5-1-2006

Teaching Time Savers: A Recommendation for Recommendations

Michael E. Orrison Jr.
Harvey Mudd College

FOCUS is published by the Mathematical Association of America in January, February, March, April, May/June, August/September, October, November, and December.

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Instructions for submitting articles for FOCUS can be found at http://www.maa.org/pubs/writingforfocus.html.

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Periodicals postage paid at Washington, DC and additional mailing offices. Postmaster: Send address changes to FOCUS, Mathematical Association of America, P.O. Box 90973, Washington, DC 20090-0973.

ISSN: 0731-2040; Printed in the United States of America.

FOCUS

Volume 26 Issue 5

Inside

On the cover: Lennart Carleson, winner of the 2006 Abel Prize. Photo supplied by the Abel Prize Committee. Used by permission of the Abel Prize/The Norwegian Academy of Science and Letters.

FOCUS Deadlines

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Editorial Copy	July 8		September 16
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MAA Dues Structure Simplified

You'll see a different — and simpler! — structure to MAA dues, starting with the dues notice for 2007. The new structure replaces the current dues matrix. The restructuring was approved by the MAA Board of Governors in January. The goals were to: simplify the dues notice and to determine dues by considering actual costs. In particular, the new structure reflects the fact that many MAA activities do not produce revenue — such things as administration, governance, planning, and programs that are not fully funded externally (Project NExT, for example). The idea is that member dues should reflect the actual cost of these activities.

The new structure has two parts: a base rate and additional items.

The base rate for each member category includes membership and exactly one journal — one rate for just the *American Mathematical Monthly*, and another for either just the *College Mathematics Journal* or just the *Mathematics Magazine* (both of which publish half as many issues a year as the *Monthly* does). The base rate for Regular members should be approximately equal to the per-member share of the cost of MAA operations that do not produce revenue plus average cost of the journal selected. It is currently less than this, and so the rate will gradually be adjusted to that level. For 2007, the base rate for Regular members will be $178 for those choosing the *Monthly* and $158 for those choosing the *Magazine* or the *CMJ*.

Members will be able to select additional items for their total membership package. These can include membership in SIGMAAs, subscriptions to journals not included under the base rate, subscriptions to *Math Horizons*, and JSTOR access. The prices of these options will be the same in every member category, discounted or not. In 2007 the prices of additional journal subscriptions will be $56 for the *Monthly* and $36 each for the *CMJ* and the *Magazine*.

As happens now, the base rates for members in discounted categories will be certain percentages of the Regular base rate. The base rate for "Regular Discounted" members will be $142 for the Monthly and $126 for either the *Magazine* or the *CMJ*. For Retired members, the base rates will be $89 and $79, respectively; for Graduate Student members, $59 and $52, respectively.

The practical effects for 2007 will be a much simpler dues form and a modest increase in dues that better reflects the fiscal realities of the Association. Here are two examples.

1) A Regular member taking the *Monthly* and the *CMJ* will have dues of $214 ($178 Regular base with the *Monthly* + $36 *CMJ* subscription, or $158 Regular base with the *CMJ* + $56 *Monthly* subscription).

2) A Discounted Regular member taking those same journals will have dues of $178 ($142 Discounted Regular base with the *Monthly* + $36 *CMJ* subscription) or, if preferred, of $182 ($126 Discounted Regular base with the *CMJ* + $56 *Monthly* subscription). Thus, discounted members taking the *Monthly* will save (a little) money by choosing the *Monthly* as their base journal.

The Board of Governors hopes that members find the new dues structure both simpler and more logical and the dues notices simpler and shorter. Questions can be addressed to MAA Director of Membership Jim Gandorf (jgandorf@maa.org) or to MAA Budget Committee Chair Jim Daniel (daniel@math.utexas.edu).

Lennart Carleson Wins the 2006 Abel Prize

The winner of the 2006 Abel Prize is Lennart Carleson of the Royal Institute of Technology in Sweden. The six million Kroner prize, which is awarded by the Norwegian Academy of Science and Letters, comes out to a little more than nine hundred thousand dollars. The Abel Committee citation says that Carleson is receiving the prize for his contributions to harmonic analysis and to the theory of smooth dynamical systems. The Committee says that "Carleson is always far ahead of the crowd. He concentrates on only the most difficult and deep problems. Once these are solved, he lets others invade the kingdom he has discovered, and he moves on to even wilder and more remote domains of Science."

The committee specifically mentioned Carleson's famous result on Fourier series: "In 1966, to the surprise of the mathematical community, Carleson broke the decades-long impasse by proving Lusin's conjecture that every square-integrable function, and thus in particular every continuous function, equals the sum of its Fourier series "almost everywhere." The proof of this result is so difficult that for over thirty years it stood mostly isolated from the rest of harmonic analysis. It is only within the past decade that mathematicians have understood the general theory of operators into which this theorem fits and have started to use his powerful ideas in their own work."

Carleson has, of course, done quite a lot of valuable and important mathematics since then, ranging over harmonic analysis, complex analysis, the theory of quasiconformal mappings, and dynamical systems. He is also known for his solution of the corona problem, "so called because it examines structures that become apparent "around" a disk when the disk itself is "obscured," for his work on Fourier multipliers, and for his work, with Benedicks, on the Hénon strange attractor.

King Harald of Norway will present the Abel prize at a special ceremony to be held in Oslo on May 23. The ceremony will be followed by the full-day Abel Lectures, to be held at the University of Oslo on May 24, and the Abel Party, on May 27. For more information, including an expository account of Carleson's work by Marcus du Sautoy, visit http://www.abelprisen.no/en/.

A Pilgrimage to Ramanujan's Hometown

By Krishnaswami Alladi

The district of Tanjore (Tanjavur in Tamil) in the state of Tamil Nadu, in South India, has been a seat of culture for several centuries. Tanjore has produced some of the greatest composers of Carnatic music, the classical music of South India. Tanjore is also very well known for art in various forms; in particular, Tanjore paintings of Hindu gods, which have crystal glass pieces imbedded, are much appreciated both for their special beauty and art value. The Tanjore district also has the greatest concentration of Hindu temples, and some of them are architectural marvels.

It was in the midst of this region steeped in culture, in the town of Kumbakonam, that the Indian mathematical genius Srinivasa Ramanujan lived and made some of his amazing discoveries. In December 2003, my wife Mathura and I had the opportunity to visit Kumbakonam, see the humble home from which a thousand theorems emerged, and visit several temples in that area, including the one next to Ramanujan's home where he prayed regularly.

The outlines of Srinivasa Ramanujan's life are well known. He was born to an orthodox Hindu brahmin family on December 22, 1887. Among the brahmins, there are two main subcastes in South India, the Iyers, who worship Lord Shiva the Destroyer as the primary diety, and the Iyengars, who worship Lord Vishnu the Protector as the main diety. Ramanujan was an Iyengar, and from his parents he learned many verses of the Vedas, the Hindu holy scriptures, as well as stories from Hindu folklore and epics. Ramanujan and his family offered prayers regularly at the Sarangapani temple for Lord Vishnu in Kumbakonam, which was just down the street from his home.

Ramanujan showed his unusual talent for mathematics very early. Often in the middle of the night he would get up and write down mathematical formulae on a piece of slate, lest he should forget them in the morning when he woke up.

Krishna Alladi and George Andrews with R. Sethuaman, Vice-Chancellor of SASTRA in front of a Ramanujan statue that was unveiled during the conference.

He would then record these marvelous formulae in his now famous notebooks. Ramanujan had a special veneration for the Goddess Namagiri of the temple in the neighbouring town of Namakkal, and we are told that the Goddess of Namakkal would come in his dreams and give him these formulae.

Ramanujan later moved to Madras (now called Chennai), the capital and largest city in Tamil Nadu, where he attended College. His obsessive preoccupation with mathematics led to a neglect of other subjects and so he had to drop out of college. The advantage of being in Madras, however, was that he could come in contact with persons, both Englishmen and Indians, who could appreciate his work. Some of them suggested that he should communicate his findings to leading mathematicians in England — India was a British colony at that time. The rest is history.

The two letters Ramanujan wrote to G. H. Hardy of Cambridge University are considered to be among the most significant in mathematical history. In these letters Ramanujan communicated many of the bewildering mathematical formulae he had discovered. The letters convinced Hardy and his peers that Ramanujan was a mathematical genius; the result was an invitation to come to Cambridge.

Orthodox Hindus believed that it was a sin to cross the oceans, and so Ramanujan declined this invitation. But Hardy persisted. One night, his mother had a dream in which she saw Ramanujan being honored by foreigners in a great assembly. In that same dream the Goddess of Namakkal ordered the mother not to stand in the way of her son's recognition. Thus with his mother's permission, Ramanujan sailed for England in 1914.

Hardy, being an agnostic, dismissed the Goddess of Namakkal stories as mere fables. However, I should point out that it is very natural for Hindus to accept such stories. Hindu belief is that there is a divine origin to every aspect of knowledge, including music, and that is why much of Hindu classical music is devotional.

Hindus believe in the story of Kalidasa, the greatest sanskrit poet, who was transformed from an uneducated cowherd to a poet par-excellence overnight because the Goddess Kali wrote her blessings on his tongue. Thus it is very natural for Hindus to accept the Goddess of Namakkal as a divine origin of Ramanujan's great discoveries.

In England, within a short span of five years, Ramanujan wrote several fundamental papers, some with Hardy, that revolutionized various areas of mathematics. But conditions were difficult in England at that time, partly because of the First World War. Ramanujan was a strict vegetarian, and food to suit his dietary needs was difficult to get in wartime England. He also did not take care to protect himself from the cold English winters. Thus he had to return to India in 1919, a very sick man. Hardy was concerned that Ramanujan might not live long, and so he worked hard to get him elected as Fellow of the Royal Society (FRS) in 1918. What a recognition for someone who did not even have a college degree! Ramanujan died shortly after his return to India.He was 32 years old.

About 15 years ago, the Shanmugha Arts, Science, Technology and Research Academy (SASTRA) was created in Tanjore. Unlike public colleges and universities in India, where most admission is based on a quota system for certain underdeveloped segments of society, admission to private educational institutions like SASTRA is based on merit. Thus in a short span of time, SASTRA has attracted some of the brightest students and the best teachers, and therefore grew both in size and quality to attain the status of a deemed university. Owing to this successful growth, SASTRA recently opened a second campus at Ramanujan's hometown, Kumbakonam.

In 2003 SASTRA University purchased the home of Ramanujan, and will maintain it as a museum. Ramanujan is an idol and inspiration to all students in India, and hence the preservation of his home was essential to the spirit and hope of Indian intellectuals. SASTRA also created a Srinivasa Ramanujan Centre with a library that contains several Ramanujan memorablia, as well as books, papers, and journals relating to his work. We now have the active involvement of administrators, academicians, and students in the preservation of Ramanujan's legacy. To mark the occasion of the purchase of Ramanujan's home, the Srinivasa Ramanujan Centre held an International Conference on Number Theory and Secure Communications in December 2003. I was invited to lecture on my work. Other plenary speakers at this conference included George Andrews from The Pennsylvania State University, Noam

Krishna Alladi and George Andrews in front of Ramanujan's home in Kumbakonam, December 21, 2003.

Ramanujan used to sit on this cot and look through the window at the passersby on the street as he worked on his mathematics.

Elkies of Harvard University, Samuel Wagstaff of Purdue University, and Antol Balog of The Hungarian Academy of Sciences. George Andrews gave the Opening Lecture as well as the concluding Ramanujan Memorial Lecture on December 22, Ramanujan's birthday. The conference was supported by the Indo-US Forum, the Number Theory Foundation, and several funding agencies in India. The President of India, Dr. Abdul Kalam, inaugurated the conference and declared Ramanujan's home open as a museum and national treasure.

The overseas delegates and their families were accommodated at Sterling Resorts in the Swami Malai, near Kumbakonam. Swami Malai derives its name from a temple there for Lord Subramanya, who as a child explained the deep meaning of the sacred Hindu syllable Om to his father Lord Shiva. The significance of this story is that knowledge has no age barriers. Swami, which means God, refers here to Lord Subramanya, and Malai which means mountain in Tamil, refers to a little hill on top of which the temple is located.

Sterling Resorts is an amazing place. It is a set of cottages with tiled roofs, in a farm or plantation setting. There are plenty of banana trees and several cows on the premises of the resort. Thus milk and all milk products required for guests are obtained fresh from the resort itself. Also, delicious Indian food is served in the Indian style, on banana leaves. On the resort grounds there is a magnificent white statue of Lord Shiva with his young son Lord Subramanya on his lap whispering the meaning of Om into his father's ear.

When all guests arrived at the resort, we were given a very warm traditional welcome, namely, we were not only greeted with garlands and flowers, but trained staff at the resort in traditional Indian dress, washed and massaged our feet with fragrant water. I suppose the tradition came about because in the past travellers used to arrive by foot, and so this foot massage was a welcome relief. We arrived by a van from Madras, yet we immensely enjoyed and appreciated this traditional welcome.

A statue of Lord Shiva with his son Lord Subramanya on his arms whispering the meaning of the Hindu syllable 'Om' into his father's ears.

Although Sterling Resorts has an old fashioned style, the rooms have all amenities. There are no note pads near the telephone to take down messages. Instead, you are provided a slate and a piece of chalk. When I went to bed I hoped that like Ramanujan, I too would get a formula in my dream so that in the middle of the night I could get up and write it down on the slate with the piece of chalk.

Seeing Ramanujan's home was itself a dream come true. What an inspiration to see this small humble home from where so many significant mathematical discoveries poured forth. The home has only three rooms surrounding a small courtyard — a bedroom, a kitchen, and a dining area. In the back there is a well and a bathroom. This was a typical village home. As was customary, a family of four to eight lived here. Not every one could sleep in the bedroom, and so members of Ramanujan's family slept in the courtyard as well. There is a window in the bedroom overlooking the street. As a boy Ramanujan used to sit on the bedroom cot doing mathematics and watching the passers-by on the street.

