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Teaching Time Savers: Style Points

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FOCUS

Volume 26 Issue 6

On the cover: The 2006 USA team at the International Mathematical Olympiad, Ljubljana Slovenia, July 17, 2007: Alex Saltman, Deputy Leader; Ryan Ko, Silver Medal, Allendale, NJ; Zuming Feng, Leader; Zachary Abel, Silver Medal, Dallas TX; Yi Sun, Silver Medal, Saratoga, CA; Steve Dunbar, MAA Director of American Mathematics Competitions; Alex Zhai, Silver Medal, Champaign, IL;, Arnav Tripathy, Gold Medal, Chaepl Hill NC; Zeb Brady, Gold Medal, Van Nuys, CA.

U.S. Team Comes in 5th at 2006 IMO

By Harry Waldman and Fernando Q. Gouvêa

At the 2006 International Mathematical Olympiad, held Ljubljana, Slovenia, nearly 500 young mathematicians competed in solving problems posed in a test administered on July 12 and July 13. The USA team came in 5th among the 90 participating countries. Top honors went to the People's Republic of China (214 points), followed by Russia (174), Korea (170), and Germany (157). Iran and Moldova placed among the top ten teams.

Overall, the IMO awarded 42 gold medals, 87 silver and 124 bronze medals. The top three individual contestants tied for first place with 42 points, the maximum possible score. They were Zhiyu Liu of China, Iurie Boreico of Moldova, and Alexander Magazinov of Russia.

The USA team has consistently finished in the top five for the last seven IMOs. The six members of the USA team got 152 points overall, receiving 2 gold and 4 silver medals. The team members and their results were:

- Zachary Abel, a graduate of Greenhill School in Dallas, TX received a silver medal.
- Zarathustra Brady, who attends Magnolia Science Academy in Van Nuys, CA, received a gold medal.
- Ryan Ko, who graduated from Philips Exeter Academy in Exeter NH and is from Allendale, NJ, received a silver medal.
- Yi Sun, who graduated from Harker School in Saratoga, CA, won a silver medal.
- Arnav Tripathy, who graduated from East Chapel Hill High School in Chapel Hill, NC, won a gold medal.
- Alex Zhai, who attends University Laboratory High School in Champaign, IL, won a silver medal.

The 2006 IMO was the 47th in the annual series of international mathematical competitions. The competition poses six math questions to be solved, three very challenging problems each day in a 4.5 hour session.

The MAA is the main sponsor of the USA team at the IMO. Additional contributions come from 23 organizations and companies in the mathematical sciences.

The US team members are selected for their high scores in the various stages of the competitions organized by MAA's American Mathematics Competitions program, including the USAMO (for which see page 4). More details on this year's IMO are available at http://imo2006.dmfa.si.

One of the testing rooms during the competition. Photograph by George Csicsery.

The US team waiting for the opening ceremonies to begin. Photograph by George Csicsery.

USAMO Winners Fêted in Washington, D.C.

By Harry Waldman

The 35th U.S.A. Mathematical Olympiad Awards Ceremonies took place in Washington, DC on Sunday and Monday, May 21 and 22. This event honored the twelve top winners of the annual USA Mathematical Olympiad (USAMO), the premier high-school level mathematical problem solving competition in the United States.

The two day celebration began with a Sponsors' Reception at the MAA Headquarters, at 1529 18th. St. N.W. Representatives of the sponsoring organizations of the American Mathematics Competitions along with members of the MAA Executive Committee greeted the winners and their families. On Monday morning, the winners toured the Cryptologic Museum at the National Security Agency and enjoyed a talk on classical cryptography from one of the on-site mathematicians.

The 2006 USAMO winners were Yakov Berchenko-Kogan of Raleigh, North Carolina; Sherry Gong of San Juan, Puerto Rico; Yi Han of Pittsburgh, Pennsylvania; Taehyeon Ryan Ko of Allendale, New Jersey; Brian Lawrence of Kensington, Maryland; Tedrick Leung of Winnetka, California; Richard McCutchen of Silver Spring, Maryland; Peng Shi of Toronto, Canada, Yi Sun of San Jose, California; Arnav Tripathy of Chapel Hill, North Carolina; Alex Zhai, of Champaign, Illinois; and Yufei Zhao of Toronto, Canada.

Dr. John Marburger, III, Director of the Office of Science and Technology Policy in the Executive Office of the President, hosted the celebratory reception and dinner in the Diplomatic Reception Rooms of the U.S. Department of State. The formal awards ceremony, presided over by MAA President Carl C. Cowen, took place in the Dean Acheson Auditorium of the State Department where Dr. Fan Chung Graham, Akamai Professor in Internet mathematics at UC San Diego gave the USAMO address, "Graph Theory in the Information Age."

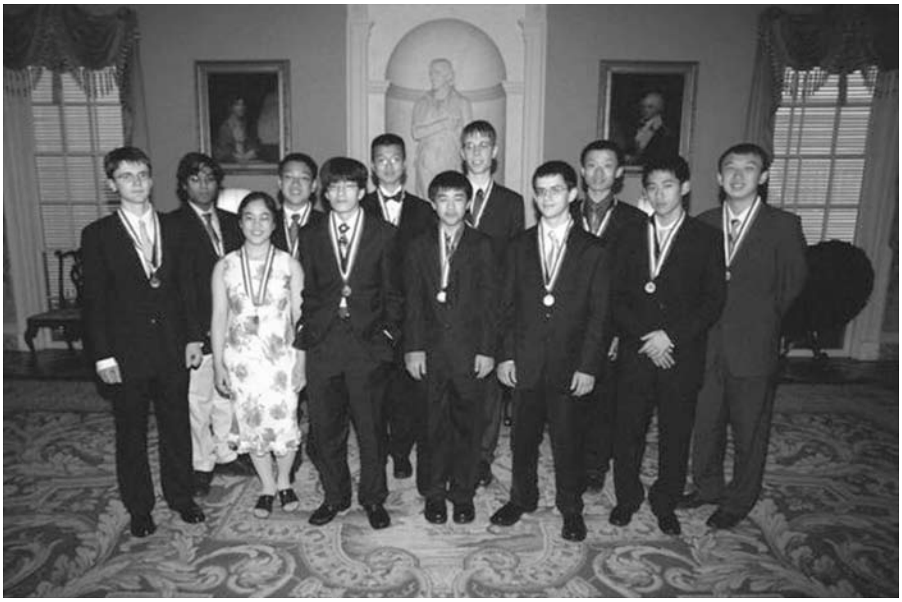
Winners received the USAMO Medal, named in honor of Gerhard C. Arenstorff, twice a winner of the USAMO and a member of the first USA team in the International Mathematical Olympiad.

After dinner, Brian Lawrence received the Samuel L. Greitzer/Murray S. Klamkin Award for his superior achievement in the Olympiad exam. Dr. James Carlson, President of the Clay Mathematics Institute, designated Brian Lawrence as the eighth CMI Mathematics Olympiad Scholar as Brian best fulfilled the prize's criteria of elegance, beauty, imagination, and depth of insight.

The Robert P. Balles Distinguished Mathematics Student Award, given to each of the twelve winners, is a prize given to the winners in an effort to recognize and reward their high achievement in the world of mathematics competitions. Robert P. Balles is a life long student of mathematics, former community college instructor of mathematics, and retired businessman who established this generous prize in 2005.

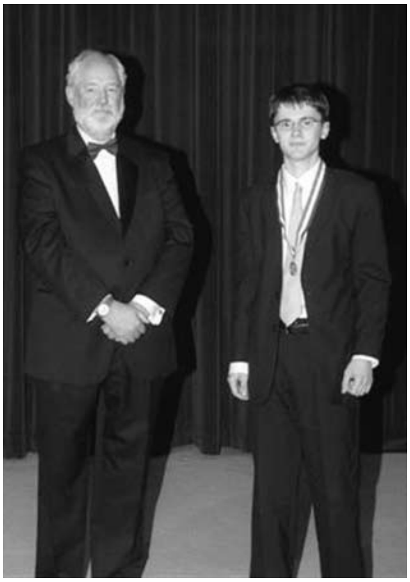
The highlight of the evening came when the Akamai Foundation Scholarships were presented to the 1st place winner, Brian Lawrence, 2nd place winner, Alex Zhai, and 3rd place winner, Yufei Zhao, by Wendy Ravech, Director of the Akamai Foundation. These scholarships are in the amounts of \$20,000, \$15,000, and \$10,000, respectively. By awarding these scholarships, the Akamai Foundation hopes to encourage these and other students to continue their pursuit of mathematics education.

The road to the USAMO began with the American Mathematics Contest 10 (AMC 10) and American Mathematics Contest 12 (AMC 12) exams. In February, about 240,000 students from over 4,000 schools participated in these contests. The AMC 10 and AMC 12 have 25 questions from the high school mathematics curriculum to be answered in a timed 75 minute format. The problems range from easy to quite challenging. The top 5% of scorers on the AMC 12 and the top 1% of scorers on the AMC 10 are then invited to take the American Invitational Mathematics Exam (AIME).



35th USA Mathematical Olympiad Winners

From left to right: Brian Lawrence, Arnav Tripathy, Sherry Gong, Yi Sun, Tedrick Leung, Yi Han, Alex Zhai, Richard McCutchen, Yakov Berchenko-Kogan, Peng Shi, Taehyeon Ryan Ko, Yufei Zhao



President Carl Cowen with 1st place winner and Clay Mathematics Institute Olympiad Scholar winner Brian Lawrence.

Dr. Fan Chung Graham giving the Olympiad address titled "Graph Theory in the Information Age."

Melanie E. Wood (USAMO winner in 1998 and 1999) with Sherry Gong.

Three big checks from Akamai. Photograph by Bill Rundell.

Tina Straley speaks. Photograph by Bill Rundell.

The AIME is a challenging 15 question contest spanning 3 hours. The difficulty of the questions ranges from equivalent to the most difficult on the AMC 12 to extremely difficult. In March, nearly 12,000 students took the AIME. Based on a combination of scores from these two contests, 430 students were invited to take the USA Mathematical Olympiad (USAMO) exam which was held on April 18 and 19.

The USAMO is a 6 question proof-essay contest, taking 9 hours over two days. The problems on the USAMO would be challenging even to professional mathematicians. This year's USAMO and solutions are available on the web by choosing "Students" on the MAA home page (http://www.maa.org) and following the links. The twelve winners and other young students who took the Olympiad exam are invited to the Mathematical Olympiad Summer Program (MOSP) for advanced training for the International Mathematical Olympiad (IMO).

The 2006 Mathematical Olympiad Summer Program was held on the campus of the University of Nebraska-Lincoln from June 11 to July 1 with 54 students and 14 instructors and graders in attendance. The students received a mix of training on mathematical problem solving, proof-writing and deeper instruction on algebra, geometry, number theory, combinatorics, probability, and trigonometry in preparation for solving Olympiad-style problems. The summer program was funded in part with a grant from the Akamai Foundation.

The final US team for the IMO was selected from among the 12 winners at the MOSP. Each year since 1974, a small team of exceptionally talented high school students has represented the United States at the IMO. See page 3 for news on the US team's performance at the IMO.

Association for Women in Mathematics Announces Michler Prize

The Association for Women in Mathematics (AWM) has announced that Gerhard Michler of Essen, Germany donated $1 million to Cornell University to establish a prize in the memory of his daughter, Ruth Michler, who was tragically killed in November, 2000 while riding her bicycle. The prize will be administered by AWM and will be known as the Ruth I. Michler Memorial Prize of the Association for Women in Mathematics.

The AWM press release described Ruth as "a constant source of energy, persistence, and talent." She was born in Ithaca, NY, while her father was a visiting mathematician at Cornell. She studied in Oxford and did her graduate work at the University of California at Berkeley. She taught briefly at Queen's University in Canada, and then went to the University of North Texas at Denton. Longtime readers of FOCUS Online may remember her two reviews for our Read This! column; the editor also remembers her indignant refusal to review a book that she felt was unworthy of the attention.

At the time of her death, Ruth was 33 years old; she had recently been promoted to Associate Professor and was spending the year as a Visiting Scholar at Northeastern University on an NSF POWRE grant. She was struck and killed by a construction vehicle, while waiting to cross a busy intersection near the Northeastern campus. The prize in her memory will enable other mid-career women to follow Ruth's example and more deeply pursue their own mathematical research.

Ruth Michler

The prize will be awarded annually by the AWM to a recently promoted female associate professor of mathematics (or equivalent) working at a university other than Cornell. The prize is intended to allow the winner to spend four to six months at Cornell to pursue a research or book project. The application deadline for the first prize is November 1. For details about the Michler Prize and the applications process, see http:// www.awm-math.org/michlerprize.html.

Is the Poincaré Conjecture Proved At Last?

By Fernando Q. Gouvêa

The Poincaré Conjecture, one of the Clay Mathematics Institute's million-dollar Millennium Problems, may be settled at last. In 2002 and 2003, Grigori Perelman of the Steklov Institute in St. Petersburg posted several papers to an online preprint archive in which he claimed to have proved Thurston's Geometrization Conjecture, which is known to imply Poincaré. Specialists have been reading his papers and developing his ideas since then. Two recent papers, published almost simultaneously, have claimed a complete proof based on Perelman's ideas. One is "Notes on Perelman's Papers," by Bruce Kleiner and John Lott (posted to the ArXiv preprint server on May 25, 2006); the other is "A Complete Proof of the Poincaré and Geometrization Conjectures—Application of the Hamilton-Perelman Theory of the Ricci Flow," by Huai-Dong Cao and Xi-Ping Zhu (published in the June 2006 issue of the *Asian Journal of Mathematics*).

To understand the conjecture, start with the three-sphere S^3, i.e., the set of points (x_1, x_2, x_3, x_4) in R^4 satisfying the equation $x_1^2 + x_2^2 + x_3^2 + x_4^2 = 1$. This is perhaps the simplest compact three-manifold. One way in which it is simple is the fact that any loop embedded in it can be continuously deformed to a point. Poincaré conjectured, early in the 20th century, that this property in fact characterizes the three-sphere, that is, that any other compact three-dimensional manifold with the loop contracting property would have to be homeomorphic to S^3. While very plausible, this conjecture turned out to be extraordinarily difficult to prove.

Analogues of the conjecture in dimension five and higher were proved in the 1960s by Smale, Stallings, and Wallace. The four-dimensional version took twenty more years, being proved by Freedman in the 1980s. It now seems that the original three-dimensional conjecture has finally been settled. Perelman's methods are based on ideas of Richard Hamilton on the "Ricci flow" and on William Thurston's high-powered "Geometrization Conjecture," which provides a very general description of all closed three-manifolds with finite fundamental group. Thurston's conjecture contains the Poincaré Conjecture as a special case. It is the Geometrization Conjecture that seems to have been proved, therefore settling also the Poincaré Conjecture.

Interest in the conjecture was heightened by the fact that in 2000 the Clay Mathematics Institute made it one of its seven Millennium Problems, offering one million dollars for its solution. One can read more about the conjecture and the Millennium Problems at the CMI web site at http://www.claymath.org/millennium/Poincare_Conjecture/.

Curiously, it is unclear whether Perelman will win the prize. The rules for the Millennium Prizes specify that the work must be published in a refereed journal and must survive the examination of the mathematical community for at least a two-year period. So far, Perelman shows no indication of any intention to publish his papers. Perelman's preprints are fairly sketchy and would probably not be publishable as they stand. The two exegeses by Kleiner and Lott and by Cao and Zhu are immensely longer than the Perelman's original papers, and both claim to contain the full details of the proof, leaving an interesting knot for the Clay Institute to disentangle.

