College Algebra reform (I definitely believe there is a need for that.)

There were so many interesting sessions and talks and I could not attend all of them. One about which I heard really nice things was the Teaching Awards Recipients Presentation. I also did not make it to any of the MAA Minicourses, which I really regret. But next year it will be all this good math stuff plus it will be in New Orleans. Crawfish and beignets, here we come! ■

Nora Franzova teaches at Harford Community College in Maryland.

Finding Your Second (and Third...) Job

By sarah-marie belcastro and Michael Prophet

At the January 2000 Joint Meetings in Washington, DC the Young Mathematicians Network and Project NExT sponsored a Panel Discussion entitled "Finding Your Second Job." With the apparently improved job market, the topic of finding a second (or more generally a next) job seems to be on many peoples' minds, illustrated, for example, by the turnout at the Panel Discussion of about 60 people.

The panel discussion was organized by Phil Gustafson (Mesa State University), moderated by Michael Prophet (University of Northern Iowa) and included a panel of 4 tenure-track/tenured people: Edward Aboufadel (Grand Valley State University), Dan Schaal (South Dakota State University), Michele Intermont (Kalamazoo College), and Anita Solow (Randolph-Macon Woman's College).

The panelists at the discussion on "Finding Your Second Job" at the Washington, DC Joint Mathematics Meetings, January 2000

The format was simple: the moderator posed various questions to the panel and discussion ensued. The audience was encouraged to offer answers, as well as responses to panel answers. The default situation was supposed to be that of an applicant currently holding a tenure-track job. We summarize below the main points that were raised—a more detailed (and much longer) summary appears in the February 2000 *Concerns of Young Mathematicians* newsletter, available at http://www.math.uni/~prophet/panel.

A tenure track position gives you the time and ability to create your own future opportunities. Keep your vita updated, because your situation may change and you may want or need to change jobs.

A good reason to be on the market is a mismatch between your concerns and those of your current institution. Consider those things that make you tense when you get up in the morning.

The best time to apply is 3 or 4 years out of the doctorate; in general it's more difficult for those with tenure to find jobs (mostly due to financial considerations of the hiring department).

Be highly selective; customize your application, particularly the cover letter.

Mention your reasons for leaving your current job in your application, but phrase them positively.

Be more concrete the second time around in your teaching statement. Improve your teaching.

Get a letter of recommendation from someone (perhaps the chair, if appropriate) in your current department.

Consider letting an administrator know that you're on the market in time to get your courses covered. If you like your current job, request a leave of absence when you obtain a new job.

Here are some more issues we would like to see addressed. Therefore, we invite you, the readers, to let us know what you think about the following questions. We will amalgamate the responses in a follow-up article in the *Concerns of Young Mathematicians* newsletter.

- How many teaching letters should you get?
- Where can you get teaching letters if not from your current department?
- How many research letters should you get?
- Is it important to get a research letter from your graduate advisor?
- Who do you ask for research letters?
- How much credit do people in the jobs get toward tenure?
- How does one point out, in the application packet, the improvements one has made over time? (How do you express why are you compatible with institution X now, whereas you were not before?)
- What are some complaints that people tend to have about their jobs, which can be resolved by changing jobs?
- What are some complaints that people have in common about their various jobs, which usually cannot be resolved by changing jobs?
- How much personal/family information should be included in the application packet, and why? ■

Please send responses to:
smbelcas@math.uni.edu or
mike@banach.math.uni.edu.

sarah-marie belcastro and Michael Prophet teach at the University of Northern Iowa and served this year on a hiring committee together. While Mike attempts to excel at competitive trivia, sarah-marie prefers to study feminist philosophy of science.

Innovative Programs Address Professional Development of Teaching Assistants & Adjuncts

By Teri J. Murphy, William Branson, Sol Friedberg, Luise-Charlotte Kappe, James Madden, David Manderscheid, Lisa Mantini, Elena Marchisotto, Paul McCreary, Andrew Nestler, Jodie Novak, Sue Plisch, Natasha Speer, Julia Wilson, and Lee Zia

At the Joint Meetings in DC, the AMS-MAA Committee on Teaching Assistants and Part-Time Instructors organized the Special Session, "Innovative Development Programs for Teaching Assistants and Part-Time Instructors" (organizer, Teri J. Murphy). The Committee sought to gather and disseminate information about sample programs that support TAs and adjuncts in their efforts to be effective instructors. The twelve 25-minute talks described a variety of models. Although most of the programs were designed to meet the needs of a particular institution, or team of institutions, some themes nevertheless arose from the session.

Need, Momentum, and Support

The need for comprehensive development programs for TAs and adjuncts has reached a critical level. Some campuses maintain the tradition of handing new instructors the textbook and a syllabus, with no additional preparation or development opportunities. The result is a set of fledgling instructors who do the best they can in isolation. For instructors who must adjust to a new language and culture the task is even more daunting. Many institutions have recognized this need. The programs described during the session were examples of efforts to increase and improve development opportunities. Some of the programs described were initiated by TAs, some by faculty, some by teams of institutions. Several graduate teaching assistants spoke about their enthusiasm for teaching and their motivation for their own efforts to improve development opportunities at their institutions. They pointed out that many TAs engage in spontaneous, informal conversations with other TAs as an outlet (often, the sole outlet) for their interest in teaching. They also pointed out that such informal interactions are useful but inadequate for addressing TAs' needs as current and future teachers. In addition, they suggested that experienced TAs themselves can play an important role in the design and implementation of development activities, and that their peer relationship to new TAs can be an advantage in this role. All of the speakers underscored the need for departmental support (not just money) in providing opportunities for TAs, adjuncts, and permanent faculty to discuss issues related to teaching.