After offering prayers at the Brihadeeswara temple, our hosts at SASTRA took us to a few shops in Tanjore town containing a wonderful collection of local art. My wife wanted to purchase a Tanjore painting during a visit there. So we actually went to the home of a local artisan and bought a lovely painting of Lord Krishna. This now adorns the wall of the puja (worship) room in our home in Gainesville, to remind us every day of the rich cultural experience we had in Tanjore district. The visit was truly an unforgettable mathematical pilgrimage.

Krishnaswami Alladi is Professor and Chairman of the Department of Mathematics at the University of Florida. His research is in number theory, an area where Ramanujan made spectacular contributions. He is also the Editor-in-Chief of The Ramanujan Journal, *an international publication devoted to all areas of mathematics influenced by Ramanujan. A version of this article appeared in the newsletter of LOTUS (The Lord of the Universe Society), in Honolulu, Hawaii.*

The First SASTRA Ramanujan Prizes

by Krishnaswami Alladi

On 20 December 2005, the First SASTRA Ramanujan Prizes were awarded at Kumbakonam, India, Ramanujan's home town, to Professors Manjul Bhargava (Princeton) and Kannan Soundararajan (Michigan). To be there and participate in a function when the First SASTRA Ramanujan Prizes were awarded to two of the most brilliant young mathematicians was one of the most thrilling moments of my life.

In the preface to the first issue of the *Ramanujan Journal*, I said that "the very mention of Ramanujan's name reminds us of the thrill of mathematical discovery." Ramanujan is an inspiration for mathematical aspirants and researchers the world over and a role model and idol for all in India, where he is a household name. There can be no better way to commemorate Ramanujan than to award these prizes for exceptional mathematical creativity at a very young age.

SASTRA University, under the leadership of Vice Chancellor Prof. R. Sethuraman, has made laudable efforts to foster the legacy of Ramanujan and to support mathematical research. Their latest step is the creation of the SASTRA Ramanujan Prize to recognize significant contributions to mathematics. The age limit for the prize was set at thirty two in order to recognize doctoral and post-doctoral research, and also because Ramanujan achieved so much in his brief life of thirty two years.

The decision to create the prize was made during a discussion I had with the Vice-Chancellor during the International Conference on Fourier Analysis and Number Theory at SASTRA University, Kumbakonam, in December 2004, which I had the pleasure of inaugurating. The Vice-Chancellor announced that this annual prize of $10,000 will be first awarded at the International Conference on Number Theory and Mathematical Physics at SASTRA's Srinivasa Ramanujan Centre in Kumbakonam in December 2005. I was invited by SASTRA to form and head the 2005 Prize Committee. The members of the Committee were Krishnaswami Alladi, Chair (University of Florida), Manindra Agarwal (IIT Kanpur), George Andrews (Penn State University), Jean-Marc Deshouillers (University of Bordeaux), James Lepowsky (Rutgers University), Tom Koornwinder (University of Amsterdam), and Don Zagier (Mac Planck Institute, Bonn, and College de France).

The Committee was pleased to receive several excellent nominations of brilliant young mathematicians from around the world supported by leaders in the field. It turned out that two candidates of Indian origin emerged as the best in this international competition — Manjul Bhargava of Princeton University and Kannan Soundararajan of the University of Michigan. The decision was to award prizes to both Bhargava and Soundararajan whose areas of research are algebraic number theory and analytic number theory, respectively. Thus the prizes recognized research in two of the main branches of number theory.

Both Bhargava and Soundararajan have made impressive contributions and their rise to the top can only be described as meteoric. Bhargava wrote a revolutionary thesis under the direction of Andrew Wiles at Princeton in which he produced composition laws for forms of higher degree, the first major progress in this direction since the time of Gauss. Soundararajan, who also received his PhD from Princeton, this time under the direction of Peter Sarnak, has made spectacular contributions to combinatorial and analytic number theory, prime numbers, the theory of the Riemann zeta function, Dirichlet L-functions, and random matrices.

The SASTRA Ramanujan Prizes of $10,000 each were awarded to Bhargava and Soundararajan on 20 December, 2005 during the the International Conference on Number Theory and Mathematical Physics. The presenter was Aurobindo Mitra, Executive Director of the Indo-US Forum for Science and Technology, which provided significant support for the conference.

The opening lecture of the conference was a talk by Soundararajan on "Large character sums: the Polya-Vinogradov theorem." The conference concluded with the Ramanujan Commemoration Lecture by Bhargava in which he announced his most recent spectacular result (joint with Jonathan Hanke), namely, the complete determination of all universal quadratic forms, thereby solving a problem which has its origins in Ramanujan's work. It was fitting that Bhargava announced this on Ramanujan's birthday (December 22) and in Ramanujan's home town!

Found Math

Colman McCarthy: But did you go to a high school where they required you to go into an algebra course? Did you take algebra in high school?

Mary Gray Davidson: Certainly.

McCarthy: Yes. How often do you go home and talk with your husband about the latest algebraic insight you have had? Do you do that?

Davidson: (Laughter) I can't help my high-school-aged daughter with her algebra!

McCarthy: Exactly. So here it is irrelevant to our adulthood, but they make us take this nonsense. And geometry. If you like algebra, fine… $\pi r^2 x$, bachazoids, crackazoids, lunazoids, hemorrhoids… Who cares!! You ever see a help wanted ad for an algebraist? I haven't. But the world is crying out for peacemakers. We are not teaching the kids how to be the essential thing. We have conflicts all our lives.

Colman McCarthy, founder of the Center for Teaching Peace and Washington Post *columnist, interviewed Mary Gray Davidson on the* Common Ground *program on NPR, September 10, 1996.*

"Just tell me *how*: I don't care about the theory behind it!"

By Jeff Suzuki

Most of us have been in the situation of trying to explain the conceptual basis of a technique to students who only want to know "how to" and don't care about the underlying theory. The problem is exacerbated in math education courses, where many students already know "how to," and often care little for abstract theory.

There are many ways to justify time spent on theory. First, there's the philosophical: Mathematics is more than a set of rules to be memorized and applied, but a rich, interconnected intellectual structure. Second, there's the pedagogical: If you understand the theory, you'll be a better teacher. But my experience is that while students may accept these reasons, they do not really believe them. Hence I offer another way to emphasize the importance of theory: Just as knowing many algorithms allows you to pick the easiest one to use in any given circumstance, understanding theory allows you to choose the easiest way to apply a given algorithm.

A simple example of the importance of theory is the problem of finding the prime factorization of N. Without theory, we would have to check every prime number to see if it is a potential divisor. With theory, we know we need only check primes less than or equal to $\sqrt{N}$; hence theory saves us a great deal of work. But in practice, theory plays no further role, so students soon forget the role played by theory in reducing their workload.

A better example of the importance of theory is the application of the Euclidean algorithm to find the GCD of two numbers. To find the GCD of m and n using the Euclidean algorithm, divide the larger by the smaller to obtain a quotient and a remainder r_1. Then divide the smaller by the remainder to obtain a new quotient and a new remainder r_2; then divide r_1 by r_2 to obtain yet another quotient and another remainder r_3. Continue dividing the remainders until one ends with a division that "comes out evenly;" the last divisor is the GCD. For example, to find the GCD of 1769 and 841, we would perform the following divisions:

1769 ÷ 841 = 2 with remainder 87
841 ÷ 87 = 9 with remainder 58
87 ÷ 58 = 1 with remainder 29
58 ÷ 29 = 2 with remainder 0

Hence 29 is the GCD. The "rules only" understanding of the Euclidean algorithm and the division algorithms give us no choice: these are the steps we must follow, however difficult they may be. But theoretical understanding will allow us to create an easier path to the solution.

For example, the application of the Euclidean algorithm begins by dividing 1769 by 841. Without understanding division as a repeated subtraction, we must apply the division algorithm. But if we understand the theory of division, we can choose to apply the division algorithm, or divide by repeated subtraction. If we make this latter choice, our first subtraction is:

1769 – 841 = 928

If we understand the theory of divisibility, then we know that any number that divides 1769 and 841 must also divide 928. Thus we have a choice: Continue the subtraction, or find the divisors of 928, which must include the GCD of 1769 and 841.

Finding the divisors of 928 seems difficult, so we choose the easier path and continue the subtraction:

928 – 841 = 87

Again, the GCD of 1769 and 841 must also divide 87, whose divisors are easy to find since 87 = 3 × 29. Thus the GCD must be one of 1, 3, 29, or 87. It is easy to verify that 3 does not divide 841, so it cannot be the GCD, nor can it be any factor of the GCD (so 87 = 3 × 29 is also eliminated). A trial division shows us that 29 divides both 1769 and 841, and hence it is the GCD.

We might have chosen to find the divisors of 928: it is an even number, which suggests the possibility of an easy factorization. In fact, 928 = 2 × 2 × 2 × 2 × 2 × 29. It is obvious that 2 cannot be the GCD of 1769 and 841, nor can it be a factor of the GCD. Hence the GCD of 1769 and 841 is either 1 or 29.

As another example of how theoretical understanding makes solving difficult problems easier, consider the problem of finding the prime factorization of a number such as 4699. The "rules only" algorithm requires test division by primes less than ≈ 68.54.

Theory gives us an option: Suppose N is a product of primes, and the GCD of N and 4699 is 1. Then 4699 will not be divisible by any of the prime factors of N. For example, 1001 = 7 × 11 × 13. If the GCD of 4699 and 1001 is 1, then we can exclude these three primes simultaneously. Since we can find the GCD using the Euclidean algorithm, this seems to offer an improvement on the standard algorithm.

While we could use the Euclidean algorithm to find that the GCD of 4699 and 1001 is indeed 1, we would have to perform eight divisions to do so, whereas trial divisions would have only required three divisions to eliminate three primes. But if we understand the theory, we can simplify the procedure significantly. The key in the following is that theory gives us options; if these options seem too difficult to take, we will ignore them and return to the algorithm.

Our first division gives us:

4699 = 4 × 1001 + 695

If 7, 11, or 13 divides 695, then 7, 11, or 13 would 4699. Rather than dividing 695 by 7, 11, and 13 (the very divisions we were hoping to avoid), we instead remove the obvious factor of 5 to find 695 = 5 × 139. We could try and factor 139, but let's focus on the question at hand: Is 139 divisible by 7, 11, or 13? Again, we can apply a theoretical understanding to sidestep some difficult work: Since 139 = 140 – 1 = 110 + 29 = 130 + 9, it is obviously not divisible by 7, 11, or 13.

We can continue: the next three primes are 17, 19, and 23, and 17 × 19 × 23 = 7429. Rather than dividing 7429 by

4699, we remember that division is repeated subtraction, and:

$$7429 - 4699 = 2730$$

Again, if 17, 19, or 23 divided 2730, they would divide 4699 as well. It is easy to find that $2730 = 2 \times 3 \times 5 \times 7 \times 13$, so we can eliminate 17, 19, and 23 as potential factors.

Our next set might be 29, 31, and 37, where $29 \times 31 \times 37 = 33263$. We have:

$$33263 = 7 \times 4699 + 370$$

Repeated subtraction is probably the fastest way to find this quotient. Since 33263 is divisible by 37, and 370 is obviously divisible by 37, then 7×4699 must also be. We find $4699 = 37 \times 127$. Thus instead of twelve test divisions (for the primes from 2 to 37), we had to perform only one; moreover, the test divisions were not guaranteed to produce a factorization, while the division we actually performed (by 37) was guaranteed to work. Hence applying an algorithm without understanding the theory leads to a lot of work, and most of the work done will produce no usable answer; applying the algorithm and theoretical understanding reduces the work, and ensures that the work that is done is actually necessary and useful.

Jeff Suzuki teaches at Brooklyn College, part of the City University of New York.

Is Math Anxiety on the Way Out?

By Harry Waldman

Scientists may have located the brain function that is most important to mathematical ability. Researchers at University College London claim to have discovered the area of the brain linked to dyscalculia, a mathematical learning disability. The findings may prove that there is a distinct part of the brain used for counting. Establishing that is a crucial step towards better diagnosis and an understanding of why many people struggle with mathematics.

The results, which appear in a paper published this week in the *Proceedings of the National Academy of Sciences*, explain that an area of the brain widely thought to be involved in processing number information generally has in fact two quite distinct functions. One function is responsible for counting how many things are present while the other is responsible for knowing how much.

It is the discovery of the part responsible for counting or numerosity that is a major finding for Professor Brian Butterworth, who has also published *The Mathematical Brain*, and is an authority on dyscalculia. He believes his findings are the key to diagnosis of dyscalculia.

"Now that we know where to look for the differences in brain activation between those who suffer from dyscalculia and those who don't have the learning disorder, we will be able to come up with better diagnosis and insights," Butterworth said. " Imagine assessing how many men versus women are in a room by counting them at the door as they enter the room, let's say 3 women and 4 men, and then try assessing the difference by looking at the room when everyone is present.

"Both methods of assessing the number of people should produce the same result. Instead of assessing numbers of men and women, subjects saw blue and green squares shown in a sequence or blue and green squares shown on screen at the same time. We found that both methods activated the same brain region.

"But when we showed subjects the colors merged and appearing either as a continuously changing square or as one cloudy colored rectangle different results were produced and a different brain network lit up. This is because the brain was no longer able to try to count the objects. Instead, it had to assess how much color was in the block and guess whether there was more of one color or another.

"By comparing these two types of stimulus, we identified the brain activity specific to estimating numbers of things. We think this is a brain network that underlies arithmetic and may be abnormal in dyscalculics."

The project was supported by the European Union Research Training Network Grant and the Medical Research Council Centre Grant. For more information contact Alex Brew in the UCL press office at: a.brew@ucl.ac.uk.

New MAA Section Governors for 2006

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Correction

On page 31 of the April issue of FOCUS, the web address for Pi Mu Epsilon was given incorrectly. The correct address is http://www.pme-math.org.

Archives of American Mathematics – H. S. Vandiver Papers

By Kristy Sorensen

The H. S. Vandiver Papers at the Archives of American Mathematics are open for research after the completion of an extensive preservation and access project. The AAM's archival assistant, Nikki Thomas rehoused the papers and photographs into archival-quality folders and boxes, and removed paperclips and staples to ensure their continued preservation. In addition to the preservation of the papers, Thomas created a more detailed inventory of the papers that will assist our researchers in accessing this extensive collection.