In addition to the CMI site noted above, one should check the site maintained by Kleiner and Lott, http://www.math.lsa.umich.edu/~lott/ricciflow/perelman.html, which contains links to many other online materials related to the work of Perelman. See also the news story published in the *Wall Street Journal* on July 21, 2006 (page A9). Details on all the Millennium Problems can be found in Keith Devlin's *The Millennium Problems* and in the recent official publication from the American Mathematical Society and the Clay Institute, *The Millennium Prize Problems*, ed. by J. Carlson, A. Jaffe and A. Wiles. Devlin's account of the conjecture is aimed at the general public, while the article by Milnor in the official volume is more technical (but still quite readable). *The Asian Journal of Mathematics* is at http://www.ims.cuhk.edu.hk/~ajm/ and the ArXiv preprint server is http://arxiv.org.

Found Pedagogy

"If we can start them thinking about science early, and taking the right courses early, then science is not difficult — it's exciting. I see this as a marvelous beginning of an effort not only to educate, but to prepare a work force."

(State Senator Pete Knudson of Utah, on the state's plans to organize science camps for teenagers, one of which is AWE+SUM, which stands for "Attend Westminster, Explore Science, Use Math." See http://goed.utah.gov/science/.)

University of Mississippi Graduates Record Number of African-American PhDs

By Tristan Denley

Readers of FOCUS may have seen the national headline news from the Department of Mathematics at the University of Mississippi. At our spring commencement, UM broke the national record among American colleges and universities for producing the most African-American PhD graduates in mathematics at one commencement. On Saturday, May 13, the University awarded doctoral degrees to Joe Anderson of Rosedale, Mississippi, Carla Cotwright of Los Angeles, Bryan Williams of Missouri City, Texas, and Adrian Wilson of Jackson, Mississippi.

New PhD graduates Carla Cotwright, Bryan Williams, and Adrian Wilson with math department chair Tristan Denley.

The milestone warranted making headlines across the country, and it did, in media outlets statewide, as well as some regional spots and a couple of national hits. But in many of my conversations since the announcement, colleagues, friends and others have expressed puzzlement as to why this accomplishment was newsworthy at all. Even a columnist from a prominent publication that covers issues of diversity was surprised: Don't students graduate with PhDs every year — even in mathematics?

In fact, the figures show that the number of minority doctoral graduates in mathematics is much smaller than expected. The 2005 American Mathematical Society survey, for example, reported 1,116 new doctoral graduates. But only 14 of those graduates were African-American. In fact, the figures are similar for students of any minority race. In light of these figures, the impact of UM's four recent graduates comes into clearer focus.

Don Cole, UM's associate professor of mathematics and assistant to the chancellor for multicultural affairs, said, "What happened on May 13 in Oxford was an historic milestone, unprecedented in the United States, with only the University of Maryland coming close, in 2000. Indeed only a few of the nation's larger institutions have produced more African-American doctorates in mathematics overall." Furthermore, Cole said, "with continued faculty efforts to provide deserving students with financial assistance and challenging learning experiences, as well as a commitment to sustain a nourishing campus environment for minority students, the University of Mississippi can become the nation's leader in producing African-American mathematicians."

In the context of the exuberance surrounding the announcement, I am reminded of the years of quiet work by many that brought us to this level of success. Dedicated people across the University and at all levels of the administration support our commitment to increase the number of minorities completing doctoral degrees. Such a desire reflects this institution's commitment to inclusiveness, mirroring a sustaining minority undergraduate population, a committed faculty and a supportive administrative structure. In particular, this year's achievement is a result of the Graduate School's aggressive recruitment and retention programs for minority students, the mathematics department's innovative external and internal financial programs, the research faculty's outreach to minority students, the administration's leadership to coordinate these efforts and Chancellor Robert Khayat's passion for diversifying the campus. "These four will be role models to other people, both black and white, and we will see I hope an additional interest among students to come to this university or to other universities to pursue math and science as their careers", said Chancellor Robert Khayat.

In the mathematics department, work toward this goal began almost six years ago under the leadership of Professor Gerard Buskes, my predecessor as chair. He was the driving force behind an application for GAANN (Graduate Assistance in Areas of National Need) funding from the Department of Education. In his proposal, Buskes pointed to a large pool of talented minority students in this region and concluded that they had the potential to become interested in the beauty of mathematics. "I thought at the time that if I were to be able to successfully recruit, train and graduate from this talented pool, then I would be able to make some contribution to a slow transformation from Mississippi as a largely agricultural state to Mississippi as a technology-based economy," Buskes said. "That the success would be as strong as it now turns out to be is beyond my wildest dreams, and I am proud of each of these students now receiving their PhDs," Buskes said.

The resources that GAANN funding provided and the students that it enabled us to recruit had a transforming effect not only on those students but also on our program. When I became chair, 12 months later, there were fresh graduate students, many of whom were minority and/or female, who had entered the program focused on trying to obtain the highest academic degree possible. They dramatically increased the size our PhD program at a single stroke. This change in perspective was hugely important. Up until that time, students often began graduate work with their eyes set no further than a master's degree. They saw graduate mathematics as a ticket to a teaching job at a junior college. Here was a chance to raise their dreams.

"I was pleasantly surprised that the academic atmosphere greatly outweighed any concerns that I had about the university," Cotwright said. "With the support of the Graduate School staff and professors in the mathematics department, I felt that while the PhD in mathematics is a difficult program, it was something that I could be confident and successful in pursuing." Cotwright completed a bachelor's degree in mathematics at California State University at Long Beach and holds Master's degrees in mathematics from both UM and Southern University/A&M College in Baton Rouge, LA. The larger number of students interested in research has provided opportunities to intensify the department's research activities, and the additional funding has allowed graduate students to attend national and international workshops and conferences as never before. I have rarely attended a conference without coming away hungry to work on a problem that I saw there, or simply catching the excitement of the new areas that other researchers have begun to explore. All of this was true of our students too. As they saw others stand and share the results that they had found, they began to come together as a community who wanted that for themselves.

However, in the end, we all know that graduate research is not really a team sport. An enormous amount of the credit goes to these graduates' faculty advisers James Reid, Haidong Wu and Alan Paterson. Their careful and dedicated work one-on-one with these students allowed them to blossom into promising young mathematicians. All four already have teaching positions, or are deciding between offers for the fall.

Indeed, this is not the end of their story or our story, but another beginning for both. An important impact of these four graduates is that others like them are following the same path here at the University of Mississippi. This summer, we have three more minority students completing PhD requirements. And the older students are encouraging those coming behind them to follow in their footsteps on the road to doctoral research. And to cap it all off, I was recently notified that a new GAANN grant proposal has been approved.

In the words of now Dr. Adrian Wilson, "I am certain this milestone will serve as an incredible catalyst in the African-American community to increase the interest in mathematics. It is my dream that one day an accomplishment of this caliber won't be looked at as a University graduating four African American Mathematicians, but rather four American mathematicians."

Tristan Denley is chair of the Department of Mathematics at the University of Mississippi. He holds a PhD from the University of Cambridge, U.K.

Slocum Puzzle Collection at the Lilly Library

Jerry Slocum, who has been collecting and studying puzzles for over fifty years, has announced that he will donate his collection of 30,000 puzzles and 4,000 books about puzzles to the Lilly Library at Indiana University. The library opened its new *Slocum Puzzle Room* on August 3. About 400 puzzles are on display, most of them mechanical puzzles such as Chinese Rings and Rubik's Cube. Visitors to the library will be able to test their wits by attempting to solve the puzzles.

An article on the exhibit, including photos of several puzzles, appeared in the July 25, 2006 issue of the *New York Times*. It describes Slocum as "a retired engineer and a former vice president of Hughes Aircraft," who is also "the author of 10 books on the history of puzzles, including a recently published account of the sudoku-like *15 Puzzle*." (We beg to differ about the supposed similarity between the *15 Puzzle* and Sudoku!) The book, which is co-authored with Dic Sonneveld, will be distributed by MAA. A review appeared in July in the our online book review column; see the main *MAA Reviews* site or go to http://www.maa.org/reviews/15puzzle.html. For more on the Lilly Library, see http://www.indiana.edu/~liblilly/

New Site for Mathematics Jobs

A new web site that collects employment ads of interest to mathematicians has been created in Switzerland. Located at http://www.math-jobs.com/, it allows searches by country and by type of job and also includes links to articles with tips for those looking for a job. One of them, for example, links to an article about "How to get from a poor country into a rich country (as a Mathematician or other Quant)." As usual, applicants get access to job listings for free, but employers have to pay to have their ads listed. The site belongs to Luchsinger Mathematics, with headquarters in Zurich.

Oral History and the Archives of American Mathematics

By Kristy Sorensen

Oral history interviews can be some of the most revealing and detailed resources for archival research. A good interview can provide a researcher with a uniquely rich documentation of an individual life and a moment in history.

The Archives of American Mathematics at the Center for American History actively collects oral history material and makes it available to our patrons. We have audiocassettes and videotapes containing interviews with a wide variety of mathematicians and mathematical educators. In many cases we also have full-text transcriptions of the interviews as well as supporting biographical material, making the oral histories an even more valuable resource.

Conducting high-quality interviews is a skill that can be mastered by anyone, and you may find that undertaking an interview with a friend or colleague is as rewarding an experience for you as it is for them.

As in many topics, the Internet has a great number of sources that can help guide you in conducting an oral history interview. Some particularly helpful websites include:

Archival Leaflet Series, "Doing Oral History," by L. Dale Patterson, Archivist, The General Commission on Archives and History of the United Methodist Church (http://www.gcah.org/oral.html): This site provides an overview of best practices as well as a list of concrete tips that will make the interview process go more smoothly.

"One Minute Guide to Oral History," by Carole Hicke, The Bancroft Library Regional Oral History Office, UC Berkeley (http://bancroft.berkeley.edu/ROHO/resources/1minute.html): The name says it all! This is a nice concise guide on the basics of oral history creation.

Cyndi's List of Genealogy Sites on the Internet, Oral History and Interviews (http://www.cyndislist.com/oral.htm): An extensive collection of oral history links – if it is available online, it is probably listed here.

If you are interested in conducting an oral history interview, or if you would like to use our existing oral histories in your research, please contact the archivist at the information below.

Online inventories for collections in the Archives of American Mathematics that contain oral history material include:

R. H. Bing Interviews:
http://www.lib.utexas.edu/taro/utcah/00306/cah-00306.html

Melvin Henriksen Oral History Collection:
http://www.lib.utexas.edu/taro/utcah/00496/cah-00496.html

R. L. Moore Legacy Collection:
http://www.lib.utexas.edu/taro/utcah/00310/cah-00310.html

Mathematical Association of America Records, Committees Section (Leon Henkin interview):
http://www.lib.utexas.edu/taro/utcah/00476/cah-00476.html

NCTM Oral History Project Records:
http://www.lib.utexas.edu/taro/utcah/00319/cah-00319.html

Albert W. Tucker Papers:
http://www.lib.utexas.edu/taro/utcah/00301/cah-00301.html

The Archives of American Mathematics is located at the Research and Collections division of the Center for American History on the University of Texas at Austin campus. Persons interested in conducting research or donating materials or who have general questions about the Archives of American Mathematics should contact the archivist, Kristy Sorensen, at k.sorensen@mail.utexas.edu, or by phone at (512) 495-4539.

Making the Most of Your Sabbatical

By Jennifer R. Galovich, Charles R. Hampton, William A. Marion and Thomas Q. Sibley

Sabbatical! No students banging down your door, no grading, no lectures to prepare, no committees, no campus politics, no whining, and you get paid (sort of). What's not to love? Together the authors represent a total of twelve successful sabbaticals, but that success is not automatic. Here are some pointers from our collective experience:

Cartoon by John Johnson

Advance Planning — Nuts and Bolts

Most places won't just let you walk out the door every seventh year. There is probably some kind of application process. Find out what it is. Make sure that you know all the details regarding deadlines, procedures and criteria, as well as the less tangible institutional traditions and standard practices. (Ask senior colleagues about this if you are not sure.) Keep all these factors in mind as you put together your proposal, and don't hesitate to consult if any part of the process is unclear. Once you have determined that you are in fact eligible (check your faculty handbook), have decided on one vs. two semesters (we recommend two — see below), and have some idea what you would like to accomplish, we recommend that you consult with your department chair. You will need her support, and this is when you can find out if your project or timing will need tweaking in order to be aligned with some departmental or institutional need of which you are not aware.

Institutions will (quite reasonably) be disposed toward supporting projects that benefit the institution. That said, it is critical to choose a project that you are aching to tackle. The authors have engaged in projects such as writing a text, developing a bioinformatics curriculum, monitoring and analyzing gerrymandering and redistricting after the 1990 census, studying of the philosophy of mathematics, auditing courses in theoretical computer science and pursuing those items listed in the "future directions for research" chapter of the dissertation. Whatever you choose, without daily deadlines to spur you on, you will need the project to call you. And institutional agendas can change, sometimes without warning. Ultimately, what's good for you is good for the institution, but it can be helpful in the application process to understand how to make those connections explicit.

Not all institutions are able to fund all applicants, so the process may be quite competitive. Your written proposal is your chance to make your case — why is this project good for you, why is it good for the institution/department, and why should anyone believe you can do it? You will need to provide convincing evidence that you are serious about your project, know how to make it happen, and can accomplish your objectives in the time available. (This is yet another reason to choose two semesters.) If you are going away, you will need a letter of support or invitation from the host institution; if you are engaged in a writing project, you may need a letter from your editor or publisher. Your institution may also require letter(s) of support from colleagues regarding the value of your project and your preparedness for it, as well as a letter from your department chair.

Ideally, your sabbatical project has its roots in some idea(s) you've already begun to ponder. What additional preparation will you need in order to accomplish your project? If you are changing fields, you may need to audit a course, do some additional reading and writing, or attend a professional meeting or workshop in the new area. If you are writing a text, you will want to have a prospectus and some initial chapters already in the works. If you are picking up an old project, set aside time to review (and find) your old notes and papers. Your proposal should have enough detail to be compelling, but it should not be voluminous.

Keep your audience in mind as you write. At smaller institutions, the members of the committee reviewing proposals may come from a variety of disciplines. You may need to explain (briefly) how research in mathematics differs from research in, say, biology or English literature. Finally, as with any writing project, follow the guidelines and run your proposal by a disinterested third party before you send it off.

Though you may not need to put it in your proposal explicitly, we recommend that you have a backup plan, in case you find a counterexample in your first week, or the project turns out to be more like Mt.

Everest than Mt. Shasta. (Or, as happened to one of us, someone publishes your idea before you were finished thinking about it. The lemonade from those lemons was a series of ultimately successful undergraduate research projects.)

Go Away

The authors are unanimous in their advice to take full year sabbaticals and go away from your home institution if at all possible. One of us has even taken several sabbaticals abroad. We know that going away can be difficult — in most institutions, you will take a significant pay cut for a full year sabbatical compared to a semester sabbatical, and if you go away as well, the financial challenges are magnified. Sometimes this can be addressed by advance planning — some host institutions may be willing to hire you (or your spouse/partner) on a part-time basis. (However, be warned that even part-time employment will dilute your energy for your project, unless it is directly related.) Or your project may be just what some funding agency is looking for and you can apply for a grant. (Don't forget the Fulbright folks for sabbaticals abroad.) We also note that there are significant tax advantages (a sabbatical qualifies as a job away from home), and recommend a pre-sabbatical consultation with a professional and/or purchase of one of the tax guides for college teachers, such as the one published by Academic Information Service, Inc.