Preparation vs. On-going Development

The Special Session sought to showcase innovative programs that address the needs of TAs and adjuncts in the current complex teaching environment. Traditional models of instructional training include orientation sessions before classes start, and regular meetings of instructors for a particular course. As with the informal conversations mentioned above, in many cases, such efforts have been useful but still leave a need for additional activities. One alternate model presented by several speakers builds on a philosophy of ongoing development. These programs hold classes or seminars (some required, some voluntary, some counting for credit), in which participants (varying combinations of TAs, adjuncts, and permanent faculty) explore issues related to teaching. Activities can include readings, discussions, analysis of case studies, observations and videotaping, consultations with experienced instructors, assignments to experiment, role-playing, modeling activities and further reflection. In addition to building skills, such activities center on helping instructors to reflect on their own beliefs (which affect their behaviors) about teaching, learning, the needs and strengths of students, and the nature of mathematics. Some programs have the long-term goal of preparing participants for careers that include teaching. Such programs are particularly well-placed for improving the quality of undergraduate mathematics education (short- and long-term) because the faculty of the future (2- and 4-year colleges, as well as research universities) are largely drawn from the current pool of graduate students. The speakers also believed that professional development programs can be used as tools to recruit students and that graduate students who participate in development programs have an advantage on the job market.

Need for Dissemination

The talks drew as many as 40 audience members. Some of these listeners attended all 12 talks. Some of these listeners came from institutions that are examining or re-examining the roles of experienced instructors, permanent faculty, and the administration in the preparation, development, and mentoring of TAs and adjuncts. Several people (speakers and audience-members alike) suggested that the mathematics community provide a forum for discussing issues and experiences related to the preparation and development of these teachers of college mathematics.

In the current environment of rapidly rising costs for higher education and ever-increasing competition for the best students, colleges and universities have become more conscious of students' needs and more concerned about the quality of teaching. Mathematics departments are being told by their administrations, if they didn't already know it, that TAs need more preparation than being handed a textbook and a syllabus. Yet external pressures are not the sole motivation for the attention to the preparation and ongoing development of TAs. If we look deeper, we find that, in fact, TAs are happy to develop. In many cases, they look forward to a career that includes teaching as a primary responsibility and they want to explore this part of their career while they are graduate students.

While most of the talks described programs for TAs, few speakers discussed programs that include or target adjunct instructors. The Committee believes that some of the themes discussed above are relevant to adjuncts as well (e.g., the need for support and opportunities for collaboration and development) and that there are other issues yet to surface. Thus, the Committee would like to hear from more programs that include or target adjuncts. If you have information about such programs, please contact Murphy (tjmurphy@math.ou.edu) or Suzanne Lenhart (lenhart@math.utk.edu). ■

Call for Nominations:

Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student

The Morgan Prize Committee is seeking nominations for the 2000 award. The Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student is awarded jointly by the AMS, MAA, and SIAM. The prize, which was endowed by Mrs. Frank Morgan of Allentown, PA, seeks to recognize and encourage outstanding mathematical research by undergraduate students.

Nominations and research papers may be submitted by a student or by a nominator on behalf of a student. The recipient's research need not be confined to a single paper and need not be published, but must have been completed as an undergraduate. The recipient must have been enrolled as an undergraduate student in a US, Canadian, or Mexican college or university in December, 1999.

All submissions must include at least one letter of support from a person familiar with the student's research. See http://www.maa.org/awards/morgan_nom.html for more detail.

Nominations and submissions should be sent to the Morgan Prize Committee, c/o Robert Daverman, American Mathematical Society, University of Tennessee, Department of Mathematics, 312C Ayres Hall, Knoxville, TN 37996-1330, by June 30, 2000. Questions should be addressed to Robby Robson, 2000 Morgan Prize committee chair, robby@math.orst.edu.

$4 million Gift to Trinity College Establishes Three H.L. Dorwatt Professorships

The Department of Mathematics at Trinity College in Hartford, CT received a gift of $4 million from an anonymous alumnus, who was a mathematics major at Trinity and who had no previous history of giving to the College. The gift establishes the Robert C. Stewart Faculty Development Fund to endow three postdoctoral teaching positions and to enhance research opportunities for members of the Department. The Fund is named after a long-time former member of the Department at Trinity whom the donor regarded as crucial in his development.

When the program endowed by the Fund becomes fully operational, Trinity will set up three H. L. Dorwart Visiting Assistant Professorships, to be filled on a staggered three-year basis by new or recent doctorates. (Dorwart, a mathematician who died in 1998 at the age of 96, was Stewart's mentor.) The areas of specialization of the visitors will be chosen to match the areas of interest of members of the Department.

The first position, for 2000-01, will be in functional analysis, and it is anticipated that the next two hires will be in graph theory and special functions. Aside from highly competitive salaries, the visitors will also have adjusted teaching loads, as will the members of the Department whose areas they match. Department members will also have increased sabbatical opportunities. ■

Letter to the Editor

About the "Math Wars"

Concerning the "math wars", I'd like to enter the fray.

I used to think that we mathematicians and mathematics educators were, by and large, examples of intelligent life. I guess I was wrong. Lately a lot of us have been thumping our chests: "Me Tarzan! Me Smart! Me Know! Those other guys stupid!"

Let's see: I know some stuff you don't know and you know some stuff I don't know. Of course the stuff I know is important and the stuff you know is worthless.

Perhaps all this bravado is understandable given that we are half-blinded by a world undergoing incredibly rapid change and so the future is a blur.

Thus, if some of us can find temporary comfort by planting our feet firmly in air and speaking with great certainty, the rest of us will understand, shrug our shoulders, and look away.

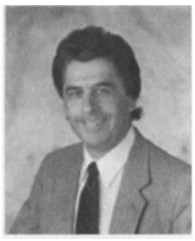
Andrea Rothbart
Webster University
St. Louis, MO

Check out the Columns on MAA Online

MathTrek, MathMuse

Ivars Peterson

Devlin's Angle



Keith Devlin

Math Chat

Frank Morgan

Cut the Knot!

Alex Bogomolny

Check them out at http://www.maa.org/news/columns.html

Short Takes

Summer Short Course in Durango

Fort Lewis College will host an MAA Short Course entitled "Teaching Dynamical Systems Across the Curriculum" on June 5th–9th, 2000. The instructor for the course will be Robert L. Devaney from Boston University. The author of several textbooks in dynamical systems theory, Devaney has also written *Chaos, Fractals, and Dynamics: Computer Experiments in Modern Mathematics* and *A Tool Kit of Dynamics Activities.*

This course will focus on methods by which ideas from dynamical systems theory may be included in various parts of the undergraduate curriculum. These topics provide an ideal opportunity to give students (particularly lower division students) a glimpse of modern ideas in mathematics in a setting that is germane to the course at hand.