These papers consist of correspondence, research notes, bibliographies, lecture notes, notebooks, drafts of publications, reprints, and photographs documenting the career of Harry Schultz Vandiver. Vandiver (1882-1973) was a number theorist who is best known for his work on Fermat's Last Theorem, Bernoulli numbers, and his expository writing on mathematics. He was a professor at the University of Texas at Austin from 1924 until his retirement in 1966.

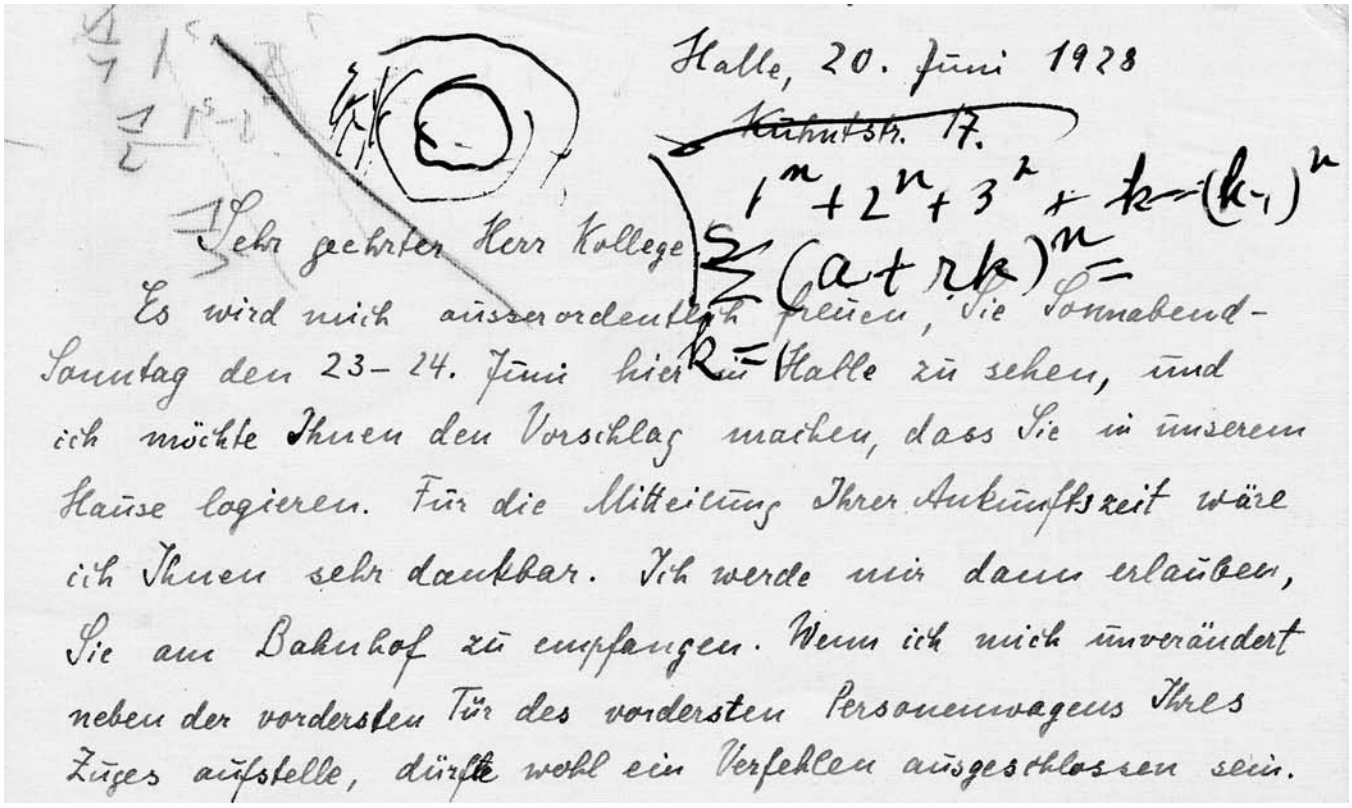
The collection includes Vandiver's writings, notes, and bibliographies on Fermat's Last Theorem, as well as documentation and correspondence relating to the early use of computers in this research. By far the richest section of the H. S. Vandiver Papers is his correspondence, containing over 2500 letters written from 1910 to 1965. Correspondents include A. A. Albert, E. T. Bell, R. Bellman, G. D. Birkhoff, S. G. Bourne, R. Brauer, L. Carlitz, A. Church, H. S. M. Coxeter, L. E. Dickson, H. H. Hasse, I. M. Herstein, S. Lefschetz, D. N. Lehmer, E. H. Moore, C. A. Nicol, E. L. Post, B. L. van der Waerden, and A. L. Whiteman.

The preservation and cataloging work completed on this collection will ensure that it is available to our researchers for many years to come.

An inventory for the H. S. Vandiver Papers is available here: http://www.lib.utexas.edu/taro/utcah/00303/cah-00303.html

H. S. Vandiver with his son, Frank, ca. 1930. From the H. S. Vandiver Papers at the Archives of American Mathematics, Center for American History, The University of Texas at Austin.

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



Halle, 20. Juni 1928

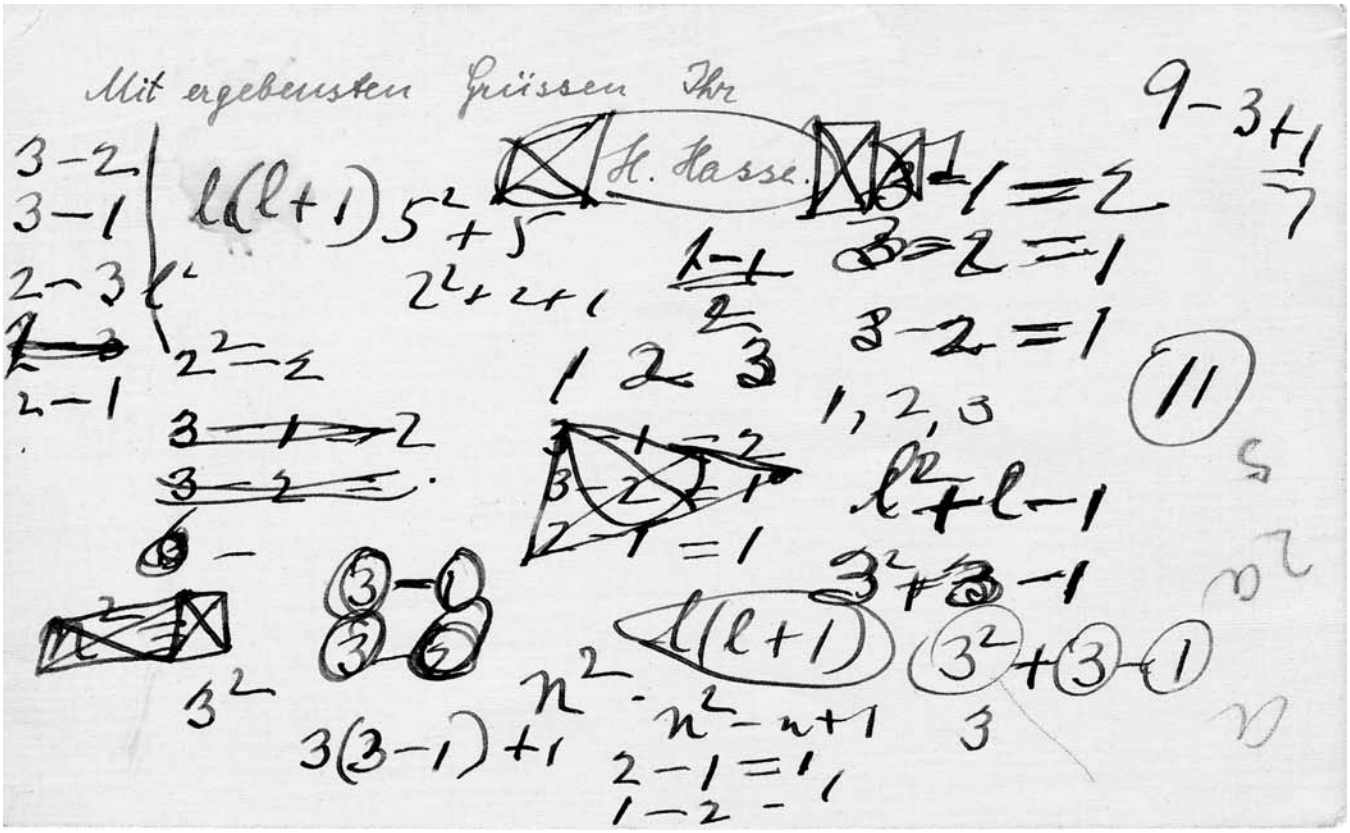
Kaiserstr. 17.

Sehr geehrter Herr Kollege!

Es wird mich ausserordentlich freuen, Sie Sonnabend-Sonntag den 23–24. Juni hier in Halle zu sehen, und ich möchte Ihnen den Vorschlag machen, dass Sie in unserem Hause logieren. Für die Mitteilung Ihrer Ankunftszeit wäre ich Ihnen sehr dankbar. Ich werde mir dann erlauben, Sie am Bahnhof zu empfangen. Wenn ich mich unverändert neben der vordersten Tür des vordersten Personenwagens Ihres Zuges aufstelle, dürfte wohl ein Verfehlen ausgeschlossen sein.

Mit ergebensten Grüssen Ihr

H. Hasse.



Postcard from H. Hasse to H. S. Vandiver, with mathematical notes by Vandiver, June 20, 1928. From the H. S. Vandiver Papers at the Archives of American Mathematics, Center for American History, The University of Texas at Austin.

Complex *NUMB3RS?*

By Sarah J. Greenwald

Mathematicians appreciate that the television show *NUMB3RS* is raising public awareness about the importance, beauty, and usefulness of mathematics. But in its second season it has been promoted as more than mere entertainment. The fact that the CBS website now offers classroom worksheets as part of an educational initiative co-sponsored by CBS, Texas Instruments (TI), and the National Council of Teachers of Mathematics (NCTM), and that recent items in AMS and MAA publications suggest that this initiative is a good way to attract students to the mathematics profession blurs the distinction between *NUMB3RS* as television entertainment and *NUMB3RS* as school curriculum. We should think carefully about whether the mathematical community should endorse the show to the extent that it has. The way that mathematics and mathematicians are depicted in the show may not, in the end, be all that positive when trying to encourage students to pursue a mathematical career.

The violence and sexual innuendos on the show make any classroom use more complex. *The Art Gallery Problem* worksheet on the CBS website is aimed at grades 8–12. It begins: "In the *NUMB3RS* episode "Obsession," pop star Skylar Wyatt is being stalked in her home by an intruder." There is no indication of the difficulties in discussing stalking with eighth graders, nor are there any suggestions of how to do so in a way that will lead to successful implementation and positive effects for students.

The representations of mathematicians are also quite problematic for use with students without addressing some of the related issues. Consider the relationship between Charlie, the main character, and Amita, his former graduate student. In an interview with NCTM, Gary Lorden, one of the show's mathematics consultants, says, "I think it would be great if they made it more of a collaboration and less of a beautiful assistant sort of thing." One of the website questions for students to work on was whether Amita wrote a love letter to Charlie; some episodes have explored a romantic relationship between them. Note, however, that she is still a student, obtaining a second PhD in a related field. Such a relationship could affect her future career and would violate faculty guidelines at many institutions. For example, what happens when she needs a letter of recommendation? If we are going to use Amita in the classroom, all of this comes along with that use.

Alex Kasman, who runs the MathFiction web site, says:

"The mathematician is, like so many fictional mathematicians, somewhat quirky... He has stated, without explanation, that he does not drive. (Considering that he lives in Los Angeles, this might not be merely quirky but seriously crazy.)... In the second episode, the mathematician seems unable to control his brain, working on P vs. NP rather than a more important problem (that could save the life of his brother and other FBI agents) as if he was in a trance..."

Charlie often fits the stereotype of the gifted mathematician who readily finds the right answer. He even has what the producers refer to as "Charlie visions," during which he does mathematics. While the producers consult with mathematicians during production, terms are sometimes mispronounced or used incorrectly. Little attempt is made to show how mathematicians actually think, and mathematics is often presented as consisting entirely of formulas, rather than concepts and logical connections between them. In the second season, the mathematics on the show has made less sense, including such topics as "deep current sets." Nevertheless, the worksheets are advertised as exposing students to real-life mathematics used in FBI cases. While these representations can work well for the television show, they can be problematic for use with students.

In fact, research studies have shown that stereotypical representations of mathematicians can actually discourage students from pursuing more mathematics. As mentioned in the article "Who? How? What?" in the *Mathematics Teacher*, "We know that many students perceive mathematics as a discipline that is done by others rather than people like themselves. The 'others' may be the smartest students (Oakes 1990), boys (Meyer and Koehler 1990), or specific ethnic groups (Moody 1997)." The authors of "Mathematics: a dilemma for feminists," in *Transforming the Disciplines*, discuss how examples of exceptional women mathematicians such as Noether can be detrimental. A number of studies show that television commercials that are gender-stereotypic caused some women to underperform on a math test, avoid more math questions in favor of verbal questions on an aptitude test, and indicate less interest in quantitative career fields than those who had not been exposed to the commercials. To encourage students to study mathematics, numerous authors recommend exposing students to mathematicians whose style of doing mathematics is identifiable to the students as being similar to the way they do mathematics. Additional studies and full bibliographic references can be found at http://SimpsonsMath.com/wim.html.

As teachers, it is we who are ultimately responsible for what we bring into our own classrooms. But since NCTM's name is associated with the *NUMB3RS* worksheets, some may incorrectly assume that any difficulties or cautions are discussed in the teaching notes. Jonathan Farley of Hollywood Math and Science Film Consulting proposed the program in early 2005, but it is TI and NCTM who run the worksheets program. In a session on *NUMB3RS* co-sponsored by the AMS, MAA, and TI at the Joint Mathematics Meetings, Johnny Lott, past president of NCTM, mentioned that the worksheet authors receive from TI a summary of all or part of an episode, and sometimes think, "What can we do

now? Can we do anything with this?" The intense time pressure to post worksheets before a show airs can cause fundamental problems.

