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<th>New Titles in Mathematics</th>
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| **STOCHASTIC PARTIAL DIFFERENTIAL EQUATIONS**  
A Modeling, White Noise Functional Analysis Approach  
H. Holden, Norwegian Institute of Technology; B. Øksendal, University of Oslo; J. Ubœ & T. Zhang, Stord/Haugesund College  

Stochastic methods have become increasingly important in the analysis of a broad range of phenomena in natural sciences and economics. Many processes are described by differential equations where some of the parameters and/or the initial data are not known with complete certainty. To compensate for this lack of information, one introduces stochastic noise resulting in stochastic differential equations. At the same time there has been considerable development in the basic mathematical theory of stochastic differential equations. In this book the authors give a comprehensive introduction to the topic. Their approach is based on a rigorous introduction of white noise as the fundamental object.  

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| **MINIMAX THEOREMS**  
M. Willem, Institut de Mathématique Pure et Appliquée, Belgium  

Willem's book is devoted to minimax theorems and their applications to partial differential equations. Presenting basic minimax theorems in a simple and unified way, starting from a quantitative deformation lemma, the author gives many applications to problems dealing with lack of compactness, in particular, problems with critical exponents and existence of solitary waves. The book contains many recent results and some unpublished material, such as a modulo-2 topological degree.  

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M. Monastyrsky, Institute for Theoretical and Experimental Physics, Moscow  

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The first part of this book deals with the life and research activity of Riemann. The second part of the book discusses various applications of topology to contemporary physics, mainly pertaining to two of its branches: field theory and condensed matter, including liquid crystals and superfluid liquids.  

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From the AMS

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Adieu to the Mathfest

The Seattle Mathfest is the last such meeting to be held in this format in this century. For the Society this represents the 98th Summer Meeting. The program offers a rich variety of scientific and social events. Seattle lies at the heart of one of the fastest growing economic regions in the United States. Many recreational opportunities can be found within a few minutes of the center, including mountain climbing, hiking, camping, fishing, water sports, professional sports, and coffee drinking.

Among the notable events at this meeting are the keynote lecture by Dr. William Perry, secretary of defense, and the Hedrick Lectures by Dr. Richard Askey of the University of Wisconsin. Mathematicians should find a rich selection of sessions and lectures.

Early in the previous decade, the governing bodies of the AMS decided not to hold a national summer meeting. The final implementation of this decision was not effected until last year, when the Council of the Society decided not to participate in a joint summer meeting for the remainder of this decade.

The Summer Meeting has played a significant role in the scientific life of the Society. When first held, the Summer Meeting was the only scientific meeting sponsored by the Society during the summer. Participants combined travel to the meeting with vacations, so that the Summer Meeting was populated by mathematicians and their families. The sites were often attractive university settings, such as Seattle, where summer vacation activities were close to the meeting site.

The lifestyles of mathematicians have changed significantly since those idyllic times. The politics of departmental life, including significant reductions in travel support and significant changes in promotion and tenure procedures, have changed. Spouses and other family members are not as willing to wait several days during a vacation while the mathematician in the family attends lectures—perhaps the spouse should be attending another conference or summer meeting and the kids would rather be hanging at the mall.

Furthermore, the Society and other organizations offer a plethora of specialized conferences, summer institutes, and workshops that are more attractive to the modern specialized mathematician. The gurus of a subject don’t go to Seattle. They go rather to Oberwolfach for a week or they attend the AMS Summer Research Institute (also held this year in Seattle). The June 1996 issue of these Notices contained two and a half pages announcing meetings during July 1996 and one page of announcements for meetings in August 1996. These Mathfests have (had) a lot of competition for the fewer funds that mathematicians have available for travel.

The Society itself will continue to provide ample meetings activities for its members to enjoy during the summer. There are the AMS-IMS-SIAM Joint Summer Research Conferences in the Mathematical Sciences, the AMS-SIAM Summer Seminar in Applied Mathematics, in addition to the Summer Research Institute. Without the boundary condition imposed by the Mathfest, sectional meetings can be held in early September and earlier in October or also during the summer months.

Also, the Society, jointly with the London Mathematical Society and the South African Mathematical Society, is sponsoring a meeting in South Africa at the end of June 1997. There will be another joint AMS-Mexican Mathematical Society meeting late in 1997.

Plans are now under way for a one-week meeting sponsored by the Society during the summer of 2000 (probably in Berkeley) as part of the International Mathematical Union World Mathematical Year 2000 activities. Details on this will soon begin to appear.

So, as we experience the last of the joint Mathfests, we can rest assured that the Society will continue to provide an excellent menu of conferences, institutes, and scientific meetings during the summer.

Robert Fossum, Secretary, AMS
Letters to the Editor

Need for Whistleblower Protection


"When mathematical work may affect the public health, safety or general welfare, it is the responsibility of mathematicians to disclose the implications of their work to their employers and to the public, if necessary. Should this bring retaliation, the Society will examine the ways in which it may want to help the 'whistleblower', particularly when the disclosure has been made to the Society."

AMS members might like to have a real-life example of the reason for the inclusion of this paragraph in the Guidelines. While the following example concerns physicists, there is no doubt that mathematicians are not immune to this kind of nonsense.

The affair was succinctly described in the APS e-mail column "What's New" by Robert Park, April 19, 1996. He reported:

JUST BECAUSE EVERYONE KNOWS DOESN'T MEAN IT'S NOT A SECRET. Two physicists who published classified information obtained from public sources are seeking whistleblower protection from DOE secrecy zealots. Hugh DeWitt at Livermore, who once helped to expose the Star Wars X-ray laser fraud, quotes open congressional debates. Alex DeVolpi of Argonne cleared his paper with his lab. DeWitt was slapped with a Category A infraction; DeVolpi lost his clearance. Both are Fellows of the American Physical Society.

More details can be found in the Federation of American Scientists' Secrecy and Government Bulletin #57, April 1996.

Murray Gerstenhaber
University of Pennsylvania
Linda Keen
Herbert H. Lehman College (CUNY)
Elliott Lieb
Princeton University
(Received May 10, 1996)

Platonic Beliefs

Verena Huber-Dyson commented on my review of Roger Penrose's book Shadows of the Mind as follows: "First, direct perception—or intuition—of the infinite sequence of natural numbers need not commit you to Platonic beliefs. Of course you are right; how can we talk about true but unprovable statements if we don't have some native concept of Mathematical Truth to base all this talk on? The fascinating questions are, how we find those truths, where we take our axioms from. Maybe Penrose does have something to say to these questions."

Indeed he does have something to say. According to Penrose, "We shall find ourselves driven towards a Platonic viewpoint of things. According to Plato, mathematical concepts and mathematical truths inhabit an actual world of their own that is timeless and without physical location. Plato's world is an ideal world of perfect forms, distinct from the physical world, but in terms of which the physical world must be understood. It also lies beyond our imperfect mental constructions; yet, our minds do have some direct access to this Platonic realm through an 'awareness' of mathematical forms, and our ability to reason about them." The nature of this access is acknowledged to be a "mystery". However, as my review made clear, the author of Shadows of the Mind is a Platonist.

William Faris
University of Arizona
(Received June 3, 1996)
In Memoriam: Olga Taussky-Todd

Edith H. Luchins and Mary Ann McLoughlin

Olga Taussky-Todd passed away in her sleep on Saturday, October 7, 1995, at the age of 89, at her home in Pasadena, California, where she was Professor Emeritus of Mathematics at the California Institute of Technology. She is survived by her husband of 57 years, the mathematician John (Jack) Todd, also Professor Emeritus of Mathematics at Caltech. He reported that her death, a consequence of a broken hip from which she had not fully recovered, was swift and peaceful. It is a profound loss for Jack, for Caltech, and for the worldwide mathematics community.

Olga Taussky-Todd was a distinguished and prolific mathematician who wrote about 300 papers. Throughout her life she received many honors and distinctions, most notably the Cross of Honor, the highest recognition of contributions given by her native Austria. Olga's best-known and most influential work was in the field of matrix theory, though she also made important contributions to number theory. Perhaps Olga herself can best describe her mathematical tastes and motivations, as she did in a 1985 memoir:

[For a large part] of my life all I wanted to work in was number theory. But this was frustrated through many circumstances. In fact, it took a long time before I could return to my dream subject. But apart from the complications in my career, I developed rather early a great desire to see the links between the various branches of mathematics. This struck me with great force when I drifted, on my own, into topological algebra, a subject where one studies mathematical structures from an algebraic and from a geometric point of view simultaneously. From this subject I developed a liking for sums of squares, a subject where one observes strange links between number theory, geometry, topology, partial differential equations, Galois theory, and algebras.

The theses written under my guidance reflect the main areas of my own research. At present these are: commutativity and generalized commutativity of finite matrices, which includes the difficult problems concerning eigenvalues of sums and products of matrices, and on the other hand, integral matrices... These two subjects sound quite different, but they have important intersections, a fact on which I am working very hard, with some success, interpreting facts in number theory via facts in matrix theory, which involves

Edith H. Luchins is emeritus professor of mathematics at the Rensselaer Polytechnic Institute. Her e-mail address is luchie@rpi.edu. Mary Ann McLoughlin is associate professor of mathematics at the College of St. Rose, Albany, NY. Her e-mail address is mcloughlin@rosnet.strose.edu.
noncommutativity. This is nothing new in principle, but has not been exploited sufficiently until recently. Some facts in modern number theory have been better understood by considering numbers as one-dimensional matrices, and then generalizing to matrices of higher dimension, thus giving more meaning to the original results. I became interested in these methods as soon as I heard of them. Some go back to Poincaré who had great ideas in more subjects than people realize. I have gone my own way on this kind of work.

—Olga Taussky-Todd [17]

This memorial article offers reminiscences written by students and colleagues about Olga Taussky-Todd and her mathematics and ends with a biographical sketch of her long and eventful life.

Remembering Olga Taussky-Todd

From Charles Johnson, College of William and Mary

Olga Taussky-Todd often said that number theory was her first love, but in many ways she had the greater impact on her second love: matrix theory. She was involved with many of the major themes of twentieth century research in matrix theory, and the vast majority of her Ph.D. students were in matrix theory, several being major developers of the field in the latter half of the century. Perhaps most important she had an aesthetic sense and taste for topics that served to elevate the subject from a descriptive tool of applied mathematics or a by-product of other parts of mathematics to full status as a branch of mathematics laden with some of the deepest problems and emblematic of the interconnectedness of all of mathematics. Her influence on what people do and how well they do it will continue to be felt for some time.

Olga had an almost motherly love of several enduring topics in matrix theory, including Geršgorin’s theorem, Lyapunov’s theorem (these two thrust upon her, in part, by her and Jack’s assistance in the war effort), the L-property, matrix commutators, the generalized Cayley transform \( A^{-1}A^* \), the field of values, and “cramped” matrices.

Geršgorin’s theorem is one of those remarkable mathematical facts that has maximum utility, yet is relatively simple and beautiful. If \( A = (a_{ij}) \) is an \( n \times n \) complex matrix, then all the eigenvalues of \( A \) lie in the union of the discs \( \{ z \in \mathbb{C} : |z - a_{ii}| \leq \sum_{j \neq i} |a_{ij}| \} \). The fact, discovered independently by many authors over the years, long pre-dates Olga, but she did the most (beginning with her 1949 American Mathematical Monthly article “A recurring theorem on determinants” [7]) to popularize it and begin mathematical study of fine points, such as the occurrence of eigenvalues on the boundaries of the discs. In the meantime the subject has developed rapidly with many dozens of papers, including generalizations to other implicit functions of a matrix, such as the field of values, singular values and permanent roots, and enough material to constitute the book that Olga once planned to write.