Copernicus Missing

A copy of Copernicus' *De revolutionibus orbium coelestium* ("On the revolution of the heavenly spheres") was reported stolen from the St. Petersburg Science Academy this February. Copernicus' book is only one of 23 other rare books from the 16th and 17th centuries that seem to have been stolen from the Science Academy library. During the last two years, two other copies of Copernicus' famous book have been stolen from libraries in Poland and in the Ukraine. Interpol is investigating, and libraries worldwide have been warned to be on the lookout for the books. Keith Devlin discussed the theft and the significance of Copernicus' book in the March edition of *Devlin's Angle*, his regular column for MAA Online. See http://www.maa.org/news/columns.html to access the columns by Devlin and others that appear on MAA Online.

New Undergraduate e-journal

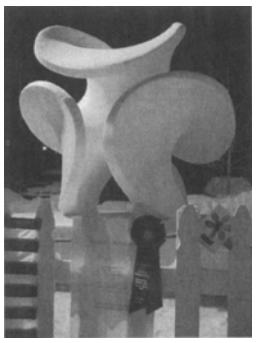
A new electronic journal called *The Morehead Electronic Journal of Applications in Mathematics* was recently created. Its purpose is to provide an outlet for research work done by undergraduates, especially the work coming from the various undergraduate research projects. The journal's web page at http://www.morehead-st.edu/colleges/science/math/mejam/ explains that the journal "accepts papers which are outside the realm of the typical undergraduate curriculum and which emphasize the applications of mathematics while maintaining significant mathematical interest. Papers may be historical, expository, or completely original in nature but must adhere to strict academic standards and must emphasize some aspect of the applications of mathematics." The editors encourage faculty supervising undergraduate projects to consider working with students to produce an article and then to submit it to the journal. Everyone hopes this will encourage more undergraduates to do research and perhaps to go on to graduate school.

NCTM Tries to Set the Record Straight

In reaction to the recent intense debate on school mathematics, the National Council of Teachers of Mathematics (NCTM) has released three one-page documents aimed at "setting the record straight." The first document summarizes NCTM's basic position on mathematics teaching: "school mathematics must meet the needs of a much greater proportion of students than in the past; technology, when used appropriately, can enhance learning; and the most important skill that business and industry demand is an ability to solve problems." The second document discusses the NCTM *Standards* and their impact on mathematics teaching in the US and in Canada. The third presents NCTM's argument for why school mathematics should change rather than stick to more traditional approaches. The three documents are available at the NCTM web site at http://www.nctm.org/about/commonsense.html.

Macalester Team Sculpts Snow

At the Elite Breckenridge International Snow Sculpture Championships, the Macalester College/Minnesota team



Enneper surface sculpture

(sponsored by Wolfram Research, Inc.) were awarded second place among 17 entrants from nine countries. The Macalester entry was an Enneper surface, a beautiful minimal surface with tremendous symmetry and esthetic appeal. Stan Wagon, one of the team members, said that the Enneper surface sculpture "has tremendous overhangs, which make working it in snow quite dramatic. Fortunately the weather turned cold on the last days." Visit the site at http://www.math.macalester.edu/snow2000 to see the Macalester sculpture along with much more information about the competition. For more details and better photos of the sculpture, see the April issue of *Math Horizons.*

Publishers Offer Prize for Proof of Goldbach's Conjecture

Bloomsbury Publishing (USA) and Faber and Faber (UK) have announced that they are offering a one million dollar prize to any person who can prove Goldbach's Conjecture within the next two years. The prize is being offered to help promote the book *Uncle Petros and Goldbach's Conjecture*, by Apostolos Doxiadis (see the review by Keith Devlin on MAA Online's *Read This!* section, which can be found on the web at http://www.maa.org/reviews/reviews.html). To be eligible for the prize, the proof must be submitted to a journal indexed by *Mathematical Reviews* by March 15, 2002, must be published by that journal by March 15, 2004, and must be judged to be correct by a six-member judging panel whose members will be mathematicians chosen by the publisher. See Faber's web site at http://www.faber.co.uk/ (click on "Book News") for more information on the prize. ■

Standards-Based Education

By Robby Robson and M. Paul Latiolais

What does an undergraduate degree in mathematics mean? Does its holder have a well-defined set of abilities, knowledge, and skills? Why is it of value? Exactly what does it mean to have completed a linear algebra or calculus course? Professionalism makes answering these types of questions a responsibility; accountability and competition in higher education makes answering them a necessity.

Standards-based education offers an approach to answering these questions in a way that can inform and guide curriculum and instruction. At its core is the establishment of explicit performance standards and learning outcomes that can be meaningfully assessed, universally understood, independently verified, and easily compared. Among its consequences is a system in which progress can be measured by demonstrated proficiency rather than by courses passed, credits earned, or comparison with peers. Our intention here is to explain standards-based education in broad terms and to state a case for taking it seriously.

What Are Standards?

The standards of "standards-based education" specify knowledge and skills that students must demonstrate in order to progress or be awarded a certification such as credit or a degree. They also describe the performance corresponding to various levels of proficiency. When applied to entire curricula, standards often address general processes ("applies mathematical techniques to solve problems from physics and engineering"), whereas standards for individual classes are more likely to include specific sets of skills and knowledge ("can express vectors in a given basis" or "demonstrates an understanding of the fundamental theorem of Calculus"). The complete specification of a standard includes sets of criteria for demonstrating proficiency ("can accurately sketch the proof and use the fundamental theorem to differentiate integrals") and examples of sufficient, deficient, and exemplary performance.

A frequent first reaction to those arguing for learning outcomes and standards is that we already have them. After all, each of us has a list of topics, educational objectives, and grading criteria for the classes we teach. The standards-based approach, however, demands that objectives and assessment methods be publicly stated, explicitly linked, and agreed upon by a larger community. As mathematicians we may think of this as the injection of rigor into the educational process.