For example, three worksheets from "The Running Man" episode were removed shortly after they were posted. Presumably this is because someone realized the worksheets were unusable due to the finished show being so different from their working script. Unfortunately, many of the worksheets that remain on the CBS website suffer from the same problem: they explore events that never happen on air or even contradict episode events. They are useless as a tie-in to the program. In addition, the worksheets do not contain links to the traditional curriculum and they do not mention NCTM standards or Committee on the Undergraduate Program in Mathematics (CUPM) guidelines. Lott remarked, "We have no idea what teachers are doing with this and how teachers are using them." Until class testing, surveying, and revisions occur, at a minimum, there should be some kind of teacher forum to discuss what works and what doesn't.

Of course, TV portrayals of most professionals are to some degree inaccurate glorifications and stereotypes; why should a portrayal of a mathematician be any different? But if we are to follow President Bush's remarks from the recent State of the Union address, namely that "we need to encourage children to take more math and science," then we must identify and correct inaccurate portrayals of our profession, especially stereotypes that could keep students out of math classes. Someone browsing the CBS website might even conclude that the show's representation of mathematics and mathematicians is one that is endorsed by the mathematics community as a good tool for teaching students. Popular culture can indeed be a powerful way to engage students, but care must be taken to use it effectively. Without careful research and reflection related to the benefits and difficulties with using *NUMB3RS*, we run the risk of having the positives outweighed by the negatives.

Sarah J Greenwald is Associate Professor of Mathematics and a women's studies faculty member at Appalachian State University who regularly works with inservice and preservice middle grades and high school teachers. She is a 2005 Mathematical Association of America Alder Award winner for distinguished teaching, in part because of her use of popular culture, and she has spoken about this topic on NPR and all over the country. She helps maintain http://SimpsonsMath.com *and has published related peer-reviewed articles and organized sessions on mathematics in popular culture at national meetings. At the January Joint Mathematics Meetings, she gave some suggestions to Linda Beheler, the Texas Instruments Education Support Team person whose name appears on all of the* NUMB3RS *educational program publicity. Beheler suggested that she write up her critique.*

Graduate Student Poster Session at MathFest

Thursday, August 10, 3:00 pm – 4:30 pm
Graduate students are invited by MAA Committee on Graduate Students and The Young Mathematicians Network to submit abstracts for the session. Applications should be submitted to Professor Jim Freeman, jfreeman@cornellcollege.edu, by Tuesday, June 12, 2006.

Letter to the Editor

Historical Cryptography

When I saw Keith Devlin's article on Math Awareness Month in the March FOCUS, I thought about one of the tasks our NSF-REU students did last summer. They had a great time and did some very interesting things, which I describe below. Jeffrey Adler directed the project. Ryan Fuoss (Taylor University) and Amanda Youell (Clemson University) were the student researchers.

We had at our disposal a collection of documents that form part of a correspondence between the sixteenth-century kings of Spain and their ambassadors in Italy. Michael Levin (an associate professor of history at the University of Akron) copied these documents from the Archivo General de Simancas in connection with his ongoing research. Each item of correspondence was originally sent in code. The cipher text versions of documents sometimes consist of numbers, and sometimes symbols. The goal of this project was to decrypt all these documents and provide historians with a simple algorithm to decrypt the volume of documents at the Archivo in Spain.

To this end, a short course in cryptography was given to these students during the first two weeks of the program. Breaking the codes was a challenging task since, in the words of the students' final report, the "documents are over four hundred years old, the ink has leaked through, and the handwriting finds its closest modern parallels on prescriptions." Another challenge was that, interestingly, neither of the students who chose to work on this project knew any Spanish. However, the students were ultimately successful not only in generating keys for the specific encryption schemes used, but in coming up with methods that others could use to generate further keys for other documents that further historical research on this period will uncover.

Judith Palagallo
University of Akron

Math March Madness — Highlights from the 2005 Putnam Competition

By Joseph A. Gallian

The NCAA basketball tournament is not the only manifestation of March madness. Results from the annual Putnam competition are also announced every March. The Sixty-sixth annual Putnam competition, held in December 2005, had 3545 participants from 500 institutions and 395 teams. Harvard won the team competition for the 25th time, while Princeton, which has never won the team competition, finished second for the ninth time. Duke had no one finish in the top 16 and only one in the top 24, but its team finished third for the fifth consecutive year. It was also the fifth consecutive year in which the Duke Putnam team did better than the Duke basketball team. Coincidentally, the last time Duke's team won the Putnam Competition, the announcement came in late March 2001, within a few days of Duke's basketball team winning its last national championship.

Although MIT had three of the six winners, seven of the highest 15 scorers, and 23 of the top 75, it placed only fourth in the team competition. The University of Waterloo finished in the top five for the 17th time. Alison Miller won the Elizabeth Lowell Putnam Prize as the highest finishing woman and became the first woman ever to be a member of the winning team. Three of the top five three-person teams included women. The top five scores on the 120 point exam ranged from 100 to 80. The 2005 competition is the fourteenth in which ties resulted in there being more than five winners. Twelve of these ties have occurred since 1970.

The median score was one point. This was the sixth time in the last seven years that the median score was one or zero.

Counting multiplicity, 103,812 people have taken the Putnam exam over the course of its history. In total, there have been 257 individual winners of the competition; 364 counting multiplicity. In the 2005 competition Daniel Kane of MIT was a winner for the third time in three attempts. He is the twenty-second person to win the competition three times or more. Matthew Ince of MIT was a winner while his twin brother Nathan, also from MIT, received honorable mention.

All six Putnam Fellows are former members of the U.S. Mathematics Olympiad team. Remarkably, only two seniors from the United States ranked among the top 24 scorers. Judging from the top 196 scorers, the following problem was the most difficult with only five participants receiving any points.

[B5] Let $P(x_1,\ldots,x_n)$ denote a polynomial with real coefficients in the variables $x_1, \ldots, x_n$, and suppose that

$$\left(\frac{\partial^2}{\partial x_1^2} + \cdots + \frac{\partial^2}{\partial x_n^2}\right) P(x_1,\ldots,x_n) = 0 \quad \text{identically}$$

and that

$$x_1^2 + \cdots x_n^2 \quad \text{divides } P(x_1,\ldots,x_n)$$

Show that P = 0 identically.

A comprehensive up-to-date history of the Putnam competition is available at http://www.d.umn.edu/~jgallian/putnam05.pdf.

Joe Gallian is a member of the FOCUS editorial board.

The Ten Commandments for Mathematicians

10. Thou shalt not covet thy colleague's office, nor his salary, nor his grants, nor his teaching load.

9. Thou shalt not bear false letters of recommendation nor referee's reports.

8. Thou shalt not plagiarize.

7. Thou shalt not submit the same paper to two journals.

6. Thou shalt not kill a career.

5. Honor thy teachers and thy students.

4. Thou shalt remember the sabbatical and keep it holy.

3. Thou shalt not take the word "proof" in vain.

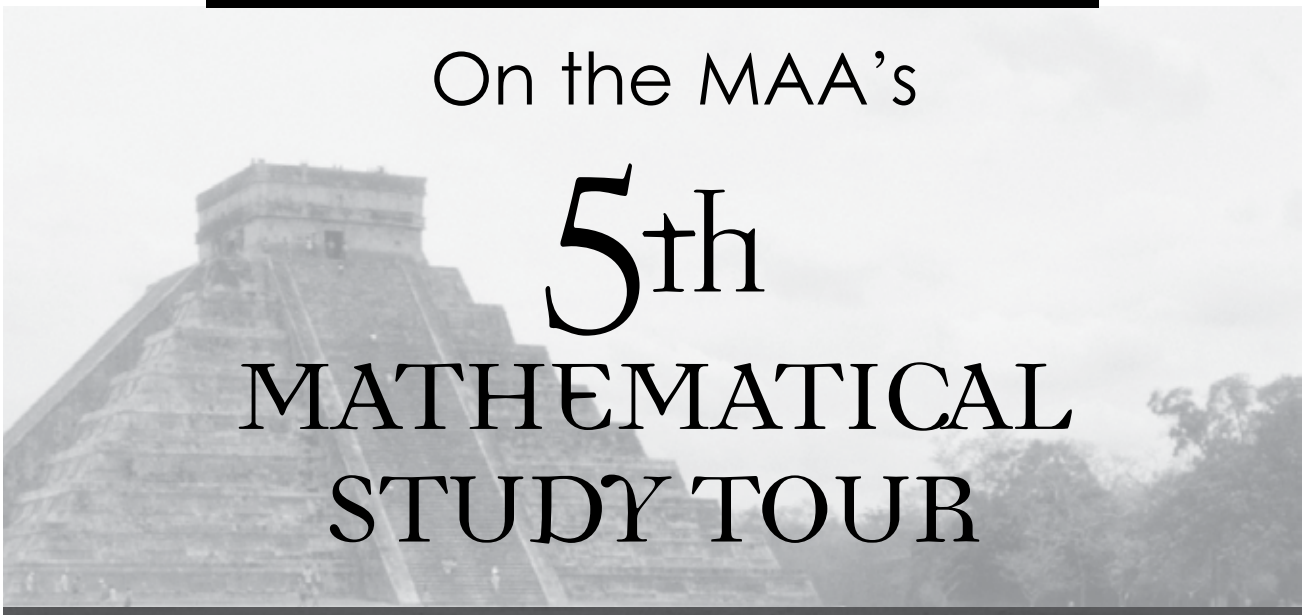
2. Thou shalt create no unnecessary committees.

1. Thou shalt know the truth and the truth shall maketh thee free. (The truth shall followeth from three lemmas, a routine Mathematica computation left as an exercise for the reader, and a remark of David Hilbert.)

Delivered on Styrofoam tablets by "Moses," aka Bruce Resnick, at a Mardi Gras party in Urbana, Illinois.

Travel to the land of the

Ancient MAYA



On the MAA's

5th MATHEMATICAL STUDY TOUR

December 26, 2006–January 2, 2007

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

COST $2,310 per participant

COST SAVING OPTION Share a room with another participant and pay $2,160

Cost does not include airfare.
Number of travelers is limited to 30.

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New MAA Position Reflects Growth of Publications

By Tina Straley

With Don Albers stepping out of the position of Director of Publications, the Association is in an excellent position to continue to build upon his outstanding accomplishments. Don arrived at MAA as Director of Publications and Programs in 1991. Since that time, he has overseen many changes and tremendous growth of the publications department. His titles over the years suggest these changes: Director of Publications and Programs, Director of Publications and Electronic Services, and finally Director of Publications. In this last iteration of his position, Don oversees three programs: book publication; print journals and periodicals; and web resources that include a digital library, two magazines, and numerous periodical columns.

Under Don's leadership, MAA launched *Math Horizons*, four new book series, and all of the resources currently on the web including MathDL and a new, yet to be released, site, Math Gateway, linking sixteen mathematical digital libraries.

Although the MAA advertised for a Director of Publications to take over all of Don's assignments, we found that the job has grown too big for one person. Don's new assignment as MAA's Book Editorial Director will allow Don to turn his attention fully to the books program, which published twenty-six new titles in 2005 alone. Don will oversee acquisitions and project development while Elaine Pedreira Sullivan will oversee production and distribution. But that leaves the other parts of what is now the Publications Department untended. Thus, MAA is seeking someone to oversee MAA periodicals and web resources.

The MAA website has tremendous potential. To fulfill the MAA's vision statement adopted in 2005, the MAA website should be the first place people will go to when they think about undergraduate or expository mathematics. The MAA website should be the preeminent resource for high school, college, and graduate students seeking academic and career information and assistance. The MAA website should be the destination for faculty seeking resources for teaching and for mathematicians in all fields looking for enrichment and enjoyment.

MAA journals will soon be available online and that resource will open up new possibilities for MAA membership worldwide and can better serve students and young faculty who use the web as their first choice for information. Publications such as *Math Horizons, Convergence*, and *JOMA* can reach many more audiences than they currently do.

Thus with a reorganization of the publications component of the MAA into two departments, one for book production and the other for journals, web resources, and other communications of the MAA, the Association will be poised for continued growth and to better serve our members and other constituencies.

Please see the advertisement on the facing page for details of the search for the new Director of Publications for Journals and Communications.

Parents Aren't Worried About Math and Science

By Fernando Q. Gouvêa

According to a February 15 Associated Press report, a majority of the nation's parents think "things are fine" as far as their children's mathematics and science education goes. In a poll done by Public Agenda, 70% of parents said that their children are getting the right amount of mathematics and science in school. The poll also asked children between 6 and 12 whether they thought mathematics and science would be important to them after they finished high school, and over half of them said no.

The poll results are in stark contrast with what the administration and business leaders are saying about the crucial role of mathematics and science. Concerned about the nation's economic competitiveness, leaders are stressing the need for better mathematics and science education. But parents rank this issue fairly low on their list of concerns about schools; they are more worried about "bad language, cheating or the pressure for good grades."

When asked whether more mathematics and science would be a good thing, parents agree that it would be. But when the question becomes specifically about what they see in their own child's school, they feel things are fine on that score. The AP story quotes a parent who argues that there aren't a lot of jobs around that "scream math and science."

The Public Agenda report can be found online at http://www.publicagenda.org/research/pdfs/rc0601.pdf.

Found Math

U.S. Gains 108,000 More Jobs, but Pace of Growth Slows

Headline in the New York Times, sent in by Michael Doob of the University of Manitoba, who asks "How many derivatives can you count?"

Director of Publications for Journals and Communications

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

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

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

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

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

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

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

Candidates should send a resume and letter of interest to:

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

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

Reserve the Dates!

