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Robert Devaney Receives NSF Director's Award

Robert L. Devaney of Boston University was one of six university faculty members to receive this year's National Science Foundation Director's Awards for Distinguished Teaching Scholars. The awards recognize faculty members who have found significant ways to connect research and teaching. Each winner receives $300,000 over four years to continue and expand their work. Devaney was the only mathematician among this year's winners, which ran the gamut from astronomy to tectonics.

The NSF Director's Awards were established last year by NSF Director Rita Colwell. They are are part of NSF's effort "to promote an interest among academics for both disciplinary scholarship and for the education of undergraduates in science, technology, engineering and mathematics education — including students not majoring in those fields."

Robert Devaney, who obtained his Ph.D. from the University of California at Berkeley under Stephen Smale, works in dynamical systems, especially complex analytic dynamics. In addition to having written many books and papers, Devaney is well-known as an exceptional speaker who can communicate mathematical ideas to all kinds of audiences. He has given over 1,100 invited lectures all over the United States and in 30 other countries. (In his home page he notes that the only continent in which he has not yet given a talk is Antartica.) Several of his lectures are available on videotape from Science TV or Key Curriculum Press. He is also involved in many other projects, including one dedicated to using technology effectively with high school and college students.

Devaney received the Award for Distinguished University Teaching from the Northeastern Section of the MAA in 1994, and the Deborah and Franklin Tepper Haimo Award for Distinguished University Teaching the following year.

Robert L. Devaney

For more information, visit the NSF web site at http://www.nsf.gov/od/lpa/news/02/pr0239.htm and Devaney's home page at http://math.bu.edu/people/bob/.

CBMS Releases Report on Undergraduate Programs in the Mathematical Sciences

The Conference Board of the Mathematical Sciences has released Statistical Abstract of Undergraduate Programs in the Mathematical Sciences in the United States, by David J. Lutzer, James W. Maxwell, and Stephen B. Rodithe, also known as the "CBMS2000 report." This is a far-reaching analysis of the state of undergraduate programs in the mathematical sciences in the United States. The report presents data on mathematical sciences enrollments, majors, curriculum, and faculty. In addition, the CBMS2000 report studies the spread of calculus reform, distance learning, dual enrollments, the mathematical education of pre-service K-8 teachers, and the educational background of faculty teaching undergraduate statistics. Mathematics departments in two- and four-year colleges and universities will receive copies of the report, and individuals may purchase copies from the American Mathematical Society, or may download the report from http://www.ams.org/cbms/.

One of the findings of the report is that despite a general rise in college enrollments during the 1990s, enrollments in mathematics did not increase during that decade. Since 1995 the number of bachelor's degrees in mathematics has in fact dropped by about 14%. The report noted a 35% increase in part-time faculty since 1990 and a 45% rise in statistics enrollments over the past ten years. The report also contains lots of information about two-year colleges. A summary of the two-year college information appeared in our May/June issue of FOCUS.

With the support of the National Science Foundation (NSF), CBMS has surveyed two- and four-year college and university mathematics programs every five years since 1965. The report is circulated to mathematics and statistics departments, college and university administrators, and to the NSF and other government agencies as a resource to aid in allocating resources and planning effective programs.

Group Discusses Digital Educational Resources in Mathematics

By Lang Moore

The recently formed Mathematical Sciences Conference Group on Digital Educational Resources held its second meeting at MAA headquarters on February 15-16. This is a group of 21 individuals representing 15 organizations or projects concerned with digital libraries that have significant mathematical content. The first meeting was also held at MAA Headquarters in March 2001. This year the group adopted the name, elected the first chair, Lang Moore of Duke University, and agreed to make the meetings an annual event. The group continued the work, begun last year, on a core mathematical taxonomy for digital library material.

The goal is to have a common classification scheme that could be used as a basis for creating subject area metadata for mathematical materials in the various digital libraries. (The metadata entries for materials in a digital library are analogous to the catalog entries in a conventional library.) The common taxonomy will enable users to use one request to search over all the participating libraries. For example, a user in one library interested in seeking material on the distribution of primes could search all the participating libraries at the same time.

A committee consisting of Kurt Cogswell of the MERLOT Digital Library; Terry Herrera from the Eisenhower National Clearinghouse; Russell Herman from the iLumina Digital Library; Brandon Muramatsu from the SMETE Open Federation; and Robby Robson from Eduworks continued the work and have now published the final taxonomy. A report displaying this final taxonomy can be found at http://www.uncwil.edu/people/hermanr/MathTax, together with an outline of the guidelines that the committee followed and a sketch of the steps that led to this agreement.

The following individuals participated in the meeting: Don Albers (MathDL and MAA), Bob Cowles (National Security Agency), Doug Ensley (MathDL and Shippensburg State University), Kurt Cogswell (MERLOT and South Dakota State University), Terry Herrera (Eisenhower National Clearinghouse), Russ Herman (iLumina and University of North Carolina at Wilmington), Dave Hill (Demos with Positive Impact and Temple University), Dan Kalman (Project Welcome and American University), Gene Klotz (Math Forum and Swarthmore College), Susan Kornstein (College Board), Nancy Lane (Ethnomathematics Digital Library and the University of Hawaii at Manoa), Lang Moore (MathDL and Duke University), Shirley Moore (Active NetLib and University of Tennessee), Brandon Muramatsu (SMETE Open Federation and the University of California, Berkeley), Robby Robson (Eduworks), Jean Poland (Cornell University Library), David Smith (MathDL and Duke University), Amanda Tracey (MathDL and Hood College), Frank Wattenberg (MathDL and the United States Military Academy), Eric Weisstein (Mathworld and Wolfram Research), and Jim White (Project Welcome and Mathwright).

Call For Contributed Paper Session Organizers

The MAA Committee on Sessions of Contributed Papers would be delighted to hear from MAA members who are interested in organizing sessions or who have suggestions for topics. Planning is now underway for the MathFest in Boulder, Colorado, July 31-August 2, 2003 and for the Joint Mathematical Meetings in Phoenix, Arizona, January 7-10, 2004. The deadline for receipt of proposals for contributed paper sessions for the Boulder MathFest is October, 16, 2002 and for the Joint Meetings in Phoenix is December 31, 2002.

Send (preferably by e-mail) proposal title, name(s) and address(es) of the organizer(s), and a one-page summary to the chair of the committee, Howard L. Penn, Department of Mathematics, U.S. Naval Academy, Annapolis, MD 21402; Tel: (410) 293-6702; Fax:(410) 293 -4883; E-mail: hlp@usna.edu. If you have organized similar sessions in the past, please include the year(s) of the meeting, the number of proposals for talks and the number accepted and the average attendance at the session.

Call For Minicourse Organizers

The MAA Committee on Minicourses is soliciting proposals for minicourses to be given at MathFest 2003 in Boulder, Colorado, July 31-August 2 and at the Joint Mathematics Meeting in Phoenix, Arizona, January 7-10, 2004. Most minicourses are related to undergraduate curriculum, although any topic of interest to the MAA membership will be considered.

To find more information on how to submit a proposal see www.maa.org/meetings/miniguide.html. The deadline for the Boulder MathFest is October 7, 2002 and for the Joint Mathematics Meeting it is December 2, 2002.

A New Look at an Old Question: Is π Normal?

by James A. Walsh

The Department of Mathematics at Oberlin College sponsors a series of student/faculty luncheons each semester. Munching on pizza provided by the Department, mathematics faculty and students interested in mathematics, from first-years to seniors, interact in an informal and enjoyable setting. Twenty to thirty minutes of each luncheon are reserved for a presentation on something mathematical, ensuring that we all head to our 1:30 classes well fed in more ways than one.

Gary Kennedy, a mathematician from Ohio State-Mansfield, graciously made such a presentation last year, with his topic the remarkable formula for π discovered by Bailey, P. Borwein and Plouffe [1; also see below]. During his talk Gary vaguely mentioned the discovery of a connection between the normality of π and chaotic dynamical systems. In fact, aware that my field is dynamical systems, he singled me out of the audience as he mentioned this discovery. Now obliged to respond to this challenge, I felt a certain kinship with the character portrayed by Gary Cooper in the classic film High Noon as I investigated this connection. Armed with my sheriff's badge, I presented my findings at a subsequent luncheon. That presentation, in which my dear Aunt Phyllis also played a role, is the basis for this article.

We all know that π is irrational (Lambert, 1761) and, moreover, transcendental (Lindemann, 1882). The first 200 billion digits in the decimal expansion of π have been computed, as has the quadrillionth binary digit (it is 0). Apparently, we know π quite well. When it comes to the limiting distribution of digits in the decimal expansion of π, however, the paucity of results is striking. Simply-stated questions such as, "Do any of the digits 0, 1, ... , 9 occur infinitely often in the decimal expansion of π?", and, "Are there 1000 consecutive zeros in the digits of π?" remain unanswered to this day.

In 1909, E. Borel, interested in the notion of a real number being random, introduced the concept of normality. A real number μ is normal to base $b \geq 2$ if every finite string of k digits appears in the base b-expansion of μ with well-defined limiting frequency b^{-k}. That is, μ is normal to base b if $\lim_{n\to\infty} N(t, n)/n = 1/b^k$ for each string t of length k, where N(t, n) is the number of times t occurs in the first n base b-digits of μ. A number is normal if it is normal to every base b.

If π were normal to base 10, the string "3" would occur with limiting frequency 1/10 in its base 10-expansion, the string "58" with limiting frequency 1/100, and so on. In addition, every finite string would occur infinitely often in its base 10 digits, so that the answers to the questions posed above would be a satisfying "yes". Statistical tests support the conjecture that π is normal to base 10 [3].

It is reasonable to ask if there are known examples of numbers normal to a base b. The answer is an unsatisfying "yes." First note that a number normal to a base b must be irrational. Also note that a number may be normal to one base and not normal when expanded in another base (base 2- versus base 3-expansions of certain members of the Cantor middle thirds set provide good examples). In 1933, Champernowne proved that 0.1234567891011..., formed by concatenating the positive integers, is normal to base 10. The Copeland-Erdös number, 0.2357111317..., formed by concatenating the primes, is also normal to base 10.

From a theoretical perspective, most numbers are normal: Borel proved that a real number chosen at random is normal with probability one. This is intuitively plausible if you think of repeatedly rolling a fair b-sided die to generate the base b-digits of a real number. Yet we do not know if any of our favorite constants, such as π, e, $\sqrt{2}$ or $(1 + \sqrt{5})/2$, is normal to any base b!

Bailey and Crandall presented a connection between base b-normality of constants and discrete dynamical systems in [2]. Suppose μ in [0,1) has base b-expansion $\mu = 0.\mu_1\mu_2\mu_3\ldots = \mu_1/b + \mu_2/b^2 + \mu_3/b^3 + \ldots$, with each μ_i in the set {0,1, ... , b-1}. If $f: [0,1) \to [0,1)$ is the function which sends x to bx mod 1, then $f(\mu) = 0.\mu_2\mu_3\mu_4\ldots$. The function f, called a shift map, is the prototypical chaotic map.

For μ in [0,1), consider the recursively defined sequence

$$x_0 = \mu,\ x_{n+1} = f(x_n), \qquad (1)$$

for all $n \geq 0$. Note that $x_n = 0.\mu_{n+1}\mu_{n+2}\mu_{n+3}\ldots = b^n\mu \bmod 1$, so that we are, in a sense, using f to sift through the base b-digits of μ. If μ is rational, the sequence (1) eventually repeats, so that $\{x_n\}$ is a finite set. If μ is irrational, $\{x_n\}$ is an infinite set with an infinite number of limit points. In this case (the one of interest to us), it is reasonable to investigate the distribution of the x_n in [0,1). For example, if μ is normal to base b, we would expect the x_n to be uniformly distributed in [0,1).

Let $\mathbf{s}=\{x_n\}$ be the sequence given by (1). Let $0 \leq c < d < 1$, and let $C(\mathbf{s}, c, d, i)$ denote the number of times x_n is in [c,d) with $n \leq i$. Then the sequence **s** is equidistributed in [0,1) if $\lim_{i\to\infty} C(\mathbf{s}, c, d, i)/i = d\text{-}c$ for all such c and d. Not surprisingly, μ is normal to base b if and only if **s** is equidistributed. This provides an alternative approach to base b-normality of μ, but to use it we still need to know all of the base b expansion of μ.