The Case for Standards-Based Education

The first case for standards and outcomes is that they promise to improve the quality and relevance of education. Good standards set clear expectations for students and assessable learning outcomes help them measure and adjust their own progress. Instructors can better determine the effect of their teaching and colleagues can gain confidence that students will have met the necessary prerequisites when they enter a class. Standards lend structure and guidance to curricular design, and their public nature helps us talk about our good work with administrators and with colleagues other disciplines. But even if we are skeptical about their utility, there is reason to take standards seriously: We may not have a choice.

New Directions in Education

Most states are implementing standards-based secondary education systems. Disciplines that use mathematics are going down the same road at the collegiate level. For example, the Accreditation Board for Engineering and Technology now requires all engineering programs to be outcomes-based. Our students and our colleagues are coming to expect education to be defined and measured in terms of outcomes and standards, and we would do well to try to meet these expectations.

There are also pressures from outside of academia. A list of courses does not mean much to a prospective employer. A statement that a student can apply differential equations and computer modeling techniques to solve problems from other disciplines means more, and such statements backed by publicly available performance standards mean the most.

Distributed Learning

Finally, the Internet and enormous growth in adult learning are rapidly changing the educational economy. Students at traditional campuses can take on-line classes offered by established colleges other than their own. "Virtual" institutions add more choices and adult learners in the work force have other options through corporate training centers. Degree requirements phrased in terms of locally understood conventions and collections of courses without explicitly defined learning outcomes will not work in this global economy. Standards become necessary to define and maintain the quality and integrity of the degrees our institutions offer and to allow comparisons of competing programs.

Closing Thoughts

Ultimately, we may have to define standards for entire degree programs, which involves identifying and agreeing upon the skills, knowledge, and abilities desired of every successful major. This is not easy, and neither is formulating a clear picture of how the desired outcomes can be demonstrated and assessed. Addressing a single course is far simpler and often requires the work of no more than one or two faculty members, but the process is both revealing and gratifying. We recommend that it be tried.

Web References on Standards-Based Education

Our article "Standards-based Education and its Implications for Mathematics Faculty" on MAA Online (http://www.maa.org/features/robson.html) presents more thoughts about the possible shape, form and consequences of standards-based education in mathematics

departments and also includes further online references. A comprehensive listing of resources of outcomes assessment, relevant to higher education, can be found at the North Carolina State University site http://www2.acs.ncsu.edu/UPA/survey/resource.htm. A reference for the implications of K-12 reform for higher education in Science is the AAAS Project 2061 Higher Education blueprint (http://www.project2061.org/tools/bluepol/HigherEd/text.html). In Engineering, the Accreditation Board for Engineering and Technology criteria document (http://www.abet.org/eac/2000.htm) includes both the new outcomes-based and the conventional criteria used to accredit engineering programs. A good source for K–12 standards-based reform the Mid-continent Research for Education and Learning site "Standards at McREL" (http://www.mcrel.org/standards). ■

Robby Robson teaches at Oregon State University. M. Paul Latiolais teaches at Portland State University

Meetings of the Association

Spring Section Meetings

Metro New York
May 7, 2000
Bronx Community College, NY

Michigan
May 5-6, 2000
Central Michigan University
Mt. Pleasant, MI

Northeastern
June 16-17, 2000
St. Paul's School
Concord, NH

Pacific-Northwest
June 15-17, 2000
University of British Columbia
Vancouver, BC, Canada

National Meetings

Mathfest
August 3–5, 2000
Los Angeles, CA

Joint Mathematics Meetings
January 10–13, 2001
New Orleans, LA

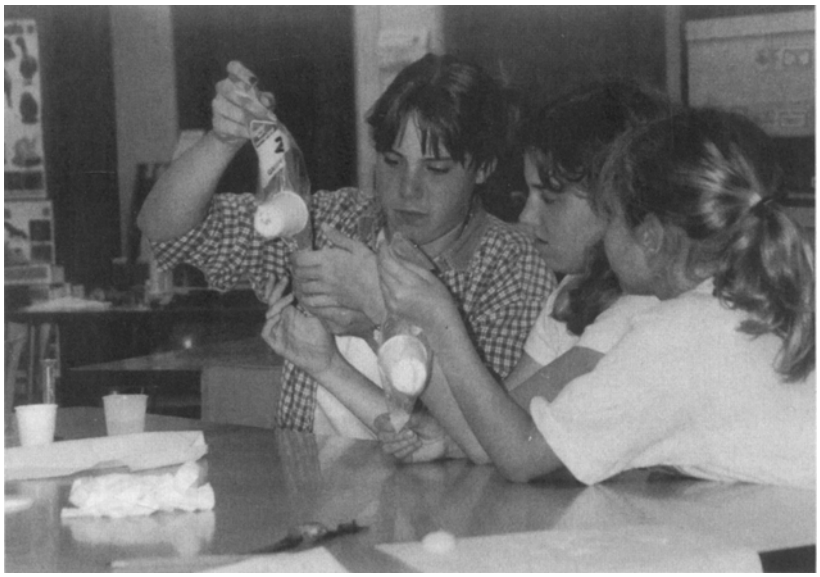
Mathfest
August 2–4, 2001
Madison, WI

Joint Mathematics Meetings
January 6–9, 2002
San Diego, CA

MAA and Tensor Foundation Announce New Awards

By Florence Fasanelli

Hundreds of women and girls have taken advantage of special programs designed to encourage college, university, and high school participants to study mathematics. Since September 1995, many such projects have been established throughout the country with funds from the Tensor Foundation. This charitable foundation, working through the MAA, has recently awarded grants for twelve projects (seven new and five renewals).



SMASHing through barriers at Emporia State University: 9th grade girls participating in SMASH (Summer Mathematics and Science Holiday), June 14-17, 1999.

Over the past five years, the projects have varied greatly, both in terms of the participants they are targeting and in their means of carrying out the goals of the program. For example, an upper level mathematics course was developed in 1995 at Arizona State University by Professor Hélène Barcelo. This course focuses on the work and life of female mathematicians. Selected original works of six women mathematicians were studied together with their biographies and the mathematical environment in which they worked: Florence Nightingale and her pioneering work in statistics; Sophie Germain and her contributions to number theory; Sofia Kovalevskaya and her work in analysis; Grace Chisolm Young and her contributions to topology; Emmy Noether and her work in algebra, and Julia Robinson and her work in logic.