Joint Mathematics Meetings
New Orleans, LA
January 5-8, 2007

William A. Massey Wins the 2006 Blackwell/Tapia Prize

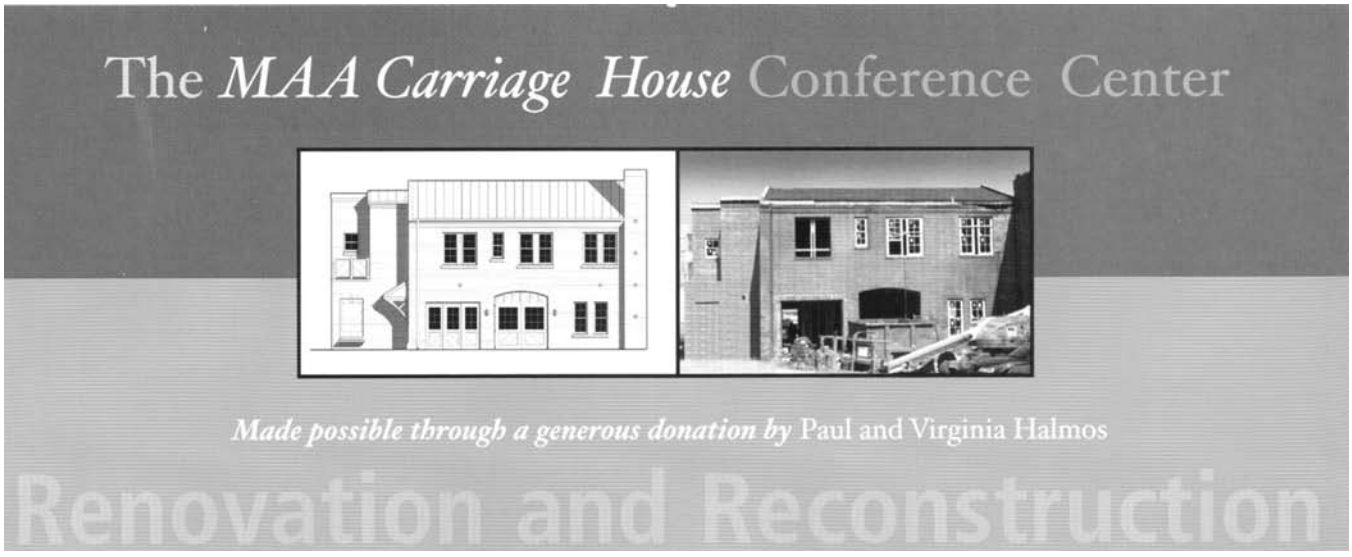
The Blackwell-Tapia Prize Committee has announced that the 2006 prize will be awarded to William A. Massey, the Edwin S. Wiley Professor of Operations Research and Financial Engineering at Princeton University. The prize is named for David H. Blackwell and Richard A. Tapia, two distinguished mathematical scientists who have been inspirations to more generations of African Americans, Latinos/Latinas, and Native Americans in the mathematical sciences. It is awarded every two years to a mathematical scientist who has made a significant contribution to research in his or her field but who has also served as a role model and contributed in other ways to addressing the problem of under-representation of certain minority groups in the mathematical sciences.

Massey has done cutting edge research in many areas, with his current interests being dynamical queueing systems; performance, pricing, priority, and provisioning models for communication systems and services; asymptotic analysis of stochastic networks; and stochastic orders on posets. His best-known contribution to addressing the under-representation of minorities in mathematics is his continuing work as primary national organizer for the annual Conference for African American Researchers in the Mathematical Sciences (CAARMS). However, his efforts extend well beyond that venue to chairing and contributing to many other national committees and conferences that address this problem, in addition to his personal mentoring of many successful minority mathematical scientists.

The prize will be presented at the Fourth Blackwell-Tapia Conference, to be held at the Institute for Mathematics and its Applications (IMA) in Minneapolis on November 3–4, 2006. See http://www.ima.umn.edu/2006-2007/SW11.3-4.06/ for more information.

What's New in MathDL?

Well, whatever it is, it won't be new by the time you read this! MathDL moves at the rhythm of the internet, with new material being added all the time. The publication lead time of FOCUS means that we have no chance of keeping up. Nevertheless, there's a way to know what's new: visit the MAA web site at http://www.maa.org and click on the "What's New in MathDL" link. You'll find listings of the latest additions to the *Journal of Online Mathematics*, *Digital Classroom Resources*, *Convergence*, *MAA Reviews*, and *Classroom Capsules and Notes*. You'll find out about things such as a new "Linear Algebra Toolkit" (posted to *DCR* on April 10), an article about "John Napier: His Life, His Logs, and His Bones" (posted to *Convergence* on April 14), a review of the new edition, now by Simmons and Krantz, of George Simmons' classic text on differential equations (posted to *MAA Reviews* on April 5), and a classroom capsule on how a chain letter is like a branching stochastic process (posted on April 18). And you can join the fun: many of these sites are interactive and all of them encourage you to contribute your own articles, reviews, and software. Come visit!



Details about naming opportunities, including Brick naming and Room naming, will be available in the near future.

Associate Director for Student Activities

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

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

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

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

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

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

Candidates should send a resume and letter of interest to:

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Morgan Prize Winners

Four winners of the Frank and Brennie Morgan Prize for undergraduate research: from left to right, Manjul Bhargava (1996), Kannan Soundarajan (1995), Melanie Matchett Wood (2003), and Jacob Fox (2005). The picture was taken by Philip Matchett Wood at a meeting on Additive Combinatorics held at the Centre de Recherches Mathematiques (CRM) of the Université de Montréal. Bhargava and Soundararajan are both Aisenstadt Chairs at the CRM during the 2005-2006 academic year.

Teaching Time Savers: A Recommendation for Recommendations

By Michael E. Orrison

I admit it — I enjoy writing recommendation letters for my students. I like learning about their hopes and dreams, where they have been and where they want to go. A recommendation letter is an opportunity to remind myself how much my students can grow while they are in college, and how much I have grown as an instructor, advisor, and mentor.

There was a time when, soon after agreeing to write a recommendation letter, I would invite the student to my office for a 15 to 30 minute chat. I wanted to make sure I had all of the facts right, and that I had enough information to write the best letter possible.

As time went by, and I found myself writing letters for about 25 students a year, the chats became increasingly difficult to schedule. Moreover, I started to find myself asking each student the same questions (e.g., "How would you describe yourself?"). These were not difficult questions for my students to answer, but they all seemed necessary to ask.

In an effort to streamline the letter writing experience, I experimented one year by asking my students to answer the questions via email. I simply sent them a list of questions, and they sent me their responses. My students now had more time to think about their responses, and what I found was that, with hardly any effort on my part, their thoughtful responses were just what I needed to write the letters I wanted to write.

Over time, the list of questions was refined and moved to a web page, currently located at http://www.math.hmc.edu/~orrison/teaching/recs.html, with some additional requests (e.g., for addressed envelopes). Soon, some of my colleagues were either directing their students to the web page, or they were creating their own similar web pages.

In the end, I think my colleagues and I recognized quickly how incredibly useful the student responses were when it came to writing our letters. Personally, I am certain that my recommendation letters are better because of my recommendations web page, and that makes me happy. Knowing that I am saving about 15 minutes per letter is just the icing on the top!

Time spent: about 20 minutes to create your own recommendations web page (or just 1 minute to add a link to my web page).

Time saved: at least 15 minutes per letter.

Home | Teaching | Research | Students | Curriculum Vitae

Letters of Recommendation

If I have agreed to write a recommendation for you, please **give me a folder** containing

- a copy of your transcript,
- a copy of your personal statement (if applicable),
- all necessary forms, and
- addressed HMC Math Dept envelopes (see Suzanne Frantz) without stamps.

Furthermore, at least **two weeks** before the first letter is due, e-mail me ("my last name" @ hmc.edu) your answers to the following questions (the more details the better):

1. What is your name, year, and major?
2. For what are you applying? (scholarship, graduate school, etc.)
3. List the programs to which you are applying, together with due dates.
4. How long have I known you, and what is my relationship(s) to you? (instructor, advisor, etc.) Have you graded or tutored for me? If so, for what class(es) and when?
5. For what class(es) have I had you, what final grade(s) did I assign you, and how did you distinguish yourself in my class(es)?
6. How would you describe yourself?
7. What are some of your academic accomplishments?
8. What are some of your nonacademic accomplishments?
9. What makes me particularly qualified to write a letter for you?
10. What makes you particularly qualified for this position/honor/award?
11. What are your long term goals and will this position/honor/award help? If so, how?
12. Additional comments (REU's, summer research, interesting jobs, hobbies, etc.)?

Please **send me e-mail reminders** as deadlines approach, and feel free to chat with me about other ways you can make the letter writing process go as smoothly as possible for you and your letter writers. Good luck!

Michael Orrison
Department of Mathematics
Harvey Mudd College

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

Short Takes

Compiled by Fernando Q. Gouvêa

Mathematics Nabs the First *PNAS* Prize

The National Academy of Science recently created a Paper of the Year prize for papers published in the *Proceedings of the National Academy of Sciences*. The first winner of the prize is Karl Mahlburg, a doctoral candidate in mathematics at the University of Wisconsin, Madison. The paper, "Partition congruences and the Andrews-Garvan-Dyson crank," published in the October 10, 2005 issue of *PNAS*, was chosen for the prize among some three thousand papers published in the journal during 2005. Mahlburg received the prize on April 23 at a meeting of the *PNAS* editorial board. The paper is available online at http://www.pnas.org/cgi/content/abstract/102/43/15373. Also available is a "companion article" by George Andrews and Ken Ono, at http://www.pnas.org/cgi/content/extract/102/43/15277.

Best Math Mystery?

The May issue of *Reader's Digest* contains their annual "100 Best of America" list. In the 2006 rankings we find an entry for **Best Math Mystery**. Their choice is "The Friday night drama ***Numb3rs***, seen by 14 million people each week, reveals how police work plus math equals great crime-solving. Now the TV show is inspiring new mathematicians. More than 22,000 middle and high school teachers are using its outreach programs in the classroom." Then they quote from *Coincidences, Chaos, and All That Math Jazz*, by Edward B. Burger and Michael Starbird: "What allows us to discuss sex, drugs, and death with such quantitative glee? Welcome to statistics." The relevance of the quote is not explained. The full *Reader's Digest* 100 best list can be seen online at http://www.rd.com/content/openContent.do?contentId=26667. They seem to always want to include something related to mathematics. In the 2005 list, Art Benjamin was named **Best Math Whiz.**

A Renie for the Brachistochrone

The advisory board of the *National Curve Bank* gives the annual Renie Award to the best new "deposit" at the curve bank. The Renie for 2005 went to an entry on the Brachistochrone, the curve of fastest descent. The article, which includes animations, *Mathematica* code, and a lot of historical information, can be found at http://curvebank.calstatela.edu/brach/brach.htm. The National Curve Bank, maintained by Shirley B. Gray, Stewart Venit, and Russ Abbott of the California State University, Los Angeles, is a resource on curves that has distinguished itself by making serious use of animation and interactivity. They can be found at http://curvebank.calstatela.edu.

A Gentle Shove

According to the *Chronicle of Higher Education* (April 7, 2006), the federal Commission on the Future of Higher Education will refrain from mandating standardized testing for college students, but will instead attempt to get colleges to adopt such assessment tools on their own. As the cost of tuition rises, commission chair Charles Miller argued, parents and taxpayers will put more and more pressure on institutions to validate the quality of the education they are delivering to students. All that is needed, he said, is "a gentle shove." When the commission issues their plan in August, they are likely to recommend that accreditation agencies pressure colleges to adopt ways of measuring what sort of impact four years in college has had on their students. The *Chronicle* also reports that the commission is likely to endorse two tests: one is called the "Collegiate Learning Assessment" (apparently already in use at more than 100 institutions); the other is the "Measure of Academic Proficiency and Progress." The article from the *Chronicle* is available online (for subscribers only) at http://chronicle.com/weekly/v52/i31/31a03301.htm.

A Ramanujan Movie is Coming

Stephen Fry, the Bristish writer, actor, and TV personality, announced that he, together with Indian movie director Dev Benegal, will produce a movie about Srinivasa Ramanujan. The report in *Media Life* magazine emphasized the dramatic story of Ramanujan's letter to G. H. Hardy and his journey from India to England. The movie will apparently focus on the relationship between the two men. Fry's comments emphasized Hardy's eccentricities and Ramanujan's genius: "There are different kinds of geniuses," Fry told *Media Life*. "He was a transcendental genius. No one understood how he could do what he did. It was so much more profound than anything else around." The *Media Life* report on the planned movie can be found online at http://www.medialifemagazine.com/artman/publish/article_3573.asp. The news was covered mostly by the British and Indian press. Another report, in the online edition of *The Independent,* quotes Benegal: "What is amazing is that two people from two completely different backgrounds found a common language in the world of numbers and maths." See http://enjoyment.independent.co.uk/film/news/article351747.ece.

Assessing Which Programs Work

Education Week reports that Education Secretary Margaret Spellings will be leading the Academic Competitiveness Council established by the Deficit Reduction Act of 2005. The council's job is to evaluate whether federally-funded programs in science and mathematics education are actually working. The council is made up largely of officials from federal agencies and from the Office of Management and Budget. The idea is to retain (and perhaps even expand) programs that are particularly effective, while eliminating those that seem to have little impact. See http://www.edweek.org/ew/articles/2006/04/12/31compete.h25.html for the details.

Cohen Goes After Algebra Once Again

Many years ago, Richard Cohen angered the mathematical establishment by writing a column claiming that learning algebra was useless. He's back at it. In an op ed piece in the February 16 issue of the *Washington Post*, Cohen uses the story of a young woman who dropped out of school because she was unable to pass her algebra course. Addressing her, he says "Here's the thing, Gabriela: You will never need to know algebra. I have never once used it and never once even rued that I could not use it. You will never need to know — never mind *want* to know — how many boys it will take to mow a lawn if one of them quits halfway and two more show up later — or something like that. Most of math can now be done by a computer or a calculator. On the other hand, no computer can write a column or even a thank-you note — or reason even a little bit. If, say, the school asked you for another year of English or, God forbid, history, so that you actually had to know something about your world, I would be on its side. But algebra? Please." For the full article, visit http://www.washingtonpost.com/wp-dyn/content/blog/2006/02/15/BL2006021501989.html.

Desperate for Teachers

In its April 19 issue, the *New York Times* reports that "New York City will offer housing subsidies of up to $14,600 to entice new math, science and special education teachers to work in the city's most challenging schools." The program is intended to attract hundreds of new teachers to the city, where about 600 current teachers are not fully qualified to teach mathematics. The extra cash will be in the form of a $5,000 initial housing grant plus a $400 per month housing subsidy. This plan adds to several already existing incentive plans that aim to attract teachers to New York.