This is where the formula for π discovered by Bailey, P. Borwein and Plouffe comes into play. In 1997 they showed that

$$\pi = \sum_{k=1}^{\infty} \frac{1}{16^k}\left(\frac{16\left(120k^2 - 89k + 16\right)}{512k^4 - 1024k^3 + 712k^2 - 206k + 21}\right) = \sum_{k=1}^{\infty} \frac{1}{16^k}\frac{p(k)}{q(k)}. \qquad (2)$$

If, for each $k \geq 1$, the expression $p(k)/q(k)$ in equation (2) was in the set $\{0,1,...,15\}$, equation (2) would provide a base 16-expansion for π. Unfortunately, this is not the case; for example, $p(1)/q(1)$ is greater than 50.

Not to be deterred, however, remember that π is normal to base 16 if and only if the corresponding sequence (1) is equidistributed in [0,1).

$$16^n\pi = \left(\sum_{k=1}^{n} 16^{n-k}\frac{p(k)}{q(k)} \sum_{k=n+1}^{\infty} 16^{n-k}\frac{p(k)}{q(k)}\right) \bmod 1$$
$$= (y_n + r_n) \bmod 1.$$

As an exercise, you might show that y_n is given recursively by $y_0 = 0$ and $y_n = 16y_{n-1} + p(n)/q(n)$, for $n \geq 1$. Now, since $\deg(p) < \deg(q)$, r_n tends to 0 as n goes to infinity. We use the fact that if a sequence $\{a_n\}$ is equidistributed and the sequence $\{b_n\}$ satisfies $b_n \to 0$ as n goes to infinity, then the sum $\{a_n+b_n\}$ is equidistributed. We conclude: if $\{y_n \bmod 1\}$ is equidistributed in [0,1), so is $\{(y_n+r_n) \bmod 1\} = \{16^n\pi \bmod 1\}$, and π is normal to base 16. Pretty neat.

As a second example, you are invited to mimic the above steps, starting with the expression

$$\log 2 = \sum_{k=1}^{\infty} \frac{1}{2^k}\frac{1}{k}$$

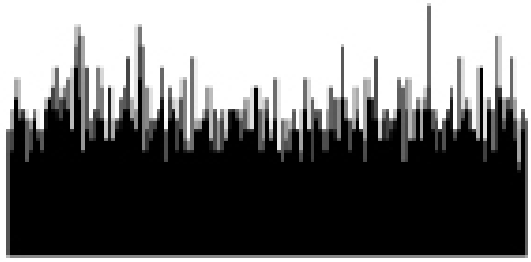
(think base 2). The term $2^n \log 2 \bmod 1$ can be written in the form $(y_n+r_n) \bmod 1$, with y_n given recursively by $y_0 = 0$ and $y_n = 2y_{n-1} + 1/n$, for $n \geq 1$. Since the corresponding rational function $p(k)/q(k) = 1/k$, we again have $r_n \to 0$ as n goes to infinity. Then if $\{y_n \bmod 1\}$ is equidistributed in [0,1), so is $\{(y_n+r_n) \bmod 1\} = \{2^n \log 2 \bmod 1\}$, implying log 2 is normal to base 2.

More generally, consider any number defined by a generalized polylogarithm series (GPS) $\mu = \sum_{k=1}^{\infty} \frac{1}{b^k}\frac{p(k)}{q(k)}$ with the following stipulations: (a) the functions p and q are polynomials with integer coefficients; and (b) q does not vanish at any positive integer; and $\deg(p) < \deg(q)$. As in the two examples above, $b^n\mu \bmod 1$ can be expressed as a sum $(y_n+r_n) \bmod 1$, with y_n given by $y_0 = 0$, $y_n = by_{n-1} + p(n)/q(n)$, $n \geq 1$, and $r_n \to 0$ as $n \to \infty$. Bailey and Crandall prove that μ is rational if and only if there are a finite number of limits of convergent subsequences of $\{y_n \bmod 1\}$, in which case they say the sequence $\{y_n \bmod 1\}$ has a finite attractor. For example, since π is irrational, its associated sequence $\{y_n \bmod 1\}$ given above does not have a finite attractor.

We can now state an intriguing hypothesis presented in [2]. The authors hypothesize that the sequence $\{y_n \bmod 1\}$ associated with a GPS as defined above either has a finite attractor or is equidistributed in [0,1). So, assuming the hypothesis is true, any irrational with a base b-GPS is normal to base b. The argument follows along the lines of those given earlier for π and log 2. In particular, π it would follow that is normal to base 16 and log 2 is normal to base 2.

Many GPSs are presented in [2]. For example, the hypothesis implies that log(1111111111/387420489) is normal to base 10. More familiar constants are also normal: $\sqrt{2}$ and $\sqrt{e}$ are each normal to base 4. This, of course, assumes the hypothesis.

The histogram below shows the distribution of the first 10^4 elements in the sequence $\{y_n \bmod 1\}$ associated with π. Though numerics will not yield a proof, perhaps numerical investigations with tools more sophisticated than a spreadsheet will provide insight. Also recall that, by Borel's result, the sequence $\{16^n y_0 \bmod 1\}$ is equidistributed for almost all real numbers y_0. It is intriguing to ask if adding the term $p(n)/q(n)$, specified in equation (2), leads to equidistribution of the particular sequence
$y_0 = 0$, $y_n = (16y_{n-1} + p(n)/q(n)) \bmod 1$, for $n \geq 1$.



Is π normal to base 16?

In the end I am satisfied with the response I gave to students and faculty regarding Gary Kennedy's "challenge". In fact, as my presentation drew to a close, I could not help but feel a bit like Gary Cooper must have felt at the end of High Noon, riding off into the sunset with the beautiful Grace Kelly.

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[1] Bailey, D., Borwein, P., Plouffe, S., "On the rapid computation of various polylogarithmic constants," Mathematics of Computation **66** (218) (1997), 903-913.

[2] Bailey, D., Crandall, R., "On the random character of fundamental constant expansions," Experimental Mathematics **10** (2) (2001), 175-190.

[3] Wagon, S., "Is π normal?", The Mathematical Intelligencer 7 (1985), 65-67.

Jim Walsh has taught for 10 years at Oberlin College. He has also taught for 3 years in a public high school and for 2 years in the Peace Corps. He enjoys, among other things, watching old films with his wife Debbi. He can be reached at jim.a.walsh@oberlin.edu.

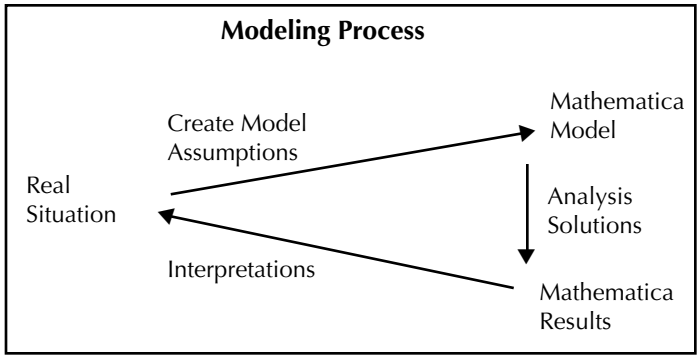
The Curriculum Foundations Workshop on Interdisciplinary Core Mathematics

By Don Small and Kathi Snook

Engineers, physical scientists, and mathematicians came together for a Curriculum Foundations Interdisciplinary Workshop, held at the U.S. Military Academy at West Point. Dr. William Wulf, President of the National Academy of Engineers, gave the keynote address, entitled "The Urgency of Engineering Education Reform." He noted that academia has not kept pace with changes in the professions and is failing to educate students to be technologically literate. With respect to mathematics, he encouraged changing the curriculum in order to spend less time on continuous, deterministic mathematics and more time on discrete and probabilistic mathematics.

Participants were divided into four groups to examine the following areas: (a) Interdisciplinary Culture; (b) Anticipated Advances in Technology; (c) Goals and Content of the Courses; (d) Instructional Techniques. Strong consensus was developed on the major issues listed below, although questions remain about how to implement the desired changes.

Incorporate more modeling into the curriculum. Emphasize real-world problem solving in the sense of modeling as illustrated in the diagram to the right, rather than in the sense of exercises.



Each group viewed modeling as an effective means of addressing their areas of interest. The Interdisciplinary group saw modeling as the best approach to break down current barriers to interdisciplinary cooperation. Real-world problem solving is inherently interdisciplinary. Technology is moving curriculums toward the modeling process and away from the solution process as it replaces hand computation and simplifies the "what-if-fing" process. Members of the Goals and Content group agreed with increasing the emphasis on modeling as a means to prepare students to become competent, confident, and creative problem solvers. The members expressed concern, however, over the conflict between the "math way" (e.g., emphasizing limits as the major "primitive") and the "science way" (e.g., emphasizing rates of change as the major "primitive"). The Instruction group viewed modeling as an effective way to address multiple learning issues such as communication, interpretation, and sensitivity analysis.

Emphasize "learning how to learn." Although not identical in meaning, the frequently heard phrases "lifelong learner," "learning to think," "mental discipline," and "learning the mathematical thought process" all offered perspectives on learning how to learn. Incorporating an emphasis on inquiry and rewarding intellectual curiosity were viewed as an effective approach to learning how to learn.

Effectively and appropriately use technology. Participants were particularly interested in using technology for visualization, discovery, and computation. Additionally, undergraduate technology experience should prepare students for the world into which they will graduate. Two important concerns were raised: How is technology effectively and appropriately integrated into the curriculum? How will the increased use of technology and loss of some hand calculation skills impact the curriculum?

Shift from teacher-centered to learner-centered instruction. This pedagogical shift necessitates less coverage and greater depth, less lecturing and more small group activities. Participants also recognized that this shift implies adjustments in resourcing time and in designing appropriate assessments. Reducing coverage provides the time required for student-learning activities, but may also pose a serious conflict to many instructors. Additionally, preparing for a class where students will be actively participating may require more planning time than preparing for a lecture. Traditional assessments are teacher-centered in the sense of minimizing grading time, maximizing coverage and focusing on well-constructed, well-defined skill type questions. In a curriculum that is changing to emphasize modeling—solving real-world problems that are often neither well constructed or well defined, participants recognized that assessment practices must also change. There was not consensus on how to make these shifts in time allocation or assessment.

Value multiple learning activities. Throughout the workshop participants focused on process as being more important than content. As stated previously, there was consensus about modeling and problem solving and agreement that students must be actively engaged—constructive experiences are more important than spectator experiences. Participants identified projects, discovery work, writing, presentations, calculator or computer laboratory sessions as examples of possible learning activities.

Integrate data analysis, statistics and probability into first and second year courses. Although process was seen as more important than content, these important concepts are many times missing from the early parts of the curriculum. As modeling is incorporated into the curriculum, the seeds of data analysis, statistics and probability concepts can be integrated with these real-world models.

Value interdisciplinary cooperation and interaction. Participants raised serious concerns with regard to the present state of interdisciplinary cooperation and in-

teraction. Although there is (theoretical) agreement on the benefits of interdisciplinary cooperation, several barriers exist such as system inertia, fiefs and turfs, publish or perish syndromes focused on narrow results, entrenched attitudes, lack of a reward system, and time. The low level of interdisciplinary cooperation restricts student development as well as constraining reform efforts in mathematics, physics, and engineering.

The following major curriculum initiative was presented as a five-year plan. (This initiative is presently being developed at the U.S. Military Academy with planned implementation starting in fall 2003.)

Major Curriculum Initiative: Create a core sequence of courses focused on developing competent, confident, and creative problem solvers. The instruction, based on modeling and inquiry, would interweave continuous and discrete mathematics. Calculus topics of rates of change, accumulation, transformations, approximations, and others would arise through modeling realistic situations

rather than studying specified subjects. Similarly, data analysis, statistics, probability, graph theory, matrix algebra and other discrete topics would also arise through modeling realistic situations. The program would be inherently interdisciplinary, as real-world situations are interdisciplinary.