Other challenges are presented by family circumstances. These vary so much that it is hard to give advice. However, we do report that the same factors that make it work for you can also make it work for your family. Finding housing and deciding what to do with your own house can be a bit nerve-racking, but on both fronts we recommend faculty bulletin boards, the always helpful secretary to the Dean or Provost, and http://www.craigslist.org. Of course, taking your children out of school and placing them in a new school environment can make for a difficult transition, but is potentially a very enriching experience for them.

However, the advantages of going away are many: Ideally, you return from your sabbatical renewed and refreshed — hard to do when you are surrounded by the same old same old. Going away means not only taking advantage of new opportunities but also being able to decline the old ones. And you may have access to books, journals and software that are not easily available at your home institution, not to mention the interactions with many colleagues who will share and spur your interests.

You probably have some ideas about what kind of place would work best for your project — perhaps you have some specific places in mind. You may be drawn by the opportunity to work with a particular person or research group, or perhaps the institution supports a special project such as the IMA at the University of Minnesota, MSRI at UC Berkeley, or the MBI at Ohio State University. However, it is worth discovering (perhaps through colleagues) the nature of the work climate at your host institution. If you are expecting to do a lot of collaboration and everyone is a Lone Ranger, you could be sadly disappointed. Depending on your project, a non-academic institution may appeal to you, but in our experience, corporations and laboratories are not tuned in to the rhythms of academic life. In particular, you may be expected to be more immediately available than your institution's application process permits. In any case, if you choose a non-academic setting, be sure that your mutual expectations about what you will do and when you will do it are in sync.

Wherever you go, make a connection with someone there, by e-mail, shared acquaintance, or just introduce yourself at a meeting. Find out what the host institution's procedures are, and what they will be able to offer you. In our experience, most institutions are quite welcoming, though less accommodating the more you ask for. Visiting scholar status, parking permits and access to libraries are easy (though parking may not be free). An office (even shared), phone, computer and secretarial services are a bit harder, but most places are willing if these are available at all. In general, we have found that it is fairly easy to wrangle an invitation someplace as long as you don't want any money.

Making it Work

Academics typically work too hard, with grading and class preparation regularly spilling into the evenings and weekends. Sabbaticals are an opportunity to interrupt that cycle and make a clean break from the distractions of campus politics and requests from colleagues to help with chores. Find a new rhythm that fits your project, and doesn't wear you out. Work on your project regularly, but don't feel guilty about taking time off if that's what you need. Galovich and Sibley have a rule that you can't bring work home from the office.

In any case, whether or not you go away, don't isolate yourself. Make time to enjoy your surroundings (whatever they are), exercise, and take advantage of serendipitous opportunities, such as travel, auditing a class or working on a side project that you stumble on. If you are going to a new place, e-mail the chamber of commerce, get a city map, check out the local newspaper (e.g., on-line). You could also resurrect old interests — get that clarinet out of the attic and join a community orchestra or other music or drama group. Or you could take on a new interest, such as getting involved in a community service project.

Whatever you do and wherever you do it, refresh, renew, learn and enjoy!

Jennifer Galovich is Associate Professor of Mathematics at St. John's University (MN); Charles Hampton is Johnson Professor of Mathematics at The College of Wooster; Bill Marion is Professor of Mathematics and Computer Science at Valparaiso University; Tom Sibley is Professor of Mathematics at St. John's University (MN). Hampton, Marion and Sibley are also former department chairs. The authors served on a MAA Project NExT panel at the San Antonio Joint Mathematics Meetings. This article is a compilation of their remarks.

Some Advice for Graduating PhD Students

By Felix Lazebnik and Keith E. Mellinger

What to tell a graduating PhD student in mathematics? One thing we learned is that everybody has a different answer to this question. There are many different pressures placed upon new mathematicians. In what follows, we will assume that a graduating student answers the question "To be or not to be?" as "To be." Unfortunately, this does not resolve all the problems. Everyone's experience, circumstances and difficulties are so very special, right?

Your situation is not that special. Many new or budding Doctors-of-Philosophy have had similar problems of their own, the same ambitions, aspirations and doubts. Life for the young and talented is not easier than for, well, just about anybody else. Relax and stop blaming the circumstances. It is up to you to make choices. Remember Woody Allen: "The only thing standing between me and greatness is me." In what follows, we assume that you have sorted personal problems like finding a partner, dealing with parents, or owning a dog. What is left is research and teaching.

You may have mixed feelings about research. Make up your mind about this, at least for the first six years. Do not question this decision every month and be ready to face the consequences. The demography of institutions where people can do good research has changed. The internet, email, and low rate telephone services, ameliorate the problems caused by the absence of a good library, limited resources for travel, and lack of a colleague in the next room who can understand your math. If you decide you will be doing research, it is clear what to do: read, think, call, email, go to conferences to meet others, many of whom are in the same position as you, and *collaborate*. If you do not have travel funds, pay your own way. Share driving and hotels with others. This way you can attend more meetings. Consider it as an investment in your future. And again, read, read, read.

You may feel pressure to publish early in your career. With that in mind, the following advice might be easier to say than do. *Try to work only on those problems which you really like*. It will make you happier. The consequences are obvious.

Similarly, *you may have mixed feelings about the role of teaching in your career*. Teaching can help you to become a better scholar. This is true even if you teach only undergraduate courses. Think about what you teach from different perspectives and you will find many related questions crying for answers. Like "what if instead of that assumption, I use an alternate assumption?" "Can this be generalized?" "How and why did this notion/theorem appear?" "Why does this boring theorem/exercise appear in just about every text? Why should I teach it?" In other words, *teaching can help you with your research*. Listen to your students. They can ask good questions. It is certainly possible that an innocent question asked by a student in class could lead you to a new research problem.

Your situation is not that special. Many new or budding Doctors-of-Philosophy have had similar problems of their own, the same ambitions, aspirations and doubts. Life for the young and talented is not easier than for, well, just about anybody else. Relax and stop blaming the circumstances.

Teaching often helps relieve the frustrations of research, and the emotions you get from it can help you to resume your research program. Don't buy in to the myth that success in one area (teaching or research) implies failure in the other. Nevertheless, it is possible that *teaching can hurt your research*, primarily by taking time and energy, and by stirring negative emotions. This is especially true if you are an ambitious teacher. Be aware of this. You may like both research and teaching, but only a few of us can do both things really well *simultaneously*. Fortunately, there exists this wonderful time of year called summer.

Finally, to quote the renowned Joe Gallian, *find your niche in the profession*. Whatever you decide, there is something important and valuable you can do. Think about the mission of your institution and follow your instinct.

Those are probably our most important points to share. But here are a few other things to think about.

Get on publishing that dissertation right away. At the end of your thesis you may think that what you did was minor. "OK, it was sufficient for the degree, but who really needs it? Probably many people could do the same thing if they decided to work on it." Nonsense. It is hard to judge the value of your work at this time. It's very likely that, in ten or fifteen years, you will read what you published and be surprised with how nontrivial the logic and the arguments are! You will feel much better about the work. And no one can predict how your published word will echo in the future. And it is harmless. Try to publish your PhD thesis. You might even start putting your thesis into article form before graduation. This will help you to hit the ground running after graduation. Your PhD thesis is your first class ticket to publication at this point in your life. Don't let it go.

Take advantage of every speaking opportunity you can get towards the end of your time in graduate school. You will, undoubtedly, be expected to give talks. If nothing else, you will be expected to speak to a diverse group while being interviewed for a job. You don't want this to be a new experience. Along the same lines, *learn how to write well*.

Mathematicians have a bad reputation for their writing skills. Don't be one of those guys. Give details eloquently and understand that good writing comes with practice.

There is a difference between state schools and private schools. For instance, when interviewing, you might discover that publicly supported schools often offer lower starting salaries, but better opportunities for salary increases over the years. Find information on faculty salaries. Remember to look not just at starting salaries, but also what associate professors are earning. Also, ask questions about benefits. Ask around. See how much people are paying for things like health insurance. Many public schools have very good insurance plans that beat the private schools.

Meet as many people as you can. Network. Go to conferences. Introduce yourself. Ask questions. Talk to people. Assuming you make a good impression, the more people you meet the better off you'll be. This requires no further explanation. Some mathematicians are quiet, aloof people. Try not to be, especially when you're fresh on the market.

A 12 hour teaching load and a high research expectation are not very compatible. Many faculty teach 12 hours (or 4 courses) per semester and very much enjoy it. But be a little cautious of such a teaching load coupled with an expectation of three or more scholarly publications per year.

Keep all your options open and apply for different kinds of jobs. This might be easier to say than to do. But you never know what's going to happen out there in the job market. Post-doc opportunities are more plentiful these days (especially for U.S. citizens), so don't rule such things out thinking that you have no chance. You could have the pleasure of learning a whole new area of mathematics while having a very low teaching load your first few years out of graduate school. Such experiences have far-reaching consequences.

Don't be surprised if your first year of full time teaching seems more difficult and less fulfilling than you expected. Reality check! Your first year out of graduate school will be difficult. You'll probably be teaching much more than what you are used to, and your schedule will change dramatically. Be ready.

Document your teaching material, even if it is in imperfect form. How many times do you think you'll be teaching first semester calculus? Answer: a lot. So make notes, write good quizzes and exams, and make nice handouts. Anything you do now will make your life easier down the road.

There will be many activities begging for your time, more than you can do in a 24-hour day. And most of them will be sensible worthwhile things to do. Learn when to say "Yes" and when to say "No." You need to find your niche. If undergraduate research is your thing, then say yes to the opportunities that will help you to grow in that direction. If research is not your thing, agree to be on a university committee, or to teach a new course. Do say "yes." But also learn when saying "no" is the better answer.

Reality Check! Your first year out of graduate school will be difficult.

Apply for grants, but do not make it an initial priority. Grants help us to achieve some goals in both research and teaching. But they are neither a necessary nor sufficient condition for measuring one's success in the discipline. Your administration values them. Unfortunately, many people often equate receiving them with the notion that you are "good" or "valuable" (a separate issue entirely). But we can guarantee you that you will never receive a grant if you do not apply. So keep an eye out and apply when you can.

Exhibit good "mathematical citizenship." Have lunch with colleagues, discuss what new math you learned while preparing for today's class or what difficulties you had. Share and ask for interesting problems. Share clever student responses. Inform your colleagues about the last article you read in FOCUS or the *Notices of the AMS*, or even in a newspaper. It is not always easy to be a good professor. We need each other; it is easier to jog with other people running next to you.

There are many activities which are essential for the survival of our profession, but often do not bring you much credit. For example, refereeing, reviewing, translating, editing the writing of a colleague, talking at length to students, posting a useful document on the web, etc. Do not be afraid to be generous with time spent on such things. Many people do notice and will be grateful. It helps to feel that you belong to something important, like the Eternal Order of Mathematicians. Welcome aboard.

The authors are thankful to Peter Haskell for inviting Keith Mellinger to Virginia Tech in the fall of 2005 to speak to the graduate students about some of the issues mentioned here. In addition, we thank Professor Haskell for carefully reading the article and making several valuable suggestions. In particular, we are grateful to him for mentioning an editorial by John Ewing (Some Advice for Young Mathematicians, Notices of the AMS, v. 45, no. 11, Dec. 1998, p. 1452) where some similar suggestions to young mathematicians were made.

NUMB3RS: Positive and Negative

The May/June issue of FOCUS included the article "Complex NUMB3RS," by Sarah J. Greenwald, in which the author expressed her doubts as to the pedagogical value of the well-known television show. We received many letters responding to the article, several of which we collect here.

Thank you, Prof. Greenwald

I am delighted to see that there are at least a few people in the mathematics community who are not running around and crying "they like us! they like us!" just because someone decided to make a TV program featuring a young, curly-haired, socially adept, handsome, fiendishly clever mathematician who hardly ever seems to actually sit down and work on his mathematics. And he solves crimes too. If anything, Prof. Greenwald was too generous.

Outis Niemand
Dystopia College

Complex, perhaps, but good nevertheless

I write about the math behind NUMB3RS on my blog, at http://www.atsweb.neu.edu/math/cp/blog/. I am also a consultant to the show. From both standpoints, I'd like to take exception to the "review" of the show by Sarah Greenwald in the May/June FOCUS. I will deal with her major points one by one.

1. "The violence and sexual innuendos on the show make any classroom use more complex." Well, yes, more complex is true — certainly for kids in elementary school. The fact is, NUMB3RS is far less violent than most crime shows on TV, and many of the issues it raises are exactly the ones that high schools are trying to deal with every day: sexual harassment, stalking, rape, and general physical violence. The show comes down very firmly on the law-and-order side on these issues. The sex is quite tame by TV standards and romance and sensitivity are emphasized in many scenes. The emotional consequences of violence are also portrayed in nearly every episode, as are the consequences of greed, overweening ambition, and gambling. I could give dozens of examples of morality tales within episodes — I've read and reread the scripts of all of them.

2. Amita's relationship with Charlie is touching and innocent. She was a student of his, and we know that while they had that relationship they had no other. In an early episode he tells his father (who'd like to marry off his sons) that he can't date Amita because she is his student. Then she finishes her PhD (pretty good role-model that). Their first "date" ends up with them talking mathematics and then being introspective about that fact; the reason Charlie even suggests a date is that his affection for her is kindled by his explicit admiration of some mathematical advice she offers him: this is as clear as day if you watch the episode. If any television character ever respected a member of the opposite sex as a person and not as a sexual object, it is Charlie. He and Amita never embrace or kiss until Amita smooches Charlie (to his surprise) when he suggests that Amita renew ties with her family in India. This occurs in a very positive show about Amita's affection for her family and sympathy for her fellow Tamils. In any case, Amita, having completed her thesis in combinatorics and electing to write another in cosmology, is certainly free to contemplate a different relationship with Charlie. The issue of Amita's career and its independence from Charlie has been the subject of some very interesting shows recently, which raise exactly the issues of career and relationship that are deep and difficult. They have yet to be resolved on the show.

3. "Charlie often fits the stereotype of the gifted mathematician who readily finds the right answer." Well, he is a gifted mathematician: that's what the show is about. To say that gifted people fit a stereotype that they employ their gifts successfully is hardly a statement with great content. A show about a talented basketball player would likewise show some balls being put through some hoops. However, although Charlie sometimes shows off, he works hard at what he does, is nearly always shown struggling with mathematical problems, and often makes mistakes. Many times he is redirected to the correct path by his father, Larry the physicist, or Amita. The episode "Convergence" shows some of his major professional work being disproved, and how he eventually patches it up; did Greenwald see this?

4. "Little attempt is made to show how mathematicians actually think and mathematics is often presented as consisting entirely of formulas rather than concepts and logical connections between them." This is exactly not true and I could show you dozens of scripts where the role of logic and concepts is emphasized over mere formulas. In fact, that's one of the themes of the show. Yes, there are equations that are written without much explanation: that's where my blog comes in. The show is not about teaching math, it's about the usefulness of math. It is a fact that many shows have Charlie "dropping names" of various arcane and technical sounding results. This is a valid criticism of the show, and something I and other consultants have been trying to change. And I can tell you that people at NUMB3RS are aware of this problem.