An entirely different group of participants were selected from non-traditional students at Mercy College in a program renewed in 1996. Twelve women were paired with mentors from business and industry in internships of one to two weeks at local organizations. Student responsibilities included attending internet training sessions, completing a career instrument, researching career options, and attending monthly meetings. They also solve posted mathematics problems, solved a real-life application provided by their mentors, and prepare portfolios of their work on the program.

In 1999, a project was funded to bring together hundreds of printed studies, book reviews, courses, workshop curricula, and articles for publication in a volume of resources for those who are trying to make a difference in the culture and help women succeed.

On the campus of Manhattan College in Riverdale, NY, middle-school children attend the Jonas Bronck Academy, a public magnet school established by the Board of Education two years ago. With funding from the MAA/Tensor Foundation, beginning in 1999 for two years, female college mathematics majors initiated a mathematics club for middle-school girls. The MathZone meets for two hours weekly at the Academy. The mathematics majors are responsible for the curriculum of the club, but they receive strong continuous support from the faculty, including a series of five workshops which introduce them to new curricular material, including game theory, knot theory, and modeling. This program will expand in the academic years 2000-2001 to two more schools in District 10, a district where 80%

MAA/ TENSOR FOUNDATION
Grantees 2000-2001

Nüket Acar
The Penn State University

Paul Chacon, James Derr,
Hortensia Soto-Johnson
University of Southern Colorado

Corine Fitzpatrick, Kathryn Weld
Manhattan College

Angela C. Hare
Messiah College

Joyce Hilliard-Clark
North Carolina State University

Ann Kajander
Lakehead University, Canada

Amy Miko, Peter Skoner
Saint Francis College

Bonnie L. Oppenheimer
Mississippi University for Women

Karen Schotter
Stevens Institute of Technology

Mazen Shahin
College Misericordia

Ann E. Trahanovsky-Orletsky
Morris College

Lynda Wiest
University of Nevada, Reno

of the students are eligible for free lunch. At the heart of this program is the opportunity for college students who are excited about mathematics to work with middle school girls.

Another program being renewed for a second year of funding takes place each summer at the University of Southern Colorado. Twenty-four local high school students who have completed high school algebra are given an introduction to probability and statistics, Euclidean and non-Euclidean geometry, and a sense of college life in this weeklong residential program. Various problem-solving sites on the Internet are utilized each day, and in the evenings professional women speak about the mathematics they use in the workplace. The participants keep in touch with one another by e-mail after the camp is over. Building a community among young women who like mathematics is vital for them to persist in the field.

The Lore-El Center for Women in Engineering and Science at Stevens Institute of Technology will establish an electronic mentoring program to encourage high school students to take a full and advanced mathematics and science curriculum in high school. Twenty undergraduate members of the Society of Women Engineers will be trained both at the beginning and throughout the project in how to engage in effective e-mail mentoring. At a seminar where female instructors will teach dynamic laboratories, the mentors will each be assigned two mentees chosen by their high school teachers. At the end of the project an electronic newsletter will be sent to participants to keep them informed of special programs, scholarship opportunities and relevant career information. This program should help students connect their mathematics and science coursework to college majors and real life applications.

Information about applying for a Tensor grant can be found on MAA Online at http://www.maa.org/projects/maaprograms.html#tensor. The next target date for proposals will be February 1, 2001. For further information contact Dr. Florence Fasanelli, MAA/Tensor Foundation Program Director, at MAA headquarters. ■

MAA Contributed Papers at the New Orleans Meetings Preliminary Announcement

The MAA is planning a wide range of Contributed Paper Sessions for the Joint Mathematics Meetings to be held in New Orleans in January 2001. The organizers listed below solicit contributed papers pertinent to their sessions. Sessions generally limit presentations to ten minutes, but selected participants may extend their contributions up to twenty minutes. Each session room contains an overhead projector and screen; black boards will not be available. Persons needing additional equipment should contact, as soon as possible, but prior to September 15, 2000: the session organizer whose name is indicated with an asterisk (*). Please note that the submission procedure has changed and the dates scheduled for these sessions remain tentative.

Submission Procedures for MAA Contributed Papers

Submit your abstract directly to the AMS. Concurrently, send a one-page summary of your paper directly to the organizer. The summary need not duplicate the information in the abstract. In order to enable the organizer(s) to evaluate the appropriateness of your paper, include as much detailed information as possible within the one-page limitation. Your abstract and summary must reach the AMS and the organizer by Friday, September 15, 2000.

The AMS will publish abstracts for the talks in the MAA sessions. Abstracts must be submitted on the appropriate AMS form. Electronic submission is available via the Internet or email. No knowledge of LaTeX is necessary, however, LaTeX and AMS LaTeX can be accommodated. These are the only typesetting systems that can be used if mathematics is included. To see descriptions and to view the electronic templates available, visit the abstracts submission page on the Internet at http://www.ams.org/abstracts/instructions.html, or send e-mail to: abs-submit@ams.org, typing HELP as the subject line.

Completed e-mail templates must be sent to ABS-SUBMIT@AMS.ORG with SUBMISSION as the subject line. Abstracts submitted electronically are quickly either acknowledged, with a unique abstract number assigned to the presentation, or rejected, with a short message on what information is missing or inappropriate. All questions concerning the submission of abstracts should be addressed to:

abs-coord@ams.org.

Here are the codes you will need: MEETING NUMBER: 962

The EVENT CODE is the seven characters appearing before the title of the sessions shown below, e.g., MAA CP A1

The SUBJECT CODE is the last two-character letter/number combination from the event code list, i.e., A1, B1.