In closing his keynote address, Bill Wulf provided an on-going challenge to the participants of the workshop as he told the story of Wayne Gretzky's response to the question of what has made him such an effective hockey player. Wayne Gretzky said, "he doesn't skate to where the puck is, he skates to where the puck will be." Our challenge is to identify both the "puck" and where it is going.

Proceedings of the workshop, including the 35 position papers that were submitted, can be found at http://www.dean.usma.edu/math/outreach/ILAP/workshops. Volume 61 in the MAA Notes series, Changing Core Mathematics, (edited by Chris Arney and Don Small) is based on the Interdisciplinary Workshop.

This issue includes two articles on Curriculum Foundations, a project of CRAFTY, the MAA Committee on Calculus Reform and the First Two Years. Earlier articles have described the project as a whole (November 2000), the workshop on the mathematics courses needed by physics students (March 2001), and by computer science students (May/June 2001). Future articles will focus on other client disciplines. CRAFTY is a subcommittee of CUPM, the Committee on the Undergraduate Program in Mathematics, which is undertaking a review of the whole undergraduate curriculum.

Claire & Helaman Ferguson Receive the JPBM Communications Award

At SIAM's Fiftieth Anniversary meeting in July, the Joint Policy Board for Mathematics presented its Communications Award to Claire and Helaman Ferguson. The citation said that the Fergusons "together have dazzled the mathematical community and a far wider public with exquisite sculptures embodying mathematical ideas, along with artful and accessible essays and lectures elucidating the mathematical concepts."

Helaman Ferguson began his studies as an apprentice to a stone mason, then studied painting at Hamilton College and sculpture in graduate school. He received his Ph.D. in mathematics from the Universty of Washington in Seattle and taught the subject for 17 years at Brigham Young University. He now lives and works in Laurel, Maryland where he has set up an extensive studio in his home. In addition to selling his works, he designs algorithms for operating machinery and for scientific visualization. He has exhibited and sold his sculptures worldwide.

Claire Ferguson has worked closely with Helaman as curator, expositor, and publicist on his mathematical sculptures. She is author of the book Helaman Ferguson, Mathematics in Stone and Bronze. She is also an artist in her own right and has won scholarships and prizes for her work.

The Joint Policy Board for Mathematics (JPBM) is comprised of three organizations: the American Mathematical Society, the Mathematical Association of America, and SIAM. The JPBM Communications Award was first established in 1988 to reward and encourage writers and artists who, on a sustained basis, accurately convey the content and spirit of mathematics to non-mathematical

The Umbilic Torus by Helaman Fer-

audiences. Past winners of the award include James Gleick (author of Chaos), Ivars Peterson (author of several books, many articles in Science News, and a regular column on MAA Online), Joel Schneider (creator of "Square One TV"), Martin Gardner (author of many books and, for many years, of the "Mathematical Games" column in Scientific American), and Sylvia Nasar (author of A Beautiful Mind).

For more on Helaman Ferguson's sculpture, visit http://www.helasculpt.com/.

The *Curriculum Foundations* Workshop on Chemistry

By David Bressoud

Nine chemists met at Macalester College in November 2000 for the MAA Curriculum Foundations Workshop in Chemistry. Their charge was to provide advice for the planning and teaching of the mathematics curriculum as it affects chemistry majors. Two of the participants (Craig and Engstrom) were members of the American Chemical Society's (ACS) Committee on Professional Training, the committee that sets the requirements for the ACS accredited major. Three mathematicians (myself, Tom Halverson from Macalester, and Roger Howe from Yale) were present to answer questions and probe for clarification.

With remarkable efficiency and unanimity, the chemists identified and then fleshed out six themes that they feel are essential for the mathematical preparation of chemistry majors. Quotes are taken from the report cited at the end of this article.

Multivariable relationship—The mathematics requirement for most chemistry majors is at least two and often three semesters of calculus. Some students also take linear algebra or differential equations. Almost all problems in chemistry are multivariate. The most pressing concern that the chemists voiced was that their students see multivariable functions early and often so that they are comfortable with them. They noted that while a course in linear algebra is seldom required of chemistry majors, concepts of bases, orthogonality, and eigenvectors are important in chemistry and should be among the highest priorities.

Numerical Methods—These are at the heart of the mathematics used most frequently.

"Technology makes it possible to address old questions more quantitatively and more realistically than was possible in the past. The complexities of real chemical material can be approached more fully. [...] In general, solving these problems depends on multivariate analysis and numerical methods. Use of computers is assumed."

Visualization—Geometric visualization is one of the highest priorities for chemists. "Chemistry is highly visual. Synthetic chemistry ... depends on being able to visualize structures and atomic and molecular orbitals in three dimensions." The chemists deplored the fact that "geometry has been largely squeezed out of the secondary school curriculum. Little background in geometry helps explain why chemistry students have growing difficulty with the spatial relationships that are at the heart of much chemical thinking."

Scale and estimation—Chemists work across scales that range from subatomic to cosmic. Students need a working sense of orders of magnitude and the ability to do order-of-magnitude estimation.

Mathematical reasoning—The chemists wrote: "Students must be able to follow and apply algebraic arguments, that is, 'listen to the equations', if they are to understand the relationships between various mathematical expressions, adapt these expressions to particular applications, and see that most specific mathematical expressions can be recovered from a few fundamental relationships in a few steps. Logical, organized thinking and abstract reasoning are skills developed in mathematics courses that are essential for chemistry."

Learning how to reason mathematically requires writing mathematics. "Today's mathematicians and chemists agree on the value of having students write to learn mathematics and chemistry." The report explains that this fosters critical thinking skills and builds student confidence in using mathematics as an active language.

Data analysis—Few chemistry students take a course in statistics, but statistical inference runs throughout courses in analytical chemistry and, to a lesser extent, courses in physical chemistry. The topics that chemists feel their students need include probability, combinatorics, distributions, uncertainty, confidence intervals, and propagation of error.

Calculus is still at the core of the mathematics that chemistry majors need, but the chemists pared the essential techniques down to integration and differentiation of polynomials, logarithms, exponentials, and trigonometric functions, differentiation of inverse functions, and integration by parts. Beyond these techniques, what they considered most important are the ideas of calculus: derivative as slope or rate of change, integral as area or accumulator, knowing what is held constant in a partial derivative, understanding the interplay of graphical, symbolic, and numerical interpretations, being able to read and write calculus as a language for describing complex interactions. And they expressed a profound desire that students not come out of calculus thinking that the variable has to be x and the function labeled f.

As in most science and technical majors, it is not possible to require more math classes. Chemists teach many of these essential mathematical topics on the fly within the relevant course. But the chemists present wonderful opportunities for mathematicians. A course that combined three-dimensional visualization with linear algebra and drew on the rich set of examples within chemistry would entice many of their students.

Reference:

Norman C. Craig. 2001. Chemistry Report: MAA-CUPM Curriculum Foundations Workshop in Biology and Chemistry. Journal of Chemical Education **78.** 582—6.

David Bressoud is DeWitt Wallace Professor of Mathematics at Macalester College. He was the local organizer for the Curriculum Foundations Workshop on Biology and Chemistry held at Macalester College in November 2000.

NSF Beat

By Sharon Cutler Ross

The NSF's Directorate for Education and Human Resources, Division of Undergraduate Education, has announced a new round of awards in the Course, Curriculum, and Laboratory Improvement (CCLI), Educational Materials Development (EMD) track. Approximately $2.5 million was awarded to 20 projects of which eleven are "proof-of-concept" projects. A proof-of-concept project is designed to demonstrate the feasibility of a prototype. Other awards went to projects intended to fully develop a product or practice. Three awards are to a consortium of three institutions, and two are multi-year awards. A broad range of individual undergraduate mathematics courses is targeted by this group of projects, from pre-service courses for elementary school teachers, statistics, geometry, calculus, to group theory and abstract algebra. One project aims to develop a set of new courses, and others seek to develop tools for use in a spectrum of undergraduate mathematics courses. These projects reflect the continuing process of adapting and incorporating technology, especially Web-based options, for teaching undergraduate mathematics.

A variety of projects deal with courses for pre-service teachers. At Drexel University (W. Shumar et al.), an on-line mentoring guide will be developed and assessed. Connecting the mathematics content courses required of elementary education majors with how children understand and learn mathematics is the goal of a project at Purdue University (D. Feikes). Somewhat more exotic is a project to develop modules on knot theory for pre- and in-service secondary mathematics teachers (California State University Chico, N. Portnoy and T. Mattman).

Three awards are for projects that focus on the teaching of statistics: courses for biology and engineering majors (Pennsylvania State University, W. Harkness et al.), a web-site for educational data analysis and assessment (University of South Carolina, R. West and J. Lynch), and statistics for advanced science, mathematics, and engineering students (University of California, Berkeley et al., D. Nolan and T. Speed).

Development of an applied geometry course for engineering, computer science, and applied mathematics students will help unify virtual and reality-based geometric intuition (Rose-Hulman University, D. Finn). Another project is designed to improve the teaching of geometry for pre-service teachers by the use of interactive technology and innovative pedagogy (Cardinal Stritch University, B. Reynolds and W. Fenton).

The calculus sequence remains an area of curricular activity. A consortium of Drury University (C. Allen and C. Browning), Central Missouri State University (S. So), and Lamar University Beaumont (D. Daniel and W. Mahavier) is continuing work on materials for problem-based, modified Moore method Calculus I, II, and III. A proof-of-concept proposal at CUNY (P. Wilkerson et al.) will explore a combination of multimedia-based and traditional materials for Calculus I incorporating student (electronic) portfolios. Several proposals deal with upper division courses. Materials presenting physical applications of group and representation theory will be developed at Haverford College (S. Singer). A computer lab manual for use in abstract algebra courses is under development at St. Louis University (J. Rainbolt). A new course on diffraction with related software will be the product of the project at Southern Illinois University Carbondale (D. Kammler). A scientific computing course designed to provide experience in developing and prototyping software is planned at Arizona State University (F. Kostelich and M. Carlson) as part of a modified track for mathematical sciences majors. Materials for a set of courses on mathematical modeling are the product goal of the project at Colorado State University (M. Kirby and G. Dangelmayr).

A project to develop an on-line national curve bank (see the article on page 17) is based at California State University Los Angeles (S. Gray and S. Venit). The database will include interactive mathematical curves and related exercises. A mathematical visualization program will be developed into a resource for a number of undergraduate mathematics courses at Brandeis University (R. Palais). Similar work on an on-line system for generating and delivering homework problems is the aim of the project at the University of Rochester (A. Pizer et al.).

Full abstracts for the projects listed here and contact information for the PIs can be found at the NSF website.

Proof of the Catalan Conjecture Announced

Preda Mihailescu has announced that he has proved the Catalan Conjecture. The conjecture, which states that the only two consecutive powers are 8 and 9, was first formulated by Eugène Catalan in a 1844 letter to Crelle's Journal. Since then, many mathematicians have worked on the problem. In our May/June 2001 issue we reported on an important new result that had been obtained by Preda Mihailescu, then an "amateur mathematician" working at a Swiss fingerprinting company. (See "The Latest on Catalan's Conjecture", by Andrew Granville, FOCUS, May/June 2001.) Now at the University of Paderborn, Mihailescu announced that he had proved the full conjecture in April of 2002. A manuscript with the proof is in circulation and other specialists have expressed confidence that the proof is correct. For more on Mihailescu's proof, see Ivars Peterson's June 24, 2002 Math Trek column on MAA Online.