5. "Research studies have shown that stereotypical representations of mathematicians can actually discourage students from pursuing more mathematics." Well, research studies in education, I am sorry to say, have "shown" all sorts of things. Education is not a scientific field, and the definitions of terms like "stereotypical" and "discourage" are hardly precise. I've also read (and commented on) a fair amount of nonsense in the *Mathematics Teacher*. Kids who like some activity, be it a sport or game or subject, want to be like the people they identify as excelling in it. If you like basketball, you want to be like Shaq; if you're into soccer you want to be like Mia Hamm; if you bike,

you're inspired by Lance, not someone who rides, uh… the way you do. However, Greenwald misses the whole point of Amita as a role model: she is a woman who likes math, is good at it, and isn't ashamed to admit it. She didn't feel she had to drop out of the top algebra class, or take AB instead of BC calculus: she's not afraid of challenges. Similarly, Charlie shows that it's OK to learn and read and know things. He's not big and pushy and fearless: he's sympathetic, compassionate, committed to the life of the mind, and he abhors violence. Are these bad role models?

6. Greenwald goes on to question the usefulness of the TI-NCTM website containing exercises linked to NUMB3RS. I have gone to this site many times and have referred readers of my blog to it when appropriate. The site is very uneven, as Greenwald says, and also pretty low-level. Since I have been explaining the math of the NUMB3RS show since way before this site appeared, I assumed that I could work with NCTM; however, they have refused to respond either to calls or e-mails. This is rather strange since we have the same goals. In any case, the shortcomings of the TI-NCTM website are hardly a reason to criticize the show itself.

7. Greenwald also creates a straw man when she suggests that the CBS NUMB3RS website is implying that the mathematics community endorses the show as a "good tool for teaching students." No one is saying anything like this. NUMB3RS doesn't teach any math and doesn't intend to. Its goal is to show that "we all use math everyday" and that there are people who are good at math and love doing it. I would say that it achieves these ends quite admirably. Does anyone object to that as a modest first step?

Mark Bridger
Northeastern University

It works for us

Sarah Greenwald's article "Complex NUMB3RS" in the May issue discusses the potential issues with using the TV show and associated classroom activities as a mathematics teaching tool. As a math educator for more than 16 years and a district math curriculum administrator, I disagree with her assessment that the program could discourage students from pursuing more mathematics.

Educators in my district have been using the NUMB3RS activities since they launched last September as part of the "We All Use Math Every Day" initiative by CBS and Texas Instruments, in association with the National Council of Teachers of Mathematics (NCTM). The overwhelming response is that students not only enjoy watching the show, but also are more enthusiastic about learning math because they see it being used in "real life" situations and not just in a textbook.

The classroom activities are extremely beneficial because they translate the math concepts from the show into hands-on problems that students can solve themselves. Some of the activities follow the show plots and others explore related concepts. The activities are aligned to state and national curriculum standards, and they are an excellent tool for teaching concepts and discussing how math impacts students' lives outside of the classroom.

Greenwald is correct that educators should use discretion in bringing tools into the classroom. 28,000 educators and supporters around the nation have decided the We All Use Math Every Day program is worth signing up for. Based on my district's experience, I encourage all math educators to sign up at http://www.cbs.com/numb3rs to receive a teacher kit and learn more about the activities for themselves.

Nancy L. Foote
Math Curriculum Specialist
Higley, AZ

The show, yes, but perhaps not the worksheets

Concerning Sarah Greenwald's "Complex NUMB3RS?": As a former homeschooling parent (who home-schooled largely because I felt that "school-type things" such as tests and other stressful and enforced practices are too often invasive and detrimental to learning and to learners), I question the very idea of using worksheets in the school curriculum to supplement the TV program NUMB3RS. It seems to me that the main beauty of a program like NUMB3RS is that it's non-invasive; people can simply watch and enjoy the program, while simultaneously observing and appreciating the math (or anything else) that it imparts, on perhaps a subconscious level. An interesting program all by itself without "obligation" is the kind of thing that is lacking in so many other educational situations, and perhaps well enough should, at least in some settings, be left alone.

I'm sure that many students enjoy and benefit from the worksheets, but for others it could spoil the fun and the positive feelings. In grade school, having to write an essay every September on "How I Spent My Summer Vacation" can spoil that summer vacation. I'm not saying we should completely "lose" the NUMB3RS worksheets; I'm just saying that they should be used sensitively and with care.

Marion D. Cohen
University of Pennsylvania

Sarah Greenwald Responds:

I am pleased that the article has received so many responses. Fictional entertainment shows should not be held to a role-model standard; instead, that it is our responsibility as educators to be proactive and carefully consider how to address the complexities that arise from popular culture explorations. How we should handle the topics of violence, sexuality, genius stereotype, mental illness, etc.?

I hope that the deep thinking necessary to effectively use popular culture in the classroom will continue to evolve.

Letters to the Editor

More Sudoku

I enjoyed the recent article "The Sudoku Epidemic," and I must say that I have also been caught up in the craze. I especially liked the puzzle using the letters of logarithm. I enclose an alternative sudoku puzzle using the same letters. I was also able to incorporate another mathematical term into the puzzle. [See puzzle on this page. The solution is on page 37]

Kory Boughton, University of Wisconsin Whitewater

Puzzle

L		G						
I				O	T		A	G
				H		O	I	
	R						M	I
	L			M		H		
G			I				R	
				G				
							T	
T		H		L	R	A	G	

Things I Learned at an MAA Section Meeting

Here are some opinions that I heard at the Spring Meeting of the Northeast Section of the MAA that may interest your readers:

"You have an inalienable right to be interested in and enjoy mathematics." — from a college Dean.

"A Geek is someone with strong and possibly uncommon or unique interests. A Dork is someone lacking in social skills. Geeks and Dorks are not the same. It is far better to be a Geek than a Dork." — from college students.

Randall Covill

More Recommendations on Recommendations

Many thanks for the article in May/June 2006 FOCUS about the Harvey Mudd College-based webpage that helps students provide their professor with all the information necessary for a recommendation letter. FOCUS readers may also want to also look at a similar webpage hosted by our department http://www.cs.utep.edu/DeptCS/HowToGetARec.pdf. Our webpage also has detailed explanations of some of the requirements. By combining the best features of different websites, FOCUS readers will be able to come up with their own "Recommendation for Recommendations."

Vladik Kreinovich, University of Texas at El Paso

One More Commandment

Yankee catcher Yogi Berra once appeared on a postgame radio interview and received as an honorarium a check for $50 written as "Pay to Bearer." He replied "After all these years in the league, you'd think they'd know how to spell my name."

Well, after 30-plus years in the MAA, may I offer as the 0-th Commandment: "Thou shalt check the names of thy authors carefully in thy galleys."

Bruce Reznick, University of Illinois at Urbana-Champaign

Mea culpa, mea culpa, mea maxima culpa. Our apologies.

And An Axiom

I enjoyed reading the "Ten Commandments for Mathematicians" in the May/June issue of FOCUS. I wouldn't add another commandment, but perhaps would suggest an axiom: "Division by zero is the immaculate exception."

Keith Ferland, Plymouth State University

Successful ways to get students to math talks?

Do readers of FOCUS have any innovative methods for encouraging undergraduates to attend departmental colloquia? Our talks are aimed at upper-division mathematics and computer science majors (we offer degrees in both), yet even with outstanding speakers and attractive topics we're lucky to get one or two students at each talk.

For various reasons we have been reluctant to offer some credit hours for attending colloquia, as we do for our Putnam problem-solving sessions, or to require majors to write short summaries of some talks, as has been tried but with limited success elsewhere. Any suggestions that have worked?

Peter Ross, Santa Clara University

On Richard Cohen on Algebra

It is very aggravating to listen to Dumbbells tell the world that they have lived a full life and found no use for algebra. (See *Short Takes* in our May/June 2006 issue, page 22.) What they really mean is that they are too stupid to see the uses of algebra which abound on every side.

Surveys will show that nine out of ten rocket scientists could not hold their jobs without algebra. But these writers are obviously not rocket scientists.

So, if the question is "Algebra?", the answer should be "Please! Please! Pleeease!!"

Those who say that algebra does not teach us anything about ourselves should be asked: "What is there about you that anyone would want to know? Especially if you can't or won't master algebra?" Algebra, and the mathematics that derives from it, tells us a great deal about the world we live in, as any scientist will affirm. Any university professor can tell you that he has a class load of foreign students who came here to learn what we (and the West generally) has to offer: Science, Engineering, and, above all, Mathematics. I doubt that anyone would come here to learn what algebra's critics have to offer. They can find plenty of *that* at home. Even the Third World has plenty of their kind of wisdom.

James P. Coughlin, Towson University

Richard Cohen caught off-base

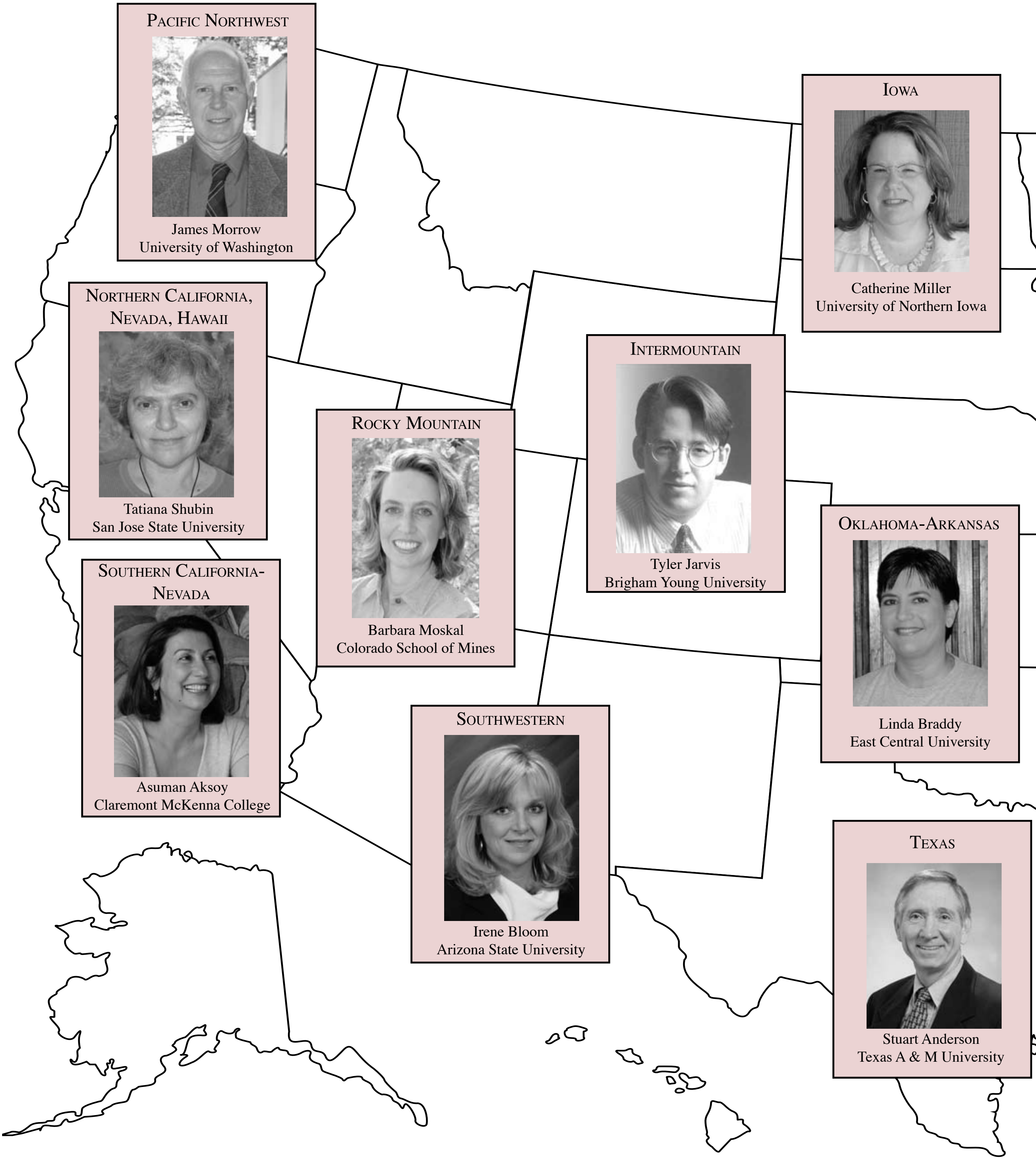
When Richard Cohen's *Washington Post* dig at algebra instruction appeared in the *San Jose Mercury News* on February 16, I wrote a brief letter to the editor which the paper then published the next day. Perhaps the readers of FOCUS would enjoy it too:

Writer Shows Why He Flunked Algebra

Richard Cohen is a good writer, but his reasoning needs attention. He says, "Writing is the highest form of reasoning. Algebra is not." In his writing, he then somehow blames algebra for the dismal lack of geographic knowledge exhibited by a student named Shelly who is a whiz at math. I can understand why he perhaps had trouble organizing his thoughts in algebra class.

Les Lange, Capitola, CA

2006 Award Winners for



Distinguished Teaching

Wisconsin

Robert Calcaterra
University of Wisconsin, Platteville

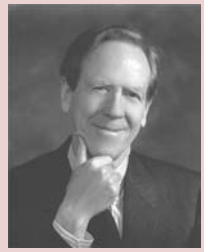
Michigan

Timothy Carroll
Eastern Michigan University

Seaway

Morris Orzech
Queen's University, Ontario

Northeastern



W. Gilbert Strang
Massachusetts Institute of Technology

Ohio

Thomas Price
University of Akron

Allegheny Mountain

James Sellers
Pennsylvania State University

New Jersey

Bonnie Gold
Monmouth University

Kentucky

J. Austin French
Georgetown College

Indiana

Daniel Maki
Indiana University

Southeastern

William M. Priestley
Sewanee
The University of the South

Louisiana-Mississippi

Richard DeVault
Northwestern State University of Louisiana

Florida

Lubomir Markov
Barry University

Other Section Award Winners:
(No picture supplied)

Eastern Pennsylvania-Delaware
J. Patrick Brewer
Lebanon Valley College

Maryland-DC-Virginia
David Kung
St. Mary's College of Maryland

Missouri
Timothy Ray
Southeast Missouri State University

How to Help Your Students Get the Most Out the MCM and ICM

By Holly Zullo, Mark Parker, and Kelly Cline

Each February the Consortium for Mathematics and Its Applications (COMAP) coordinates the Mathematical Contest in Modeling (MCM) and the Interdisciplinary Contest in Modeling (ICM). Students from around the world compete at their home institutions in teams of three, working on an open-ended applied mathematics problem. The problems are big, messy, and not at all like a homework problem; instead, they resemble an applied research problem. Past problems have included estimating the global effects of a large meteor impacting Antarctica, studying dinosaur hunting strategies, and developing methods for detecting submarines in the ocean. In other words, the students spend 96 hours working on a problem that is unlike anything they have ever seen before.

Steffan Francischetti, Kyle Nixon, and Ben Dunham: Carroll College's 2006 Outstanding MCM Team at Work.

Most students have great fun with the contest and learn a lot of math. Best of all, it can be a really inspiring experience. The contest gives them a chance to test themselves against a genuinely difficult problem with no faculty training wheels to help when they get stuck, giving them a taste of what it is like to use mathematics in a real-world situation. The modeling contest has become one of the high points of the year for our department, luring more students to pursue majors and minors in mathematics.