MAA CP A1 Great Theorems of Mathematics

This session focuses on expository talks on important theorems of mathematics. The talks should address as much history and applications as time will permit, but should make some effort to show the audience the spirit of the proof (or proofs) of the result. The idea is to present to a general audience theorems that "everyone has heard of" but for which the proof is not generally well-known. The idea for this session comes from conversations overheard in department coffee rooms where mathematicians from different fields discuss the most significant results in their own area.
Wednesday and Thursday mornings
Cheryl Olsen (*)
Department of Mathematics
& Computer Science
Shippensburg University
Shippensburg, PA 17257
phone: (717) 477-1360
fax: (717) 477-4009
email: clolse@ship.edu
Doug Ensley, Shippensburg University

MAA CP B1 Chaotic Dynamics and Fractal Geometry

Ideas from Chaotic Dynamics and Fractal Geometry relate to most areas of the undergraduate mathematics curriculum. This session invites papers which investigate the impact of these two fields on undergraduate mathematics. The papers, which should have an expository flavor, might include new developments in either chaos or fractals, interesting or novel applications, undergraduate research experiences, or innovative approaches for exploring these topics in undergraduate mathematics.
Wednesday and Thursday mornings
Denny Gulick (*)
Mathematics Department
University of Maryland
College Park, MD 20742-4015
phone: (301) 405-5157
fax: (301) 314-0827
e-mail: dng@math.umd.edu
Jon Scott, Montgomery College

MAA CP C1 Innovative Uses of the World Wide Web in Teaching Mathematics

This contributed paper session will focus on creative uses of the World Wide Web in mathematics instruction. Proposals are solicited on original uses of Web resources in the classroom. We are looking for presentations involving the use of real data sets, instructional materials, interactive simulations, videoconferencing, or other topics of interest for educators who are currently using, or planning to use, the Web in their classes.
Wednesday and Thursday afternoons
Marcelle Bessman (*)
Department of Mathematics
Jacksonville University
Jacksonville, FL 32224
phone: (904) 744-3950 x7304
e-mail: mbessma@ju.edu
Brian Smith, McGill University

MAA CP D1 Re-Defining What a Modern "College Algebra" Experience Means

The term "College Algebra" encompasses a wide variety of offerings ranging from elementary algebra up through college algebra and trigonometry courses and even precalculus courses. What is common is an image of the students who take such courses—those who lack some or all of the traditional algebraic skills needed for calculus. Today, there are many pressures to re-define all of these traditional courses which have prompted a major MAA curriculum initiative to re-define what a "college algebra" experience should be. This session seeks contributed papers that will: (1) Present new visions for any of the courses that fall under the "college algebra" rubric. (2) Describe individual experiences implementing such courses. This includes new content, new

pedagogical features (collaborative learning, student projects, communication of ideas, etc), assessment and evaluation, student reactions to the courses, and so forth. (3) Discuss and/or demonstrate the use of technology in such courses. (4) Discuss what is known about enrollment trends relating to these courses. (5) Describe the connections between college algebra courses and courses in other disciplines. The session is being co-sponsored by the Committee on the Undergraduate Program in Mathematics (CUPM), the Committee on Calculus Reform and the First Two Years (CRAFTY), the Committee on Two Year Colleges (CTYC), the Committee on Quantitative Literacy (CQL), and the CUPM Subcommittee on Service Courses.
Wednesday and Thursday mornings
Sheldon P. Gordon (*)
Department of Mathematics
SUNY at Farmingdale
Farmingdale, NY 11735
phone: (516) 451-4270
e-mail: gordonsp@farmingdale.edu
Florence S. Gordon, New York Institute of Technology, Arlene H. Kleinstein, SUNY at Farmingdale, Mary Robinson, University of New Mexico, Valencia Campus, Linda Boyd, Georgia Perimeter College, Barbara Jur, Macomb Community College

MAA CP E1 Innovative Practices in Statistics Education

Statistics instruction that reflects current thinking includes data analysis and design of data production as well as probability and inference as major content areas. Students often have opportunities to produce real data and deal with the issues that arise in dealing with real data. With use of technology, students are able to analyze data more extensively and they come to realize that statistical practice requires an iterative process of question, data, and analysis. Their conceptual understanding of statistics is quite different from understanding gained from analysis of contrived, "clean" data that appears in many texts. Students who have had active experiences with data collection and analysis using technology are better able to interpret computer output of statistical information produced by others and consider whether conclusions are warranted. Faculty who teach statistics—in introductory courses, in sections of courses that satisfy general education requirements or prepare prospective elementary teachers, or in cooperation with faculty from other disciplines—are invited to contribute papers relative to data collection, use of technology and other innovative, active learning experiences that they include in their statistics instruction.
Friday and Saturday mornings
Mary M. Sullivan (*)
Rhode Island College
600 Mt. Pleasant Avenue
Providence, RI 02908
phone: (401) 456-9851
fax: (401) 456-8379
e-mail: mmsullivan@ric.edu
Carolyn Cuff, Westminster College
Mary T. Parker, Austin Community College

MAA CP F1 Courses and Programs that Illustrate Recommendations of the Mathematical Education of Teachers Document

This session will focus on mathematics courses and programs for future teachers that illustrate the recommendations of the Mathematical Education of Teachers (MET) Document (available at www.maa.org/cbms/). Proposals should describe clearly the intended audience of the course, its mathematical content, and instructional strategies.
Wednesday and Thursday mornings
Judith Covington (*)
LSU-Shreveport
Department of Mathematics
One University Place
Shreveport, LA 71115
phone: (318) 797-5354
fax: (318) 795-4221
e-mail: jcovingt@pilot.lsus.edu

MAA CP G1 Integrating Mathematics and Other Disciplines

The session will present:

- discussions of the content of current mathematics courses in the first two years in the light of the way other disciplines use mathematics and the expectations they have of our students
- discussions of how applications of mathematics in other disciplines can be incorporated into mathematics courses in a way that enhances mathematical understanding
- presentations of exemplary courses or course modules.

Submissions are encouraged from teachers in engineering, the physical and social sciences, and management and public policy, showing examples of how mathematics is used in their courses. Submissions are also encouraged from mathematicians who have successfully incorporated such material into their courses.
Friday and Saturday mornings
William McCallum (*)
Department of Mathematics
University of Arizona
Tucson, AZ 85721
Phone (520) 621-6886
fax: (520) 621-8322
e-mail: wmc@math.arizona.edu
Deborah Hughes Hallett, University of Arizona, Yajung Yang, SUNY, Farmingdale

MAA CP H1 Serving the Needs of Developmental Students: Who Are They, Where Do They Come From, Where Do They Go?