Preda Mihailescu

2002 Award Winners

Pacific Northwest

Andrew C-F Liu
University of Alberta

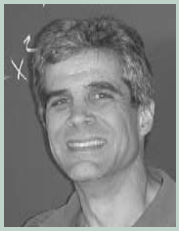
North Central

Robert Lacher
South Dakota
State University

Northern California

Paul Zeitz
University of San Francisco

Rocky Mountain



Gene Abrams
University of Colorado at
Colorado Springs

Nebraska-SE SD

Chris Masters
Doane College

Indiana

Mic Jackson
Earlham College

Southern California

Judith Grabiner
Pitzer College

Southwestern

Philip A. Leonard
Arizona State University

Texas

William D. Clark
Stephen F. Austin
State University

for Distinguished Teaching

Northeastern

Laura L. Kelleher
Massachusetts Maritime Academy

Wisconsin

David Beran
versity of Wisconsin-Superior

Michigan

Charlene E. Beckmann
Grand Valley State University

Seaway

Norman Rice
Queen's University

Metro Ny

Joe Kirtland
Marist College

Illinois

M. Vali Siadat
Richard J. Daley College

Ohio

David Minda
University of Cincinnati

EPaDel

David R. Hill
Temple University

New Jersey

Evan Maletsky
Montclair State University

Missouri

Bob Sheets
Southeast Missouri State University at Cape Girardeau

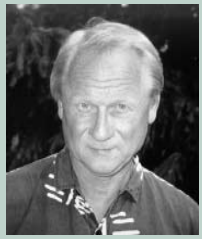
Kentucky

John Wilson
Centre College

Southeastern

Ron Harshbarger
University of South Carolina-Beaufort

Md-Dc-Va



Robert Lewand
Goucher College

Louisiana-Mississippi

Kathleen Lopez
South Louisiana Community College

Florida

Li Zhou
Polk Community College

Filling the Mathematics Education Faculty Gap

By M. Lynn Breyfogle and Elizabeth Mauch

As the "Sputnik generation" of mathematicians retires, colleges and universities nationwide are scrambling to fill vacancies. Traditional vacancies in the areas of statistics, pure mathematics and geometry continue, but many new positions require a candidate who is prepared to teach mathematics education courses for future K-12 teachers. We consider these positions "new" because the nature of both the course content and instructional strategies have changed dramatically in response to a recent nation wide emphasis on teacher training. As a result, many institutions need to hire professionals who are not only qualified to teach mathematics, but who have a firm grasp of how younger students learn, current issues in educational research and how course content and methodologies need to be developed from research findings.

Most universities have either a mathematics education department separate from a larger mathematics (or for that matter, education) department, or at least have large subgroups of mathematics education faculty in the mathematics department. However, this is not typically the case for mathematics departments at large or small colleges. We will focus on those college mathematics departments who typically employ fewer than three professors charged with teaching mathematics to future K-12 teachers. From this, we see two distinct subsets:

1) The mathematics department is part of a small (typically private) institution where mathematics education courses would only be part of one professor's course load.

2) The mathematics department is part of an institution in which one, or possibly two, professors would be responsible for teaching all of the mathematics education courses offered by the department.

We will examine a case where a mathematics education candidate is considered for a position within a department similar in structure to the one described in subset 1 above (labeled Candidate A), and another mathematics candidate is to be considered for a position within a department similar in structure to the one described in subset 2 (labeled Candidate B). While we realize that recent graduates face many possibilities, these are two that we feel could result in potentially difficult transitions for both the candidate and the department. We also acknowledge that the second scenario is much more likely than the first, given the current job market and increased demand for mathematics education PhD's (For more information see the Chronicle of Higher Education, February 19, 2002 issue, or online—for subscribers—at http://chronicle.com/jobs/2002/02/2002021901c.htm).

Case 1: Candidate A

Candidate A began her undergraduate experience as a mathematics major at a liberal arts college. During her sophomore year, Candidate A decided that she wanted to become a math teacher. She obtained a teaching certificate in mathematics by completing (in addition to the coursework in her major) a sequence of education courses and a student teaching semester. Upon graduation, Candidate A obtained a position in a local high school. While she enjoyed success as a teacher, she came to realize that many of her students were plagued with math anxiety that seemed to stem from poor mathematical experiences with prior teachers.

Although Candidate A loved her students, she decided that she could make a greater impact on the field of mathematics education if she worked with future teachers. She thought that if she could excite and instill the love of mathematics into future elementary and secondary school teachers, they would then create a wonderful learning environment for their students. As a result, she enrolled in graduate school to learn more about teaching and learning mathematics and went on to earn a Ph.D. in mathematics education.

In graduate school, Candidate A taught at least one course for pre-service elementary teachers per semester. She was responsible for all aspects of the course from designing and implementing the lessons to creating and grading tests. After a few years she team-taught the secondary mathematics methods course with a tenure-track mathematics educator and also developed her research agenda. She was treated as an equal within the mathematics education faculty and felt welcome and supported. En route to the Ph.D., she earned a master's degree in mathematics education and took nearly enough mathematics graduate courses for an MA in mathematics. Upon graduation, Candidate A sought to obtain a position in a college or university mathematics department as opposed to an education department.

Case 2: Candidate B

Like Candidate A, Candidate B began her career as a mathematics major in a liberal arts college. She enjoyed mathematics and like Candidate A, also obtained a teaching certificate by completing the required coursework and student teaching semester. Upon her graduation, Candidate B decided to pursue her love of mathematics by enrolling as a traditional full-time Ph.D. student. All of her courses focused on mathematics content and her dissertation was in a traditional mathematics field. Her teaching experience in graduate school revolved around homework sections of calculus. Students who did not understand the mathematics content and didn't seem to be helped by traditional calculus teaching in the large lecture halls seemed to seek out Candidate B for assistance and guidance. As a result, she began to develop an interest in how teaching strategies could be improved. In an effort to learn to more fully develop her own teaching ability, Candidate B taught summer courses at a local community college and at a private liberal arts college. Upon her graduation, Candidate B sought a position in a mathematics department, but became more interested in researching and investigating the teach-

ing of mathematics rather than her pure mathematics training.

Benefits

Some of the benefits that each of the candidates bring to the two positions might be obvious, but the reader might be surprised by some of the additional benefits that we have identified:

Candidate A brings real-world and graduate education experience in the field of mathematics education—this gives her mathematics education preservice teachers a realistic perspective on what it means to be a teacher. Candidate A can also provide her students with valuable insights on how best to analyze and assimilate meaningful instructional strategies, since she has an understanding of both the importance of research within the profession as well as the practical realities of applying the research findings to real classroom settings.

Candidate B shares Candidate A's interest in mathematics education research, a valuable addition to any department. Candidate B's decision to pursue her PhD directly after graduation from her undergraduate institution, coupled with her work with undergraduate students while pursuing her advanced degree puts her in a position to identify with the problems, needs and concerns of undergraduate students.

Although each candidate has a different educational background, both A and B enjoy mathematics education. Both candidates would likely promote interesting discussions and idea exchanges within their departments.

With a new push for university faculty to assess their own teaching and develop a research agenda that includes "scholarship of teaching", both candidates could be helpful to the department by providing ideas and valuable assistance in understanding the nature of teaching mathematics.

Pitfalls

Of course, the transition for neither the candidate nor the department can be entirely without pitfalls, some of which include the following.

For Candidate A:

Candidate A could be asked to teach first or second year undergraduate classes in pure mathematics, courses which may require a good deal of additional preparation on her part, given the fact that Candidate A's graduate focus was on mathematics education. However, a benefit to this scenario for Candidate A (and her students) is that she will likely employ the latest proven teaching strategies to help her students learn.

Candidate A could face colleagues and upper level mathematics students who do not feel her mathematics education Ph.D. is equivalent to a Ph.D. in mathematics.

Candidate A may face some form of tenure and/or promotion discrimination by both faculty and administration tenure boards because of her research interests and resultant publications. Some institutions may attempt to assert that her research isn't of the same caliber as her colleagues in the mathematics department because it focuses on educational issues and not on pure mathematics.

Candidate A will most likely be the only mathematics educator in the department, which can be an extremely isolating experience after her graduate years spent with a group of mathematics education specialists.

For Candidate B:

Candidate B could be asked to teach undergraduate classes in mathematics education, courses which may require a good deal of additional preparation on her part, given the fact that Candidate B's graduate focus was on pure mathematics. If she is to be successful, Candidate B will need to focus a great deal of her time and attention on current issues in education.

Candidate B could face colleagues who feel that she is not doing enough "pure math" research—and view her research as based upon her students playing with manipulatives in a classroom or purely anecdotal or observational research.

Candidate B could be met with resistance from the institution's education department for teaching courses that the education department feels should be their responsibility, not the responsibility of a mathematician.

Conclusions:

Before seeking qualified candidates to fill a mathematics education position, it is important for a department to decide what its priorities are and what expertise they want to cultivate. In addition, a department should be aware of the potential weaknesses and possible feelings of isolation any candidate may experience and be ready to support them however necessary. In other words, every department really needs to examine the needs of their students and the college as a whole, thereby identifying what type of educator they want as their newest department member.

Before any interview takes place, the department should make explicit its priorities and expectations in the job description. Once appropriate candidates are selected for an interview, members of the search and screen committee should have a pre-established set of questions designed to ascertain how well the candidate will succeed in fulfilling the needs of the college, the department and the students. Once a successful candidate is identified, the department should reiterate its expectations, especially in terms of tenure and promotion, formally and in writing within the body of the initial contract. Finally, and perhaps most important, it is incumbent on the members of the department to make new faculty members feel welcome and a part of the mathematics community.

For job seekers, it is best to be open and honest about what you would like to do in terms of teaching and research throughout the entire application and interview processes. Ask questions to be sure that you know what is expected of you as a new faculty member and what is required

continued on page 16

continued from page 15

of you to achieve tenure. Once you have accepted a position, strive to be involved in the activities hosted by the mathematics department, using them as a way to network both inside and outside the department for support. Make it a point to interact with both members of the mathematics and education department to gain valuable insights and information. Finally, establish a mutually convenient time to meet with other mathematics educators in similar situations to avoid the feeling of isolation.

Any time a department hires a new member, difficulties for both parties will inevitably occur. In this paper, we have examined only two scenarios among several possibilities. Yet these two scenarios reveal steps that both candidates and institutions can take-regardless of the complexity of their particular situation and set of circumstances—to make the transition easier. Although it takes an awareness and appreciation of one another's strengths and weaknesses, we believe that mathematics departments, and candidates for positions within those departments, who take the time to garner this appreciation will ultimately develop an educationally fruitful environment for their students.

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Elizabeth Mauch is an assistant professor in the Department of Mathematics, Computer Science & Statistics at Bloomsburg, PA. Her research interests include issues related to primary students' ability to do mathematical problem solving. She is also interested in pure mathematics research in Algebraic Geometry. She can be reached by email at emauch@bloomu.edu.

Short Takes

Six Mathematicians Elected to the National Academy of Sciences

Late in April, the National Academy of Sciences elected 72 new members and 15 foreign associate members. This year's list includes six mathematicians: David W. McLaughlin of the Courant Institute, Peter Sarnak of Princeton University, Peter W. Shor of AT&T Laboratories, David O. Siegmund of Stanford University, Yum-Tong Siu of Harvard University, and David P. Ruelle of the Institut des Hautes Etudes Scientifiques, who was elected as a foreign associate. More information on the National Academy of Sciences, including the full list of new members, can be found at the NAS web site at http://national-academies.org.

Elibron.com Sells Reprints of Older Books

New technology is making it much easier to get copies of old and/or rare books. One example is Adamant Media, a Boston-based company that developed agreements with two major libraries in Russia to scan and reprint old books in many fields. Over 50,000 such books are available at their web site at http://www.elibron.com, both as paper reprints and in electronic form. Mathematics offerings include classics by Archimedes and Al-Khwarizmi and more recent books by Todhunter, Salmon, and others.

50 Billion Zeros of Zeta

Sebastian Wedeniwski, with the help of many others and about 550 PCs, has computed the first 50 billion zeros of the Riemann zeta function. Every one of those zeros has real part 1/2, as predicted by the Riemann Hypothesis, and they are all simple zeros. The computation, which is done in distributed fashion using idle time on ordinary PCs and workstations, confirms the Riemann Hypothesis for all zeros whose imaginary part is less than 13,486,858,172.324. At this point, the program is available only for users at IBM Deutschland Entwicklung GmbH., but there are plans to make it available for other users who want to join the fun. See http://www.hipilib.de/zeta/index.html for more information.

Saxon Math Books Have Growing Market Share

According to Education Week (May 1, 2002), the series of mathematics textbooks from Saxon Publishers has dramatically increased its market share over the last ten years. Despite being controversial, Saxon's books have about "11% of the K-4 market, 8% of the 5-8 market, and 3% of high school classrooms. That's a greater share than the combined total of the top two products underwritten by the National Science Foundation: Everyday Math, published by McGraw-Hill, and materials published by Dale Seymour Publications."