However, if you want this to happen, you can't just sign up a few bright students and throw them in the deep end, hoping that things will turn out well 96 hours later. Your students will be much more successful if you can provide support by helping them form teams, running practice sessions prior to the contest, and then making sure they have what they need during the contest. We provide each team with a room of their own on campus (an NP-hard task considering that the contest runs through both a Friday and a Monday). We make sure that they have computers and internet access. We even provide food, munchies, and caffeine to help fuel them through those late nights.

The pre-contest practice sessions are particularly helpful in arming our students with the skills they need in order to make sure that this contest is a fabulous learning experience instead of an overwhelming disaster. Teams need to be formed early and meet regularly for practice. We try to form our teams in early November and get practice sessions going immediately. We generally have five meetings, each one lasting about two hours. But what should we do with our ten hours of practice time? First we need to recognize what skills are needed for this contest. We break these skills into three categories: communication, problem solving, and writing.

Communication

Although students may have experience working on group projects, it is likely that there is nothing in their backgrounds that has come close to preparing them to work with two other people on one project for 96 straight hours. They need to learn how to be sure that everyone's ideas receive proper consideration, how to keep everyone busy with a valuable task, and how to resolve the conflicts that will inevitably arise. Last year we invited a faculty member from Communications to meet with our students and work with them on small group communication skills. We found that during the contest weekend students were much more aware of the need for communication, and they were actively practicing the skills they had been taught.

One dangerous pitfall that many teams face is that when a disagreement comes up, they vote, two students on one side, one student on the other, the majority rules and the thoughts of the third student are ignored. Several times we have seen a team member frozen out who then feels disenfranchised and left out. Instead, students need to be told right from the beginning that voting is off the table, and that all decisions need to be made by consensus or not at all. If there's a 2–1 split then they need to sit down and talk things through, and the two need to listen very carefully to the thoughts of their teammate, to understand where he or she is coming from, and to figure out what they are not seeing.

It's also important to remind the students to spend time listening very carefully to all of their teammates. The most talkative person usually ends up being the team leader, and more quiet students are ignored. However, being talkative has little to do with intelligence, and some very smart people are quiet and perhaps shy. Students need to listen, to make sure that everyone is participating, and if someone on their team isn't speaking up, they should specifically ask for their teammate's opinion.

Problem Solving

MCM problems are big, and the students need help managing problems of this magnitude. They need to learn a modeling process where they take a large problem, make simplifying assumptions to develop an initial model, and then relax assumptions to develop more realistic models as time permits.

We use about half of each practice session to have our teams carefully look at past problems. Our standard exercise has been to hand out a problem from a previous year and have each team read the problem statement carefully, brainstorm ideas, and then outline their solution strategy. This can be very useful, because it gives the students a sense of what to expect, as well as a little practice in how to get started. However, these sessions often result in a laundry list of minutiae that could be important to the problem, without settling on any particular starting point.

To avoid this trap, we now send students off with a problem and a goal of finding a very simple model for the situation. Rather than wandering around all the possible complications of a problem, we want them to focus on the bare minimum details and simplifying assumptions. Once they have a very simple model, they can decide what complicating factor would be added next.

Last year, we gave students the Coal Tipple Problem (MCM Problem B, 1993). In this problem, students are asked to analyze the operation of a coal tipple which is used to load coal trains. Three trains arrive stochastically throughout each day, with a high capacity train arriving on Thursdays, and the students are given the details about how much coal the tipple can hold, how much time it takes to the load the tipple, how much the trains can hold, and the relevant costs involved.

The students must determine the number of crews to have on duty to load the tipple and the average monthly costs. Last year, after 30 minutes of brainstorming and work, our students developed initial models that assumed all days were equivalent and that the three train arrivals were deterministic and evenly spaced throughout the work day. Next, the teams planned to incorporate some form of probability distribution into their models and account for the non-homogeneity of the work days. This exercise of creating a minimal model seemed to help the students quickly get started during the contest.

Writing

The end result of this contest is a written paper that is submitted for judging. Students tend to greatly underestimate the time necessary to prepare this paper, and they sometimes flounder when it comes to writing as a group. Often a team will do some really good mathematics, but not put nearly enough time into writing the paper, resulting in something barely coherent. Also, the writing should be as collaborative as possible, and every team member should read and try to improve every word in the paper. A team that divides up the sections of the paper and then blindly combines them together at the end will rarely turn in a lucid document.

It is not easy to convince the students to set aside enough time for the writing part of the contest. We can talk at them all we want about writing, but in the end they have to experience it first-hand to get the point. To provide them this experience, we give the students a simple optimization problem from first-semester calculus, and we ask them to solve the problem and write a paragraph or two describing their solution process. Although they are able to solve the problem in about five minutes, most have trouble completing the writing in the allotted 30 minutes. They learn a lot about how to write as a team, but even more importantly, they learn how long it takes to write about even a small amount of work. We always encourage students to begin writing almost immediately during the contest, and to cease all work shortly after the halfway point and devote all their energy to writing up their results.

The MCM provides a great opportunity for students to challenge their skills in mathematics, teamwork, and mathematical writing. They will get the most out of this opportunity if they have some preparation and advance practice with their teams. In the end, whatever their rankings are, we want the students to feel satisfied with the work they did during the weekend, and to come away more excited about the power of mathematics.

For more information on the MCM/ICM, see http://www.comap.org. For more information about the MCM/ICM at Carroll College and our preparation, see http://www.carroll.edu/~mparker/mcm.html.

Holly Zullo, Mark Parker, and Kelly Cline teach at Carroll College in Helena, Montana and have been involved in the Modeling Contest for the past eleven years.

The COMAP Undergraduate Modeling Contests

The Mathematical Contest in Modeling (MCM) challenges teams of students to clarify, analyze, and propose solutions to open-ended problems. The contest attracts diverse students and faculty advisors from over 500 institutions around the world.

The Interdisciplinary Contest in Modeling (ICM) is an extension of the Mathematical Contest in Modeling (MCM) designed to develop and advance interdisciplinary problem-solving skills as well as competence in written communication

Teaching Time Savers: Style Points

By Michael E. Orrison

When I began as an assistant professor, I had a pretty good sense of how much time it would take for me to prepare for each class. After a few conversations with my new colleagues, I even had a good sense of how much time I should devote to tasks like office hours and committee work. Somewhere in the middle of grading my first exam, though, it became painfully clear that I had underestimated the amount of time I would need to grade exams!

It was (and still is) important to me that my students felt my exams were fair, both in how they were written and in how they were graded. I tried to create exams that gave students ample opportunity to demonstrate their mastery of the course material, and I genuinely looked forward to reading their responses. By the end of that first semester, however, I felt certain that I was spending too much time and energy simply trying to navigate each exam. For example, I was having a hard time deciding what was or was not scratch work.

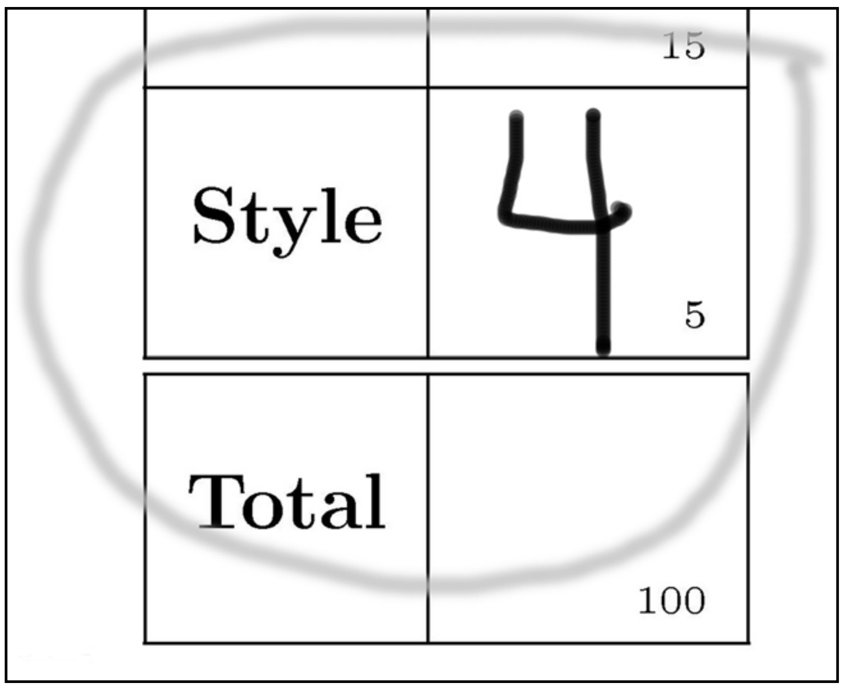
The next semester, as an experiment in my multivariable calculus course, I reserved five of the 100 points on the first exam for what I called "Style Points." I told the students that I expected almost everyone to receive all five points. I also told them that if I had to reread a solution several times to find a train of thought, or if a solution was illegible, ambiguous, or incoherent, it would affect their Style Points, and that they should therefore give some thought to how they presented their work.

The result was dramatic. Without much work on my part, most solutions on the exam seemed to have a beginning, middle, and end. In fact, most solutions actually seemed to flow (more or less) with direction and purpose. This helped me give more honest and focused feedback. In addition, the mere presence of Style Points led to lively and worthwhile discussions about the importance of good writing, regardless of one's field of study. As a bonus, I was also saving about two minutes per exam. With sixty or so students in my two sections of the class, the savings quickly added up.

I now use Style Points for all of my classes, but I occasionally vary the setup. For example, in my advanced courses, my students can no longer gain Style Points — they can only lose them. I should point out, however, that it has been several semesters since any of my advanced students has actually lost any Style Points. This used to surprise me. Then I remembered that, after sharing the idea of Style Points at a department meeting a few years ago, many of my colleagues decided to make Style Points a part of their exams too. Most of my advanced students have therefore already been thinking about their mathematical writing style for several semesters. This, of course, gives me even more time to enjoy reading what they write in my course!

Time spent: about 5 minutes in one class period to explain how Style Points can be gained (or lost) on your exams.

Time saved: about 2 minutes, on average, for every exam you grade.



Teaching Time Savers are articles designed to share easy-to-implement activities for streamlining the day-to-day tasks of faculty members everywhere. If you would like to share your favorite time savers with the readers of FOCUS, then send a separate email description of each activity to Michael Orrison at orrison@hmc.edu. Make sure to include a comment on "time spent" and "time saved" for each activity, and to include pictures and/or figures if at all possible.

What I Learned from... Teaching with Technology

By Meighan Dillon

When I went to work at a college that used scientific calculators in its core mathematics curriculum in 1992, I bit the bullet and learned my way around the little machine. I did not particularly like teaching with the calculator, but thought it better to lead rather than follow in the effort, lest someone force me, blind, down an unfortunate path. Towards that end, I became a technology leader in the department. Five years after starting at the college, I was at the vanguard of the effort to integrate the TI-89, a calculator with symbol manipulation capability, into our curriculum.

Using the TI-89 was a big change, but students and faculty adjusted. In the meantime, I embarked on an ambitious program of professional development that went way beyond calculator techniques. I learned web page design and built up a collection of devices for classroom demonstrations. I made slide shows with PowerPoint, exploiting its animation capabilities. I used web sites in class two or three days some weeks.

My enthusiasm for technology in teaching escalated beyond an approach into a pair of grant proposals. The first project was a plan to overhaul calculus and differential equations emphasizing project work and deemphasizing calculations. It was funded at the state level. The second project was a plan to retrofit a classroom that would put computers in the students' hands. It was funded at the federal level. Thus was born the Integrated Classroom for a Blended Approach to Course Delivery.

The year of the grant proposal was also the year I spent at a research department at an engineering institute of some renown. In the small, underfunded college, we had classrooms equipped with large-screen computers and web access for demonstrations. In the big-time engineering institute, they had classroom hook-ups for laptops that no one seemed to use. The effect was almost comically low-tech. Visiting speakers with laptop presentations were anomalous. When folks went all out technically, they used overhead projectors. They never talked about electronic gadgetry to facilitate the presentation of mathematical ideas. They did talk a great deal about mathematics. For their own onerous calculations, they used software, in private, with proficiency and abandon.

Teaching there was at once ludicrous and revelatory. It seemed absurd to teach differential equations without an easy way to show slope fields in class, for instance. As I struggled to learn new mathematics myself in courses and seminars, though, I felt my own engagement reenergize my teaching. I started thinking I had spent too much time fussing with toys and not enough time growing mathematically. My enthusiasm for the integrated classroom project waned.

Enthusiasm waxed anew when I returned to my home institution and saw my new classroom: a modern computer with a flatscreen monitor for each student, a Smart Board for me. Tables and chairs were arranged to foster interaction among students and a fluid shift of their attention from the Smart Board, to print, to software, to the blackboard, to the TI-89. After a few weeks of teaching this way, I went to a conference and reported with proselytizing zeal about interactive learning, access to the best of what's out there, students putting their hands on applets under my gimlet gaze.

Sometime in the middle of the next year, I unplugged the computers. The students quickly realized they had to pounce on the plugs the first time my back was turned so they could still check email and surf the web in class. Next, I unplugged the cables connecting monitors to CPUs. The more intrepid students developed proficiency working plugs and pins behind my back, and still managed to surf the web in class. That semester ended, and I bolted the door to my room and the blended approach, tired of vying with the machines for control of the students' attention, and with the students for control of the machines.

It was no surprise that the students appreciated internet access in class to a fault. Maybe it was so exasperating because I was the one supplying them with electronic dope.

Have I abandoned technology in teaching? That would be neither possible nor desirable. The TI-89 is still required in all our precalculus and calculus courses; I use it happily but sparingly. The now-elderly big-screen computers in our classrooms get a regular workout in my hands for demonstrations in class. Animated and interactive graphics that depict derivatives, intersecting cylinders, and the Frenet basis moving along a space curve, for example, have become invaluable to me over the years.

My evolving opinion is that technology should occupy a small but important place in teaching and learning mathematics. The details of its role should depend on the students and instructors using it. Technology as an aid to learning mathematics is ineffective with students who are reluctant to acquire basic computational skills. They lack the firepower for precise mathematical thinking required to interpret calculations done by machine. Instructors loathe to familiarize themselves with technology as an aid to teaching should be encouraged to overcome their aversion, if only because it is better to make an informed decision. I doubt that the impact of technology on learning is so dramatic as to warrant forcing the issue, though, especially with faculty members who are engaged mathematically. The same could be said of students who dislike using calculators. Is there a sound pedagogical reason to press the use of calculators on these students? I doubt it. Make them aware of what technology can do, but let them study mathematics while they have the chance.

Meighan Dillon's web page at http://math.spsu.edu/dillon/nsf.htm *links to most of the electronic materials she uses in her classes.*

The Open Source Revolution

By Jeff Suzuki

Computer Algebra Systems (CAS) and Dynamic Geometry Software (DGS) are powerful methods of investigating mathematics, but institutional licenses for Mathematica or Geometer's Sketchpad can be quite expensive. Graphing calculators with CAS and DGS software exist, at a cost of a few hundred dollars. Does this mean CAS/DGS will only exacerbate the gap between rich and poor institutions? Not at all: those on more modest and realistic budgets can turn to open source software.

"Open source software" is software whose code is freely available for anyone who wants to examine and modify it. For the computer gurus this means that if they find a bug in the program, they can fix it; if they decide the program needs additional features, they can add them. Periodically, these changes are collected and a new version of the software is released.

The main implication for non-programmers is that open source software is free, since there is no reasonable way of apportioning profits among the programmers. Unlike "free" or "student" versions of proprietary software, there is no functional difference between versions. For mathematicians, the open source model has another advantage: proprietary software is a black box that delivers answers with no means of verifying their validity. Open source CASs have their source code available for examination.