Until we understand the needs of our developmental students, how can we decide what kinds of courses they need? These needs vary from one school to another. Contributions are invited from programs which have investigated the incoming background of their students, students' future plans, where the students actually end up, and how this knowledge has led to program changes. Summaries of research in these areas helpful to faculty teaching in these programs is also welcome.
Wednesday and Thursday afternoons
Su Dorée (*)
Augsburg College
Campus Box # 61
2211 Riverside Avenue
Minneapolis, MN 55454
phone: (612) 330-1059
fax: (612) 330-1649,
e-mail: doree@augsburg.edu
Bonnie Gold, Monmouth University

MAA CP I1 The Undergraduate Seminar in Mathematics

This 10 minute contributed paper session will focus on the role and content of the mathematics seminar in an undergraduate program for majors. Presenters should

address issues pertaining to:

- appropriate topics and focus for such seminars
- seminar objectives and how they are achieved and measured
- requirements from student participants
- equitable student participation
- developing and measuring student presentation skills
- the role of the faculty leader(s)
- relationship and interplay with other mathematics courses
- appropriate place within the undergraduate curriculum
- prerequisites and credits for enrollment
- equitable grading

We seek submissions that will share insights and experiences (both good and bad) of faculty members who have led or are planning such seminars.
Wednesday afternoon
Barry J. Arnow (*)
Department of Mathematics
Kean University of New Jersey
Union, NJ 07083
tel: (908) 527-2494
fax: (908) 527-3168
e-mail: barnow@turbo.kean.edu
George Avirappattu, Kean University of New Jersey

MAA CP J1 Computer Algebra Systems in Upper-Division Mathematics Courses

The use of Computer Algebra Systems (CAS) in the undergraduate curriculum has become widespread over the past few years. However, most of the applications have been in the lower division courses; in particular, these systems are seeing extensive use in Calculus I, II, and III. This session will provide the opportunity for participants to see applications of CAS in higher level courses. Such courses may include Ordinary and Partial Differential Equations, Numerical Analysis, Modern Algebra, Real and Complex Analysis, etc. The list of courses that can utilize a CAS to aid learning is endless and we hope that the session will reflect this. We hope to see applications in a variety of systems-standard packages like Mathematica, Maple, MathCAD, and MatLab; as well as more specialized packages like GAP, PARI, etc. The session would entertain general concept presentations, but would emphasize specific examples, activities, and resources for use in particular courses. We hope that the participants will leave with great ideas about how to incorporate a CAS activity into one of their courses.
Friday morning
Kent M. Neuerburg (*)
Department of Mathematics
Southeastern Louisiana University
Hammond, LA 70402
phone: 504-549-2204
fax: 504-549-2099
e-mail: kneuerburg@selu.edu
Andrew Lang, Oral Roberts University

MAA CP K1 Implementation of National Projects on Local Campuses

The role of mathematics educator has changed immensely over the last decade. Faculty are now expected to make proper use of technology, emphasize mathematical modeling, and develop interdisciplinary applications and/or courses. These expectations have spawned a variety of successful national projects. The purpose of this session is to enhance awareness of the different national projects, and to encourage implementation at the local level. Papers are solicited regarding local adaptation and adoption of successful national projects aimed at enhancing the undergraduate mathematics curriculum. Submission of proposals via e-mail is preferred by the organizers.
Saturday morning
Stuart Boersma (*)
Division of Mathematics
Alfred University
Alfred NY 14802
phone: (607) 871-2258
fax: (607) 871-2339
e-mail: boersma@alfred.edu
Constant J. Goutziers, SUNY Oneonta

MAA CP L1 Classroom Demonstrations and Course Projects that Make a Difference

The use of course projects and classroom demonstrations enables the instructor to show students that mathematics is meaningful and applicable in a variety of real-life situations. Demos, important tools for instruction in any class format, enable the instructor to engage the student on a level beyond that created by lectures. Projects are useful in helping students to apply the course material and to make connections between mathematics and the real world. This session invites presentations about favorite instructional demos and course projects appropriate for any level in the undergraduate mathematics curriculum designed to engage students and enable them to gain insight into mathematics. Presenters who discuss demos are encouraged to present the demonstration, if time and equipment allow, and to discuss how to use it in a classroom setting. Presenters who discuss projects are encouraged to discuss the specifics of how the project was conducted and how it was evaluated. Proposals should describe how the demo/project fits into the course, the use of technology or technology requirements, if any, and the effect of the demo/project on student attitudes toward mathematics.
Friday morning
David R. Hill (*)
Mathematics Department
Temple University
Philadelphia, PA 19122
phone: (215) 204-1654
fax: (215) 204-6433
e-mail: hill@math.temple.edu
Sarah Mabrouk, Boston University
Lila F. Roberts, Georgia Southern University

MAA CP M1 Putting the "Service" Back into Service Courses

Traditionally service course content in the mathematical sciences has been driven by the needs of client disciplines, needs which are often conflicting. If we were to consider "service" from the standpoint of students, what mathematical and quantitative skills and principles will serve students regardless of major. For this session, we invite descriptions of innovative courses that serve students in a broad sense by teaching them mathematical or quantitative skills they can apply to their future studies and work. Papers should give specific details about goals, course development, implementation, and assessment.
Saturday morning
Thomas L. Moore (*)
Department of Mathematics
and Computer Science
Grinnell College
Grinnell, Iowa 50112
phone: (515) 269-4206

fax: (515) 269-4984
e-mail: mooret@grinnell.edu
Ahmed Zayed, University of Central Florida

MAA CP N1 College Mathematics in Depth with Dynamic Mathematics Software

This session will seek contributors to present creative uses of software for geometry, algebra, statistics, and other mathematical domains in support of both exploration and reasoning across a broad range of classical collegiate mathematics. By inviting contributors and selecting among contributions, we will give special priority to presentations that take the step *beyond* using the computer as a tool for motivation, experiment, or data collection purposes, and put the focus on using these tools for the development of important content and sophisticated mathematical reasoning. As examples, we've seen presentations of explorations and extensions of vector fields, visualized with dynamic geometry software, linking symbolic and visual representations in ways that help students reason about differential equations. In another domain, exceptional statistical software now exists that moves beyond the processing of the data and helps students understand the nature and subtleties of the mathematics behind statistical analysis.
Saturday morning
E. Paul Goldenberg (*)
Education Development Center
55 Chapel Street
Newton, MA 02158-1060
phone: (617)618-2513
e-mail: pgoldenberg@edc.org.
Jean-Marie Laborde, Laboratoire Leibnitz Grenoble, France, Barbara Pence, San Jose State University