Saxon's books focus on basic math skills, using an approach that emphasizes drill, practice, and review. They are often criticized for ignoring the big ideas of mathematics in favor of developing mechanical skills. On the other hand, some teachers praise the series for helping students achieve good results on standardized tests.

Celebrating 800 Years of the Liber Abbaci

The year 2002 is the 800th anniversary of the completion of one of the most famous books in the history of mathematics: the Liber Abbaci, by Leonardo of Pisa, often known as Fibonacci. (It is interesting to note that the name "Fibonacci" seems to have been given to him in the 19th century; there is no evidence that he ever used it for himself.) Springer-Verlag will be publishing an English translation of the book this fall.

The University of Pisa, together with the "Giardino di Archimede - Un Museo per la Matematica" and the SISMEL (Italian

Society for the Study of Latin Middle Ages) are organizing a series of events to celebrate the anniversary, including an international meeting on "Leonardo Fibonacci: Matematica e societá nel mediterraneo del XII secolo," to be held in Pisa and Florence on November 20-23, 2002. There will also be a museum exhibit on Leonardo of Pisa, "A Bridge on the Mediterranean Sea: Leonard of Pisa, the Arabic Science and the Renaissance of Mathematics in Europe" (Pisa, November 2002-February 2003).

RAND Posts Draft Report on Mathematics Education

A draft of the RAND report on "Mathematical Proficiency for All Students: Toward a Strategic Research and Development Program in Mathematics Education," has been posted online at http://www.rand.org/multi/achievementforall/math/. RAND is inviting all educational researchers, administrators, teachers, curriculum developers, and other educators to submit reactions, suggestions, and feedback to the panel for use in preparing a final draft in Fall 2002.

Online Handbook of Mathematical Discourse

Charles Wells, an emeritus professor of mathematics at Case Western Reserve University, is interested in introducing teachers and students to the way we use words in mathematics, not technical words that would be defined in textbooks, but rather words that mathematicians use that often befuddle uninitiated students. To do this, he has created an online Handbook of Mathematical Discourse. Take a look at http://www.cwru.edu/artsci/math/wells/pub/abouthbk.htm.

Major Changes Coming for the SAT

The College Board has announced plans to introduce major changes to the SAT beginning in the spring of 2005. The new test will, they hope, be "a more accurate predictor of students' performance in college." To achieve this, the test will be changed in order to reflect more closely what actually happens in high school mathematics. The new SAT will have sections on mathematics, "critical reading," and writing. The mathematics section will include more advanced material than the current version, covering the material normally studied in Algebra I, Geometry and Algebra II. (The current test covers only material from the first two.) More details can be found at http://www.collegeboard.com/about/newsat/newsat.html.

The Ideology of Mathematics Education

The American Enterprise Institute hosted a forum on mathematics education reform in March. NCTM President Lee Stiff, NSF Director Rita Colwell, former NCTM president Gail Burrill, Tom Lovelace of the Brookings Institution, David Klein of the University of California Northridge, and Michael McKeown, cofounder of Mathematically Correct, participated in the discussion, which was moderated by Lynne Cheney. A detailed summary of the debate can be found on the AEI web site at http://www.aei.org/cs/cs020304.htm.

ICME-10 Scheduled for Denmark in 2004

The 10th International Congress on Mathematics Education will be held in Copenhagen, Denmark, on July 4-11, 2004. The first announcement and other preliminary information on the congress can be found on the web at http://www.icme-10.dk/.

Getting Out Early

An article entitled "Early Exit," in the June 21 issue of the Chronicle of Higher Education, discusses how special incentives for early retirement are impacting colleges and universities. The article highlights, among others, the Department of Mathematics and Statistics at the University of Massachusetts at Amherst, which is losing 13 of its 50 faculty members to early retirement this year. The early retirements are a way to reduce costs for the affected universities, but they will create huge gaps in course offerings that will have to be dealt with somehow. The benefits offered for those retiring early are usually quite attractive, but another factor stimulating faculty to retire is the fact that those who remain will have to deal with difficult staffing problems in a time of financial retrenchment.

Fall Section Meeting Schedule

EASTERN PA & DELAWARE- November 9, 2002 - University of Pennsylvania, Philadelphia, PA

INDIANA-October 5, 2002 - Indiana University Northwest, Gary, IN

MD-DC-VA-November 11-2, 2002 - University of Maryland, College Park, MD

METRO NEW YORK-Fall 2002 - York College (CUNY) Queens, NY

NEW JERSEY -October 26, 2002 - Fairleigh Dickinson University, Madison, NJ

NORTHEASTERN-Joint Meeting with Seaway Section: June 21-22, 2002 - Williams College, Williamstown, MA

OHIO-October 25-26, 2002 - Kent State University-Trumbull Campus, Warren, OH

SOUTHERN CALIFORNIA-October 12, 2002 - Cerritos College, Cerritos, CA

SEAWAY-November 1-2, 2002 - SUNY. at Potsdam, Potsdam, NY

MAA Announces Writing Awards at MathFest 2002

As happens every year, the MAA announced some of its most important prizes and awards at the Burlington MathFest. The Allendoerfer, Evans, Ford, and Pólya Awards recognize the best expository writing published in Mathematics Magazine, Math Horizons, the American Mathematical Monthly, and the College Mathematics Journal, respectively. More information on the winners can be found at http://www.maa.org/news/MathFest02awards.html.

Carl B. Allendoerfer Award

Mark McKinzie and Curtis Tuckey
"Higher Trigonometry, Hyperreal Numbers, and Euler's Analysis of Infinities,"
Mathematics Magazine, Vol. 74, No. 5, December 2001, pp.339-368

Trevor Evans Awards

James Tanton
"A Dozen Questions about the Powers of Two"
Math Horizons, Vol. 8
September 2001, pp 5-10

Frank A. Farris
"The Edge of the Universe"
Math Horizons, Vol. 8
September 2001, pp. 16-23

George Pólya Award

Timothy G. Feeman
"Conformality, the Exponential Function, and World Map Projections"
College Mathematics Journal, Vol. 32, November 2001, pp. 334-342

Lester R. Ford Awards

Peter Borwein & Loki Jorgenson
"Visible Structures in Number Theory,"
The American Mathematical Monthly, Vol. 108 No. 5, December, 2001, pp. 897-910

Dirk Huylebrouck
"Similarities in Irrationality Proofs for π, ln2, $\zeta(2)$, and $\zeta(3)$"
The American Mathematical Monthly
Vol. 108, March 2001 pp. 222-231

Greg Martin
"Absolutely Abnormal Numbers,"
American Mathematical Monthly
Vol. 108, October 2001, pp. 746-754

David Lindsay Roberts
"Moore's Early Twentieth-Century Program for Reform in Mathematics Education"
American Mathematical Monthly
Vol. 108, October 2001, pp. 689-696

2002 Morgan Prize Winners Announced

Ciprian Manolescu has been named the winner of this year's Frank and Brennie Morgan prize for undergraduate research. Manolescu won the prize for his work on Floer homology, done while he was an undergraduate at Harvard. Honorable mention went to Michael Levin for his work on quadratic inequalities for the descent statistic of permutations, done while an undergraduate at Harvard but based on work done at Cornell's REU program.

Ciprian Manolescu was born in Alexandria, Romania, in 1978. Soon after that his family moved to Pitesti, Romania, where he lived until coming to the U.S. for college in 1997. During high school he participated in several math contests, winning three gold medals at the International Mathematical Olympiad. As an undergraduate at Harvard University, he also took part in the Putnam Competition, winning the first prize in 1997, 1998, and 2000. Starting in the sophomore year he has been working as a course assistant for several mathematics classes at Harvard, obtaining certificates for distinction in teaching. In the spring of 1999, Ciprian took a reading course in differential geometry with Professor Peter Kronheimer. This sparked interest in the subject and he continued working under Professor Kronheimer's guidance for the next years. During the summers he benefited from grants from the Harvard College Research Program. He graduated from college summa cum laude in 2001, and received the Hoopes prize for his senior thesis, "Finite dimensional approximation in Seiberg-Witten theory." Currently, Ciprian is a student in the mathematics department at Harvard University. His research interests include topology, differential geometry, and mathematical physics.

Michael Levin grew up on the south side of Chicago. He became interested in mathematics at an early age, and in sixth grade he began attending math programs during the summer. In high school he took a number of math courses at the University of Chicago. He went to college at Harvard University where he majored in mathematics. Michael spent the summer after his sophomore year at the Williams College REU where he worked on knot theory research. The next summer, he worked on combinatorics research at the Cornell REU. While in college, he developed an interest in theoretical physics. He is currently a first year graduate student in the MIT physics department. He hasn't yet chosen a research group, but he is potentially interested in both theoretical condensed matter physics and string theory.


Ciprian Manolescu

The Frank and Brennie Morgan Prize, which is awarded jointly by the MAA, the American Mathematical Society, and the Society for Industrial and Applied Mathematics, recognizes and encourages outstanding mathematical research by undergraduate students. It was endowed by Mrs. Frank Morgan of Allentown, PA (the mother of Professor Frank Morgan of Williams College), and also carries the name of her late husband. A joint committee of the AMS, MAA, and SIAM chooses the winner.

For more information on this year's winners and their work, visit MAA Online at http://www.maa.org/news/MathFest02awards.html.

MAA to Develop Online Magazine on History of Mathematics and Its Use in Teaching

By Victor Katz

The MAA has received a planning grant from the National Science Foundation to demonstrate the feasibility of an online magazine in the history of mathematics and its use in teaching. The target audience is teachers of grade 9-14 mathematics, be they secondary teachers, two- or four-year college teachers, or college teachers preparing secondary teachers. Victor J. Katz, University of the District of Columbia, is the PI for the grant and Frank Swetz, Penn State University Harrisburg, is the co-PI.

The two editors aim to have initial articles posted in the Mathematical Sciences Digital Library, currently available at http://www.mathdl.org, before the end of 2002. Among the types of possible articles are:

Expository articles dealing with the history of various topics in the secondary curriculum. These articles should appeal to multiple audiences. The bulk of the material should be designed to teach practicing teachers some history and how to use it, but some parts of the article could be aimed at faculty who are preparing teachers and other parts could be directly usable by students. Articles should utilize the online medium; they should have some interactivity, some interesting graphics, some animation, or some full-color illustrations. It is not necessary that the author know how to program. We will have experts to do that. The author just needs to describe in some detail what he/she envisions.

Translations of original sources of material accessible to the target audience. For example, translations of some of Euler's articles would be welcome as well as articles by medieval Indian or Chinese authors. We would prefer, where feasible, to post both the original and the translation and include commentary on the context of the material. We would like to have links to other sources dealing with the mathematician involved and, of course, have interactivity or animation if warranted.

Historical problems: these could be problems taken directly from historical sources or could be created to allow students to construct their own knowledge of a particular topic by following the historical development. A comment on the context and source of the problem would be useful, and, again interactivity would be welcome.

If you have already written material that would be appropriate for this magazine, or if you just have an idea for a possible article, please send an email to Victor Katz (vkatz@udc.edu) with as much detail as possible.

The National Curve Bank Makes Its Debut

By Shirley Gray

The debut of the National Curve Bank, a mathematics web site at http://curvebank.calstatela.edu featuring participation, animation and interaction, was announced on the 4th of July. Earlier, MAA members from research institutions, liberal arts colleges, state universities, community colleges, and three high schools accepted invitations to join the National Curve Bank Advisory Board. This advisory group also includes individuals who design web sites, manage large corporate sites, or teach computer graphics. The NAB is more than window dressing for grant seeking: over the past year its members have beta tested various trial releases; and, from deciding on Mozart for the opening music to discussions of the appearance in a wide variety of browsers, working with these talented people has been both invaluable and fun.

The mission statement on the Curve Bank home page defines the focus:

National Curve Bank PIs and co-workers (back row left to right): Dr. Stewart Venit, J.R. Lara, Jennifer Cha, Gayle Burns, Hong Kha, Alexander Tascon. Front row left to right: Louis Santillan, Dr. Shirley Gray.

The National Curve Bank is a resource for students of mathematics. We strive to provide features - for example, animation and interaction - that a printed page cannot provide. We also include geometrical, algebraic, and historical aspects of curves, the kinds of attributes that make the mathematics special and enrich classroom learning.