Lyapunov’s basic theorem relates general matrices whose eigenvalues lie in the right half plane to positive definite matrices (whose quadratic forms lie in the right half plane). All eigenvalues of the \( n \times n \) complex matrix \( A \) have positive real part if and only if there are positive definite (Hermitian) matrices \( P \) and \( H \) such that \( PA + A^*P = H \). In particular, if \( H \) is taken to be the identity (or for any fixed positive definite \( H \)), there is a unique and positive definite solution \( P \) to the above equation exactly when \( A \) is as described. Again, Olga both popularized and spearheaded mathematical investigation of the fundamental idea of this beautiful fact. The beauty lay, Olga realized, in the relation between the inertia of the quadratic form of \( P \) and the radial distribution of the spectrum of \( A \), and this was the source of some of the early generalizations. Since then, the subject has become a major industry in inertia theory/eigenvalue localization, matrix equations, operator theory, and numerical analysis.

Olga was always fascinated with McCoy’s theorem. If two \( n \times n \) matrices \( A \) and \( B \) are simultaneously (upper) triangularizable by similarity, then there is an ordering \( a_1, \ldots, a_n \) of the eigenvalues of \( A \) and \( b_1, \ldots, b_n \) of the eigenvalues of \( B \) so that, given any polynomial \( p(x, y) \) in noncommuting variables, the eigenvalues of \( p(A, B) \) are the numbers \( p(a_i, b_j), i = 1, \ldots, n \). McCoy showed the converse: if every (!) polynomial exhibits the correct eigenvalues in a consistent order, then \( A \) and \( B \) are simultaneously triangularizable. How much may the requirement of “all polynomials” be weakened? Two matrices \( A \) and \( B \) are said to have the “L-property” if the above polynomial condition holds for
all linear (!) polynomials in \( A \) and \( B \). This was studied by Motzkin and Taussky [10], and it turns out to be weaker than simultaneous triangularizability, except under additional hypotheses, such as normality.

The above are a small sample of Olga's tastes and influences in matrix theory. Further examples of what motivated her interests in matrix theory are given in Olga's own words in her 1988 *Monthly* article "How I became a torchbearer for matrix theory" [19].

As a student of Olga's I have many fond recollections of her idiosyncrasies as well as inspirations and kindnesses. For example, she had rather particular ideas about mathematical writing. No pictures or diagrams were allowed, and, much as I wanted to write "\( n \times n \)" to describe the dimensions of a matrix in my thesis, it had to be "\( n \)-by-\( n \)". I, and my students, still write "\( n \)-by-\( n \)". At the time I was a student, Caltech used an oral Ph.D. qualifying exam. Mine was to be mid-morning on a Monday. Somehow, Olga felt I was unduly nervous about the event (perhaps because I'd recently seen the Elliot Gould movie "Getting Straight") and called me up over the weekend to tell me that she and John would take me to the beach on Sunday to relax. The exam went fine, partly because one of the examiners, David Boyd, came an hour late—leaving Marshall Hall to ask me about group theory and the Riemann zeta function.

*From Robert Guralnick, University of Southern California:*

I first met Olga Taussky in spring 1977, a few months before I started a two-year appointment as a Bateman Research Instructor. Olga arranged that I get an office next to hers and as soon as I arrived asked me to referee a paper for her. Over the next two years, I learned an enormous amount of matrix theory from her and through her seminar. I was very impressed by some of Olga's early matrix theory papers. In particular, her joint paper with Motzkin [10] (if \( \lambda A + \mu B \) is diagonalizable for all values of \( \lambda \) and \( \mu \), then \( AB = BA \) in the mid-1950s was a tour de force and really introduced some new ideas; for example, they used algebraic geometry to study properties of matrices.

Olga was very helpful to me throughout my career. She introduced me to many well-known mathematicians. She helped me in my appointment at USC, and I am sure she was contacted about promotions. I would generally go to Caltech once a week to see Olga and attend her seminars.

Olga was a very good friend as well. Every time I would visit her in her office she would offer me some candy: either some European chocolate or a Kit Kat bar.

She was an amazing lady—very frail looking but quite tough. I recall that she went on the Oberwolfach hike in 1984 and kept up with the group, at age 78.

*From Helene Shapiro, Swarthmore College:* On my first day at Caltech as a new graduate student, Olga came over to me in the lecture hall, introduced herself, and welcomed me to Caltech. I had arrived in January 1976 and felt somewhat out of place starting in the middle of the academic year; this warm welcome from Professor Taussky-Todd meant a great deal to me.

In my second year at Caltech I took the advanced matrix theory course with Olga. The topics included McCoy's theorem about simultaneous triangularization of sets of matrices, work on commutator relations and other results involving generalizations of commutativity, theorems about cramped matrices, and some work on integral matrices. These were topics of particular interest to Olga, and the course was a wonderful introduction to matrix theory as a research area of mathematics. Most of this material would not be found in textbooks, and so this course really helped introduce me to mathematics as it appears in journals and papers rather than in standard courses and texts. In this course I began to see how theorems in matrix theory, and their proofs, were related to many other areas of mathematics.

Because of this course, I decided I wanted to work in matrix theory and was delighted when Olga agreed to be my thesis advisor. She met with me once a week while I was working on my dissertation. Her knowledge of the literature was amazing—it seemed that whenever I asked about something, she could direct me to specific papers dealing with that problem. I felt very fortunate to have this chance to work with someone who had such a command of the field. She insisted that I always give the original source for known results, even those that could be found in textbooks. This was an important lesson for me.

Jack and Olga Todd were so kind and gracious to us—I remember a wonderful brunch for the
graduate students which they had in their lovely home, and Olga sometimes brought me lemons and kumquats from their garden. Olga had a very special way of expressing herself, so that her stories and advice made a vivid and long-lasting impression. I often think of the sign Olga kept on her desk: "It's nice to be important, but it's more important to be nice".

**From Tom Apostol, Caltech:**

Although her initial appointment as research associate did not specifically require any teaching duties, Olga voluntarily taught one course or seminar every year. These were intended primarily for graduate students, but many undergraduates attended them as well. Thirteen Caltech Ph.D. students wrote their theses under her direction, and she was proud of the fact that two of them were women.

Olga interacted regularly with young post-doctoral appointees and junior faculty, often doing joint work with them. She was also instrumental in bringing to Caltech many distinguished visitors who shared her research interests—people such as Drazin, Frölich, Hlawka, Macbeath, O'Meara, Paul, Roquette, Varga, Wielandt, and Zassenhaus. She had frequent contacts and mathematical discussions with senior members of the Caltech mathematics faculty, notably Bohnenblust, DePrima, Ryser, and Ward.

I first met Olga when she attended a number theory conference at Caltech in 1955. After she and Jack joined the Caltech faculty, we became colleagues and close friends.

All of us here at Caltech were proud of the fact that someone of her stature and reputation joined our faculty. She was of course the first woman faculty member of the Caltech mathematics department and also the first woman to receive tenure at Caltech.

She was always active in research. Although Olga and I never worked together on any mathematics problems, we jointly organized many seminars related to number theory. I had enormous respect for her mathematical talents and for her sensitivity as a kind and caring human being.

I recall her uncanny ability to tell instantly the number of letters in any word or name that was mentioned to her. When I first told her that the Greek origin of my own last name was Apostolopoulos, she immediately said that it had 14 letters. I asked her several times how she did this, but she never revealed her secret. Jack claimed that this remarkable ability clinched their job offer at Caltech, when then-president Lee DuBridge asked for the number of letters in the Institute's full name and Olga shot back the answer.

**From Fergus Gaines, University of Dublin:**

I came to Caltech as a graduate student in the fall of 1962. All the first-year graduate students in mathematics were required to take part in the elementary seminar which met once a week throughout the academic year. That year the seminar was directed by Olga and her husband, Jack, and each week one of the students had to lecture on a paper from the literature, while another student was required to write up the lecture. The topic for the year was matrix theory, and Olga and Jack were extremely helpful to all the students, guiding and encouraging them. I recall a social evening in the Todds' house to which all the first-year graduate students were invited. Also present was a bright, young staff member with his wife—they had only recently arrived at Caltech—and the wife said to Olga, "One of the problems in being married to a mathematician is that I can't really talk to my husband about his work. I don't understand it at all. Do you understand your husband's work?" With excellent tact, Olga answered with her characteristic smile, "A little!"

My interest in matrix theory was aroused by the elementary seminar, and during my first summer at Caltech Olga gave me a small problem to work on—justifying the National Science Foundation grant I held. That resulted in a small paper. As a result of that summer working with Olga, she became my thesis advisor, and I graduated with my Ph.D. in 1966.

Olga was a superb advisor, encouraging, cajoling, and always there to help. She insisted that I call to see her for one hour every Friday morning to discuss my progress for each week, whether there was any progress or not! She was always kind and encouraging and a great support.

Olga had a very wide knowledge of mathematics and, of course, of matrix theory in particular. She put this down to the fact that during her years in the National Bureau of Standards she was required to read every journal that came in to them. She was always very keen to assign the right priority to the discoverer of some theorem, and she had a well-nigh encyclopedic knowledge of the literature in linear algebra. This knowledge is exemplified in her famous paper, "A recurring theorem on determinants" [7]. She had many hundreds of correspondents around the world, most of whom wrote to her with queries about matrix problems because they had seen her name on one of the many papers she wrote. They all got an answer!

She was always interesting to talk to, particularly when she reminisced about her time in Göttingen. She introduced me to many well-known mathematicians. One piece of advice she gave me: "When you are working on a problem,
do not discuss it with other people until it is finished!" The reason she said this was because once she discussed a problem with a well-known mathematician while she was still working on it, and he completed it before she did. She was quite hurt by that, but in her usual kind way she forgave him, saying, "His brain is so active, he couldn't help but think about it until he had solved it."

My own view is that her greatest contribution to matrix theory was that she made the subject so well known: by posing problems to talented mathematicians to solve; by writing superb survey articles, which introduced so many people to the subject; by her inspiring lectures, both at conferences and at the many short courses on special topics that she organized at Caltech. I do not know which part of her work she herself was most proud of, but she always had a soft spot for that area of mathematics which combined linear algebra and number theory.

When I studied at Caltech, her position was research associate. We graduate students used to wonder why this was so, and why she was not a full professor at that time.

Olga was a great advisor, but she was also kind to me and my wife in many other ways. We were frequent visitors to the Todds' home. It was not unusual for them to take us for a Sunday afternoon drive to some scenic spot, and we still treasure the gift she gave us for our wedding.

From Richard Varga, Kent State University:

Olga was always interested in students, and she brought out the very best in her pupils and her postdoctoral fellows, such as Morris Newman and Alan Hoffman.

I was first introduced to Olga and Jack in 1954 at the Bureau of Standards, shortly after I finished my Ph.D. degree at Harvard. Then later at a meeting in Los Alamos in 1955 I had a chance to chat with her during a stroll in the Bandelier National Monument, where we did indeed "talk shop". I was totally unprepared to be able to speak technically with such an already-famous person, but she was extremely kind, and she quickly led the polite conversation to a discussion of technical questions in matrix theory related to the Perron-Frobenius theory of nonnegative matrices and to ideas related to the Gershgorin circle theorem. This lengthy discussion had a decisive impact on me, as these topics became an integral part of my first book, *Matrix iterative analysis* of 1962. It was as though she was attempting to create a "research fire" for these ideas, and she was, in truth, totally successful here!

Over the years the lives of Olga and Jack have intertwined with my life and the lives of my family, as a consequence of our many visits to Caltech. Olga was not only a great mathematician—surely one of the world's most outstanding women mathematicians—she was a part of our extended family. Her death was very sad for us, and we will sorely miss her.