Sources. PNAS prize: National Academies email newsletter, Brian Hayes in http://www.bit-player.org. Math Mystery: email communication, *Reader's Digest* web site. Renie: email communication. Gentle Shove: NASSMC Briefing Service, *Chronicle of Higher Education*. Ramanujan Movie: John Derbyshire in *National Review Online, Media Matters*, *The Independent*. Spellings and the Competitiveness Council: NASSMC Briefing Service, *Education Week*. Cohen: *Washington Post*. Teachers: James Taranto's *Best of the Web, The New York Times*.

President Bush Establishes National Mathematics Advisory Panel

By Harry Waldman

President Bush has issued an executive order creating a National Mathematics Advisory Panel whose purpose is to advise him and Secretary of Education Margaret Spellings on the best use of scientifically based research in the teaching and learning of math. Much like the influential National Reading Panel, the mathematics advisory board will bring together experts to evaluate the effectiveness of various approaches to teaching mathematics and creating a research base to improve instructional methods for teachers.

The group's interim report will be submitted to the President and the Secretary Spellings by January 31, 2007 with specific recommendations on a range of topics related to math education, based on the best available scientific evidence.

"We look forward to receiving the panel's recommendations, and we hope it will form a blueprint on how to promote excellence in mathematics education," Secretary Spellings said. "As I've said before, it is more important than ever that our students receive solid math instruction in the early grades to prepare them to take and pass algebra and other challenging courses in middle and high school."

Among the topics to be addressed in the panel's report are the skills needed for students to learn algebra and be ready for higher levels of mathematics and the appropriate design of systems for delivering math instruction that combine elements of learning, curricula, instruction, teacher training, and standards, assessments and accountability. Another concern of the panel will be to report on what research still needs to be done to support mathematics education.

The National Mathematics Advisory Panel is part of the President's plan to strengthen mathematics education so that America's students receive the tools and skills necessary for success in the 21st century. Included in his fiscal year 2007 budget request is $10 million to carry out the group's recommendations.

The spending plan also includes $250 million for the newly proposed Math Now programs. Secretary Spellings stressed the need for today's high school graduates to have solid mathematics skills — whether they are proceeding to college or going directly into the workforce. The secretary and others have pointed out that U.S. students are performing below their international peers on math and science assessments. For example, only seven percent of U.S. fourth- and eighth-graders have achieved the "advanced" level on the 2003 Trends in International Mathematics and Science Study (TIMSS) test. By contrast, in Singapore, 38 percent of fourth-graders and 44 percent of eighth-graders reached that level.

MAA Contributed Paper Sessions
New Orleans Joint Mathematics Meeting, January 5-8, 2007

Call for MAA Contributed Papers

The MAA Committee on Contributed Paper Sessions solicits contributed papers pertinent to the sessions listed below. Contributed paper session organizers generally limit presentations to ten or fifteen minutes. Each session room contains an overhead projector and screen; black/white boards will not be available. Speakers needing additional audiovisual equipment should contact, as soon as possible, but prior to Tuesday, September 26, 2006, the session organizer whose name is followed by an asterisk (*). Organizers have been advised that the majority of speakers in a session must require the use of additional audiovisual equipment in order to justify the expenditure. Please note that the dates and times scheduled for these sessions remain tentative.

Applications of Discrete Mathematics
Monday morning
Thomas Koshy*, Framingham State College
tkoshy@frc.mass.edu
Thomas Moore, Bridgewater State College
The advent of modern digital computers has increased the need for a better understanding of discrete mathematics. The tools and techniques of discrete mathematics enable us to appreciate the power and beauty of mathematics in designing problem-solving strategies in everyday life, especially in computer science, and to communicate with ease in the language of discrete mathematics.

Discrete mathematics has a wealth of intriguing applications to a variety of areas, including abstract algebra, casino games, coding theory, computer science, cryptography, decision theory, electronics, genetics, graph theory, organic chemistry, management science, number theory, sports, and the theory of scheduling, to name a few. They are well with in reach of undergraduate and graduate students, as well as advanced high school students. They are a powerful way to manifest both the power and the beauty of discrete mathematics, and to provide new opportunities for experimentation and exploration, and for advancing the frontiers of mathematical knowledge. Accordingly, this contributed paper session focuses on the rich and fascinating applications to discrete mathematics to numerous fields of human endeavor.

Assessment of Student Learning in Undergraduate Mathematics
Monday morning
William Martin*, North Dakota State University
william.martin@ndsu.edu
Bernie Madison, University of Arkansas
Project SAUM (Supporting Assessment in Undergraduate Mathematics) has organized four workshop series for teams of faculty from a wide variety of mathematics departments across the country since 2002. This session invites contributed papers that (a) describe assessment projects in undergraduate mathematics programs, (b) report findings of those projects, and (c) describe faculty and departmental responses to those findings. Papers are solicited from any individuals or groups actively involved in assessment and are not restricted to the participants of Project SAUM workshops.

Building Diversity in Advanced Mathematics: Models That Work
Sunday morning
Patricia Hale*
California State Polytechnic University, Pomona
phale@csupomona.edu
Abbe H. Herzig, University at Albany, SUNY
Papers presented at this session give models of programs that have been successful at supporting diverse groups of people (women of all races, African Americans, Latinos and Chicanos, and Native Americans) in their pursuit of advanced mathematics study and careers. Presentations will span the educational pathway, since issues of diversity need to be addressed at every educational and professional juncture. Proposals are sought that describe successful programs for post-doctoral (faculty), graduate, undergraduate or pre-college students. We interpret "success" broadly, and are looking for ideas that should be shared with others in the mathematics community as models for promoting diversity across the educational spectrum. These might be academic or extracurricular programs, which have targeted any group of people traditionally underrepresented in the mathematical sciences. Historical perspectives are also welcome.

Chaos and Fractals
Friday afternoon
Denny Gulick*, University of Maryland
dng@math.umd.edu
Jon Scott, Montgomery College
Chaotic dynamics and fractal geometry have gained prominence in mathematics and applications. Because of the varied nature both of the mathematical insights and the applications, the goal of this special session is to make such results available to a larger mathematical audience. We invite papers on topics related to either chaotic dynamics or fractal geometry. The papers need to have an expository flavor.

College Algebra: Concepts, Data, and Models
Monday morning
Florence S. Gordon*, New York Institute of Technology
fgordon@nyit.edu
Mary Robinson, University of New Mexico Valencia Campus; Norma Agras, Miami Dade Community College; and Laurette Foster, Prairie View A&M University
The MAA, under the leadership of CRAFTY, is conducting a

national initiative to refocus the courses below calculus to better serve the majority of students taking these courses. The goal is to encourage courses that place much greater emphasis on conceptual understanding and realistic applications compared to traditional courses that too often are designed to develop algebraic skills needed for calculus. We seek to address all the college level courses below calculus, with particular emphasis on offerings in college algebra and pre-calculus that focus on conceptual understanding, the use of real-world data, and mathematical modeling. We seek presentations that:

• present new visions for such courses,
• discuss experiences teaching such courses,
• discuss implementation issues (such as faculty training, placement tests, introduction of alternative tracks for different groups of students, transferability problems, etc),
• present results of studies on student performance and tracking data in both traditional and new versions of these courses and in follow-up courses,
• discuss the needs of other disciplines and the workplace from courses at this level,
• discuss connections to the changing high school curricula and implications for teacher education.

This session is co-sponsored by CRAFTY and the Committee on Two Year Colleges.

Communication Theory in Undergraduate Courses
Saturday afternoon
Tim McDevitt*, Elizabethtown College
McDevittT@etown.edu
Effective communication is a cornerstone of our modern society, and mathematics is fundamentally important for rapid, economical, error-free, and private communication. Mathematical communication theory is a very broad and deep subject that involves mathematics at all levels of difficulty, and this session invites papers describing effective ways of enhancing existing courses (like calculus, linear algebra, differential equations, number theory, or abstract algebra) with topics from communication theory at an appropriate level. Areas of interest include, but are not limited to, image, sound, or data compression, signal processing, error correcting codes, cryptology, and Fourier or wavelet analysis.

Content Courses for the Mathematical Education of Middle School Teachers
Friday morning
Laurie Burton*, Western Oregon University
burtonl@wou.edu
Maria Fung, Western Oregon University, and Klay Kruczek, Western Oregon University
In 2001 the CBMS MET document proposed a series of recommendations for the mathematics curriculum and instruction of prospective middle school teachers. This session invites papers describing how institutions are designing courses toward meeting these goals for the mathematical education of pre-service middle school teachers. Papers contributed to this session should describe the content and structure of the courses at your institution that are specifically designed and offered for pre-service middle school teachers. Additionally these papers should describe how the courses fit into your institutional program and should describe how the courses address the MET recommendations. We also ask that papers describe course prerequisites, teaching strategies and pedagogical approaches. Presenters are encouraged to share sample activities and/or course syllabi and to share curriculum sources and resources. Courses offered for future elementary teachers covering content beyond the Mathematics for Elementary Teachers foundational series will also be considered. This session is sponsored by COMET: The Committee on the Mathematical Education of Teachers.

Countering "I Can't Do Math": Strategies For Teaching Under-Prepared, Math-Anxious Students
Sunday afternoon
Winston Crawley*, Shippensburg University
jwcraw@ship.edu
Kim Presser, Shippensburg University
How can we create a comfortable learning environment for under-prepared or math-anxious students and, in particular, how can we constructively assess student learning? What classroom practices are especially effective with such students and how does research on student learning inform those practices? How might the recommendations of the 2004 CUPM Curriculum Guide influence our approach in teaching developmental or introductory courses to better reach these students? This session invites papers on all aspects of "what works" in teaching under-prepared, math-anxious students.

Entertaining with Math
Friday afternoon
Timothy P. Chartier*, Davidson College
tichartier@davidson.edu
Performing arts such as juggling, music, dance, magic, and drama can enrich the classroom. Beyond entertaining students, such demonstrations can offer new and novel perspectives on mathematical content and engage a class in a fun, educational and interactive activity. This session seeks to provide a forum in which presenters may demonstrate and discuss creative ways of teaching and presenting mathematics using techniques generally associated with entertainment and the performing arts. Proposals should clearly delineate the mathematical subject that will be covered. When a short performance or portion of a performance is included, a presenter should also incorporate a clear discussion of how a presenter's methods can be adapted for general classroom use. Descriptions of classroom activities that are suitable for use by teachers and professors without a performance background are also strongly encouraged.

Euler in the Classroom
Friday morning
Robert Bradley*, Adelphi University, bradley@adelphi.edu
Amy Shell-Gellasch
This contributed papers session solicits talks that describe ways to incorporate the mathematics of Leonard Euler into the classroom. We are looking for papers that describe ways to use his mathematics, science or the history of his life and times in

the secondary and undergraduate mathematics curriculum. This session is sponsored by the History of Mathematics Special Interest Group of the MAA (HOMSIGMAA).

Getting Students to Discuss and to Write about Mathematics
Saturday morning and afternoon
Martha Ellen (Murphy) Waggoner*, Simpson College
Charlotte Knotts-Zides, Wofford College, and Harrison W. Straley, Wheaton College
This session invites papers about assignments and projects that require students to communicate mathematics through oral presentations, classroom discussions and writing. These assignments/projects can come from any area of mathematics including courses for mathematics or related majors, mathematics service courses or mathematics education courses. Each presenter is encouraged to discuss how the use of the assignment/project helped students to improve their understanding of mathematics, their communication of mathematics, and their attitude toward mathematics. Of particular interest are innovative implementations of such assignments/projects including peer review of student writing or presentations, using mathematical writing or presentations as part of service learning, rubrics for assessing student writing and presentations, using student writing or oral presentations as part of program assessment, and programs to help students improve written and oral communication of mathematics.

How to Start and Develop Undergraduate Level Financial Mathematics Programs
Sunday morning
Youngna Choi*, Montclair State University
choiy@mail.montclair.edu
The proliferation of complex financial products over the last two decades has increased the demand for quantitative skills needed in the financial industry, and this ushered in a "new mathematics" that is now known as financial mathematics. Leading research institutions have developed graduate level programs in this area, and as a result of the increasing demand and the practicality of the subject, undergraduate institutions have started offering programs in financial mathematics at various levels, from a single course to a major concentration track. Nationwide website searches in 2005 revealed that over 60 institutions are offering formal undergraduate majors in financial mathematics. These programs have been established in three ways: as a subsidiary of existing graduate programs, as an extension of existing actuarial programs, and as an independent program on its own.

Innovative and Effective Ways to Teach Linear Algebra
Saturday morning
David Strong*, Pepperdine University
David.Strong@pepperdine.edu
Gil Strang, Massachusetts Institute of Technology
Linear algebra is one of the most interesting and useful areas of mathematics, because of its beautiful and multifaceted theory, as well as the enormous importance it plays in understanding and solving many real world problems. Consequently, many valuable and creative ways to teach its rich theory and its many applications are continually being developed and refined. This session will serve as a forum in which to share and discuss new or improved teaching ideas and approaches. These innovative and effective ways to teach linear algebra include, but are not necessarily limited to: (1) hands-on, in-class demos; (2) effective use of technology, such as Matlab, Maple, Mathematica, Java Applets or Flash; (3) interesting and enlightening connections between ideas that arise in linear algebra and ideas in other mathematical branches; (4) interesting and compelling examples and problems involving particular ideas being taught; (5) comparing and contrasting visual (geometric) and more abstract (algebraic) explanations of specific ideas; (6) other novel and useful approaches or pedagogical tools. Presenters should discuss their own experience in using their presented idea or approach in their own teaching.