We welcome participation. We encourage you to submit your best web animation as a "deposit" in the National Curve Bank. Also, we welcome information about other outstanding sites that deal with the same subject. We will provide links to your home site and thus give your work a wide audience. Please see "Submit Your Curve" on the Home Page for details.

This project is supported by a National Science Foundation DUE-CCLI Educational Materials Development grant, the Arnold and Mabel Beckman Foundation, and two California State University Innovative Instruction Awards. The PI is Dr. Shirley Gray, sgray@calstatela.edu, and the co-PI is Dr. Stewart Venit, svenit@calstatela.edu, of the Department of Mathematics, California State University, Los Angeles, CA 90032. Please contact either one for a poster or pamphlet.

Mathematical Olympiad Summer Program Brings Together Talented High School Students

By Steven R. Dunbar

For three and a half weeks in June and July, 178 of the best high school mathematics students in the nation grappled with challenging mathematical problem solving at the Mathematical Olympiad Summer Program (MOSP) held on the campus of the University of Nebraska-Lincoln in Lincoln, NE. This extraordinary group of young mathematics students spent up to 8 hours every weekday in classes learning problem solving techniques and solving Olympiad-caliber problems in both team and individual contests.

On the weekends and evenings (when not working on homework!) the students enjoyed a variety of social and recreational activities as well as hearing colloquium talks from mathematicians.

All of the students were invited to take the USA Mathematical Olympiad (USAMO) exam in May. Each USAMO participant had already survived two challenging preliminary examinations: the American Mathematics Competition held in February 2002 and the American Invitational Mathematics Exam held in March and April.

USAMO 2002 Winners from left to right in the front row: Ricky Liu, Alison Miller, Neil Herriot, Tiankai Liu and Inna Zakharevich. Ann Watkins, President of the MAA is on the left in the front row, and Tina Straley, MAA Executive Director is on the right. In the back row the winners from left to right are: Alex Xue, Po-Ru Loh, Gregory Price, Steve Byrnes, Anders Kaseorg, Daniel Kane, and Michael Hamburg.

The 178 students who came to the 2002 MOSP (as well as the USAMO at MIT in May) were the guests of the Akamai Foundation and the Mathematical Association of America. The American Mathematics Competition is a program of the MAA and is presented by the Akamai Foundation.

Among the 178 participants at MOSP were the top twelve named as the USAMO Winners. Two of the USAMO Winners are young women, and one of them tied with four men for first place at the USAMO. After taking yet another rigorous two-day Team Selection Contest six students and one alternate were named as the USA team for the 43rd International Mathematical Olympiad to be held in Glasgow, Scotland on July 19-30.

The IMO will attract 500 of the most talented mathematics students from more than 80 countries. The USA team will consist of Daniel Kane, Madison, WI; Anders Kaseorg, Charlotte, NC; Ricky Liu, Newton Centre, MA; Tiankai Liu, Exeter, NH; Po-Ru Loh, Madison, WI; and Alex Xue, Chandler AZ. Allison Miller of Niskayuna, NY is the alternate. Titu Andreescu is the Head Coach and Zuming Feng is the Assistant Coach. The problems of the

Mathematical Olympiads at all levels are regarded as quite difficult, to the point that most professional mathematicians find them challenging.

The MOSP content covers the subjects that appear on Mathematical Olympiads, generally pre-calculus mathematics. However the coverage is deep and sophisticated, including number theory, advanced Euclidean geometry, polynomial theory, inequalities, invariants, combinatorics and counting methods. Students started with a session on writing a proof-solution to a problem. They practiced their skills frequently with homework sets and contests which were graded and discussed daily. A typical problem is Problem 6 from the Team Selection Contest: Find in explicit form all pairs of positive integers (m,n) such that mn - 1 divides $m^2 + n^2$.

While in Lincoln the MOSP participants, in addition to solving tough mathematical problems, also enjoyed sports and cultural activities including bowling, soccer, swimming, ultimate frisbee, jazz concerts, and a play on the origins of calculus put on by the students themselves. They were treated to stimulating lectures, picnics, impromptu piano concerts by participants, rousing card games and chess matches in the dorm lounges. A favorite activity was conversation with other students from around the United States who really like math. Careful listening revealed that not all conversations were about mathematics!

The complete list of the 12 USAMO Winners, along with their hometowns and schools, the Honorable Mentions, and the questions on the USAMO as well as the answers can all be found at http://www.unl.edu/amc/. More pictures and information about the USAMO and the MOSP are also available on the Web site.

Steven R. Dunbar is the Special Assistant to the MAA Executive Director for Pre-College Outreach. He divides his time between the University of Nebraska at Lincoln and American Mathematics Competitions. His home page is at http://www.math.unl.edu/~sdunbar.

The five first place USAMO winners are: (from left to right) Inna Zakharevich, Tiankai Liu, Daniel Kane, Po-Ru Loh, and Ricky Liu. Ann Watkins, MAA President, is on the far right.

NSF Funds Three New Mathematics Institutes

The National Science Foundation announced that it will fund three new research institutes to help strengthen the mathematical sciences in the United States. The three new institutes will receive funds that are projected to total $24 million over the next five years. In addition, the NSF also renewed funding for the School of Mathematics at the Institute for Advanced Studies in Princeton. The new funding is in addition to the three institutes already funded by NSF: the Institute for Pure and Applied Mathematics at the University of California, Los Angeles; the Institute for Mathematics and its Applications at the University of Minnesota; and the Mathematical Sciences Research Institute in Berkeley, California.

The Mathematical Biosciences Institute at Ohio State University will focus on interdisciplinary work neuroscience, cell processes, and other biological problems. The Statistical and Applied Mathematical Sciences Institute in Research Triangle Park, North Carolina, will sponsor work tying together statistics, applied mathematics, and other disciplines, with a focus on data-driven and model-driven scientific challenges. Finally, the Research Conference Center of the American Institute of Mathematics (AIM) in Palo Alto, California, will host research workshops on fundamental and interdisciplinary mathematical sciences.

For more on the NSF awards, see the press release at http://www.nsf.gov/od/lpa/news/02/pr0256.htm.

The Statistical and Applied Mathematical Sciences Institute

By James O. Berger

The Statistical and Applied Mathematical Sciences Institute (SAMSI) is a partnership between the National Science Foundation and the consortium of Duke University, North Carolina State University, the University of North Carolina at Chapel Hill, and the National Institute of Statistical Sciences (NISS). SAMSI will be housed in the NISS building in the Research Triangle Park, North Carolina. SAMSI will be led by Director James O. Berger, Duke University, and Associate Directors H. Thomas Banks, North Carolina State University, Alan F. Karr, National Institute of Statistical Sciences, and J. Stephen Marron, University of North Carolina at Chapel Hill.

The Statistical and Applied Mathematical Sciences Institute (SAMSI)

SAMSI's mission is to forge a new synthesis of the statistical sciences with the applied mathematical sciences and disciplinary science to confront the very hardest and most important data- and model-driven scientific challenges. The scientific efforts at SAMSI will be organized into programs of six months to one year in duration. The 2002-2003 programs are (i) Inverse Problem Methodology In Complex Stochastic Models; (ii) Stochastic Computation; and (iii) Large-Scale Computer Models for Environmental Systems. There are numerous opportunities for participation in SAMSI activities by researchers, including postdoctoral fellows, graduate and undergraduate students, and teachers. For additional details about SAMSI, its programs and opportunities for participation, see the web site http://www.samsi.info.

James Berger is the director of SAMSI.

AIM Research Conference Center: A New Math Institute

By Helen Moore

There's a new NSF-funded institute devoted to mathematics. The American Institute of Mathematics (AIM), a nonprofit math institute in Palo Alto, CA, has received a $5 million grant from NSF to found the AIM Research Conference Center (ARCC), which will begin running workshops in autumn 2002.

"We are extremely gratified to have been awarded this grant," said Brian Conrey, Director of AIM. "AIM collaborations have led to some nice results as the 80 papers in our preprint series demonstrate. The recent proof of the Perfect Graph Conjecture, which followed from work started with an AIM project, also shows the power of focused collaborative research."

Whereas fifty years ago mathematical collaboration was relatively rare, today approximately half of all mathematical papers are written by multiple authors. ARCC will help develop and support collaborations by holding small, focused research workshops, with entire groups of attendees devoting themselves to a specific mathematical goal. Special attention will be devoted to facilitate collaborations which include women, underrepresented

The AIM Research Conference Center (ARCC)

minorities, and researchers at primarily undergraduate institutions. To aid in collaboration before and after workshops, there will also be an accessible website which includes open problems and progress updates.

Workhops will be held at AIM in Palo Alto, CA for the first two years, but then the AIM Research Conference Center will move to Morgan Hill, forty miles south of Palo Alto. The ARCC buildings will be styled after the "Alhambra" in Granada, Spain, known for its mathematically intricate patterns. The new site will include a lecture hall, an extensive library, and visitor accommodations. Eventually, ARCC will hold twenty-four weeklong workshops each year, on a diverse range of topics. Up to 32 researchers will participate and be housed on-site during each workshop. The future ARCC site is adjacent to the largest state park in northern California, Henry W. Coe State Park, which has several hundred miles of hiking trails.

AIM itself has been around since 1994, when it was founded by Silicon Valley businesspeople John Fry and Steve Sorenson, to support research mathematics. John Fry received an undergraduate degree in mathematics at Santa Clara University, and was inspired by his professor and former MAA president, Gerald Alexanderson, who is chair of the board of trustees of AIM. AIM has sponsored conferences, small focused research groups, public math lectures, and math activities for local high school students. See http://www.aimath.org/ for more pictures and information about AIM and ARCC.

Helen Moore is Associate Director of the AIM Research Conference Center

MBI Ties Together Math and Biology

The Mathematical Biosciences Institute (MBI) at Ohio State University is to be a place for vigorous research in mathematical biology and related fields. Its goals include sponsoring the development of new "mathematical theories, statistical methods, and computational algorithms for the solution of fundamental problems in the biosciences." It will seek to involve both mathematical scientists and bioscientists in this effort and to nurture a community of scholars interested in these problems.

MBI plans to sponsor special emphasis years, workshops on topics of current interest, education programs, and research projects. During 2002-2003, the MBI will be running a program on Mathematical Neuroscience. This is to be followed by a program on Mathematical Modeling of Cell Processes during 2003-2004.

For more information on MBI, visit their web site at http://mbi.osu.edu.

First Online PREP Workshop is a Success

How can you use an online map of Virginia to estimate the area of the state? One answer is contained in online materials created by a team from Hollins University as part of MAA's PREP workshop, Authoring Online Interactive Materials in Mathematics. This first online PREP workshop was held July 16-19. The workshop instructors, Lang Moore and David Smith from Duke and Frank Wattenberg from West Point, ran the workshop from the Duke campus. Sixteen teams of 2-4 participants worked at different institutions in the United States (with one individual in England and one team in Portugal) - for a total of 38 individuals.

Communication among the instructors and the participants was enabled by a variety of free software and judicious use of long-distance. The online presentations were recorded and are available for view at the workshop web site: www.math.duke.edu/education/prep02. In addition, many of the projects created by the teams during the workshop are also available at this site. The focus of the workshop was on the creation of interactive, web-based materials for undergraduate mathematics. Presentations by the instructors covered basics of HTML, creation of web pages using Word and Dreamweaver, working with applets and graphics, and the basics of Maple.

A particular focus was the use of easily modifiable applets created as part of the Lite Applets Project, a component of MAA's Mathematical Sciences Digital Library (MathDL). The area-of-Virginia module uses a Lite applet that enables the user to pick off screen coordinates of points on a graphic and transfer them to a spreadsheet. The Lite Applet Project is directed by Frank Wattenberg. The other two instructors also have ties to MathDL. David Smith is Editor of the Journal of Online Mathematics and its Applications (www.joma.org), the journal of MathDL; Lang Moore is Executive Editor of the Library.

Have you developed material suited to on-line presentation? The MAA is looking for proposals to offer professional development workshops over the web. If you have an idea you would like to submit, please contact Michael Pearson, Director of Programs and Services at MAA, pearson@maa.org.