From Frank Uhlig, Auburn University (paraphrased from a 1995 letter to Jack Todd):

I remember how dedicated Olga was to her note pad, which she took to every math lecture to jot down notes, to do her own math, and which kept her so productive. From my times in Pasadena, [at] her conference visits, talks, and lectures, I carried away a high esteem for any mathematical thought or idea and a dogged determination to plug away at it.

I feel that mathematics has come around to claim me totally. I wake up to do math and go to sleep (or not) thinking about it. So this was the long-term effect of knowing Olga.

From Philip Hanlon, University of Michigan:

Probably the thing I remember most vividly about Olga is what a kind and sensitive person she was. She could be difficult for sure on professional matters, but when it came to personal (or personnel) matters, particularly those involving families, she was very sensitive and understanding.

As an advisor Olga was very dedicated. She was unusual in that she felt obliged to train me in the subject areas as well as direct my research. We met at least once a week, at which time she would ask me to report on readings that she'd given me earlier. Often this reading was off the subject of my dissertation work—just something I should know.

Often she would report with great satisfaction that someone else had taken one of her results and generalized it considerably. I was puzzled by her attitude towards this situation. Finally I worked up the nerve to ask if she didn't feel disappointed not to have been the one to have stated and proved the result in its full generality. I remember her answer distinctly: "We mathematicians are too quick to credit the developer and forget the explorer."

The Life of Olga Taussky-Todd
The Early Years

Olga Taussky was born on August 30, 1906, in Olmütz in the Austro-Hungarian Empire under the rule of Franz Josef. Olmütz (which after World War I became Olomouc in the Czech Republic) had a strong tradition of learning and music.

Olga was the second of three daughters of Julius David and Ida Pollach Taussky. Her father
was an industrial chemist, who together with his father, Samuel Taussky, wrote a text on vinegar in 1903.

My mother was a country girl. She was rather bewildered about our studies and compared herself to a mother hen who had been made to hatch duck eggs and then felt terrified on seeing her offspring swimming in a pond...She was educated to be a housewife and she made a nice home for all of us. Some evenings when I did not fall asleep readily I heard my parents in the kitchen making a late supper for themselves and the relaxed tone of their voices made me feel good. In some ways she was less old-fashioned than my father. The idea of us children using our education later to earn our living seemed all right to her, but not to him.

—Olga Taussky-Todd [17]

Her father preferred that, if his daughters had careers, they be in the arts, but they all went into the sciences. Ilona, three years older than Olga, became a consulting chemist in the glyceride industry, and Hertha, three years younger than Olga, became a pharmacist and later a clinical chemist at Cornell University Medical College in New York City.

In 1909 the family moved to Vienna and, in the middle of World War I, to Linz, a small town in upper Austria where her father was director of a vinegar factory. Recognizing her mathematical ability, her father assigned her the challenge of figuring out how much water to add to mixtures of various vinegars to attain the acidity level required by law. She set it up as a mixture problem and solved the resulting Diophantine equation in positive integers. Her solution was posted in the factory. Her father died during her last year in the gymnasium, leaving the family devastated, emotionally and financially. Olga increased her tutoring load and consulted for the vinegar plant.

Higher Education and Beyond: Göttingen, Vienna, Bryn Mawr

Despite some concern about funds for college, with her family’s approval Olga followed her older sister to the University of Vienna. She first majored in chemistry (“a wonderful subject,” [17, p. 315]) but then changed to mathematics. Kurt Gödel was a fellow student and friend [18].

The first year she took a course on number theory, taught by Philipp Furtwängler, as well as his seminar on algebraic number theory in her second year. Olga wrote her thesis just as class field theory was being invented. A result that had just been proved is that given an algebraic number field \( F \) with ring of integers \( O \), there is a naturally defined unramified, normal extension field \( H \) of \( F \), called the Hilbert Class Field, in which the lifting of all ideals in \( O \) become principal. Moreover, the Galois group of \( H \) over \( F \) is the class group \( G \), the group of ideals in \( O \) modulo the principal ideals. Because of that last fact, the intermediate subfields between \( H \) and \( F \) correspond to the subgroups \( M \) of \( G \). An obvious conjecture was that for an intermediate field \( K \), the corresponding subgroup \( M \) can be described in terms of the ideals coming from \( F \) which are not yet principal in \( K \). Furtwängler had proven this result when the class group is \( \mathbb{Z}^2 \times \mathbb{Z}^2 \).

The problem that Furtwängler assigned to me then concerned odd prime numbers. He had already solved it for the prime number 2 but did not show this to me. After some struggle, I did indeed solve it for 3. While trying to generalize it for prime numbers larger than 3, I found that every prime number \( p \) behaves differently.

—Olga Taussky-Todd [17]

In 1930 she received the doctoral degree, and in 1932 her thesis was published in the Journal für die Reine und Angewandte Mathematik (the Crelle Journal) [1].

Together with Hans Hahn, Olga wrote a review of B. L. van der Waerden’s Moderne Algebra, Volume I (the review of Volume II appeared under her name alone) [2]. Hahn recommended Olga to Richard Courant, who was looking for an editor of Hilbert’s Werke to be published by Springer-
When Olga was hired as an assistant at Göttingen for 1931-1932, her major task was to edit the first volume devoted to number theory; the co-editors were two other young mathematicians, Wilhelm Magnus and Helmut Ulm.

Olga also took shorthand notes of Emil Artin's 1932 lectures in class field theory and edited them; they have since been translated into English by Robert Friedman in [23]. Emmy Noether ran a seminar in class field theory precisely because Olga was there and gave her opportunities to lecture. Moreover, Olga agreed to be the assistant in Courant's differential equations course, even though it required much effort. “Her wanderings began in the autumn of 1932, after Courant had advised her in writing not to return to Göttingen in view of the growing political tension at the University” [25, p. 180]. Olga returned to Vienna for the academic year 1932-1933. Tutoring supplemented her small salary.

Among other visitors at Göttingen in 1931-1932 were Oswald Veblen and his wife, who were very kind to Olga. He spoke about her to Anna Johnson Peli Wheeler, professor and head of the mathematics department at Bryn Mawr, who then offered her a fellowship for the academic year 1933-1934. In the meantime Olga had obtained a three-year research fellowship from Girton College, a women’s school in Cambridge, which permitted her to spend the first year of the fellowship at Bryn Mawr, primarily because Noether was there. Sometimes Olga went along on Noether’s weekly trips to Princeton—a dream come true for Olga, who made many friends there and wrote a paper on topological algebras with Nathan Jacobson [3]. Bryn Mawr invited her to stay another year, but Olga felt obligated to spend the remaining two years of her fellowship at Girton College.

**The Todds, World War II, London and Belfast**

In June 1935 (after Noether’s death) Olga left the United States for Girton College in Cambridge. Concerned about having Olga supervise a student who wanted to work with her in algebraic number theory, an administrator invited a male colleague to take on the task. He refused on the grounds that Olga was better qualified; accordingly, the student’s application for admission was rejected. The University of Cambridge awarded her an M.A., _ad eundem_, in 1939 after the rules were changed by an act of Parliament to permit women to be degree recipients.

With the assistance of G. H. Hardy and the head of Girton College, Olga obtained a junior-level teaching position at a women’s college of the University of London in 1937. At an intercollegiate seminar she met John (Jack) Todd, who worked in analysis and taught at another London college. Jack brought to Olga’s attention a problem that he thought should be solved: If $M$ is a normal subgroup of the group $G$ and if $N$ is a normal subgroup of $M$, then for what class of groups is $N$ a normal subgroup of $G$? It became a reason—if one was needed—for Olga and Jack to get together. The Jewess from Austria and the Presbyterian Northern Irishman were married in London on September 29, 1938, when Neville Chamberlain proclaimed “peace in our time.” Over fifty years later Olga remarked, “My life and my career would have been so different if my Irishman had not come along” [30, p. 7].

War was declared in 1939. The Todds moved eighteen times during the war. Jack was given a leave of absence from his college to take a war job, but until it materialized the Todds went to Belfast to live in his parents’ home. One of Jack’s former high school students, the young theologian Ernest Best, worked with Olga on the problem that Jack had brought to her, and they solved it [5]. Olga also worked on two problems that subsequently formed large parts of her research program: generalizations of matrix commutativity and matrices with integer coefficients. She and Jack wrote a joint paper [4] on matrices of finite period.

Olga resumed teaching in her college, which had moved to Oxford to be safer from air raids. In 1942-1943 she supervised the D. Phil. thesis at Oxford University of Hanna Neumann, who wrote on combinatorial group theory. Jack was a member of the Royal Navy Volunteer Reserve Team that went to the Mathematical Institute of Oberwolfach in Germany. He is credited with saving it from possible looting and burning in 1945, thereby earning the title, “The Savior of Oberwolfach”.

While on leave of absence from the University of London, Olga took a position at the National Physical Laboratory in Teddington, near London. She worked there from 1943 to 1946 in the so-called Flutter Group under the direction of Robert A. Frazer. Assigned to work on a boundary value problem for a hyperbolic differential equation arising from flutter at supersonic speed, Olga “realized the beauty of research in differential equations” [17, p. 326] and also developed a strong interest in the stability of matrices.

**NBS and Caltech**

In September 1947 Olga and John traveled on a Liberty ship with one hundred war brides. They went to work at the National Bureau of Standards’ (NBS) National Applied Mathematics Laboratory, headed by John H. Curtiss. Initially they spent some time at the Institute for Advanced
Study, working in the Electronic Computer Project directed by John von Neumann. Jack was asked to help in promulgating the use of high-speed computers for problems involving huge numbers of mathematical computations. Olga's title was “consultant in mathematics”. She did a great deal for the NBS and its Institute of Numerical Analysis (INA). “Her wide knowledge of mathematics and mathematicians played an important part in the development of the NBS-INA” [31, p. viii]. She refereed papers, responded to cranks, invited distinguished visitors, and recruited promising graduate students and postdocs as NBS employees, research associates, or fellows. She supervised the Ph.D. thesis of Karl Goldberg at American University in Washington, DC, while he was at the NBS. As part of the semicentennial celebration of the NBS, in 1950–1951 she organized a symposium, now widely regarded as a forerunner of the Gatlinburg-Householder Symposia. Olga contributed number theory problems (and their solutions) for the computers. She has been described as a “computer pioneer...who provided significant contributions to solutions of problems associated with applications of computers” [34].

But Olga and Jack missed teaching. They were ready when in 1957 the California Institute of Technology invited both of them. The invitation may have had its beginnings when Olga was invited in 1955 to a number theory conference at Caltech. Jack was offered a full professorship and Olga—according to the letter of appointment—“a research position of equal academic rank, called here [at Caltech] a Research Associate appointment.” Translating from her German:

Before me no women had ever taught at the university, so it was no easy matter to find the right appointment for me. It was decided that I should have a research appointment, with the permission but not the obligation to teach.

After many years of work mostly with applied mathematics, I was in the beginning rather uncertain about the teaching. But again it was the students who came to my assistance [as in the college in London]. It was clear to them that I had much mathematics to give them and they forced it out of me.

—Olga Taussky-Todd [20]

Having left a tenured position at the NBS, Olga wanted tenure at Caltech and was pleased when it was granted in 1963. “I was happiest, though, when (in 1971) my appointment was changed from research associate to full professor” [30, page 6]. She was the first woman at Caltech with this academic rank (ibid). At the mandatory retirement age of 70, Olga was retired. In 1977 she received the title of Professor Emeritus of Mathematics. Technically Emeriti are not supposed to supervise doctoral students, but Olga did, the provost wisely ruling that rules were made to be overruled.