MAA CP P1 Topics in Teaching, Learning, and Exploring Proof

For most "proof" is the heart and soul of mathematical activity. This session is devoted to papers on proof in the classroom. We particularly invite papers on the following topics but will consider others: learning theory based expository or research based essays, experiences derived from "transition" or "bridge" courses, the use of cooperative learning, and the effects of technology. In view of the NCTM *Standards 2000*, we invite discussion of the role of proof in grades K-12. It is also our plan to develop a network on issues in proof pedagogy. Papers should be submitted electronically to any of the three organizers.
Wednesday afternoon
Connie Campbell (*)
Department of Mathematics
and Computer Studies
Millsaps College
Jackson, MS 39210
phone: (601) 974-1371
e-mail: campbcm@millsaps.edi
Draga Vidakovic, Georgia State College
G. Joseph Wimbish, Huntingdon College

MAA CP Q1 Mathematics in the Age of Euler

Leonhard Euler (1707–1783) ranks among the greatest of mathematicians. Building upon the achievements of the previous century—most notably differential and integral calculus—Euler and his contemporaries advanced the frontiers of mathematics and influenced all that followed. This session invites expository contributions on the work of Euler and of other eighteenth century mathematicians. Contributors might want to examine a theorem or two from Euler's nearly inexhaustible collected papers or describe more generally his explorations in a particular mathematical subfield. Of interest are reports of classroom experiences that have engaged the student with Euler's ideas.
Thursday afternoon
V. Frederick Rickey (*)
Department of Mathematical Sciences
United States Military Academy
West Point, NY 10996-1786
phone: (914) 938-4010
fax: (914) 938-2409
e-mail: fred-rickey@usma.edu
William Dunham, Muhlenberg College

MAA CP R1 Outreach Programs for Women and Girls

The papers will describe programs currently being offered to encourage women and girls to study mathematics. A wide variety of projects will be described and the presenters will discuss what they have learned from implementing their programs.
Friday morning
Kathleen Sullivan (*)
Mathematics Department
Seattle University
Seattle, WA 98122
phone: (206) 296-5931
fax: (206) 296-2179
e-mail: ksulliva@seattleu.edu
Elizabeth Yanik, Emporia State University

MAA CP S1 ARUME Session

The Association for Research on Undergraduate Mathematics (ARUME) aims to foster a professional atmosphere for quality research in the teaching and learning of undergraduate mathematics contributed paper sessions for mathematics educators and professional mathematicians interested in research on undergraduate mathematics education. Research papers that address issues concerning the teaching and learning of undergraduate mathematics are invited. Theoretical and empirical investigations using qualitative and quantitative methodologies are appropriate. These should be set within established theoretical frameworks and should further existing work. Reports on completed studies are especially welcome.
Julie M. Clark (*)
Department of Mathematics
& Computer Science
Emory & Henry College
Emory, VA 24327
phone: (540) 944-6191
fax: (540) 944-4592
e-mail: jmclark@ehc.edu

MAA CP T1 General Contributed Paper Session

This session is designed for papers that do not fit into one of the other sessions. Papers may be presented on any mathematics related topic. Papers that fit into one of the other sessions should be sent to that organizer, not to this session. Papers should not be sent to more than one organizer. E-mail submissions are preferred.
Howard L. Penn (*)
Mathematics Department
572 Holloway Rd.
United States Naval Academy
Annapolis, MD 21402-5002
tel: (410) 293-6768
fax: (410) 293-4883
e-mail: hlp@usna.edu

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The Marcia P. Sward Fund was initiated by MAA Presidents during 1999, the final year of Dr. Sward's distinguished ten-year term as MAA Executive Director, for the purpose of dedicating the MAA headquarters lobby in her honor. The Sward Fund was opened to other friends and colleagues of Dr. Sward in the fall of 1999, and drew substantial support from many people wishing to pay tribute to her outstanding contributions to the MAA. All contributions to the Marcia P. Sward Fund are now used to benefit the MAA Building Fund.

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Please send applications and inquiries to:

Dr. Gerald Jakubowski
Dean, College of Science
and Engineering
Loyola Marymount University
7900 Loyola Boulevard
Los Angeles, CA 90045-8135
gjakubow@lmumail.lmu.edu
310-338-2834

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SOUTH DAKOTA STATE UNIVERSITY
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Assistant Professor position starting in mid August 2000. Doctorate in statistics required by September 1, 2000. Skills in teaching, research, communication and interpersonal relations required. Teach 12 hours per semester, engage in service and scholarly activities. Closing date: June30, 2000; or, until filled. Send letter of application, curriculum vita, copies of transcripts of graduate work, and arrange to have three letters of professional recommendation sent to: Dr. Timothy A. Wittig, Chair, Search Committee, Department of Mathematics and Statistics, Box 2220, SDSU, Brookings, SD 57007-1297. Phone: 605-688-6196. AA/EEO/ADA.

WEST VIRGINIA

WEST VIRGINIA STATE COLLEGE
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West Virginia State College, a historically Black, undergraduate Land-Grant institution which now serves a racially diverse, multigenerational student body of nearly 5,000 seeks to fill a tenure-track position in mathematics beginning August 15, 2000. Primary responsibility is to teach approximately twelve credits of undergraduate mathematics or computer science course per semester. Duties also include student advisement, curriculum development, committee work and scholarly activity. The missions of the college and the department require that the search focus on candidates who demonstrate excellence in teaching. Ph.D. in Mathematics or Computer Science preferred. Rank and salary negotiable. Preference will be given to those applicants with experience in the use of technology or research potential.

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Send cover letter (including email address and fax number if available), resume, statement of teaching philosophy, a copy of graduate and undergraduate transcripts and three letters of recommendation to Dr. Barbara J. Oden, Ph.D., Vice President for Academic Affairs, West Virginia State College, Campus Box 192, Institute, WV 25112-1000. Additional information about the college is available at http://www.wsc.edu/. screening of applications will begin on April 14 and will continue until the position is filled. Use of AMS Application Cover Sheet is appreciated.

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