Do you "get what you pay for?" In some cases, yes. But in many cases, open source software is as good (or better!) than proprietary equivalents. For example Open Office includes word processing, spreadsheet, presentation, and drawing software that rival (and in some cases, surpass) their commercial equivalents. Mozilla and Firefox, popular web browsers, are open source, as is the Linux operating system. Those who work on open source software do so because they enjoy it, and not because of the monetary rewards; in that sense, being an open source programmer is a lot like being a teacher!

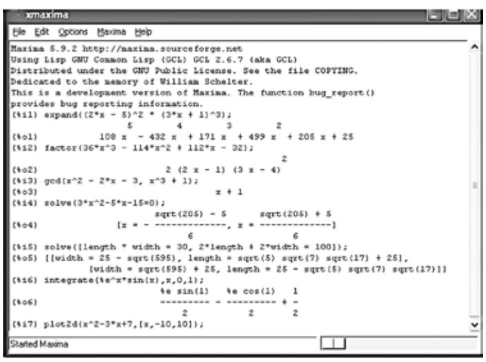


Figure 1: Maxima Commands

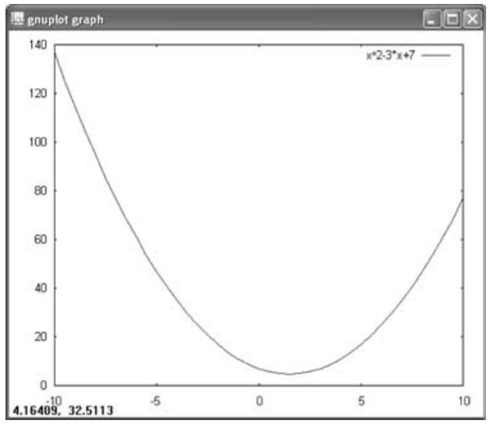


Figure 2 Graphs in Maxima

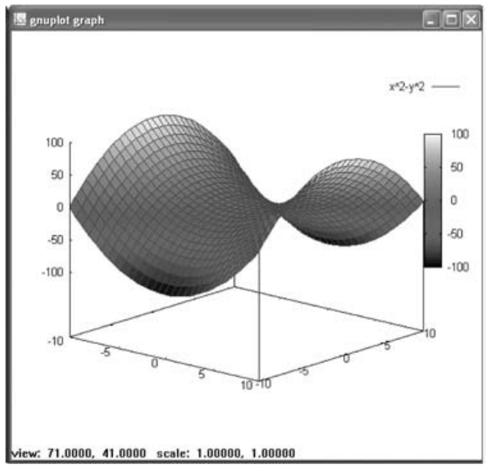


Figure 3: 3D Graph

Maxima

Open source CAS include CoCoA, done by a group at the University of Genoa; Eigenmath, a limited but easy-to-use system for algebraic operations; and Maxima, a general purpose CAS. Maxima was one of the first CAS being developed in the 1960s at MIT under the name Macsyma; it has been open source since 1998. Some examples of Maxima in action are shown in Figure 1.

While Maxima does not display math as cleanly as the current version of Mathematica, in terms of functionality and ease of use, it rivals its proprietary competitors. The main limitation of Maxima is that while it can graph several functions on the same graph (and its 3D graphing capability is excellent and allows "point and drag" manipulation of the graph to view it from different perspectives), it does not seem possible to display more than one graph simultaneously. In fact, if you have it display a graph, execution of a sequence of statements pauses until the graph window is closed (Figure 2 and Figure 3).

GeoGebra

Open source DGS includes C.a.R. ("compass and ruler," the English version of Z.u.L), KSEG, and GeoGebra, my own favorite. GeoGebra was developed by Markus Hohenwarter and Yves Kreis, and is hosted at the University of Salzburg. It is available in several languages (including German and Austrian). Like Maxima, it is comparable to its proprietary competitors.

GeoGebra has a built-in Cartesian coordinate system, and accepts both geometric commands (drawing a line through two given points) and algebraic ones (drawing a curve with a given equation). Among its more interesting features is the ability to draw tangent lines to algebraic and even transcendental curves at given points (Figure 4). You can also export your dynamic geometry construction as an interactive java applet to embed in a web page (See figure 5).

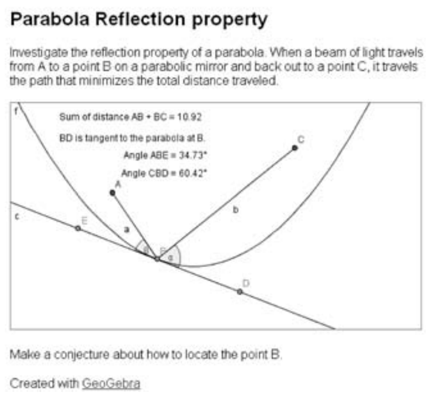


Figure 4: Constructing an Advanced Locus

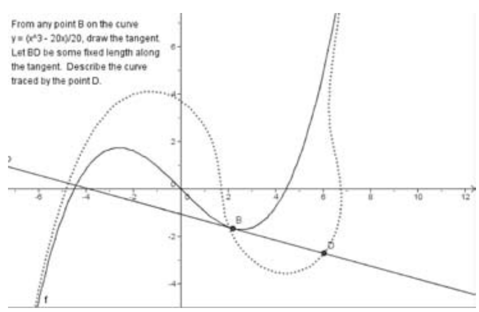


Figure 5: Interactive Web Page

More information about the ideals and implementation of the open source movement, including the the GNU general public license that applies to many open source packages and links to many of them, can be found at the GNU web site.

Jeff Suzuki (jeff_suzuki@yahoo.com) *is an Associate Professor of Mathematics at Brooklyn College. His interests include the history of mathematics, integrating technology into the curriculum, and songwriting.*

Web Addresses:

Open Office: http://www.openoffice.org

Mozilla: http://www.mozilla.org

Firefox: http://www.firefox.com/

Linux: http://www.linux.org

CoCoA: http://cocoa.dima.unige.it

Eigenmath: http://eigenmath.sourceforge.net

Maxima: http://maxima.sourceforge.net

C.a.R.: http://www.z-u-l.de

KSEG: http://www.mit.edu/~ibaran/kseg.html

GeoGebra: http://www.geogebra.at

GNU: http://www.gnu.org

Mathematical Imagery at the AMS

The American Mathematical Society has created a Mathematical Imagery web site, located at http://www.ams.org/mathimagery/. "The connection between mathematics and art goes back thousands of years," it says. "Mathematicians and artists continue to create stunning works in all media and to explore the visualization of mathematics — origami, computer-generated landscapes, tesselations, fractals, anamorphic art, and more." The site includes a large collection of images that can be viewed and even sent to friends as e-postcards. It also includes links to galleries, other web pages, and articles about art and mathematics.

Advertise!

By Richard Ehrenborg

These days it is not enough to teach interesting courses. We also have to attract students to take our courses. Even more so, we have to attract and retain students in the sciences and in mathematics.

I have been teaching a junior level course called *Applicable Algebra* at the University of Kentucky. The course begins with elementary number theory in order to cover topics including RSA, primality testing and factoring large integers. The course then continues to discuss polynomials in order to introduce finite fields and turn the attention to error correcting codes, such as BCH codes. The course focus is on the applications and how the mathematics supports them. The course aims to make mathematics appealing to the students. The goal is twofold: First, to encourage students to major in mathematics; second, to attract students from other majors, such as computer science, to double major in mathematics.

How does one get the word out to potential students? Advertise! Inspired by the NSA advertising campaign to hire mathematicians, I made a collection of posters. I handed them out to interested students and posted them around campus.

Here are the posters and some short explanations and references.

Shuffle a deck of cards
eight times.
Do it perfectly each time.
Then you are back to
where you started.
Nice card trick.
Why does it work?
If you are curious, take
CS 340/Math 340
Spring 2006

The perfect shuffles mentioned here are out-shuffles, that is, the top card stays on the top. For a deck with an even number n of cards, label the positions 0 through n–1. Now a perfect out-shuffle brings the card in position x to position $2x$ (mod n–1). So what we need to verify is that 2^8 is congruent to 1 (mod 51).

How do
pineapples
relate
to the
greatest
common divisor?
If you are curious...

Two consecutive Fibonacci numbers are the worst case scenario for Euclid's algorithm. Consecutive Fibonacci numbers also appear when counting spirals on pineapples and pine cones.

WHAT DO
CICADAS
KNOW
ABOUT
PRIME
NUMBERS?

Assume that the cicadas appear every n years. A predator that appears every k years, where k is a divisor of n, can happily eat away. Hence the fewer divisors the period n has, the more likely the cicada population will survive. Prime numbers provide the minimum. See the article by Meredith Greer in the February 2006 issue of FOCUS.

FERMAT
THOUGHT
4294967297
WAS
PRIME.
HE
WAS
WRONG.

The number in question is $2^{2^5}+1$ Euler showed that 641 is a prime factor. There is a nice way to do this using the fact that $641 = 2^7 \times 5 + 1 = 5^4 + 2^4$.

HOW
DID
THE
TWIN PRIMES
824633702441
AND
824633702443
IMPROVE
YOUR
PENTIUM CHIP?

In the computation of Brun's constant, Tom Nicely discovered that the Pentium chip could not divide. See the nice article byBarry Cipra in *What's Happening in the Mathematical Sciences 1995–1996*, pages 38–47.

WHY
IS
THE INEQUALITY
$$|\ln(lcm(1,2,\ldots,n)) - n| \leq \sqrt{n}\left(\ln(n)\right)^2$$
FOR N AT LEAST 100
WORTH
$1,000,000?

This inequality is equivalent to the Riemann Hypothesis, something that we all should care about.

HOW ARE
AN OLD GREEK,
A FRENCH LAWYER AND
A SWISS MAN
INVOLVED IN
YOU SENDING
YOUR CREDIT CARD NUMBER
OVER
THE INTERNET?

Fermat's little theorem and Euler's theorem are the basis of RSA, the first public key crypto system. Euclid also belongs since his algorithm allows us to find the decoding exponent from the encoding exponent and the secret factorization.

YOUR FRIEND (?)
CLAIMS THAT
34034065601122854197959819122215174693
IS A PRIME NUMBER.
HOW DO YOU
PROVE HER/HIM
WRONG?

Primality testing is important when you need primes for your own RSA crypto system.

What is the probability
that two people
in this room
have the same
birthday?
What does this
have to do
with
factoring
LARGE numbers?

For a year with P days and about persons, the probability is about $\sqrt{\ln(4)P}$ fifty-fifty. This fact is used to show that the Pollard Rho factoring method will factor a number N in $O(P^{1/2}) \leq O(N^{1/2})$ steps, where P is the smallest prime factor of N.

How come
your cat
can scratch
your favorite CD
and
still
it
sounds
great?

HOW DO YOU SEND
PICTURES
FROM MARS
OVER
NOISY CHANNELS
AND STILL
GET
A CLEAR PICTURE
TO GIVE
TO CNN?

The answer to both of these questions is error correcting codes. It is amazing that your CD-player can lose 2.5 mm of track and you will not hear the difference. Also note that NASA put high resolution cameras on the two Mars rovers in order to make both scientific observations and good PR for themselves.

The
NEW
engineering
MATH:
error correcting codes
and
public key cryptography.

These topics are what we mathematicians should be teaching our computer science and engineering students.

There are three people.
On each person we put either
a blue or red hat.
Each person can see
the color of the hats of the other two.
At the same time they have to guess
the color of their own hats.
If any of them is wrong, they lose.
If at least one of them is right they win
$1,000,000.
What is their best strategy?

This hat problem is related to Hamming codes, the first known class of error correcting codes. See Mira Bernstein's article in the November 2001 issue of FOCUS or the article by Joe Buhler, "Hat Tricks," in the Fall 2002 issue of *The Mathematical Intelligencer*.

Fun and interesting advertising is one way to attract more students to our classes. Finally, recall what Oscar Wilde wrote in *The Portrait of Dorian Gray*: There is only one thing in the world worse than being talked about, and that is not being talked about.

Richard Ehrenborg is Royster Research Professor at University of Kentucky. He can be reached at jrge@ms.uky.edu.

AP Calculus: Friend or Foe?

By Susan Schwartz Wildstrom

It is often argued that there is a "rush to calculus" in the school curriculum. Students, teachers, and everyone else act as if learning calculus was the goal of school mathematics. Along the way, other things might be neglected, leaving students without a good foundation for future courses. Is AP Calculus a friend or a foe?

It is not the rush to calculus that has weakened the preparation our students have for doing advanced (never mind advanced, any) mathematics. Rather, this is the result of the weaker preparation of teachers who serve our elementary school students and the dilution of the curriculum of the other high school courses (algebra, geometry, precalculus). The 1989 standards emphasize relevance, use of real-world data, data collection, data analysis, and technology (replacing drill and practice). Pursuing these goals has taken a lot of class time away from the teaching of solid mathematical processes including algebraic operations and equation solving.

Let's start with elementary school. If students could complete elementary school with a mastery of the basic operations for whole numbers, decimals, and fractions, then their middle and high school experiences could be more productive.

I believe that children arrive in school as eager learners. We can encourage or discourage them by our attitudes and enthusiasms. The classroom teacher is a major force influencing how and what these students learn. If the teacher conveys the impression that math is hard, we should not be surprised that students internalize that attitude as well. (If the big person can't do something, how could little old me do it?)

I fear that many elementary school teachers have not been required to take enough mathematics to actually understand clearly how the mathematics works. They may have taken methods courses in which just one way to do a particular operation is taught. Later, when a clever student offers an unusual approach the most common teacher reaction is to say "No! That is not the way I taught it." While teachers should be wary of "dumb-luck" methods of getting an answer, they should also examine them carefully enough to assess if they are in fact valid. And, if the alternatives are valid, teachers should strive to understand how the alternate processes work and even try to incorporate them as a part of their future teaching.

Since the mid-1980s, I have argued for math specialists in every elementary school. No school would be without a reading specialist, why not a math specialist too? Some of the services that this person could provide include information about multiple methods for teaching a concept, remediation for students who are having difficulty mastering a concept, enrichment for students who are ready for extensions of grade-level concepts, teacher encouragement, support and in-service training.

Then there is our actual high school curriculum. Its organization seems to waste a lot of time teaching mathematics as just so many individual isolated processes, unrelated one to another. Students end up wasting a lot of their effort learning these concepts in isolation. When students actually *do* see the connections of processes to one another, they are able to learn more quickly and easily because their understanding of earlier concepts can be brought to the new ones.

Students (sometimes) learn, for example, to factor quadratic polynomials. They learn to solve quadratic equations using the quadratic formula. They learn to graph quadratic functions on their calculators. It is surprising how many of them do *not* realize that setting a factor to zero and solving produces the same value that the quadratic formula does and that that very value is the x-coordinate of the point where the graph is crossing the x-axis. Does this make sense?

In some textbooks, complex numbers are taught before simplification of radicals. Current algebra (1 and 2) textbooks no longer contain an important theorem that appeared in every algebra textbook when I started my career in 1969: $\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$ if and only if $a, b \geq 0$. Are we surprised, then, that students who learn about complex numbers before simplifying radicals give us bizarre negative or complex valued answers for problems that should be straightforward? Several years ago, two colleagues who were teaching Algebra 2 in my school came and asked me why a student couldn't claim that $\sqrt{36} = -6$ by arguing as follows:

$$\sqrt{36} = \sqrt{-9} \cdot \sqrt{-4} = 3i \cdot 2i = -6.$$

My answer to them was to state the theorem about the values having to be non-negative, but when we looked at the book we were using as a textbook, it was nowhere to be found. I pulled out an older (1960s or earlier) text and, naturally, there it was. Alas, these days students getting teaching certification for grades 7–12 may have had a topology course (not part of my math major in 1969), but may not realize that $\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$ if and only if $a, b \geq 0$.