Olga was pleased that she had brought to public attention certain mathematical contributions that might otherwise have been overlooked, e.g., through her papers [8, 9] that referred to the work of Arnold Scholz and to a theorem by Kenjiro Shoda. Her publications thanked those who helped her with the germ of an idea and those who urged her to publish. Her remembrances and autobiographies expressed her indebtedness to her teachers, her associates, and her students. She spoke and wrote about Emmy Noether [14,16]. Her Noether Lecture, sponsored by the Association for Women in Mathematics, was published in extended form as “The many aspects of the Pythagorean triangles” [15]. It

Photograph of Olga and John Todd in 1962.

Photograph by Alfred Eisenstaedt, Life Magazine © 1961, Inc.
seemed to her that both in her work, as well as in the work of others, she looked "for beauty and not only for achievement" [17, p. 336].

Awards and Honors
Many honors and awards came her way. Her paper on sums of squares in the Monthly won the Ford Prize of the Mathematical Association of America in 1971. She was elected Corresponding Member of the Austrian Academy of Sciences in 1975 and of the Bavarian Academy of Sciences in 1985. The highest scientific award of the government of Austria, the Cross of Honor in Science and Arts, First Class, was bestowed upon her in 1978. The University of Vienna renewed her doctorate in 1980, awarding her the Golden Doctorate. An honorary Doctor of Science degree was granted to her by the University of Southern California in 1988. In 1991 she was elected a Fellow of the American Association for the Advancement of Science.

Olga was on the Council of the London Mathematical Society in 1946-1947. She was a member of the Council of the American Mathematical Society for six years, beginning in 1972, and served as vice-president in 1985. The Todds spent a semester at the Courant Institute for Mathematical Sciences in 1955. A decade later under Fulbright Professorships they spent a semester at the University of Vienna. In 1963 she was selected as one of nine Women of the Year by the Los Angeles Times, which pleased her, since it made Jack happy and would not make her (then all male) colleagues envious.

In 1976 Linear Algebra and its Applications [27] and Linear and Multilinear Algebra [26] published special issues dedicated to Olga. She was a founding editor of the first and an editor of both journals. She was also an editor of the Journal of Number Theory and of Advances in Mathematics. For several years she was editor of the Research Announcements section of the Bulletin of the AMS. Number theory and algebra, a book edited by Hans Zassenhaus, was dedicated to Olga (and also to Henry Mann and Arnold E. Ross); it contains her own technical survey of some of her work and her bibliography to date [12]. Her publications for the next ten years are included in a chapter on Olga in Women of Mathematics [29].

The Olga Taussky-John Todd Instructorships in Mathematics for young mathematicians with strong research promise were established by Caltech in 1990. Colleagues, friends, and students of the Todds contributed to the establishment in 1993 of the Olga Taussky-John Todd Lecture Program, through which the International Linear Algebra Society every three or four years invites talented mathematicians in linear algebra to talk about their research. Helene Shapiro gave the first lecture in March 1993, and Robert Guralnick will give the next one this year. Both were also speakers at a memorial conference held in Olga’s honor at Caltech in April; the other speakers were Benedict Gross, Philip Hanlon, and Kenneth Ribet.

Dennis Estes, who worked as a postdoc with Olga in 1966, reminisced that she used to call her male Ph.D. students and postdocs her “boys” (cf. “Noether’s boys,” [14, p. 83]) and her “bad boys” if they did not contact her for a month or so. He presented a talk about her life and work at the AMS sectional meeting at Baton Rouge in spring 1996. Bruce Reznick, an undergraduate at Caltech, wrote a survey paper on Hilbert’s 17th problem, which he dedicated to the memory of Olga and of Raphael Robinson, both of whom contributed significantly to the topic and both of whom unfortunately died in 1995. Robert C. Thompson, Olga’s early Caltech Ph.D., whom she considered among her best students, died on December 10, 1995, only about two months after his mentor, compounding the profound loss suffered by the mathematical community.

References
WORKS by OLGA TAUSSKY-TODD are referenced [1] through [23].


[23] Artin's 1932 Göttingen lectures on class field theory; Connection between algebraic number theory and integral matrices. Appendices in A classical invitation to algebraic numbers and class fields, Harvey Cohn, Springer-Verlag, New York, 1978.


1995 Annual AMS-IMS-MAA Survey  
(Second Report)

Enrollments, Faculty Characteristics, and Update on New Doctoral Recipients, Fall 1995

John D. Fulton


The 1995 Annual AMS-IMS-MAA Survey represents the thirty-ninth in an annual series begun in 1957 by the Society. The 1995 Survey was under the direction of the AMS-IMS-MAA Data Committee whose members are Paul W. Davis, Lorraine Denby, John D. Fulton (chair), Don O. Loftsgaarden, S. Brent Morris, Samuel M. Rankin III (ex officio), Donald B. Rubin, Donald C. Rung, Ann K. Stehney, and Ann E. Watkins. Comments or suggestions regarding the Annual Survey may be directed to members of the AMS-IMS-MAA Data Committee.

For these reports, departments are divided into groups according to the highest degree offered in the mathematical sciences:

<table>
<thead>
<tr>
<th>Group</th>
<th>Description</th>
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<tbody>
<tr>
<td>I</td>
<td>Mathematics, statistics, and computer science</td>
</tr>
<tr>
<td>II</td>
<td>Mathematics, applied science, operations research, and management science</td>
</tr>
<tr>
<td>III</td>
<td>U.S. departments granting a baccalaureate degree</td>
</tr>
<tr>
<td>IV</td>
<td>U.S. departments granting a master's degree</td>
</tr>
<tr>
<td>V</td>
<td>U.S. departments granting a doctoral degree</td>
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</table>

Groups I and II include the leading departments of mathematics in the U.S. according to the 1982 Assessment of Research-Doctorate Programs conducted by the Conference Board of Associated Research Councils in which departments were rated according to the quality of graduate faculty. Group I is composed of 39 departments with scores in the 3.0-5.0 range. Group II is composed of 43 departments with scores in the 2.0-2.9 range. Group III contains the remaining U.S. departments reporting a doctoral program. Group IV contains U.S. departments (or programs) of statistics, biostatistics, and biometrics reporting a doctoral program. Group V contains U.S. departments (or programs) in applied mathematics/applied science, operations research, and management science that report a doctoral program. Group Va is applied mathematics/applied science; Group Vb is operations research and management science. Group M contains U.S. departments granting a master's degree. Group B contains U.S. departments granting a baccalaureate degree only.

Highlights

- The final (spring) count of new doctoral recipients shows a total of 1,237 doctoral recipients in the mathematical sciences awarded by U.S. institutions in the period July 1, 1994, through June 30, 1995. This represents a new all-time high for the Groups we currently survey. The proportion of the 1994-1995 doctoral recipients who were females increased from 22% last year to 23% this year.

- The final count shows 579 U.S. citizens among the 1,209 doctoral recipients whose citizenship was known. This number represents a significant increase over the 473 last year and the percent of U.S. citizens among the new doctoral recipients rose to 48% from the 44% for each of the previous two years.

- Recruitment of new faculty showed the first increase in five years. The increase of 9.4% in positions under recruitment by mathematics departments in 1994-1995 placed the number of such positions well above the 1993-1994 level.

- Final counts indicate that the unemployment figure for 1994-1995 new doctoral recipients remained constant over 1994-1995 at the record high rate of 10.7% for the time of the spring update of employment status. In addition, 5% of the new doctoral recipients took part-time employment.

- The number of full-time faculty in mathematics departments decreased slightly. The number of untenured, tenure-track, doctoral faculty decreased by 3.9%. The number of nontenure-track, full-time, doctoral faculty decreased by 6.5% while the number of part-time faculty increased by 1.0%.

- The total number of full-time, first-year graduate students in Ph.D.-granting mathematics departments declined from fall 1994 to fall 1995. This decline marks the fourth consecutive year such a decline was reported.
I. Introduction

The Annual AMS-IMS-MAA Survey collects information each year about departments, faculties, and students in the mathematical sciences at four-year colleges and universities in the United States. This article reports results from two parts of the 1995 Annual AMS-IMS-MAA Survey. First, we update information about new doctoral recipients reported earlier in the December 1995 issue of the Notices (see pages 1504–1519). Second, we present results about the characteristics of faculties and of instructional programs at the undergraduate and graduate levels.

In the interest of continuity in the analysis and presentation, and to make year-to-year comparisons possible, we report the same kinds of information that were included in last year’s Second Report. Details are presented concerning employment patterns for new doctoral recipients, department faculty characteristics, and distribution of enrollments in different types of departments.

We follow the procedure started in the 1991 Second Report of reporting projections of survey responses to the entire population of mathematical sciences departments. The projections of survey responses to the entire population are done within strata defined by the survey Groups. For example, on the part of the Departmental Profile Survey concerned with faculty, there were 37 usable responses from the 39 departments in Group I (see Table 3A). The 37 responding departments reported 31 full-time faculty to have retired or died, and this tally was multiplied by 39/37 to obtain the projected value of 33 for the Group as a whole.

We caution the reader that survey responses and the proportional projections are potentially biased due to (i) selection bias of the responding departments and (ii) inhomogeneity of departments within the survey Groups. The responses and projections for total faculty size are slightly affected by this bias. Nonetheless, the problems of a possible selection bias are mitigated by the generally high response rates to the Annual Survey. In Groups with lower response rates (e.g., Groups M and B), there is greater risk of biased projections.

II. Update on the 1994–1995 Doctoral Recipients

Information about recipients of doctoral degrees awarded between July 1, 1994, and June 30, 1995, was collected from doctorate-granting departments in late spring 1995 and from a follow-up census of individual degree recipients. The First Report of the 1995 Annual Survey (December 1995 issue of the Notices, pages 1504–1519) presents the survey results obtained about new doctoral recipients up to late September 1995. Here we update the earlier figures on the basis of more complete returns.

The spring count of new doctoral recipients (Table 1A) shows a total of 1,237 doctorates in mathematical sciences awarded by U.S. institutions. This represents an increase of 15% from the 1,076 doctorates awarded during 1993–1994 and an all-time high number. Table 1B shows the overall and by gender trends in the spring count of new doctoral recipients from 1985–1986 through 1994–1995.

Citizenship status is known for 1,209 of the 1,237 new doctoral recipients. The spring count of new doctoral recipients who are U.S. citizens is 579. The proportion of 1994–1995 new doctoral recipients who are U.S. citizens is 48%, up from the reported 44% of the past two years. The spring count of new doctoral recipients who are non-U.S. citizens increased by about 4% to 630, but still was below the record high of 679 reported in the spring count two years ago. Pages 1510–1519 of the First Report present further information related to the citizenship of the 1994–1995 new doctoral recipients.