Letters to the Editor

Gender Data

Just got the most recent Focus and noticed the gender data on page 30. I wish that you had included data about gender distribution of the membership at large. This would have allowed a more interesting examination of the data that was presented.

Bill Emerson
Governor of the Rocky Mountain Section of the MAA

A reasonable request, but the MAA does not collect gender information on its membership application forms, so the data in question does not exist!

Ooops!

My article ("Internet Resources...") in the May/June issue of FOCUS has been cruelly truncated! My references and the author's bio are missing.

Henry Ricardo
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We are very sorry. Here is the missing information:

References

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[4] K. D. Cooper and T. LoFaro, "Differential Equations on the Internet," in Revolutions in Differential Equations: Exploring ODEs with Modern Technology, ed. M. J. Kallaher (Washington, D.C.: Mathematical Association of America, 1999), pp. 39-49.

Henry Ricardo is Professor of Mathematics at Medgar Evers College of The City University of New York and Vice-Chair for Four-Year Colleges of the Metropolitan NY Section of the MAA. His book, A Modern Introduction to Differential Equations, was recently published by Houghton Mifflin. He thanks his student, Ayanna Moses, for her helpful feedback on some of the web sites.

Partial Credit: the Conversation Continues

The letters in the May/June issue regarding partial credit reminded me of an incident in the freshman calculus course I took a few years ago ... well, in the spring of 1942.

A test question asked us to derive a complicated formula from some basic assumptions. A comrade had worked his way to the end, but come out with an answer twice what was desired. The proctor started walking along the aisle of our large room, picking up test papers from the desks, so he had no time to review his work and find his error.

Desperate, he wrote: "For obvious reasons, we must divide this result by two, thus obtaining ..."

He got away with it, receiving full credit!

Ed Rosenberg
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I am just getting around to reading the December issue of FOCUS and the issue of partial credit that raised by Jay Beder in a letter to the editor. I suppose that responses have come in and that there is still no satisfactory answer to a difficult question. I remember on my Ph.D. oral examination being asked what I thought I knew the most about. When I answered "phase velocity", the questioner proceeded to demonstrate that I knew almost nothing about the subject. When the examination was over (fortunately, I passed), the questioner said that he was not trying to find out what I did not know. Rather, he was trying to find out if I knew anything at all. This attitude seems to me to be a starting point for partial credit under the circumstances that you describe. Consider the answer to be the answer to a question posed by the student rather than by you. Then ask: Has this student used the problem to demonstrate that she knows anything about the subject? If the answer demonstrates the principle you were trying to test, then the student gets more partial credit. If the answer demonstrates some other principle, then less credit.

Here is a related question. Suppose that a student transforms a problem into one that she cannot solve (and maybe you can't either), then how much credit should the individual receive?

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On "College Algebra"

It was interesting to read Don Small's article "Urgent Call to Improve Traditional College Algebra Programs" in the May/June issue of FOCUS. I was particularly struck by the passage:

"Participants in the Conference rejected the traditional content ... with its emphasis on algebraic manipulation".

Isn't that the definition of College Algebra?

I wholeheartedly support the idea that a terminal course in mathematics should be some kind of data analysis/modeling course, but is such a course College Algebra? I need my students to be able to do the boring, archaic, tortuous skills from algebra in order to focus on the new techniques we introduce in calculus! (By the way, I enjoyed learning those skills myself many years ago- I did not find them boring or tortuous).

The bottom line: College Algebra should be algebra! If you want to design a terminal course in data analysis and modeling, I commend you—just don't call it something it's not: algebra!

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Committee of Experts to Discuss Studies of NSF-Sponsored Curriculum Materials

The National Research Council of the National Academy of Sciences has created a committee of experts in mathematics assessment, curriculum development, curricular implementation and teaching to assess the quality of the studies about the effectiveness of the thirteen sets of mathematics curriculum materials developed with National Science Foundation support. A selection of evaluations of non-NSF supported materials will be used for comparison purposes.

The current committee, chaired by Dr. Jere Confrey of the University of Texas at Austin, is charged with the first phase of a potentially multi-phased review process. "We have been asked to prepare a short consensus report summarizing the results of our work, which includes creating an extensive bibliography of studies, mapping those studies according to their characteristics and then advising if the quality of the evidence merits a full review."

The committee is seeking a broad set of studies that meet the following critieria: 1) they study one or more of the thirteen NSF curricula as a central variable, 2) they meet the methodological canons for acceptable inquiry associated with that methodology, and 3) they have identified authorship and affiliation so as to give credibility to the work.

The Committee is soliciting evaluation studies that include: studies with specific student outcomes, content analysis studies, students of classroom implementation and school environment and studies of teacher knowledge, teacher characteristics and professional development and will add to these classifications as committee members identify additional relevant categories. Dr. Carole Lacampagne, director of the Mathematical Science Education Board stated, "We have not limited ourselves to published studies, because summative studies of these curricula are often recently completed, but as with all NRC work, the reports must meet scholarly expectations."

The Committee is also hosting a two day workshop in Washington D.C. on September 17 and 18th. This meeting permits us to hear from various curricular designers, researchers, evaluators, mathematicians and practitioners on their points of view concerning the evaluation of effectiveness. Panel members are asked to respond to the question "How would you define and/or evaluate effectiveness of a K-5, 6-8 or 9-12 NSF-supported curricula and what evidence would be needed." They are asked to identify primary and secondary variables, methods of examining and measuring those variables, research designs and other relationships under investigations.

"These are complex questions," said Dr. Confrey, "as curricular design and implementation involve many people's participation, are measured by a myriad of local and national forms of assessment, and are used across highly variable settings, differing in values, resources, cultural contexts and forms of organization. It is imperative for us as a nation to get smarter and more sophisticated in how to conduct and evaluate such studies and to learn from our current work" Confrey added that she thinks, "I believe that this NRC work can lead towards resolution of some of the debates by bringing together people and studies from a variety of perspectives and working for a common framework to establish a solid research-based foundation to improve curriculum development and evaluation and to aid schools and districts making decisions."

Dr. Michael Feuer, director of the Center for Education, added, "As long as there is a commitment to increasing the scientific evidence on questions of education, work such as this will be needed and is directly in line with the responsibilities of the NRC to provide advice to the Nation." Suggestions of studies for review should be sent to CLacampagne@nas.edu.

SIAM Celebrates Its 50th Anniversary

The Society for Industrial and Applied Mathematics (SIAM) celebrated its 50th anniversary at a meeting held in Philadelphia on July 8-12, 2002. The meeting looked to both past and future, considering the progress made by industrial and applied mathematics since the creation of SIAM and attempting to see into the future to discern what might happen in the next 50 years.

SIAM was founded 50 years ago to advance the applications of mathematics, promote research, and provide opportunities for the exchange of information. For its 50th anniversary, the Society decided to meet in Philadelphia, where the first SIAM meeting happened and where SIAM headquarters are still located. The meeting covered a wide range of themes, from analysis to optimization, from computing to life sciences. The usual assorted lectures, contributed talks, prizes, mini-tutorials and so on were supplemented by several special events, including a keynote speech by NSF Director Rita Colwell and talks by many distinguished mathematical scientists. For more information on the meeting, visit http://www.siam.org/SIAM50.

Writing Mathematics: A Nut and a Bolt of Style

By Frank A. Farris

In his book, Style: Ten Lessons in Clarity and Grace, Joseph M. Williams shows us how to rewrite dense technical passages in order to make them easier to read. If you don't have time to read this excellent book, let me summarize one point for you: English speakers are predisposed to talk about actors taking action, and therefore we should provide that structure for our readers when we write.

As editor of Mathematics Magazine, I see a lot of manuscripts. Some of them are written with a charming sense of style, but many of them leave me thinking that the author's only concern was to set out the mathematics clearly. This is a fine place to start, but the tradition of the Magazine is to offer things that people will enjoy reading, and this requires more than clarity. Let me explain an important step authors can take in order to make their work more attractive.

There are many sources for comprehensive advice about writing mathematics; some are listed in the Editorial Guidelines at the Magazine website (at http://www.maa.org/pubs/mathmag.html). They all warn against using the passive voice, a point that Williams elaborates. My hope here is to expand on that idea and even offer some homework to help readers experience it for themselves.

First, an explanation: I wrote all the examples myself. Although some may be based on things I've read in actual manuscripts, I would not hold up anyone's writing as a public bad example. Unless it's my own.

Start by trying to read this passage:

> The negation of Euclid's Parallel Postulate was the starting point for the numerous discoveries of Saccheri, from which a concrete contradiction was surely expected by him, but which were later shown to be true in the context of noneuclidean geometry.

It is grammatically correct, but hard to read. Of course, it is inherently difficult to communicate abstract ideas, but this passage requires far too much mental juggling. Readers have to hold in mind too many syntactical elements for later assembly. The negation of Euclid's Parallel Postulate is a complicated abstraction and the sentence structure A was the starting point for B is less than concrete. It all leaves us wondering, "What happened?"

Try rewriting this yourself in a way that highlights Saccheri, who, after all, is the person whose actions we are talking about. This is my version:

> Saccheri spent his career discovering consequences that follow from assuming that Euclid's Parallel Postulate is false. Although he surely expected to reach a contradiction, his conclusions are true in noneuclidean geometry.

Notice that I used two sentences instead of one. When we have become experts on a particular bit of mathematics, we use mental shorthands that tempt us to write long sentences with too great a burden of information. One remedy for this is to break up a complicated thought into two simpler pieces.

Notice also that the complicated abstraction, assuming that Euclid's Parallel Postulate is false, comes at the end of a sentence; when we arrive there in our reading, we already know the grammar of the sentence and can handle the abstraction more comfortably. And I thought the abstraction was easier to understand when phrased as an activity.

I recently taught a course called Writing for the Mathematical Sciences, in which each student wrote two papers. To set the tone on the first day of class, I kept a straight face as I displayed one version of the first two paragraphs of my syllabus on an overhead:

> By means of written communication people can basically have the things they think be shared with other people. Having understanding of your writing by the various kinds of people about many things needs a lot of different skills to be used. In this course, developing abilities of written mathematical communication will be the principal focus.
>
> Since it is probable that really talking about exactly how meaning gets communicated gets to be too difficult of a philosophical problem, the assumption will be made that there is a common standard of expression in mathematics, which will be understandable, as long as it is clear, by a group we call American mathematicians, with some things you have to do like good English grammar, some general rules where breaking is allowed, and some things that are left up to the tasteful decision-making and stylistics of the person by whom it was written. But without talking about something as complicated as a language community, even though we need to learn all about their conventions, it is to be believed that if you can understand your own writing yourself, then its comprehensibility to other people will usually be implied in general. However, sometimes you can think you are reading your own writing, but you actually aren't.

Some students saw through my deception. They made interesting points about why this passage was hard to read, though they had to agree that it is grammatical, and even possible to decipher. Before reading on, you might enjoy rewriting it yourself. The passage illustrates various common infelicities, but to focus on today's Nut and Bolt, try to highlight an actor taking action when rewriting each sentence. Here is my version:

> Writing can help you share your experience. Depending on the kind of experience this is, and depending on whom you hope to reach, you need different skills to make yourself understood. In this course, we will practice writing to communicate mathematical experience.

> Philosophical questions of meaning and how to transmit it are tricky. To avoid such things, we will assume that the community of American mathematicians forms a well-defined language group, who can understand things written clearly in their idiom. This hypothetical community has some ironclad conventions (including standard English grammar), some mutable rules, and some relatively open choices of style and taste. Learning these standards is important, but here is some simpler advice: if you write things that you find easy to understand, your fellow students and I will probably be able to follow as well. Of course, learning to read your own writing is not as easy as it sounds.

Writing about actors taking action is not my only recommendation for a good mathematical style. I also prefer that authors lead with examples, rather than announce abstractions and give examples later. I appreciate authors' personalizing their writing by using the first person. Perhaps each of these merits an essay, preferably written by someone else.

I also have a few pet peeves about the mechanics of writing: When an author writes i.e., I will change it to that is; and when an author uses quotes to show that certain "words" are not being "used" in the customary sense, I remove the quotes and reword the passage. A misplaced modifier sometimes gives me a laugh, as in "With further instruction, these examples could be used in high school;" one imagines how difficult it must be to instruct examples. On the other hand, I am not a linguistic prig; when the setting is right, I allow authors to gaily split infinitives. And the day is probably coming when I'll print something akin to "every student must write their own paper," although that particular bullet may be dodged very easily in this particular passage.