All students now seem to have the technology — a graphing calculator is a standard requirement for most high school classes — but they seldom understand how to use it judiciously. They will turn it on to compute 9 x 5 yet they will return from the AP exam and ask me how they were supposed to find the point of intersection of $f(x) = 3x^2 + 2$ and $g(x) = \cos x$.

A friend and colleague of mine, who also taught calculus for many years, used to wonder why we taught calculus concepts in algebra 1 and 2. (Our school system has units on functions in the algebra course; they seem to leave the kids more bewildered about functions when they are done than when they started. These units include the notions of increasing, decreasing, and continuous functions; they also discuss maxima, minima, end-behavior, etc). If we were using the time we spend on those ideas to teach polynomial operations, factoring, solving equations, deeper understanding of these ideas and how they actually connect to one another, I believe the time would be better spent. In calculus we teach these concepts (increasing, decreasing, continuity, end behavior, maximum and minimum values) again, and I am not convinced that the students grasp them more quickly because of the earlier exposure. Maturity matters more.

I don't like having to stop in the middle of a calculus lesson to teach factorization of quadratic functions, why setting a factor equal to zero produces a root, and so many other topics that I always considered basic ideas of elementary algebra. I believe my calculus students would have a far easier time learning the difficult calculus notions if we didn't have the mid-topic distraction of having to review an algebraic step that is needed to complete a process.

I do believe that those students who survive calculus in our high school classes are likely to be well-served. If the course we offer in high school (which is likely to meet five days a week for forty-five minutes a class and for 36 weeks — I suspect that "block scheduling" is another fad that will eventually be cycled back out of schools) involves filling in the algebra and geometry gaps that are left by what I view as an inadequate curriculum, and if the course takes the time to explain not just how to get answers but what we are doing and why it works, then the students will arrive in math departments at universities ready for more advanced work.

The AP test does seem to do a fairly good job of detecting whether the test takers have some understanding of what calculus is about or not. Thus, students who score 4 and 5 seem to be demonstrating a readiness for college mathematics. I am not sure whether a 3 should still qualify a student to advance to a second semester course without additional proof of competency (perhaps the new MAPLE/MAA placement materials could serve that function), and I am certain that scores below 3 give evidence that a student should plan to retake calculus to build the depth of understanding that isn't yet there.

Should we be discouraging students from taking AP Calculus? Probably not. But, as I try to do, we should be looking at these people carefully early in the year, and if we see that they are too poorly prepared to succeed even with the extra algebraic support that we offer in the course, we should try to have them take a course that is more likely to help them build up the needed strength. In my school (and many others, I believe) we offer a non-AP, non-rigorous, "Calculus with Applications" class that helps students learn "how" to take derivatives and such while spending an even greater amount of time building the algebraic and trigonometric skills and understanding that is lacking. These students can enroll in Calculus 1 at their colleges with stronger basics and an introductory sense of the major concepts of calculus. They can, if they will, use this computational knowledge of limits, derivatives and integrals to help them take the time to learn more about the concepts that underlie these processes, and they too should be able to be successful in future mathematics courses.

Susan Wildstrom is the MAA Governor-at-Large representing High School Teachers. This article is based on a presentation given at a Joint Mathematics Meetings special session entitled "AP Calculus: Friend or Foe?"

In Memoriam
Karen Dee Michalowicz (1942-2006)

By Victor Katz

Karen Dee Michalowicz died on July 17, 2006 at the age of 63. She was a nationally recognized mathematics teacher at the Langley School in McLean, Virginia, having received the Presidential Award for Mathematics Teaching in 1994. Karen was especially interested in the use of history in the teaching of mathematics. In that role, she co-directed the NSF-sponsored, MAA administered grant program, *Historical Modules for the Teaching and Learning of Mathematics*, beginning in 1998. That program involved about twenty-five college and high school teachers of mathematics, who produced such a large amount of material for teaching mathematics using history that the MAA was forced to publish it as a CD. In 1998, she was also invited to participate in the study group on History in Mathematics Education, organized by the International Commission on Mathematical Instruction. After an intensive week of discussions, the group ultimately co-authored the ICMI Study, *History in Mathematics Education*, which appeared in 2000. Karen was in charge of the group writing the chapter on "History in support of diverse educational requirements — opportunities for change". Over the years, she had amassed a huge collection of mathematics texts from the nineteenth century and earlier, a collection whose contents she enthusiastically shared with students and colleagues in many presentations at national and international meetings. She will be greatly missed by her numerous friends and colleagues in the MAA, the WME, the NCTM, and the Benjamin Banneker Association, among others.

MAA is Seeking a Associate Director for Student Activities

The Mathematical Association of America (MAA) seeks an Associate Director to oversee a wide range of activities for both undergraduate and graduate students and to develop new initiatives to advance the MAA in the area of student services and programs.

The Associate Director will provide both programmatic and administrative supervision to ongoing activities, such as the MAA Student Chapter Program, undergraduate student paper/poster sessions and poster sessions and workshops for graduate students at national meetings. Working with the Committee on Undergraduate Student Activities and Chapters and the Committee on Graduate Students, the Associate Director will seek to identify successful programs currently in place in MAA's Sections that are suitable for expansion, and develop new programs such as establishing a national network for student chapters.

The Associate Director will oversee externally-funded programs for students and will develop proposals to continue existing programs and to establish new programs. The Associate Director will lead MAA efforts to develop a comprehensive collection of web-based resources for students, and work with other MAA staff and member volunteers to build an MAA student website that will be the primary web destination for students of mathematics at the undergraduate and graduate levels.

The Associate Director for Student Activities will report to the Director of Programs and Services. The successful candidate will have an advanced degree in one of the mathematical sciences, and experience working with students both in and outside of the classroom through math clubs and/or mentoring undergraduate research. Experience using on-line instruction or development of web content is a plus. Though this is a continuing position, we welcome applications from faculty members who wish to take a leave of absence from their current position.

The mission of the MAA is to advance the mathematical sciences. The MAA, with almost 30,000 members, is the largest professional association with a focus on mathematics that is accessible at the undergraduate level. Membership includes college and university faculty and students, high school teachers, individuals from business, industry and government, and others who appreciate mathematics.

Applications will be accepted and reviewed as received, but it is expected that the position will begin July 1, 2007, though a January 2007 start date will be considered. The position is located at the national headquarters of the MAA in Washington, DC. Salary will be based upon the candidate's credentials or current salary for a reassignment position. The MAA offers a generous benefits package.

Candidates should send a resume and letter of interest to:

Ms. Calluna Euving
Chief of Staff
Mathematical Association of America
1529 18th Street, NW
Washington, DC 20036

Applications may be submitted electronically to ceuving@maa.org. References will be requested after review of applications. Applications from individuals from underrepresented groups are encouraged. Additional information about the MAA and its programs and services may be found on MAA's website: http://www.maa.org. AA/EOE.

Measuring The Perception of Leadership

By Randall J. Covill

What does mathematics have to do with leadership? Quite a lot, in the sense that mathematics can be used to measure public perceptions of the presence of leadership attributes. I was recently reminded of this while reading a book on leadership attributes and an article in the SIAM Journal on Optimization about efficiently finding the median or centroid of a set of multi-dimensional data.

According to the book on leadership, common leadership attributes include respect for others, a willingness to reciprocate, shared experiences, trust, and mutual fun. It occurred to me that members of a group can be ranked in terms of the extent to which they are perceived as displaying leadership attributes. The Euclidean distance between rankings can be calculated and the SIAM algorithm for efficiently finding the median of a set of multi-dimensional data points can be used to identify the median or central member of a group of leaders.

I tried this with the following data set:

1 ,2, 3, 4, 5
1, 2, 2, 2, 5
2, 1 ,3, 4, 5
5, 4, 3, 2, 1
5, 4, 4, 4, 1

I found that the median was the leader with attribute rankings 1, 2 ,3, 4, 5 and the smallest possible sums of distances to other data points is 16.1.

Note that although the leadership attribute scores themselves are subjective, calculation of the sums of distances between scores is not subjective. The calculations are based on very basic vector and Euclidean distance calculations. What was the value of measuring leadership attributes in this fashion? In my opinion, such measurements demonstrate that public perceptions of leadership can be quantified, ranked, and used by the public to identify extreme and centrist leaders.

Randall Covill's life has truly been a journey, not a destination. His academic background includes degrees in computer science, finance and business, law and as soon as he finishes his current studies a masters degree in quality assurance and regulatory affairs.

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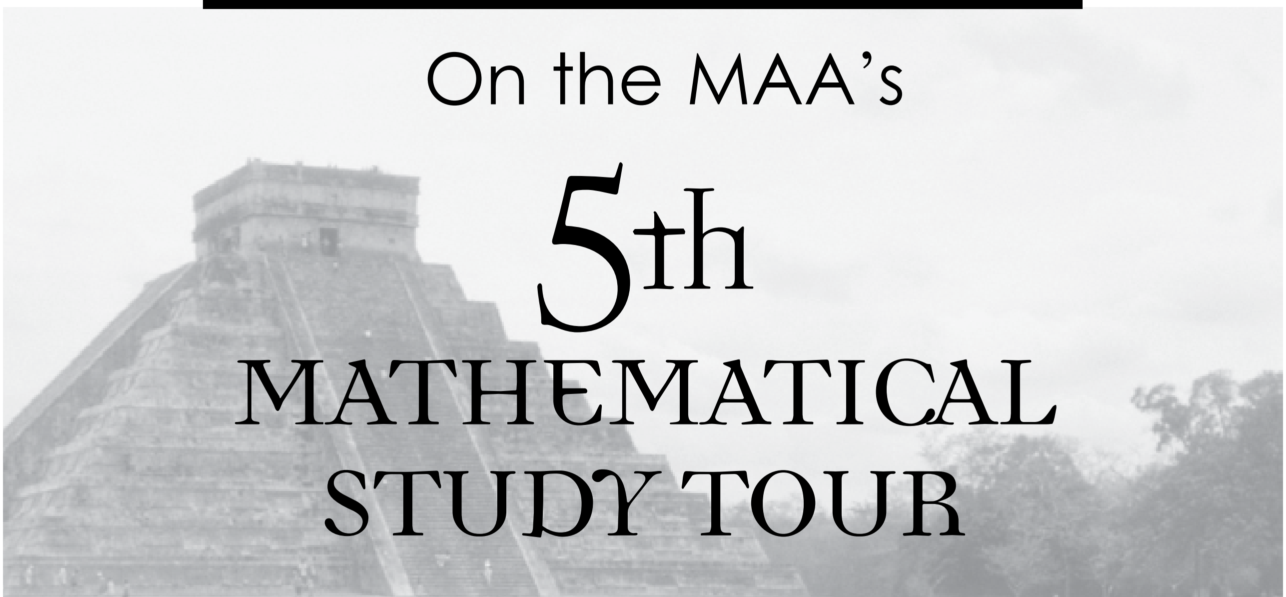

December 26, 2006–January 2, 2007

Full details, itinerary, and application, are available on MAA Online (www.maa.org).

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College Algebra Redesign at Louisiana State University

By Lawrence Smolinsky, Phoebe Rouse, George Cochran, Jimmie Lawson

LSU is restructuring its precalculus and other introductory mathematics courses with a variety of changes in delivery. In this article we consider one aspect of this new structure, which gave us an opportunity for a large scale comparison involving 2500 students using three delivery systems.

Part of the motivation for restructuring these courses was to direct resources to the place where they were most appropriate. Redesigning College Algebra is one part of a larger plan. Other introductory courses have also changed; the graduate program was expanded; the tenure-track faculty expanded; additional opportunities for undergraduate research were created; and a new partnership was formed with an LSU interdisciplinary institute, the Center for Computation and Technology.

Each course change required effective ways to use technology and a reconsideration of the division of labor and the use of our resources. For College Algebra, we had a few instructors whom we consider star teachers of pre-calculus — popular with students and believed to be very effective — but not enough of these teachers to cover the large enrollment of our introductory courses. These exceptional teachers can do an effective job in large classes of up to 200 students, but we believe that large classes are not appropriate for graduate students to teach and so we looked for alternatives.

Table I
Fall 2005 Math 1021 College Algebra
Final Exam Medians, Grade Pont Averages, and Drop Rate

Model	Final Exam Median	Number of Students	Grade Point Averages	Drop Rate
Traditional	128	743	2.11	28%
Large Lecture	152	841	2.58	20%
R2R	146	922	2.14	29%

Prior to 2004, College Algebra was taught in high-school style classes of approximately 44 students each. Classes were taught by instructors who were non-tenured teaching faculty with master's degrees or by graduate students. The department is now moving toward a computer-based system that requires more of the individual student but offers extensive support. The state, the university, and the students have made a one-time investment of over 1.1 million dollars in a large teaching laboratory (the LSU Math Lab) to supplement the new system. Tutors are available in the lab 60 or more hours per week to answer any questions students have on an individual basis. The new system is part of a US Department of Education FISPE funded program call the Roadmap to Redesign (R2R), which (for mathematics) involves universities, colleges, and community colleges in a project of pre-calculus redesign. The predecessor to R2R was the Program in Course Redesign (PCR), which was sponsored by the Pew Charitable Trusts. We often consulted the PCR alumni schools, particularly the University of Alabama and the University of Idaho.

As part of our transition away from the old system, we offered College Algebra in three formats in the fall of 2005: the traditional format, a 175 student large-lecture format with computer support, and the R2R format. The latter two formats both used MyMathLab software and required both computer homework and computer quizzes and testing for all assessments. Exact answers were required for the computer assessments. In the traditional format, sections were administered in the same manner as they have been for the last twenty-five years. Individual teachers wrote (with the guidance of the course coordinator) and graded with partial credit, each of the assessments. Students met with their teacher for three class periods. Graduate students, some of whom had experience teaching the course in previous semesters, taught these sections. The enrollment (after the initial add/drop period) was 743 students. In the large lecture format, students met with their teacher for three class periods and had computer assignments. Sections were initially capped at 175 students each. Students had required computer-based homework, quizzes, and tests. The star college-algebra instructors taught these sections. The enrollment was 841 students. In the R2R format, students met for one period with their teacher in a classroom initially capped at 44 students. They were also required to spend a minimum of 2 flexible hours each week in the LSU Math Lab. A 200-point, common, group-graded final exam was given to all the students at the conclusion of the course. Since students had taken different sorts of exams all semester, some students were going to be at a disadvantage on the final. The final exam was in the traditional style, i.e., hand written with partial credit.