Tables 2A and 2B display updates of employment data for the fall count of 1994–1995 doctoral recipients, partitioned by field of thesis research and by the survey Group of their degree department. At the time of the spring report, the employment status of 1117 of the 1,226 1994–1995 doctoral recipients was known. Of the 1117, 50% assumed academic employment in the U.S., and 64% took academic employment in the U.S. or other countries. Both of these percentages are approximately equal to similar

<table>
<thead>
<tr>
<th>TYPE OF EMPLOYER</th>
<th>Field of Thesis</th>
<th>Total</th>
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<tr>
<td>Group I</td>
<td>22</td>
<td>8</td>
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<tr>
<td>Group II</td>
<td>8</td>
<td>5</td>
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<tr>
<td>Group III</td>
<td>10</td>
<td>2</td>
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<tr>
<td>Group IV</td>
<td></td>
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<tr>
<td>Group V</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Masters</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>Bachelors</td>
<td>24</td>
<td>10</td>
</tr>
<tr>
<td>Two-year Colleges</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Other Academic Depts.</td>
<td>3</td>
<td>3</td>
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<tr>
<td>Research Institutes</td>
<td>5</td>
<td>2</td>
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<tr>
<td>Government</td>
<td>3</td>
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<tr>
<td>Business and Industry</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>Foreign, Academic</td>
<td>26</td>
<td>5</td>
</tr>
<tr>
<td>Foreign, Nonacademic</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Not seeking employment</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Still seeking employment</td>
<td>21</td>
<td>6</td>
</tr>
<tr>
<td>Unknown (U.S.)</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>Unknown (non-U.S.)*</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Column Total</td>
<td>176</td>
<td>49</td>
</tr>
<tr>
<td>Column</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subtotals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>128</td>
<td>40</td>
</tr>
<tr>
<td>Female</td>
<td>48</td>
<td>9</td>
</tr>
</tbody>
</table>

*Non-U.S. citizens who returned to their country of citizenship and whose status is reported as "unknown" or "still seeking employment".

Table 2B: Employment Status of 1994-1995 U.S. New Doctoral Recipients by Type of Granting Department, Updated May 1996

<table>
<thead>
<tr>
<th>TYPE OF EMPLOYER</th>
<th>Type of Doctoral Degree-Granting Department</th>
<th>Row Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td>89</td>
<td>5</td>
</tr>
<tr>
<td>Group II</td>
<td>19</td>
<td>14</td>
</tr>
<tr>
<td>Group III</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>Group IV</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td>Group V</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Masters</td>
<td>24</td>
<td>21</td>
</tr>
<tr>
<td>Bachelors</td>
<td>33</td>
<td>41</td>
</tr>
<tr>
<td>Two-year Colleges</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Other Academic Depts.</td>
<td>17</td>
<td>9</td>
</tr>
<tr>
<td>Research Institutes</td>
<td>17</td>
<td>1</td>
</tr>
<tr>
<td>Government</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Business and Industry</td>
<td>40</td>
<td>29</td>
</tr>
<tr>
<td>Foreign, Academic</td>
<td>78</td>
<td>23</td>
</tr>
<tr>
<td>Foreign, Nonacademic</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Not seeking employment</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td>Still seeking employment</td>
<td>53</td>
<td>27</td>
</tr>
<tr>
<td>Unknown (U.S.)</td>
<td>27</td>
<td>14</td>
</tr>
<tr>
<td>Unknown (non-U.S.)*</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Column Total</td>
<td>458</td>
<td>205</td>
</tr>
</tbody>
</table>

*Non-U.S. citizens who returned to their country of citizenship and whose status is reported as "unknown" or "still seeking employment".

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Employment of 1994-1995 doctoral recipients by U.S. Ph.D.-granting institutions increased by 16% from the corresponding figure for 1993-1994. Employment of the 1994-1995 doctoral recipients by research institutes, government, and business and industry, increased by 29% (including a 61% increase in employment by business and industry). Foreign academic employment of new doctoral recipients increased only slightly.

Among those 1994-1995 doctoral recipients taking employment in the U.S., 27% took nonacademic employment (government or business and industry). This percentage was 4 percentage points more than for the 1993-1994 doctoral recipients. The fraction of the 1994-1995 doctoral recipients taking nonacademic employment varied significantly by field of thesis. Of those whose field of thesis was either Algebra/Number Theory, Real or Complex Analysis, or Geometry/Topology, 13% took nonacademic employment. For Probability or Statistics, the analogous figure is 39%, and for Applied Math, Discrete Math/Combinatorics/Logic/Computer Science, Numerical Analysis/Approximations, or Linear/Nonlinear Optimization, the analogous figure is 35%.

Group I departments continued to award the most doctorates. Of the 1,226 doctoral degrees awarded in the mathematical sciences between July 1, 1994 and June 30, 1995, 37% (458) were awarded by Group I departments (420), more than double the number of any other Group. Production of new doctoral recipients increased significantly in all Groups except Group II, in which the increase was about 1%.

The fall unemployment rate for new doctoral recipients, based on information gathered by the time of the spring report, increased significantly from 6.7% for 1991-1992, to 8.9% for 1992-1993, to 10.7% for 1993-1994. For 1994-1995, this unemployment rate remained at 10.7%. The counts on which these rates are determined do not include those new doctoral recipients whose fall employment status was unknown at the time of the spring report. This year's rate ties last year's 10.7% rate as the highest ever reported in the spring report of the Annual Survey, and is over three times the highest rate ever reported in the spring report prior to the 5% rate for 1990-1991.

Table 2C presents the 1977-1978 through 1994-1995 trend in the unemployment rate of new doctoral recipients at the time of the spring count. The disturbingly sharp increase in the unemployment rate beginning in 1990-1991 is evident from the trend chart.

The record-tying high unemployment rate of 10.7% among the 1994-1995 mathematical sciences doctoral recipients at the time of the spring report is not the only employment concern. An additional 5% of the new doctoral recipients took part-time employment. The data presented in Tables 2A and 2B do not reflect the fact that 60% of the 437 1994-1995 doctoral recipients who took academic employment responded individually that they assumed academic positions that are not tenure-track, up 3% from last year. Fifty-five percent of those nontenure-track positions have contract durations of two years or less, down from 56% in 1993-1994. Of the 249 positions in U.S. Ph.D.-granting departments filled by 1994-1995 doctoral recipients, 37% were held by new doctoral recipients who received their degree from the same institution. Fifty-seven (5.8%) of the 976 positions reported as filled in Table 2A are part-time, and at least 17 of the 57 incumbents are still seeking full-time employment.

The names of the 1994-1995 doctoral recipients and their thesis titles were published in the January 1996 Notices, with a supplemental list appearing at the end of this article (page 859).

III. Faculty Characteristics

The Departmental Profile Survey, sent in fall 1995 to mathematical sciences departments at four-year colleges and universities as part of the Annual Survey, provided information about faculty and instructional programs. In order that more reliable year-to-year comparisons could be made, data for fall 1994 and fall 1995 was gathered, except for data on retirement, deaths, and faculty recruitment. The percent change figures reported in Tables 3E and 3F, Tables 4A and 4D, and Tables 5A, 5C, and 5D are based on these two years of data. On pages 1512-1518 of the December 1995 issue of the Notices, the First Report presented information collected earlier about faculty salaries. Since the salary reports for Groups V and M were inadvertently omitted from the December 1995 Notices, the reports for all Groups were published in the February 1996 issue on pages 209-212.

Table 3A displays losses of full-time mathematical sciences faculty due to retirements or deaths. The fall 1995 mathematical sciences faculty attrition rates for mathematics departments (Groups I+II+III+M+B) was 2.2%, a decrease from the fall 1993 reported rate of 2.3% and the fall 1994 reported rate of 2.6%. All three percentages are significantly ahead of the 1.8% faculty attrition rate re-

1 The percentages of full-time faculty in Table 3A of the Second Report of the 1994 Annual Survey in the August 1995 issue of Notices, page 868, were reported in error. The table below presents the correct data.

Table 3A. Faculty Attrition (Corrected)

<table>
<thead>
<tr>
<th>GROUP</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>I+II+III</th>
<th>IV</th>
<th>V</th>
<th>M</th>
<th>B</th>
<th>I+II+III+M+B</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of full-time faculty in Group</td>
<td>2.5%</td>
<td>2.2%</td>
<td>2.7%</td>
<td>2.4%</td>
<td>2.2%</td>
<td>1.6%</td>
<td>2.2%</td>
<td>2.2%</td>
<td>2.3%</td>
</tr>
</tbody>
</table>

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Table 2C: Percentage of New Doctoral Recipients Unemployed, as reported in the respective Annual Survey Second Report, 1978 to 1995

<table>
<thead>
<tr>
<th>Year</th>
<th>Unemployed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1978</td>
<td>0.7</td>
</tr>
<tr>
<td>1979</td>
<td>1.5</td>
</tr>
<tr>
<td>1980</td>
<td>0.9</td>
</tr>
<tr>
<td>1981</td>
<td>0.0</td>
</tr>
<tr>
<td>1982</td>
<td>1.8</td>
</tr>
<tr>
<td>1983</td>
<td>2.2</td>
</tr>
<tr>
<td>1984</td>
<td>2.1</td>
</tr>
<tr>
<td>1985</td>
<td>0.8</td>
</tr>
<tr>
<td>1986</td>
<td>2.3</td>
</tr>
<tr>
<td>1987</td>
<td>3.0</td>
</tr>
<tr>
<td>1988</td>
<td>1.4</td>
</tr>
<tr>
<td>1989</td>
<td>3.0</td>
</tr>
<tr>
<td>1990</td>
<td>2.2</td>
</tr>
<tr>
<td>1991</td>
<td>5.0</td>
</tr>
<tr>
<td>1992</td>
<td>6.7</td>
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<tr>
<td>1993</td>
<td>8.9</td>
</tr>
<tr>
<td>1994</td>
<td>10.7</td>
</tr>
<tr>
<td>1995</td>
<td>10.7</td>
</tr>
</tbody>
</table>

Reported for fall 1991. Likely, these increased attrition rates reported for fall 1992 through fall 1995 reflect the many early retirement incentive programs which have been established in academic institutions. Table 3B depicts the trend in the faculty attrition rates for mathematics departments during the years 1986–1995.

Table 3C displays Departmental Profile Survey information on the number of full-time faculty positions in mathematical sciences departments under recruitment in 1994–1995. The number of positions in mathematics departments under recruitment decreased 33% over the five straight years from 1989–1990 to 1993–1994, while an increase of 9.4% was reported for 1994–1995. Table 3D presents the trend of steady decrease in positions under recruitment in mathematics departments during 1991 through 1994, followed by the increase in 1995. Table 3C of this spring’s report as compared with Table 3C of the spring 1994 report indicates that Groups III and IV had slight decreases in positions under recruitment, while increases were reported for all other Groups.

Table 3C indicates that 84% of the positions under recruitment in 1994–1995 by mathematics departments were available to new doctoral recipients but only 64% were tenured/tenure-track. The number of tenured/tenure-track positions under recruitment by mathematics departments increased by 1% from last year’s count.

Tables 3E and 3F describe the makeup of faculties by sex, tenure status, and doctoral/nondoctoral degree in the different Groups. Table 3E indicates that the total number of full-time faculty in mathematics departments slightly decreased from fall 1994 to fall 1995. After two consecutive years of increases, the numbers of nontenure-track, doctoral, full-time faculty in mathematics departments decreased by 6.5%. Only Group II departments reported an overall increase in such faculty. On the other hand, among all Groups except Groups I and IV, there were significant decreases in the number of untenured, tenure-track doctoral faculty with an overall decrease of 3.9% in mathematics departments. Table 3F indicates that females accounted for major portions of the decreases in nontenure-track, doctoral, full-time faculty, except in Group III. After two consecutive years during which the number of nontenure-track, doctoral, full-time faculty who are females increased by 20% in mathematics departments, mathematics departments reported an 11% decline in such faculty.
Table 3A. Faculty Attrition*

<table>
<thead>
<tr>
<th>GROUP</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>I+II+III</th>
<th>IV</th>
<th>V</th>
<th>M</th>
<th>B</th>
<th>I+II+III+M+B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of full-time faculty who retired or died (Group total)</td>
<td>33</td>
<td>35</td>
<td>41</td>
<td>109</td>
<td>17</td>
<td>18</td>
<td>125</td>
<td>198</td>
<td>431</td>
</tr>
<tr>
<td>% of full-time faculty in Group</td>
<td>1.6%</td>
<td>2.0%</td>
<td>1.5%</td>
<td>1.7%</td>
<td>1.4%</td>
<td>2.9%</td>
<td>2.4%</td>
<td>2.6%</td>
<td>2.2%</td>
</tr>
<tr>
<td>Number of usable responses**</td>
<td>37</td>
<td>36</td>
<td>75</td>
<td>148</td>
<td>55</td>
<td>25</td>
<td>122</td>
<td>418</td>
<td>688</td>
</tr>
</tbody>
</table>

* Number and percentage of full-time faculty who were in the department in fall 1994 but were reported to have retired or died by fall 1995.  
** The number of usable returns varies for different sections of the Departmental Profile Survey. The response rates reported here apply to faculty size and recruitment data only. All counts are projected from the survey response to the respective Group as a whole.