Back to my primary advice to authors: go through your manuscript, underline every verb, and change the sentences where the verb is flabby. We mathematicians do so very many things; we count interesting sets, we compute approximate solutions to differential equations, we expand functions as infinite series. We speak of mathematical objects as actors in action: cosets decompose a group, pentagons can tile the plane, zeros of the Riemann zeta function may or may not all lie on a particular line. There is no shortage of vivid verbs to use. And since we represent so many of the different types of people on Earth, there is a richness to be revealed when we allow our individual selves to show through the mathematics.

Frank Farris is the editor of Mathematics Magazine.

On May 15, 2002, the MAA participated in the Coalition for National Science Funding (CNSF) Exhibit and Reception for Congress. This year's exhibitor was MAA Second Vice President Joseph A. Gallian. The subject area of his exhibit was the very successful REU program that he has run for many years at the University of Minnesota-Duluth. On the day of the exhibit, he, his two student presenters, and MAA Executive Director Tina Straley visited the offices and the exhibit with members of Congress and/or staff of every Senator and Representative from Minnesota, including a private meeting with Senator Paul Wellstone. Pictured left to right are: Tina Straley, MAA Executive Director, Joseph A. Gallian, MAA Second Vice President, Senator Paul Wellstone, Sarah Moss, Harvard University, and Melanie Wood, Duke University.

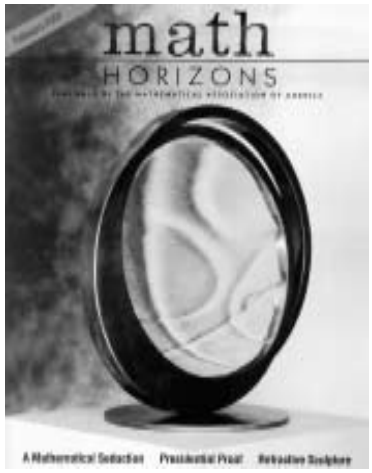
MAA Seeks New Editor for Math Horizons

The MAA is looking for candidates to succeed Stephen Kennedy and Deanna Haunsperger as Editor of Math Horizons when their terms expire in December 2003.

The Search Committee must make a recommendation soon, so that the new editor can be approved by the Board of Governors and begin handling new manuscript submissions in January 2003. Questions about the nature of the position and its workload can be addressed to Stephen Kennedy (skennedy@mathcs.carleton.edu) or Deanna Haunsperger (dhaunspe@mathcs.carleton.edu). Questions about MAA support for the editor's work can be addressed to the MAA's Director of Publications, Don Albers (dalbers@maa.org).

Applicants should submit a resume, names of references, and a statement of interest containing their ideas about the magazine. These can be e-mailed to the chair of the Search Committee, Joe Gallian, (jgallian@d.umn.edu) or sent by regular mail to Don Albers, Mathematical Association of America, 1529 Eighteenth St., NW, Washington, DC, 20036, for distribution to the Search Committee. Nominations are also welcome.

The position is to be filled by October 1, 2002, so applications should be completed not later than mid-September; earlier applications may receive preference.



2003 Grant Funding Available

The Calculus Consortium for Higher Education (CCHE) is a small non-profit public charity which is the outgrowth of an NSF funded project in innovative coursework in undergraduate education (the Calculus Consortium based at Harvard.) The mission of CCHE is to improve the teaching of mathematics in secondary schools, two-year colleges, colleges and universities. It supports workshops, meetings, conferences or research projects in innovative coursework. With that goal in mind grant requests are hereby being solicited in those four areas. Grants are usually for 1 year and for less than $25,000. Proposals should be less than five pages in length and be accompanied by a budget using NSF Form 1030. They should be sent to CCHE, P.O. Box 22333, Carmel, CA 93922 or Email: cche@redshift.com, Fax: (831) 624-7571 by November 15th for consideration by the Board of Directors in early January. Requests for an earlier review date will be considered on an individual basis. If there are any questions, please contact Thomas Tucker, Mathematics Department, Colgate University, Hamilton, NY 13346, Email (preferred): ttucker@mail.colgate.edu.

Writing for FOCUS

We are always looking for news items and articles that will be of interest to MAA members everywhere. If you'd like to contribute, here are some guidelines:

Keep in mind that FOCUS is a news magazine, not a journal. Articles should be short, informal, and whenever possible should include illustrations. We are always looking for good cover images, so let us know if you have an interesting suggestion. Please make sure you own copyright to any text or images you submit.

The best way to submit your article or news item is as an email attachment. Send to focus@maa.org or to fqgouvea@colby.edu. We take a little while to respond, but don't be afraid to email again to find out what happened if we're taking too long.

Whenever possible, send articles in Microsoft Word, text, or html format. Graphics can be sent in any format, but should have high resolution: 300 pixels come out to one inch when printed. Because such graphics files are very large, it is better to consult with the editor first.

Keep in mind that FOCUS has publication lead time of two months. See page 3 for the precise deadline for each issue.

FOCUS has an activist editor. Your deathless prose will be copyedited, both for clarity and for space.

We look forward to your contribution!

Additional Session Added for Baltimore

MAA CP AA1 Initiating and Sustaining Undergraduate Research Projects and Programs
Thursday Afternoon
James A. Davis*, Department of Mathematics and Computer Science
University of Richmond, VA 23173
(804) 289-8094; fax (804) 287-6444
jdavis@richmond.edu
Suzanne M. Lenhart
University of Tennessee
Daniel J. Schaal
South Dakota State University

This session seeks presentations from faculty supervisors of undergraduate research who have insights and experience which would assist others, either in creating individual undergraduate research projects or in creating and maintaining longer-term undergraduate research programs. The broad spectrum of undergraduate research, from small projects in courses to honors projects and full-fledged summer research programs, will be represented.

In Memoriam

Leopold Vietoris 1891-2002

Leopold Vietoris died in Innsbruck, Austria, on April 9. He was 110, having been born on June 4, 1891. According to the obituary in the "Frankfurter Allgemeine Zeitung," he was the oldest living Austrian. Vietoris' wife had died only three weeks before, at the age of 101. The couple was married for 66 years. Students of algebraic topology will recognize Vietoris's name. He did important and pioneering work in that field, but his work ranged over many other areas of mathematics, including real analysis and probability theory. As we noted in our January issue, Vietoris' most recent paper was published in 1995, when he was 104.

Laurent Schwartz, 1915-2002

Laurent Schwartz, one of the 20th century's greatest mathematicians and winner of the Fields Medal in 1950, passed away on July 4, 2002. Schwartz had recently published an autobiography, entitled A Mathematician Grapples with his Century (recently reviewed on MAA Online), in which he discussed both his mathematics and his political activism. Schwartz was an analyst who was best known for his creation of the theory of distributions, a kind of generalized function. He also did significant work on stochastic analysis.

Have You Moved?

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

Employment Opportunities

CALIFORNIA

HARVEY MUDD COLLEGE
Chair, Department of Mathematics
Harvey Mudd College invites applications for a permanent position in mathematics at the full professor level. Demonstrated excellence in teaching is absolutely essential for all candidates, as is an established record of scholarship in the mathematical sciences. The successful candidate will begin service as department chair shortly after the appointment and will possess demonstrated leadership skills to support and mentor a young, enthusiastic department. Candidates should also be willing to supervise undergraduate research and work with others in the development of the undergraduate curriculum and other departmental programs.

Harvey Mudd College is a highly selective undergraduate institution of science, engineering and mathematics with a median SAT score approaching 1500 and one year of high school calculus required for admission. Each year there are about 25 graduates in mathematics, CS/math, and mathematical biology with approximately half going to graduate school. Over 40% of mathematics alumni from HMC have entered PhD programs. The College enrolls about 700 students and is a member of the Claremont College consortium, which consists of four other undergraduate colleges, the Claremont Graduate University, and the Keck Graduate Institute of Applied Life Sciences, forming together an academic community of about 5000 students. There is an active and vital research community of over 40 mathematicians in the consortium.

Claremont is situated approximately 35 miles east of downtown Los Angeles, at the foot of the San Gabriel mountains. The community is known for its tree-lined streets and village charm. It is an easy drive from Claremont to the cultural attractions of the greater Los Angeles area, as well as the ocean, mountains and deserts of southern California.

Applicants should send a curriculum vita, a description of their teaching philosophy and accomplishments, a description of their current research program, and names and addresses of at least three persons as references. Only references of finalists for the position will be contacted. Applications will be reviewed as they are received, beginning September 15, and the position will remain open until filled. Harvey Mudd College is an equal opportunity employer and is committed to the recruitment of candidates historically underrepresented on college faculties.

Further information about the college and department may be found at http://www.math.hmc.edu.

Address for applications:

Professor Henry Krieger
Chair, Mathematics Senior
Search Committee
Mathematics Department
Harvey Mudd College
Claremont, CA 91711-5990

MASSACHUSETTS

WILLIAMS COLLEGE
The Williams College Department of Mathematics and Statistics invites applications for two positions in mathematics and one position in statistics, beginning fall 2003, all at the rank of assistant professor (in exceptional cases, more advanced appointments may be considered). We are seeking highly qualified candidates who have demonstrated excellence in teaching and research, and who will have a Ph.D. by the time of appointment.

Williams College is a private, residential, highly selective liberal arts college with an undergraduate enrollment of approximately 2,000 students. The teaching load is two courses per 12-week semester and a winter term course every other January. In addition to excellence in teaching, an active and successful research program is expected.

To apply, please send a vita and have three letters of recommendation on teaching and research sent to the Hiring Committee, Department of Mathematics and Statistics, Williams College, Williamstown, MA 01267. Teaching and research statements are also welcome. Evaluations of applications will begin on or after November 25 and will continue until the positions are filled. Williams College is dedicated to providing a welcoming intellectual environment for all of its faculty, staff and students; as an EEO/AA employer, Williams especially encourages applications from women and underrepresented minorities. For more information on the Department of Mathematics and Statistics, visit http://www.williams.edu/Mathematics.

NEW YORK

NAZARETH COLLEGE
Tenure-track position in mathematics, beginning Fall 2003. Ph.D. in mathematical sciences, demonstrated teaching excellence, commitment to innovative teaching in a collaborative environment, and use of technology in teaching required. Responsibilities include: 4 courses per semester (majors and non-majors), scholarship and service. Preference to candidates with interest in teaching applied mathematics and introductory courses in computer programming, and directing student research.

Nazareth College, a thriving, independent, co-educational, liberal arts college with 1900 undergraduates and 1200 graduate students, is minutes from downtown Rochester, noted for its cultural diversity. We seek individuals with an understanding of the benefits and importance of diversity.

Send letter of application, philosophy of teaching, curriculum vitae, transcripts, and three letters of reference to: Professor Susan Riegle, Search Committee, Nazareth College, 4245 East Avenue, Rochester, NY 14618. E-mail: smriegle@naz.edu. See: http://www.naz.edu/dept/hr/postings/faculty.html EOE/AA.

PENNSYLVANIA

LA SALLE UNIVERSITY
Department of Mathematics
& Computer Science
Tenure-Track Position
La Salle University invites applications for a tenure-track position at the Assistant Professor level beginning in August 2003. A Ph.D. in mathematics is required by the commencement of the appointment. The successful candidate will possess a strong commitment to excellence in teaching and continued scholarly activity. Duties include teaching a wide variety of undergraduate courses (12 hours each semester), student advising, curriculum development, and committee work.

La Salle University is a Roman Catholic university in the tradition of the La Salle Christian Brothers and welcomes applicants from all backgrounds who can contribute to its unique educational mission. For a complete mission statement, please visit our Web site at www.lasalle.edu.

Please submit a curriculum vita, statement of teaching philosophy, and three letters of recommendation, at least one of which addresses the applicant's teaching experience and effectiveness, to Linda J. Elliott, Chair, Department of Mathematics and Computer Science, La Salle University, 1900 West Olney Avenue, Philadelphia, PA 19141-1199 (elliott@lasalle.edu). Priority will be given to applications received by November 1, 2002. Women and minorities are strongly encouraged to apply. AA/EOE.