Innovative Examples of Using Graphs in Statistics
Sunday afternoon
Christopher J. Lacke*, Rowan University, lacke@rowan.edu
Ginger Holmes Rowell, Middle Tennessee State University
The Guidelines for Assessment and Instruction in Statistics Education (GAISE) College Report state that a statistically educated student should understand "how to graph the data as a first step in analyzing data, and how to know when that's enough to answer the question of interest" and "how to interpret…graphical displays of data – both to answer questions and to check conditions (in order to use statistical procedures correctly)." Unfortunately most introductory applied statistics courses introduce graphical displays in the first two weeks of the semester and rarely return to these important tools later on. With the ease in creating such displays with today's technology, this should not be the case. This contributed paper session looks for innovative examples of using graphical displays for exploratory data analysis and checking assumptions of traditional inference. It also seeks creative examples of graphical inference. Furthermore, it desires examples of developing and critiquing graphical displays for presentation. In order to be considered for this session, applicants should submit a one page summary of the presentation to Christopher Lacke at lacke@rowan.edu along with the abstract to the AMS. Presenters in the session will be considered for the SIGMAA on Statistics Education's Best Contributed Paper Award.

Integrating Mathematics and Biology in Undergraduate Education
Friday morning
Glenn Ledder*, University of Nebraska-Lincoln
gledder@math.unl.edu
Yajun Yang, Farmingdale State University of New York, Jack Bookman, Duke University, and James Fulton, Suffolk County Community College
The MAA published a report in 2005 called *Math and Bio 2010: Linking Undergraduate Disciplines* that outlined a number of issues and approaches in mathematics curriculum development for life science students. A number of new initiatives in this area sprung up between the collection of articles for this report and its appearance in print. More are at various stages of develop-

ment. Other initiatives focus on the incorporation of mathematical content into biology courses. This session provides a forum for mathematicians to share ideas about how to connect mathematics and biology in the undergraduate curriculum. We seek presenters who will discuss the content and format of math courses designed to meet the needs of students in the biological sciences, ways to incorporate the application of mathematics to biology in existing undergraduate mathematics courses, and ways to incorporate mathematics in existing undergraduate biology courses. Examples of desirable topics include innovative mathematics courses and curricula for biological science students, exemplary course modules (applications modules for mathematics courses and mathematics modules for biology), and student projects. Presentations from teams of mathematicians and biologists are especially welcome.

Mathematics and Biology 2010: Building Connections
Saturday morning
G. Elton Graves*, Rose-Hulman Institute of Technology
graves@rose-hulman.edu
Catherine M. Murphy, Purdue University
The CUPM Subcommittee on Mathematics Across the Disciplines requests proposals for papers on interdisciplinary course/programs jointly developed by mathematicians and biologists for undergraduate students. We especially solicit proposals from interdisciplinary teams (bring your biology colleague to JMM as a guest. We would like to hear the biologist's perspective too.). Preference will be given to collaborations which have been in effect for two or more years. Your proposal should address such nuts and bolts issues as: how you got started; roadblocks to either starting or sustaining your collaboration; intended student audience; assessment of impact of interdisciplinary experience on students.

Mathematics Experiences in Business, Industry and Government
Sunday afternoon
Phil Gustafson*, Mesa State College
pgustafs@mesastate.edu
Michael Monticino, University of North Texas
This contributed paper session will provide a forum for mathematicians with experience in Business, Industry and Government (BIG) to present papers or discuss projects involving the application of mathematics to BIG problems. BIG mathematicians as well as faculty and students in academia who are interested in learning more about BIG practitioners, projects, and issues, will find this session of interest. This session is sponsored by the MAA Business, Industry and Government Special Interest Group (BIG SIGMAA).

Mathematics of Chemistry
Monday morning
George Rublein*, The College of William and Mary
gtrubl@math.wm.edu
Mathematics makes its appearance early on in college-level chemistry courses. Physical chemistry, which is heavily laced with mathematical models, has a reputation as the most difficult course in the undergraduate chemistry curriculum. The treatment of mathematics in chemistry textbooks often bears little resemblance to the approaches that students see in mathematics courses. This session solicits contributions that show examples of models drawn from chemistry that might comfortably appear in the calculus, differential equations or linear algebra courses in which chemistry students are commonly enrolled. Chemical thermodynamics, stoichiometry and chemical kinetics are good sources for such models.

The Mathematics of Sudoku and Other Puzzles
Sunday morning
Laura Taalman*, James Madison University
taal@math.jmu.edu
Sudoku puzzles and their variants are linked to many mathematical problems involving combinatorics, Latin squares, magic squares, polyominos, symmetries, computer algorithms, the rook problem, knight tours, graph colorings, and permutation group theory. Many other puzzles also have underlying mathematical content that can be a source of open problems, undergraduate research projects, and new results. In this session we will explore the mathematics involved in solving, constructing, and analyzing Sudoku and other puzzles. We invite the submission of presentations concerning the mathematics of Sudoku, its variants, and other puzzles. Examples of presentations might include presentations of new mathematical results or computational techniques, survey talks describing known results and open problems, and discussions on using Sudoku and other puzzles as learning tools in the classroom or as the basis for undergraduate research projects. Speakers are encouraged to provide puzzle handouts for attendees if possible and relevant.

Mathlets for Teaching and Learning Mathematics
Friday afternoon
David Strong*, Pepperdine University
David.Strong@pepperdine.edu
Thomas Leathrum, Jacksonville State University, and Joe Yanik, Emporia State University
This session seeks to provide a forum in which presenters may demonstrate mathlets and related materials that they have created or further developed. Mathlets are small computer-based (but ideally platform-independent) interactive tools for teaching math, frequently developed as World Wide Web materials such as scripts or Java applets, but there may be many other innovative variations. Mathlets allow students to experiment with and visualize a variety of mathematical concepts, and they can be easily shared by mathematics instructors around the world.

Philosophy of Mathematics
Saturday morning and afternoon
Bonnie Gold*, Monmouth University, bgold@monmouth.edu
Charles Hampton, The College of Wooster
This session, sponsored by the SIGMAA for the Philosophy of Mathematics, invites papers on any topic in the philosophy of mathematics except logic and set theory. Possible topics include the nature of mathematics, the nature of mathematical objects, the nature of mathematical knowledge, the relation between mathematics and the physical world, the role of esthetics in

the development of mathematics. Papers that stem from some specific problems are encouraged, and so are those cutting across disciplines.

Reconceptualizing Content Courses for Prospective High School Mathematics Teachers
Saturday afternoon
Jean McGivney-Burelle*, University of Hartford
burelle@hartford.edu
Neil Portnoy, Stony Brook University
Today, most preservice secondary mathematics teacher (PSMT) education programs require mathematics coursework similar to that of mathematics majors and education coursework that emphasizes teaching and learning. However, there is widespread concern that together these courses do not provide prospective teachers with the depth and breadth of knowledge needed to teach high school mathematics well (CBMS, 2001). PSMTs often fail to see the connections between advanced mathematics content they are required to study and the high school mathematics they will soon teach. Further, PSMTs have difficulty translating general theories of epistemology, psychology, and pedagogy learned in their education courses into effective strategies for teaching mathematics. This session invites papers on promising practices in mathematics courses which help PSMTs to develop mathematical knowledge that is organized for teaching—knowledge which is characterized by a deep understanding of the mathematics PSMTs will teach, a sound grasp of content specific pedagogy, an awareness of conceptual barriers to learning mathematics, and an understanding of the historical, cultural and scientific roots of mathematical ideas and processes.

Research and Other Mathematical Experiences for Students Outside the Classroom
Friday afternoon
Sarah Spence Adams*
Franklin W. Olin College of Engineering
sarah.adams@olin.edu
James Davis, University of Richmond; and Susan Morey of Texas State University, San Marcos
Mathematics "happens" both inside and outside the classroom and, in fact, many mathematics majors are drawn to the subject through a special event sponsored by a Student Chapter or Math Club or through special research projects and programs. This session seeks presentations by academic, industrial, business, and/or student mathematicians so that the audience will be encouraged to organize and run special events for their students. Descriptions of activities could include, but are not limited to, special lectures, workshops for students, Math Days/Fairs, student conferences, recreational mathematics activities, problem solving activities and contests, general community-building activities, and student consulting projects. We especially encourage information about student research projects and programs, including program logistics and project ideas. Information on how such activities are organized and carried out, what activities especially grab students' interests, how students are contacted and encouraged to participate, and how the events are funded will be especially helpful. This session is organized by the CUPM Subcommittee on Undergraduate Research.

Research on the Teaching and Learning of Undergraduate Mathematics
Saturday morning
David Meel*, Bowling Green State University
meel@bgsu.edu
Michael Oehrtman, Arizona State University; and Chris Rasmussen, San Diego State University
Research papers that address issues concerning the teaching and learning of undergraduate mathematics are invited. Appropriate for this session are theoretical or empirical investigations conducted within clearly defined theoretical frameworks, using either qualitative or quantitative methodologies. Of highest priority are proposals that report on completed studies that further existing work in the field.

Teaching Innovations in Real Analysis
Sunday afternoon
Robert W. Vallin*, Slippery Rock University
robert.vallin@sru.edu
Erik Talvila, University College of the Fraser Valley
Everyone agrees that undergraduate math majors should take at least one course in real analysis. As we have all seen, though, this tends to strike fear into the heart of even strong students. This session is about how we show analysis to be the exciting and interesting discipline we know it to be. How do you ease the stress for your students? What are your favorite examples/counterexamples? Do you use Java applets, Maple or Mathematica to illustrate concepts? Have you used writing or group projects in your class? How does your version of Moore Method work? Are there different topics or techniques you favor such as nonstandard analysis or Henstock-Kurzweil integration? Your colleagues want you to share your successes with them.

Teaching Mathematics Courses Online
Friday morning
Cheryl Olsen*, Shippensburg University, clolse@ship.edu
Kate McGivney, Shippensburg University
In recent years there has been an increasing trend for undergraduate institutions to offer mathematics courses online. This session will focus both on presenting successful strategies for teaching such courses as well as describing shortcomings in delivering mathematics online. Consideration will be given to courses where at least 50% of the content is communicated via the web.

Proposals that address issues including, but not limited to, designing effective means of communication between students and the instructor, managing group projects and assignments, incorporating various technologies into the course, and implementing successful assessment strategies are welcome. Papers that address how to design an online course that meet the same course goals as a traditionally taught course are of particular interest. Finally, data based on student experiences from learning in an online environment are welcome.

Teaching Operations Research in the Undergraduate Classroom
Sunday morning
Gerald Kobylski*, United States Military Academy
Gerald.Kobylski@usma.edu
Steve Horton, United States Military Academy; Christopher J. Lacke, Rowan University; and William Fox, Francis Marion University
This session solicits papers highlighting innovative instructional strategies and assessment methods in the introductory undergraduate operations research sequence. Suggested topics include, but are not limited to, course projects, case studies, technology demonstrations, cooperative learning activities, and writing assignments. Papers may focus on original teaching materials or the creative use of previously existing ones, but all papers should provide specific learning objectives addressed by the use of such materials. Each submission must focus on operations research topics at the undergraduate level, including those in the introductory undergraduate operations research sequence or undergraduate courses in stochastic processes, queuing theory, network optimization, etc., and should be accompanied by a course syllabus.

The Scholarship of Teaching and Learning in Mathematics
Saturday afternoon
Curtis Bennett*, Loyola Marymount University
cbennett@lmu.edu
Jackie Dewar, Loyola Marymount University
The Scholarship of Teaching and Learning is an international movement where faculty bring disciplinary knowledge to bear on questions of teaching and learning and use student-based evidence to support their conclusions. Work in this area can range from small investigations around teaching innovations or the production of course portfolios to more formal investigations of student learning. Goals of this session are to: (1) Feature scholarly work focused on teaching; (2) Provide a venue for mathematicians to make their scholarly work on teaching public; and (3) Highlight evidence-based arguments for the value of teaching innovations. Reports that address issues concerning the teaching and learning of undergraduate mathematics are invited. Appropriate for this session are reports of classroom-based investigations of teaching methods, student learning difficulties, or curricular assessment. Papers should discuss more than anecdotal evidence. For example, papers might reference the following types of qualitative or quantitative evidence: student work, interviews, surveys, pre/post tests, etc.

Use of Technology in Abstract Algebra and Number Theory
Friday morning
Byungchul Cha*, Hendrix College, cha@hendrix.edu
Bo-Hae Im, University of Utah
This session concerns the use of computers, such as Computer Algebra Systems and programming languages, in abstract algebra and number theory. These technologies can provide students with highly computational examples that would be inaccessible by hand, assist in doing symbolic computations and developing algorithms, and help conceptual understanding. We invite presentations that address novel ways and various issues regarding the computational tools in teaching courses in abstract algebra and number theory. Examples of lab sessions/modules and computer exercises that can be shared by other instructors are of particular interest. After the session is over, we plan to collect such materials and make them available at a web site upon speakers' approval, aiming to serve as a clearinghouse for teachers who are interested in trying similar experiments in undergraduate courses as well as undergraduate research.

General Session
Friday, Saturday, Sunday, and Monday mornings and afternoons
Eric Marland*, Appalachian State University
marlanded@appstate.edu
Jay Malmstrom, Oklahoma City Community College
Papers may be presented on any mathematical topic. Papers that fit into one of the other sessions should be sent to that organizer, not to this session.

SUBMISSION PROCEDURES For MAA Contributed Papers

Send your abstract directly to the AMS (abstracts should not be sent to the organizer(s) who will automatically receive a copy from the AMS). Please read the session descriptions thoroughly as some organizers require an additional summary of your proposal be sent to them directly. Participants may speak in at most two MAA contributed paper sessions. If your paper cannot be accommodated in the session it was submitted, it will be automatically considered for the general session. Speakers in the general session will be limited to one talk because of time constraints. Abstract must reach the AMS by Tuesday, September 26, 2006.

The AMS will publish abstracts for the talks in the MAA sessions. Abstracts must be submitted electronically to the AMS. No knowledge of LaTeX is necessary, however, LaTeX and AMSLaTeX are the only typesetting systems that can be used if mathematics is included. The abstracts submissions page is at http://www.ams.org/cgi-bin/abstracts/abstract.pl. Simply select the New Orleans meeting, fill in the number of authors, and proceed with the step-by-step instructions.

Submitters will be able to view their abstracts before final submission. Upon completion of your submission, your unique abstract number will immediately be sent to you. All questions concerning the submission of abstracts should be addressed to abs-coord@ams.org.