Table II
Fall 2005 Math 1021 College Algebra
Participation Grade Compared to Final Grade in R2R Sections

Participation Grade	# of students receiving ABC	# of students receiving DFW	Total # of students
90-100%	182	30	212
80-89%	80	25	105
70-79%	50	21	71
60-69%	43	19	62
50-59%	11	30	41
0-49%	13	190	203
Total	379	315	694

Man plans, God laughs. When the second week of classes was to begin, Hurricane Katrina struck. Many LSU students were directly affected. Many of the students' families lost their homes. Some temporarily moved into the dorms with their children. When College Algebra students were surveyed at the end of the semester as to whether they were directly affected by Katrina,

Table III
Fall 2001-5 Math 1021 College Algebra
Median of Final Exam Medians of Instructor and TA Sections (out of 200 points)

Semester	Delivery Format	Median of Instructor-Taught Section Medians	Median of TA-Taught Section Medians	Difference between Medians
Fall 2005	R2R	146.25	143.5	2.75
Fall 2004	Traditional	154	149	5
Fall 2003	Traditional	147.75	137	10.75
Fall 2002	Traditional	145	132.5	12.5
Fall 2001	Traditional	149.5	145	4.5

Table IV
Fall 2002-5 Math 1021 College Algebra
Student Evaluation of Teaching (SET) Scores (scale of 1 to 5)

Instructor	R2R Sections	Traditional Sections
1	4.52	4.5, 4.7, 4.74, 4.75 (4.67 average)
2	4.57	4.9, 4.8, 4.64, 4.50 (4.71 average)
3	4.83, 4.74, 4.38 (4.65 average)	4.8, 4.82 (4.81 average)
4	4.58	4.16, 4.61 (4.39 average)
Method Average	4.58	4.65

half answered "yes," and many in especially large handwriting. Classes were disrupted, but the R2R sections were most affected. The university used the R2R lab as a registration center to register 3000 visiting students from New Orleans schools. The R2R students were moved to another temporary facility or worked on their own in other campus labs. This disruption occurred at the beginning of the semester, when many needed guidance with the software and the complex scheduling the course relies upon to function properly. The lab was also closed for several days surrounding Hurricane Rita and again when the New Orleans Saints games were held on campus.

Data was examined for a variety of factors, but comparison was partly limited by the previously available historical data. Final exam medians in the 3 delivery systems were compared as a measure of learning outcomes. Within the R2R system, we examined results to determine whether final grades were correlated to participation. Final exam medians of sections taught by star instructors were compared to final exam medians of sections taught by graduate students to check the sensitivity of learning outcomes to the experience of the teacher in both the traditional and R2R methods. And finally, student responses were gathered from Student Evaluations of Teaching (SET) and compared across the two delivery systems.

The results of the common final exam are given in Table I. One surprise was the success of the large lecture model. Its success may require the star instructors, or it may be due to the fact that these students were required to spend more time doing college algebra, i.e., three periods in class and monitored computer homework. The R2R model did well in comparison to the traditional model. PCR alumni schools have warned us that it takes several years for students to acclimate to the new demands of participation.

The success of the system for those who participate is shown in Table II. To receive a participation grade of 100% students had to attend the 50 minute focus group and spend 2 hours in the lab each week. Note that 86% of the students who participated at least 90% of the required time earned a grade of A, B, or C. This is a strong indication that students who participate in the R2R model are likely to be successful with a reasonable amount of effort. We did not compare ABC rates across the three methods because of the grading discrepancy.

Table III shows the comparison of the median of the final exam medians for all sections of the course taught by instructors compared to the median of the final exam medians for all sections of the course taught by TAs in the fall of 2001-4 using the traditional approach and in the fall of 2005 using the R2R approach. It appears that the final exam success of the students is less sensitive to the experience level of the teacher in R2R method than it is in the traditional sections.

Four instructors with recent experience in the traditional format taught in the R2R format in the fall of 2005. We can compare SET scores for these instructors on the question "Overall, the instructor was an effective teacher," to measure student satisfaction across the two methods. The SET questionnaire was not written to compare delivery the two methods, but is a questionnaire from the college concerning student's opinion of the teacher and his or her methods. We examined results in the R2R sections in fall 2005 verses the results in the traditional format from falls 2002-2004. The results are in Table IV. It appears that there is at most a small difference between the evaluation averages of the R2R sections and the traditional sections. While SET do not measure students satisfaction with R2R, a separate survey was administered. Students were asked if they would recommend this format to their friends and 59% answered "yes."

A comparison of the section GPA with the final exam median in Table I makes it apparent that the R2R sections were graded more harshly than the traditional sections. The difference is the grading on the 75% of the grade that was not necessarily based on the final: The R2R students were graded on getting the right answer and the traditional students were graded with partial credit. Students greatest complaint is that the lack are partial credit impacts their grade. Adjustment of the grading scale is a point of controversy among the faculty.

The R2R redesigned model will continue to develop in future semesters, and we will continue to assess the results. A few technical adjustments and additions are already planned for the fall semester of 2006. We also plan to follow the students' progress in subsequent courses in a variety of subject areas beyond mathematics. Overall, we are quite pleased with the success of this redesign and plan to implement this model in other precalculus courses in the near future.

The National Mathematics Advisory Panel — An Update

By Fernando Q. Gouvêa

The May/June issue of FOCUS included a report about the creation, by Presidential order, of a National Mathematics Advisory Panel, intended to advise the President and his Secretary of Education about the results of research in mathematics education and how they might be used to improve the teaching of mathematics in American schools. Since then, the members of the NMP have been appointed and its first meetings have occurred.

Larry Faulkner, president of the Houston Endowment and President Emeritus of the University of Texas at Austin, will be chairing the panel. The vice-chair will be Camilla Benbow, Dean of Education and Human Development, Vanderbilt University, Peabody College. Other members likely to be known to our readers include Deborah Ball of the University of Michigan, Francis Fennell (president of NCTM), Liping Ma of the Carnegie Foundation, Wilfried Schmid of Harvard, Jim Simmons of Renaissance Technologies, and Hung-Hsi Wu of Berkeley. A full list of members can be found online at the NMP web site, at http://www.ed.gov/about/bdscomm/list/mathpanel/.

The first meeting of the panel happened on May 22 and the second was on June 28 and 29. Transcripts of the meetings are posted online; the Department of Education also offers interested members of the public an opportunity to subscribe to email updates about the panel's work.

Controversy is already swirling around the panel's work. Almost immediately after the appointment of the panelists, critics objected that the panel was weighted towards critics of the NCTM and its *Principles and Standards for School Mathematics*. Also noted was the fact that only one K–12 teacher is on the panel. The Association of Women in Mathematics objected to the panel's vice-chair, Camilla Benbow, who is the author of three research articles published in the 1980s in which she argued that there are "intrinsic gender differences that favor males at the highest levels of mathematics." Benbow told the press she stands by her results, but pointed out that they represent only one small portion of a long research career.

Most of the panelists have argued that these are over-reactions. Deborah Ball was quoted arguing that the AWM's objections are misguided, saying that "having people snipe at the panelists does not help things." Tom Loveless, a senior scholar at the Brookings Institution who is also a member of the panel, argued that in fact the panel represents "an opportunity to cut through a lot of the noise surrounding math."

The NMP is expected to submit an interim report by January 31, 2007.

The National Mathematics Advisory Panel — Commentary

By Victor Katz

The first meeting of the National Mathematics Advisory Panel took place on May 22 at the National Academy of Sciences building in Washington, DC. The panel has seventeen members and is chaired by Larry Faulkner, President of the Houston Endowment and President Emeritus of the University of Texas at Austin. Some of the panelists should be familiar to members of the MAA, including Deborah Ball of the University of Michigan, Liping Ma of the Carnegie Foundation, Francis "Skip" Fennell, the President of the NCTM, and two research mathematicians, Wilfried Schmid of Harvard and Hung-Hsi Wu of the University of California, Berkeley, who have been vocal critics of recent reforms in mathematics education. Other panelists are Vern Williams, a middle school mathematics teacher from Fairfax, Virginia who was a 1994 Sliffe award winner and has had great success in developing Mathcounts teams, Jim Simons, a 1976 winner of the AMS Veblen Prize in Geometry who is now the president of Renaissance Technologies Corporation, a very successful investment firm using mathematical strategies, five professors of psychology or human development, three educational consultants, and a former California elementary school principal whose school saw great gains in standardized test scores in reading and mathematics under her leadership. It is surprising, perhaps, that Professor Wu is the only member of the MAA on the panel. And, although most of the panelists have made contributions toward mathematics education in their professional lives, it is also curious that the panel failed to include even one expert elementary teacher of mathematics.

As was made abundantly clear in the opening public meeting by several of the ex-officio members of the panel from the White House and the Department of Education, the goal of the panel is to examine the research literature on the teaching of mathematics, determine which studies are "rigorous" and "scientifically-based" rather than "anecdotal," suggest possible avenues for additional research, and craft recommendations that will "inform the future." Of course, the criteria for determining whether or not a study is "rigorous" were not specified. Nevertheless, the NMP is charged with investigating studies in at least the following five areas:

(1) the critical skills and skill progressions for students to acquire competence in algebra and readiness for higher levels of mathematics;

(2) the role and appropriate design of standards and assessment in promoting mathematical competence;

(3) the process by which students of various abilities and backgrounds learn mathematics;

(4) instructional practices, programs, and materials that are effective for improving mathematics learning; and

(5) the training, selection, placement, and professional development of teachers of mathematics in order to enhance students' learning of mathematics.

The panel members spent some time at their meeting discussing the meaning of these five categories, and it was clear that there is a great diversity of opinion among the group. Numerous questions for study were brought up, ranging from "what do we mean by algebra?" to "is pattern recognition in the early grades an important pre-algebraic skill?"; from "what is the relationship of teacher Praxis scores to their students' achievement?" to "what is the evidence for the effectiveness of particular commercial textbooks?"; from "is ability grouping constructive or destructive?" to "how can we keep mathematics teachers in the teaching profession?".

The NMP is planning to divide itself initially into four sub-panels, who will separately deal with items 1, 3, 4, and 5 in the list above. They may schedule public hearings and invite testimony from concerned individuals or organizations. But in any case they will be interested in hearing from mathematics educators at various levels. To find out more information about the panel and to contact it, go to http://www.ed.gov/about/bdscomm/list/mathpanel/index.html.

It should be noted that a similar committee with a similar charge, the Committee on Mathematics Learning (CML), was established in 1998 by the National Research Council at the request of the National Science Foundation and the U.S. Department of Education. Three years later, that committee produced its report: *Adding It Up: Helping Children Learn Mathematics* (Washington: National Academy Press), a 454-page book containing numerous serious recommendations for mathematics education, based on a multitude of research results. (See the review on MAA Reviews.) Interestingly, Professors Ball and Wu were members of the CML and authors of its final report. Among the CML's recommendations were:

(1) All students should become mathematically proficient. That is, they should possess conceptual understanding, skill in carrying out procedures accurately and appropriately, the ability to formulate and solve mathematical problems, the capacity for logical thought, and the habitual inclination to see mathematics as sensible, useful, and worthwhile.

(2) Instruction should not be based on extreme positions that students learn solely by internalizing what a teacher or book says or solely by inventing mathematics on their own.

(3) Schools should support, as a central part of teacher's work, engagement in sustained efforts to improve their mathematics instruction. This support requires the provision of time and resources.

(4) Efforts to improve students' mathematics learning should be informed by scientific evidence, and their effectiveness should be evaluated systematically. Such efforts should be coordinated, continual, and cumulative.

These recommendations, and others, were fleshed out with numerous examples drawn from educational research studies. These studies include details on what children know about numbers by the time they arrive in pre-K and the implications for mathematics instruction and details on the processes by which students acquire mathematical proficiency with whole numbers, rational numbers, and integers, as well as beginning algebra, geometry, measurement, and probability and statistics. The committee noted, however, that there were many unanswered questions about mathematics learning that remained to be answered by further studies.

How the recommendations of the NMP will differ from those of the CML remain to be seen.

Victor Katz is a well-known historian of mathematics, author of several books and articles, including the well-known survey A History of Mathematics. He has long been interested in mathematics education.

Solution to Sudoku Puzzle from page 18

L	O	G	A	R	I	T	H	M
I	H	M	L	O	T	R	A	G
R	T	A	G	H	M	O	I	L
H	R	T	O	A	L	G	M	I
A	L	I	R	M	G	H	O	T
G	M	O	I	T	H	L	R	A
M	A	R	T	G	O	I	L	H
O	G	L	H	I	A	M	T	R
T	I	H	M	L	R	A	G	O

MAA is Seeking a Director of Publications for Journals and Communications

The Mathematical Association of America seeks a highly qualified person for the position of Director of Publications for Journals and Communications. The primary responsibilities of the position are to oversee journals and other periodicals and content and resources on the MAA website. In addition, the Director will perform other duties related to communications of the MAA to our members, the public, and other specific constituencies.

A candidate should have a PhD in the mathematical sciences. Requirements include editorial experience, writing articles for journals, periodicals, and the web, and experience with creating web content. The candidate should be familiar with the MAA, have a strong interest in writing and publication, and express a vision for MAA publications in print and online.

The Director oversees publication of the Association's three journals, three magazines (two online), the Association's newsmagazine, a variety of columns and articles, the MAA Mathematical Sciences Digital Library (MathDL) and the new MAA Gateway site to other digital libraries. In addition, the Director will oversee mathematical and professional resources on the MAA website and will develop content for new resources to serve our members and the public. The Director will be responsible for communications of the MAA such as reports, news articles, and public awareness pieces.

The Director will oversee a staff of three located in the headquarters office and numerous editors and editorial boards. Duties include administration of the department and grant proposal development and management. The Director reports to the Executive Director and is a key member of the MAA's staff leadership team. S/he will work closely with other members of the staff, national and sectional officers, committees and editors, and others in strategic planning and program development.

The mission of the MAA is to advance the mathematical sciences. The MAA, with nearly 30,000 members, is the largest association in the world with a focus on mathematics accessible at the undergraduate level. Membership includes college and university faculty and students, high school teachers, individuals from business, industry, and government, and others who enjoy mathematics.

The Director is responsible for ensuring that publications encompass the interests of all major constituencies of the MAA, embrace all areas of mathematics, and are easily available to all of our members and the larger community who are interested in mathematics, especially for expository mathematics and materials for faculty and students.

Applications will be accepted and reviewed as received, but it is expected that the position will begin between January 1, 2007 and July 2007. The position is located at the national headquarters of the MAA in Washington, DC.

Candidates should send a resume and letter of interest to:

Ms. Calluna Euving
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Applications may be submitted electronically to ceuving@maa.org. References will be requested after review of applications. Applications from individuals from underrepresented groups are encouraged. Additional information about the MAA and its programs and services may be found on MAA's website: http://www.maa.org. AA/EOE.

Found Math

Ah, so this was the little genius?

Gauss made a bow, as he had been taught. He knew that there would soon be no more dukes. Then absolute rulers would only exist in books, and the idea that one would stand before such a person, bow, and await his all-powerful word would seem so strange as to be a fairy tale.

Count up something, said the duke.

(Gauss meets the Duke of Brunswick, in Daniel Kehlman's short story "The Mathematician," published in *The Paris Review* 177, Summer 2006.)

Deadlines for FOCUS are Changing

In order to make sure FOCUS goes out on time, we need to move the deadlines for editorial copy slightly earlier than they have been. We are increasing the lead time from six weeks before publication to eight weeks before, so that the deadline for the issue for month n will be the first week of month n - 2 (mod 12). We may be able to squeeze in news items received after the deadline, but longer pieces should be delivered before the dates indicated. Please note, in addition, that the October and April issues are meetings issues and therefore do not include any editorial material.

FOCUS Deadlines

	October	November	December
Editorial Copy		September 1	October 1
Display Ads	August 20	September 24	October 27
Employment Ads	August 13	September 10	October 10

Photographs courtesy of John Nitsche, M.D.; ExperienceNewOrleans.com; and New Orleans Metropolitan Convention and Visitors Bureau, Inc.

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