Table 3B. Percent of Full-Time Doctoral Faculty in Groups I+II+III+M+B Who Retired or Died

![Graph showing percent of full-time doctoral faculty in Groups I+II+III+M+B who retired or died from 1986 to 1995.]

Table 3C. Recruitment of Doctoral Faculty

<table>
<thead>
<tr>
<th>GROUP</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>I+II+III</th>
<th>IV</th>
<th>V</th>
<th>M</th>
<th>B</th>
<th>I+II+III+M+B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of open doctoral positions (Group total)*</td>
<td>198</td>
<td>81</td>
<td>139</td>
<td>419</td>
<td>75</td>
<td>38</td>
<td>276</td>
<td>524</td>
<td>1215</td>
</tr>
<tr>
<td># tenured/tenure-track</td>
<td>73</td>
<td>55</td>
<td>100</td>
<td>228</td>
<td>54</td>
<td>34</td>
<td>221</td>
<td>324</td>
<td>772</td>
</tr>
<tr>
<td># open to new doctoral recipients</td>
<td>157</td>
<td>69</td>
<td>108</td>
<td>334</td>
<td>66</td>
<td>25</td>
<td>247</td>
<td>442</td>
<td>1023</td>
</tr>
<tr>
<td># tenured/tenure-track</td>
<td>36</td>
<td>47</td>
<td>85</td>
<td>168</td>
<td>50</td>
<td>22</td>
<td>199</td>
<td>300</td>
<td>667</td>
</tr>
<tr>
<td>Doctoral hires, male</td>
<td>151</td>
<td>55</td>
<td>98</td>
<td>303</td>
<td>34</td>
<td>21</td>
<td>137</td>
<td>286</td>
<td>726</td>
</tr>
<tr>
<td>Doctoral hires, female</td>
<td>26</td>
<td>17</td>
<td>24</td>
<td>67</td>
<td>16</td>
<td>4</td>
<td>66</td>
<td>123</td>
<td>257</td>
</tr>
<tr>
<td>Nondotal hires, male</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>19</td>
<td>33</td>
</tr>
<tr>
<td>Nondotal hires, female</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>28</td>
<td>42</td>
</tr>
<tr>
<td>Number of unfilled positions</td>
<td>19</td>
<td>8</td>
<td>13</td>
<td>40</td>
<td>26</td>
<td>12</td>
<td>50</td>
<td>47</td>
<td>137</td>
</tr>
</tbody>
</table>

Subtotals of rounded table values may exhibit rounding errors.
Table 3E. Faculty Size, Fall 1995, and Percentage Change in Size, Fall 1994 to Fall 1995

<table>
<thead>
<tr>
<th>GROUP</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>I+II+III</th>
<th>IV</th>
<th>V</th>
<th>M</th>
<th>B</th>
<th>I+II+III+M+B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of full-time faculty (Group total)</td>
<td>2023</td>
<td>1749</td>
<td>2865</td>
<td>6576</td>
<td>1181</td>
<td>616</td>
<td>5270</td>
<td>77263</td>
<td>19572</td>
</tr>
<tr>
<td>% change in full-time faculty</td>
<td>-1.0%</td>
<td>-1.1%</td>
<td>0.7%</td>
<td>-0.3%</td>
<td>1.5%</td>
<td>-3.4%</td>
<td>-1.4%</td>
<td>-1.9%</td>
<td>-1.2%</td>
</tr>
<tr>
<td>Number of doctoral full-time faculty</td>
<td>1990</td>
<td>1623</td>
<td>2534</td>
<td>6148</td>
<td>1140</td>
<td>573</td>
<td>4296</td>
<td>5836</td>
<td>16272</td>
</tr>
<tr>
<td>% change in doctoral full-time faculty</td>
<td>-1.0%</td>
<td>-0.7%</td>
<td>-0.3%</td>
<td>-0.7%</td>
<td>1.1%</td>
<td>-3.8%</td>
<td>-0.6%</td>
<td>-1.0%</td>
<td>-0.8%</td>
</tr>
<tr>
<td>Number of tenured doctoral full-time faculty</td>
<td>1451</td>
<td>1335</td>
<td>1904</td>
<td>4691</td>
<td>770</td>
<td>318</td>
<td>4069</td>
<td>12077</td>
<td></td>
</tr>
<tr>
<td>% change in tenured doctoral full-time faculty</td>
<td>0.1%</td>
<td>0.5%</td>
<td>2.2%</td>
<td>1.1%</td>
<td>0.6%</td>
<td>-1.1%</td>
<td>0.4%</td>
<td>0.3%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Number of untenured, tenure-track doctoral full-time faculty</td>
<td>158</td>
<td>183</td>
<td>470</td>
<td>811</td>
<td>218</td>
<td>79</td>
<td>849</td>
<td>1450</td>
<td>3111</td>
</tr>
<tr>
<td>% change in untenured, tenure-track doctoral full-time faculty</td>
<td>4.2%</td>
<td>-11.0%</td>
<td>-8.5%</td>
<td>-6.9%</td>
<td>6.9%</td>
<td>-2.8%</td>
<td>-0.2%</td>
<td>-4.2%</td>
<td>-3.9%</td>
</tr>
<tr>
<td>Number of nontenure-track doctoral full-time faculty</td>
<td>381</td>
<td>105</td>
<td>160</td>
<td>646</td>
<td>152</td>
<td>58</td>
<td>129</td>
<td>317</td>
<td>1091</td>
</tr>
<tr>
<td>% change in nontenure-track doctoral full-time faculty</td>
<td>-7.0%</td>
<td>3.5%</td>
<td>-3.0%</td>
<td>-4.4%</td>
<td>-3.6%</td>
<td>-20.7%</td>
<td>-22.0%</td>
<td>-2.9%</td>
<td>-6.5%</td>
</tr>
<tr>
<td>Number of part-time faculty</td>
<td>156</td>
<td>152</td>
<td>595</td>
<td>903</td>
<td>162</td>
<td>31</td>
<td>1516</td>
<td>2980</td>
<td>5399</td>
</tr>
<tr>
<td>% change in part-time faculty</td>
<td>35.8%</td>
<td>18.7%</td>
<td>-5.6%</td>
<td>3.4%</td>
<td>6.5%</td>
<td>19.0%</td>
<td>0.0%</td>
<td>0.8%</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

Table 3F. Female Faculty Size, Fall 1995, and Percentage Change in Size, Fall 1994 to Fall 1995

<table>
<thead>
<tr>
<th>GROUP</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>I+II+III</th>
<th>IV</th>
<th>V</th>
<th>M</th>
<th>B</th>
<th>I+II+III+M+B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of full-time female faculty (Group total)</td>
<td>180</td>
<td>208</td>
<td>440</td>
<td>828</td>
<td>203</td>
<td>60</td>
<td>1177</td>
<td>1885</td>
<td>3890</td>
</tr>
<tr>
<td>% change in full-time female faculty</td>
<td>4.3%</td>
<td>-5.4%</td>
<td>8.0%</td>
<td>3.5%</td>
<td>2.9%</td>
<td>-3.4%</td>
<td>1.4%</td>
<td>0.6%</td>
<td>1.5%</td>
</tr>
<tr>
<td>Number of doctoral f-t female faculty</td>
<td>153</td>
<td>135</td>
<td>286</td>
<td>574</td>
<td>176</td>
<td>54</td>
<td>723</td>
<td>1122</td>
<td>2418</td>
</tr>
<tr>
<td>% change in doctoral f-t female faculty</td>
<td>0.0%</td>
<td>-3.4%</td>
<td>4.1%</td>
<td>1.1%</td>
<td>1.6%</td>
<td>-0.8%</td>
<td>4.7%</td>
<td>0.0%</td>
<td>1.6%</td>
</tr>
<tr>
<td>Number of tenured doctoral f-t female faculty</td>
<td>64</td>
<td>79</td>
<td>139</td>
<td>282</td>
<td>55</td>
<td>15</td>
<td>436</td>
<td>656</td>
<td>1374</td>
</tr>
<tr>
<td>% change in tenured doctoral f-t female faculty</td>
<td>0.0%</td>
<td>6.5%</td>
<td>2.8%</td>
<td>3.1%</td>
<td>0.0%</td>
<td>4.0%</td>
<td>6.4%</td>
<td>2.9%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Number of untenured, tenure-track doctoral f-t female faculty</td>
<td>17</td>
<td>35</td>
<td>104</td>
<td>156</td>
<td>74</td>
<td>13</td>
<td>243</td>
<td>407</td>
<td>806</td>
</tr>
<tr>
<td>% change in untenured, tenure-track doctoral f-t female faculty</td>
<td>23.1%</td>
<td>-12.1%</td>
<td>1.2%</td>
<td>-0.2%</td>
<td>15.6%</td>
<td>-10.3%</td>
<td>9.0%</td>
<td>-1.1%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Number of nontenure-track doctoral f-t female faculty</td>
<td>72</td>
<td>22</td>
<td>43</td>
<td>136</td>
<td>47</td>
<td>9</td>
<td>44</td>
<td>58</td>
<td>238</td>
</tr>
<tr>
<td>% change in nontenure-track doctoral f-t female faculty</td>
<td>-4.2%</td>
<td>-18.2%</td>
<td>17.2%</td>
<td>-1.2%</td>
<td>-13.2%</td>
<td>-2.4%</td>
<td>-24.1%</td>
<td>-19.4%</td>
<td>-11.1%</td>
</tr>
<tr>
<td>Number of part-time female faculty</td>
<td>45</td>
<td>60</td>
<td>241</td>
<td>346</td>
<td>48</td>
<td>6</td>
<td>639</td>
<td>1280</td>
<td>2265</td>
</tr>
<tr>
<td>% change in part-time female faculty</td>
<td>53.6%</td>
<td>4.2%</td>
<td>4.9%</td>
<td>9.3%</td>
<td>25.9%</td>
<td>0.0%</td>
<td>-1.2%</td>
<td>4.0%</td>
<td>3.2%</td>
</tr>
</tbody>
</table>
IV. Enrollment Profile and Undergraduate Majors

The Departmental Profile Survey obtains information about enrollments and distribution of instructional effort in the mathematical sciences departments.

Table 4A indicates that undergraduate mathematical sciences course enrollments increased by 1.3% from fall 1994 to fall 1995. The graduate course enrollments also increased by 1.3% over the same period. A comparison of Table 4B, which displays fall 1995 undergraduate enrollments distribution, with Table 4B from last year's Second Report, page 870 of the August 1995 Notices, shows a similar pattern of enrollment distributions. A comparison of Table 4C with Table 4C from last year's second report shows a considerable increase both in undergraduate and total course enrollments per full-time faculty member for Groups III, IV, V, and B, while for Group II and M, there were slight increases, and for Group I, no change reported. Also, graduate course enrollments per full-time faculty member remained essentially constant except for Groups IV and V, where the ratio increased significantly.