Employment Opportunites

FLORIDA

Florida Community College
Florida Community College one of the nations leading technology environments in higher education and the second largest community college in Florida has full-time faculty positions available in our Mathematics Department.

Florida Community College offers a competitive salary and a superior benefits package which includes health, dental, vision and life insurance coverage as well as an employer paid retirement program. Interested candidates must submit a Florida Community College at Jacksonville online application and unofficial student copies of transcripts.

Review of applications will begin in April, 2006 and continue until all positions are filled.

To complete an online application and for a complete description of this, and other positions that we have available, please visit our website at http://Jobs.FCCJ.edu

FCCJ does not discriminate on the basis of race, color, national origin, sex, religion, age or disability in employment or the provision of services and is an equal access/equal opportunity college. FCCJ maintains a smoke-free/drug-free environment.

TEXAS

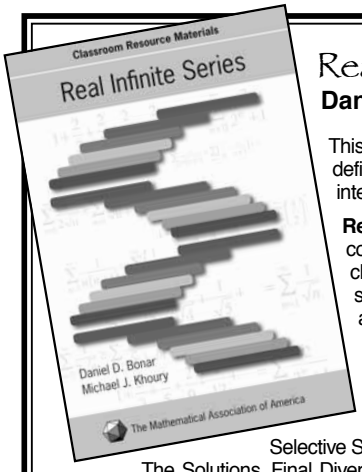
McMurry University
McMurry University invites applications for Instructor/Tutor of developmental and general education mathematics starting August 2006. A Master's degree in Mathematics or Mathematics Education with at least 18 hours of graduate courses in math is required. Excellence in teaching mathematics, a strong desire to teach developmental students and non-majors, and awareness of current trends in instruction will all be factored into the screening process. Responsibilities include teaching developmental and/or general education mathematics courses, curriculum and program development, and mathematics tutoring. This position requires a ten month, forty hours per week time commitment each year and includes benefits.

Send curriculum vitae, statement of teaching philosophy, copies of all graduate and undergraduate transcripts, and two letters of recommendation addressing your teaching ability to: Rachael Bein, DEVS/Math search committee, McMurry Box 967, Abilene, TX 79697. All applicants must be willing to support the university mission statement and core values.

For more information about the position or institution/company: http://www.mcm.edu.

New Textbooks!

From the Mathematical Association of America:



Real Infinite Series

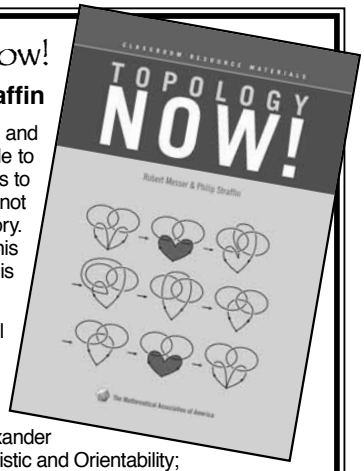
Daniel D. Bonar & Michael J. Khoury

This is a widely accessible introductory treatment of infinite series of real numbers, bringing the reader from basic definitions and tests to advanced results. An up-to-date presentation is given, making infinite series accessible, interesting, and useful to a wide audience, including students, teachers, and researchers.

Real Infinite Series presents the theory of real infinite series, including elementary and advanced tests for convergence or divergence, the harmonic series, the alternating harmonic series, and closely related results. One chapter offers 107 concise, crisp, surprising results about infinite series. Recognizing the interest in problem solving that abounds with students of mathematics, the authors devote a chapter to problems on infinite series, and solutions, which have appeared on the annual William Lowell Putnam Mathematical Competition.

From the Contents: Introduction to Infinite Series: Definitions, Special Series, Intuition and Infinity, Basic Convergence Tests, General Series. More Sophisticated Techniques: The Work of Cauchy, Kummer's Results, The Tests of Raabe and Gauss, Logarithmic Scales, Tests of Abel, Appendix: Proofs of Bertrand's Tests. The Harmonic Series and Related Results: Divergence Proofs, Rate of Growth, The Alternating Harmonic Series, Selective Sums, Unexpected Appearances. Intriguing Results: Gems. Series and the Putnam Competition: The Problems, The Solutions. Final Diversions: Puzzles, Visuals, Fallacious Proofs, Fallacies, Flaws and Flimflam, Answers to Puzzles. True or False Questions. Harmonic Series Article. References: Books on Infinite Series, Books

Classroom Resource Materials • **Catalog Code: RIS** • 274 pp., Hardbound, 2006 • ISBN: 0-88385-745-6
List: $51.95 • MAA Member: $41.95



Topology Now!

Robert Messer & Philip Straffin

Topology is a branch of mathematics packed with intriguing concepts, fascinating geometrical objects, and ingenious methods for studying them. The authors have written this textbook to make this material accessible to undergraduate students without requiring extensive prerequisites in upper-level mathematics. The approach is to cultivate the intuitive ideas of continuity, convergence, and connectedness so students can quickly delve into knot theory, the topology of surfaces and three-dimensional manifolds, fixed points, and elementary homotopy theory. The fundamental concepts of point-set topology appear at the end of the book when students can see how this level of abstraction provides a sound logical basis for the geometrical ideas that have come before. This organization exposes students to the exciting geometrical ideas of topology now(!) rather than later.

Students using this textbook should have some exposure to the geometry of objects in higher-dimensional Euclidean spaces together with an appreciation of precise mathematical definitions and proofs. Multivariable calculus, linear algebra, and one further proof-oriented mathematics course are suitable preparation.

From the Contents: Deformations: Equivalence; Bijections; Continuous Functions; Topological Equivalence; Topological Invariants; Isotopy. Knots and Links: Knot Diagrams; Reidemeister Moves; Colorings; The Alexander Polynomial; Skein Relations; The Jones Polynomial. Surfaces: Cut and Paste Techniques; The Euler Characteristic and Orientability; Classification of Surfaces; Surfaces Bounded by Knots. Three-dimensional Manifolds: The Euler Characteristic; Gluing Polyhedral Solids; Heegaard Splittings. Fixed Points: Continuous Functions on Closed Bounded Intervals; Contraction Mapping Theorem; Sperner's Lemma; Brouwer Fixed-Point Theorem for a Disk. The Fundamental Group: Deformations with Singularities; Algebraic Properties; Invariance of the Fundamental Group; The Sphere and the Circle; The Poincaré Conjecture. Metric and Topological Spaces: Metric Spaces; Topological Spaces; Connectedness; Compactness; Quotient Spaces.

Classroom Resource Materials • **Catalog Code: TPN** • 254 pp., Hardbound, 2006 • ISBN: 0-88385-744-8
List: $49.95 • MAA Member: $39.95

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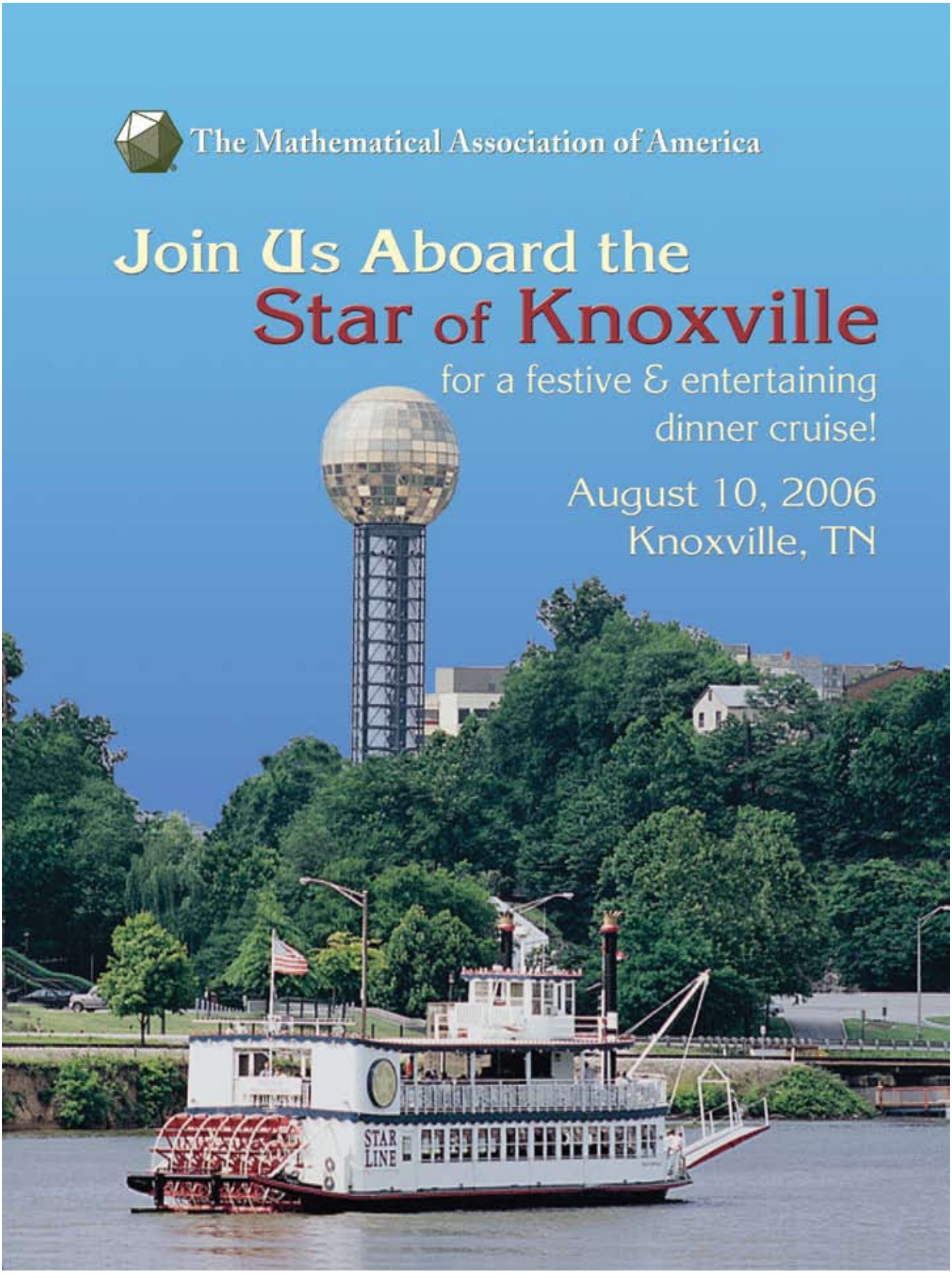
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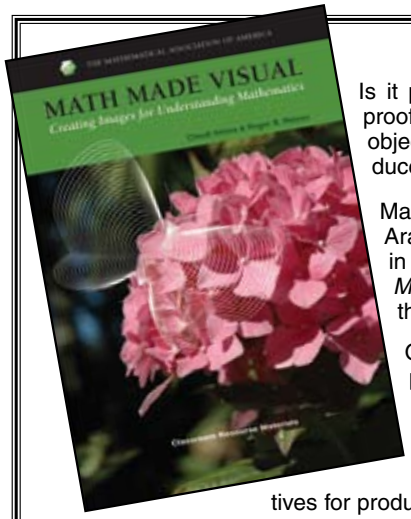


Math Made Visual • Claudi Alsina & Roger Nelsen

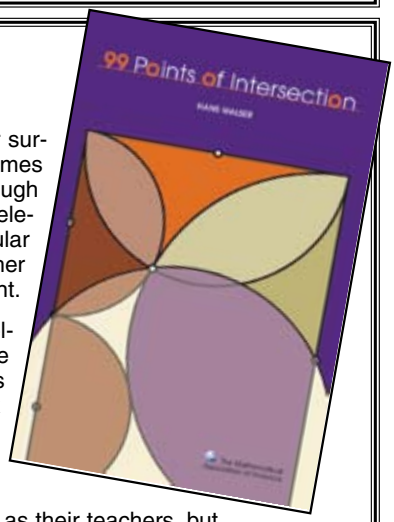
Is it possible to make mathematical drawings that help to understand mathematical ideas, proofs and arguments? The authors of this book are convinced that the answer is yes and the objective of this book is to show how some visualization techniques may be employed to produce pictures that have both mathematical and pedagogical interest.

Mathematical drawings related to proofs have been produced since antiquity in China, Arabia, Greece and India but only in the last thirty years has there been a growing interest in so-called "proofs without words." Hundreds of these have been published in *Mathematics Magazine* and *The College Mathematics Journal,* as well as in other journals, books and on the Internet.

Often times, a person encountering a "proof without words" may have the feeling that the pictures involved are the result of a serendipitous discovery or the consequence of an exceptional ingenuity on the part of the picture's creator. In this book the authors show that behind most of the pictures "proving" mathematical relations are some well-understood methods. As the reader shall see, a given mathematical idea or relation may have many different images that justify it, so that depending on the teaching level or the objectives for producing the pictures, one can choose the best alternative.

Classroom Resource Materials • Catalog Code: MMV • 190 pp., Hardbound, 2006 • ISBN: 0-88385-746-4
List Price • $49.95 • MAA Member Price: $39.95

99 Points of Intersection • Hans Walser



Translated from the original German by Peter Hilton and Jean Pedersen

The 99 points of intersection presented here were collected during a year-long search for surprising concurrence of lines. For each example we find compelling evidence for the sometimes startling fact that in a geometric figure three straight lines, or sometimes circles, pass through one and the same point. Of course, we are familiar with some examples of this from basic elementary geometry—the intersection of medians, altitudes, angle bisectors, and perpendicular bisectors of sides of a triangle. Here there are many more examples—some for figures other than triangles, some where even more than three straight lines pass through a common point.

The main part of the book presents 99 points of intersection purely visually. They are developed in a sequence of figures, many without caption or verbal commentary. In addition the book contains general thoughts on and examples of the points of intersection, as well as some typical methods of proving their existence. Many of the examples shown in the book were inspired by questions and suggestions made by students and high-school teachers. Several of those examples have not only a geometrical, but also an intriguing aesthetic, aspect.

The book addresses high-school students and students at the undergraduate level as well as their teachers, but will appeal to anyone interested in geometry.

Spectrum • Catalog Code: POI • 168 pp., Hardbound, 2006 • ISBN 0-88385-553-4
List: $48.50 • MAA Member: $38.50

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