Table 4D reports that the total number of junior/senior majors in mathematics departments (Groups I+II+III+IV+V+M+B), decreased by 2.7% from fall 1994 to fall 1995. The number of female junior/senior majors declined by 4.2% during the same period. Groups II, V, and B reported increases in female majors, with Group V reporting a sizable increase.

### Table 4A. Undergraduate and Graduate Enrollments (thousands), Fall 1995, and Percentage Change in Enrollments, Fall 1994 to Fall 1995

<table>
<thead>
<tr>
<th>GROUP</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>I+II+III</th>
<th>IV</th>
<th>V</th>
<th>M</th>
<th>B</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of undergraduate course enrollments (thousands)</td>
<td>164</td>
<td>192</td>
<td>318</td>
<td>673</td>
<td>62</td>
<td>26</td>
<td>565</td>
<td>729</td>
<td>2055</td>
</tr>
<tr>
<td>% change in undergraduate course enrollments</td>
<td>3.0%</td>
<td>5.4%</td>
<td>1.8%</td>
<td>3.1%</td>
<td>6.0%</td>
<td>5.4%</td>
<td>-1.6%</td>
<td>1.3%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Number of graduate course enrollments (thousands)</td>
<td>9</td>
<td>7</td>
<td>12</td>
<td>28</td>
<td>22</td>
<td>8</td>
<td>18</td>
<td>3</td>
<td>79</td>
</tr>
<tr>
<td>% change in graduate course enrollments</td>
<td>0.5%</td>
<td>-2.9%</td>
<td>-1.3%</td>
<td>-1.2%</td>
<td>2.6%</td>
<td>2.8%</td>
<td>0.6%</td>
<td>8.0%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Number of usable responses</td>
<td>37</td>
<td>36</td>
<td>75</td>
<td>147</td>
<td>52</td>
<td>18</td>
<td>120</td>
<td>415</td>
<td>682</td>
</tr>
</tbody>
</table>

* The number of usable returns varies for different sections of the Departmental Profile Survey. The response rates reported here apply to Tables 4A through 4C on enrollments only. All counts are projected from the survey response to the respective Group as a whole.

### Table 4B. Distribution of Undergraduate Enrollments (thousands), Fall 1995

<table>
<thead>
<tr>
<th>COURSES</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>I+II+III</th>
<th>IV</th>
<th>V</th>
<th>M</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remedial mathematics* (thousands, %** )</td>
<td>15</td>
<td>9%</td>
<td>11</td>
<td>6%</td>
<td>39</td>
<td>12%</td>
<td>65</td>
<td>10%</td>
</tr>
<tr>
<td>Precalculus</td>
<td>24</td>
<td>14%</td>
<td>43</td>
<td>23%</td>
<td>72</td>
<td>23%</td>
<td>139</td>
<td>21%</td>
</tr>
<tr>
<td>1st-year Calculus (mainstream)</td>
<td>54</td>
<td>33%</td>
<td>41</td>
<td>22%</td>
<td>54</td>
<td>17%</td>
<td>149</td>
<td>22%</td>
</tr>
<tr>
<td>1st-year Calculus (non-mainstream)</td>
<td>19</td>
<td>11%</td>
<td>24</td>
<td>13%</td>
<td>27</td>
<td>8%</td>
<td>69</td>
<td>10%</td>
</tr>
<tr>
<td>Statistics</td>
<td>2</td>
<td>1%</td>
<td>6</td>
<td>3%</td>
<td>19</td>
<td>6%</td>
<td>27</td>
<td>4%</td>
</tr>
<tr>
<td>Computer Science</td>
<td>1</td>
<td>1%</td>
<td>5</td>
<td>2%</td>
<td>6</td>
<td>1%</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>Other department courses for majors</td>
<td>32</td>
<td>19%</td>
<td>29</td>
<td>15%</td>
<td>44</td>
<td>14%</td>
<td>105</td>
<td>16%</td>
</tr>
<tr>
<td>Other undergraduate courses</td>
<td>18</td>
<td>11%</td>
<td>36</td>
<td>19%</td>
<td>58</td>
<td>18%</td>
<td>113</td>
<td>17%</td>
</tr>
</tbody>
</table>

* Arithmetic, high school algebra, geometry.

** Percents are "column percents" describing relative enrollments within the respective Survey Groups of the different types of undergraduate courses.
Table 4C. Undergraduate and Graduate Enrollments per Full-time Faculty Member, Fall 1995

<table>
<thead>
<tr>
<th>GROUP</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>M</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduate course enrollments per full-time faculty member</td>
<td>79</td>
<td>107</td>
<td>124</td>
<td>55</td>
<td>68</td>
<td>108</td>
<td>94</td>
</tr>
<tr>
<td>Graduate course enrollments per full-time faculty member</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>19</td>
<td>20</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Total course enrollments per full-time faculty member</td>
<td>84</td>
<td>111</td>
<td>128</td>
<td>74</td>
<td>88</td>
<td>111</td>
<td>95</td>
</tr>
</tbody>
</table>

Table 4D. Undergraduate Junior/Senior Majors (hundreds), and Undergraduate Female Junior/Senior Majors (hundreds), Fall 1995, and Percentage Change in Majors, Fall 1994 to Fall 1995

<table>
<thead>
<tr>
<th>GROUP</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>M</th>
<th>B</th>
<th>I+II+III+ M+B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of junior/senior majors (hundreds)</td>
<td>52</td>
<td>41</td>
<td>71</td>
<td>8</td>
<td>29</td>
<td>217</td>
<td>291</td>
<td>671</td>
</tr>
<tr>
<td>% change in junior/senior majors</td>
<td>-4.5%</td>
<td>0.6%</td>
<td>-8.3%</td>
<td>-4.2%</td>
<td>11.4%</td>
<td>-9.0%</td>
<td>4.0%</td>
<td>-2.7%</td>
</tr>
<tr>
<td>Number of female junior/senior majors (hundreds)</td>
<td>19</td>
<td>16</td>
<td>31</td>
<td>3</td>
<td>11</td>
<td>92</td>
<td>125</td>
<td>284</td>
</tr>
<tr>
<td>% change in female junior/senior majors</td>
<td>-4.4%</td>
<td>2.1%</td>
<td>-9.1%</td>
<td>-10.5%</td>
<td>33.1%</td>
<td>-10.8%</td>
<td>1.8%</td>
<td>-4.2%</td>
</tr>
<tr>
<td>Number of usable responses*</td>
<td>35</td>
<td>34</td>
<td>72</td>
<td>34</td>
<td>17</td>
<td>104</td>
<td>361</td>
<td>606</td>
</tr>
<tr>
<td>(92%)</td>
<td>(81%)</td>
<td>(78%)</td>
<td>(61%)</td>
<td>(71%)</td>
<td>(42%)</td>
<td>(37%)</td>
<td>(44%)</td>
<td></td>
</tr>
</tbody>
</table>

* The number of usable returns varies for different sections of the Departmental Profile Survey. The response rates reported here apply to undergraduate major data only. All counts are projected from the survey response to the respective Group as a whole.

Acknowledgment
The Annual AMS-IMS-MAA Survey attempts to provide an accurate appraisal and analysis of various aspects of the academic mathematical scene for the use and benefit of the mathematics community. Every year, college and university departments in the United States are invited to respond. The Annual Survey relies heavily for the quality of its information on the conscientious efforts of the dedicated staff members of these departments. On behalf of the AMS-IMS-MAA Data Committee and the Annual Survey staff, I thank the many secretarial and administrative staff members in the mathematical sciences departments for their cooperation and assistance in responding to the survey questionnaires.
V. Graduate Student Profile

Tables 5A, 5C, and 5D summarize population statistics for graduate students gathered by the 1995 Departmental Profile Survey. Table 5A indicates that the total number of full-time graduate students in mathematics departments (Groups I+II+III+M) declined by 3.8% from fall 1994 to fall 1995 and declined in every Group except Groups IV and M. Table 5C data shows that the total number of female full-time graduate students in mathematics departments decreased by 0.8% and decreased in all Groups except Groups II, IV, and M. For the fourth year in a row, the Ph.D.-granting mathematics departments (Groups I+II+III) reported a decline in the number of full-time, first-year graduate students. The decline of 2% between fall 1994 and fall 1995 was less than the 3.5% decline reported last year between fall 1993 and fall 1994. Table 5D indicates a decline of 5.7% in the total number of U.S. citizen full-time mathematics graduate students from fall 1994 to fall 1995, with Group I reporting the largest decline (8.7%). On the other hand, the number of full-time, first-year female graduate students in Ph.D.-granting mathematics departments increased slightly after three consecutive years of decline.

Tables 5A and 5D show significant declines in first-year graduate students from fall 1994 to fall 1995 for doctorate-granting mathematics departments. Running counter to these declines are the significant increases in first-year graduate students reported in all three tables for Groups IV. The four successive years of declines for the doctorate-granting mathematics departments are enough to suggest a decline in the number of new doctoral recipients four to five years hence. Table 5B presents the trend in annual percentage change of first-year graduate students in Ph.D.-granting mathematics departments during the years 1986 to 1995.

Table 5A.  Full-time Graduate Students, Fall 1995, and Percentage Change in Graduate Students, Fall 1994 to Fall 1995

<table>
<thead>
<tr>
<th>GROUP</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>I+II+III</th>
<th>IV</th>
<th>V</th>
<th>M</th>
<th>I+II+III+M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number</td>
<td>3250</td>
<td>2501</td>
<td>3389</td>
<td>9140</td>
<td>3061</td>
<td>2181</td>
<td>2844</td>
<td>11984</td>
</tr>
<tr>
<td>% change</td>
<td>-7.5%</td>
<td>-3.8%</td>
<td>-4.0%</td>
<td>-5.2%</td>
<td>2.3%</td>
<td>-0.8%</td>
<td>0.9%</td>
<td>-3.8%</td>
</tr>
<tr>
<td>Number of students</td>
<td>702</td>
<td>687</td>
<td>1070</td>
<td>2459</td>
<td>1000</td>
<td>624</td>
<td>1140</td>
<td>3599</td>
</tr>
<tr>
<td>% change</td>
<td>-6.5%</td>
<td>-1.8%</td>
<td>1.0%</td>
<td>-2.0%</td>
<td>9.2%</td>
<td>0.7%</td>
<td>-12.3%</td>
<td>-5.5%</td>
</tr>
<tr>
<td>Number of responses*</td>
<td>36</td>
<td>37</td>
<td>73</td>
<td>146</td>
<td>56</td>
<td>28</td>
<td>112</td>
<td>258</td>
</tr>
<tr>
<td>(92%)</td>
<td>(86%)</td>
<td>(78%)</td>
<td>(83%)</td>
<td>(71%)</td>
<td>(78%)</td>
<td>(46%)</td>
<td>(61%)</td>
<td></td>
</tr>
</tbody>
</table>

* The number of usable returns varies for different sections of the Departmental Profile Survey. The response rates reported here apply to Tables 5A through 5C on graduate student enrollments. All counts are projected from the survey response to the respective Group as a whole.

Table 5B.  Annual Percentage Change in Full-time, First-year Graduate Students in Groups I+II+III, 1986 to 1995
Table 5C.  Female Full-time Graduate Students, Fall 1995, and Percentage Change in Female Graduate Students, Fall 1994 to Fall 1995

<table>
<thead>
<tr>
<th>GROUP</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>I+II+III</th>
<th>IV</th>
<th>V</th>
<th>M</th>
<th>I+II+III+M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of full-time female graduate students</td>
<td>778</td>
<td>777</td>
<td>1141</td>
<td>2896</td>
<td>1287</td>
<td>512</td>
<td>1216</td>
<td>3912</td>
</tr>
<tr>
<td>% change in full-time female graduate students</td>
<td>-5.8%</td>
<td>3.1%</td>
<td>-4.5%</td>
<td>-2.8%</td>
<td>5.9%</td>
<td>-5.7%</td>
<td>3.9%</td>
<td>-0.8%</td>
</tr>
<tr>
<td>Number of first-year female graduate students</td>
<td>191</td>
<td>235</td>
<td>397</td>
<td>822</td>
<td>481</td>
<td>151</td>
<td>512</td>
<td>1334</td>
</tr>
<tr>
<td>% change in first-year female graduate students</td>
<td>-4.9%</td>
<td>-1.0%</td>
<td>3.4%</td>
<td>0.1%</td>
<td>20.9%</td>
<td>-10.1%</td>
<td>-7.9%</td>
<td>-3.1%</td>
</tr>
</tbody>
</table>

Table 5D.  U.S. Citizen Full-time Graduate Students, Fall 1995, and Percentage Change in U.S. Citizen Graduate Students, Fall 1994 to Fall 1995

<table>
<thead>
<tr>
<th>GROUP</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>I+II+III</th>
<th>IV</th>
<th>V</th>
<th>M</th>
<th>I+II+III+M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of full-time U.S. citizen graduate students</td>
<td>1642</td>
<td>1525</td>
<td>2094</td>
<td>5261</td>
<td>1697</td>
<td>1227</td>
<td>1881</td>
<td>7142</td>
</tr>
<tr>
<td>% change in full-time U.S. citizen graduate students</td>
<td>-8.7%</td>
<td>-2.6%</td>
<td>-4.9%</td>
<td>-5.5%</td>
<td>3.3%</td>
<td>-1.9%</td>
<td>-6.3%</td>
<td>-5.7%</td>
</tr>
<tr>
<td>Number of first-year U.S. citizen graduate students</td>
<td>364</td>
<td>446</td>
<td>667</td>
<td>1477</td>
<td>581</td>
<td>369</td>
<td>742</td>
<td>2219</td>
</tr>
<tr>
<td>% change in first-year U.S. citizen graduate students</td>
<td>-8.9%</td>
<td>-4.7%</td>
<td>-3.5%</td>
<td>-5.3%</td>
<td>4.8%</td>
<td>-0.3%</td>
<td>-21.3%</td>
<td>-11.3%</td>
</tr>
</tbody>
</table>

Bibliography


--- , Selected data on graduate students and postdoctorates in science and engineering, Fall 1991(NSF 92-335), Selected Pamphlet No.11: Institutional Listings (NSF 90-324-11), Selected Pamphlet No. 12: Postdoctorates and Other Nonfaculty Research Staff (NSF 90-324-12), Washington, DC, 1990.


Doctoral Degrees Conferred

1994–1995 Supplement

ARIZONA

University of Arizona (4)

MATHEMATICS
Bollschweiler, Ronald, Valuated modules over valuation domains.
Brilleslyper, Michal, The Dirichlet problem for harmonic maps from the disk into a sphere.
Olson, Steven, Homomorphisms of planar near-rings.
Sun, Hsin-min, Planar near-rings and block designs.

CONNECTICUT

Yale University (1)

BIOSTATISTICS
Ma, Zheng, A model describing the relationship among cancer morbidity, survival and mortality.

DISTRICT OF COLUMBIA

George Washington University (3)

MATHEMATICS
McNicholl, Timothy, The inclusion problem for generalized frequency classes.
Miller, William, Approaches to matroid reconstruction problems.
Ramamurti, Sita, Dynamics near the essential singularity for zero-free entire vector fields of finite order.

VIRGINIA

George Mason University (3)

ELECTRICAL ENGINEERING-INFORMATION TECHNOLOGY AND ENGINEERING
Akujuobi, Cajetan Maduabuchukwu, Wavelets and fractals: A quantitative assessment of their performance in image reconstruction, restoration and segmentation.

COMPUTATIONAL SCIENCES AND INFORMATICS
Solka, Jeffrey L., Matching model information content to data information.

STATISTICS
Poston, Wendy, Optimal subset selection methods.

The above list supplements the list of thesis titles published in the January 1996 issue of the Notices. Each entry contains the name of the recipient and the thesis title. The number in parentheses following the name of the university is the number of degrees granted by the university.
Like many of his colleagues, Bob Thomason hated to waste energy on trivial matters like fashion. He made the decision early in life to dress only in black clothing, thus simplifying that portion of his life. With his pointed goatee, he looked like a beat poet to outsiders, but mathematicians knew him as one of the greatest talents of his generation. Few have had the simultaneous grasp of topology, algebraic geometry, and K-theory that Thomason did.

Bob had diabetes and always had to strictly control what he ate. This made going to restaurants with Bob an awkward affair, because he would not eat something until he was sure it had no nutritional content. Late in October 1995, just before his forty-third birthday, he went into diabetic shock and died in his apartment in Paris. We are all saddened by his passing.

Here is an overview of Thomason’s career. For simplicity I have focused upon what I think are his three major results. A retrospective article, describing some of his mathematical contributions in more detail, will appear in a future issue of the Bulletin of the AMS.

Robert Wayne Thomason was born in Tulsa, Oklahoma, on November 5, 1952. Attracted to Michigan State University by a flexible undergraduate Honors Mathematics program, he spent two years there (1971-73). During his second year at MSU he published his first paper [6], in point-set topology. He then spent 1973-77 as a graduate student in the Princeton University mathematics department, writing his Ph.D. dissertation [7] under the direction of John Moore.

His thesis [7] describes and analyzes a simple but fundamental construction in category theory: the “canonical cofibered category” associated to any diagram $D$ of (small) categories. Since the geometric realization of a small category is a topological space, we obtain a corresponding diagram $|D|$ of topological spaces. The main result in his thesis is that the geometric realization of the canonical cofibered category of $D$ is the homotopy colimit of the diagram $|D|$ of spaces. Because of the elegance and thoroughness of his analysis, this construction has become a basic tool used routinely by topologists.

As he was graduating in June 1977, Thomason discovered the first of his major results: a proof that all infinite loop space machines produce equivalent output. In order to straighten out the technical details of his insight, he immediately enlisted the aid of J. Peter May. In a collaboration May recalls as “delightful interaction”, they reduced Bob’s argument to a characterization of infinite loop space machines by just one axiom: the “group completion” axiom; see [4].

A variation on this theme occurs in a 1979 paper by Thomason, showing that all one-fold delooping machines also produce equivalent output. Recently in [10], Thomason showed that every infinite loop space, and every $-1$-connected spectrum, arises from an infi-
Infinite loop space machine applied to a symmetric monoidal category.

Thomason then went to M.I.T. as a Moore Instructor (1977-79). During this time he developed the ideas in his thesis into a series of papers studying the homotopy theory of categories, especially symmetric monoidal categories. In one paper he proved the reassuring result that the abstract homotopy theory of categories does not depend upon a passage to geometric realizations, because fibrations, cofibrations, etc., of categories exist as part of a "closed model structure". In two detailed papers he constructed mapping cones, mapping cylinders, and other homotopy colimits within the category of small symmetric monoidal categories and showed that infinite loop space machines send these constructions to the appropriate homotopy colimits of spectra. Thomason's homotopy colimit constructions have since been central to the work of several people.

In 1979 Thomason went to the University of Chicago to begin a three-year appointment as a Dickson Assistant Professor. There he developed the notion of cohomological descent for spectra, parallel to the notion of hypercohomology in homological algebra; it has since become a basic notion in algebraic K-theory. In a paper humorously entitled "Beware the phony multiplication on Quillen's $A^{-1}A$" [8], he exposed a subtle but lethal flaw in a putative construction for the ring structure on the $K$-groups of commutative rings. He also began a four-year effort to settle the Quillen-Lichtenbaum conjectures, which connect algebraic $K$-theory to étale cohomology. After the proof of an early partial result collapsed in 1980, Thomason began to feel uncomfortable about the skepticism expressed by others. Perceiving this as persecution, he resigned from his position at Chicago in June 1980.

For the next two years Thomason held an irregular appointment at M.I.T., and then spent a year as a Member at the Institute for Advanced Study. During this period, he finished his opus [9] on the Quillen-Lichtenbaum Conjecture, which contains his second major result. Roughly, it states that the groups $K_n$ can be calculated in terms of étale cohomology for large $n$, using a formula due to Dwyer and Friedlander. This result established the first half of the Quillen-Lichtenbaum Conjecture. The final part of the conjecture, which pins down the values of $n$, is currently the focus of intensive work in Motivic Cohomology.

As part of his four-year effort culminating with [9] Thomason wrote five other papers, including the four-author paper [1] with Dwyer, Friedlander, and Snaith. Two nice applications of his descent machinery appear in other papers from that era: a proof of $Q_p$-adic cohomological purity and a rigidity theorem for $K$-theory with Gillet (their proof was contemporaneous with Gabber's).

In 1983 Thomason joined the mathematics faculty of Johns Hopkins University in Baltimore, where he stayed for six years. During this time he supervised two Ph.D. dissertations, by Masana Harada [3] and Dongyuan Yao [12]. During 1983-86 he wrote a series of papers about equivariant algebraic $K$-theory.

Starting in 1985, he mounted a sustained three-year attack upon the problems left over from Grothendieck's opus [5], especially an analysis of how the $K$-theory of a scheme depends upon its derived category of vector bundles and how to describe the effect of localization upon $K$-theory. His successful solution of this problem in 1988 [11] forms his third major result.

The story of this three-year attack reveals much about Thomason's methods. The first step in this program, which he discovered in 1985, was a "cofinality theorem" for Waldhausen $K$-theory. Today his cofinality theorem is viewed as one of the fundamental results in $K$-theory. The next step was taken during the calendar year 1987, which he spent at Rutgers University as part of a Sloan Fellowship (1985-87). That year he put everything into place except for one step: extending perfect complexes from an open subscheme to the entire scheme. On January 22, 1988, he had a dream in which his recently deceased friend Thomas Trobaugh told him how to solve the final step: use "the direct limit characterization of perfect complexes." Awakening with a start, he worked out the argument for the missing step. In gratitude he listed his friend as a coauthor of the resulting paper [11].

In recognition of the importance of his work in [9] and [11], Thomason was chosen to give an address at the Kyoto International Congress of Mathematicians in 1990.

In October 1989 Thomason made what turned out to be his final career move, to Paris. He accepted a position in the C.N.R.S., attached to Max Karoubi's laboratory URA 212 at the University of Paris VII. While there, he helped Karoubi, Kahn, and Kassel run the monthly Paris $K$-theory seminar and wrote six more papers. He remained in this position in Paris until his untimely death last October.
References


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One of the ironies of being a college educator in the United States is that one is often rewarded for not doing one’s job. That sounds like a strange thing to say, but I know that it is true.

I received my Ph.D. in 1974. I taught at state universities (Rutgers and Indiana) before moving to Johns Hopkins in 1983. When I arrived at Rutgers as a fresh Ph.D., I had little teaching experience, and the first few years were trying. Once, I was criticized for covering the entirety of the math department’s syllabus for a calculus course when the students were not “getting” some of the topics along the way (I was expected to “put the heart before the course”). I eventually learned to accept the pretenure save-your-own-hide advice that I give to assistant professors: teach so as to keep your ratings up. From then on, I had good student evaluations. But was I a good university educator? Were the students learning better? Not really. Did anyone care? Not really.

At universities where the standard for reappointment and promotion was quality research and acceptable teaching (or even entirely a research standard), it is obvious why few people wanted to rock the boat over educational matters. The goal was de facto to concentrate one’s energies on research and do enough in teaching to keep the students from complaining. That it kept many of them ignorant was not at issue.

When I moved to Hopkins, I got as a bonus an improved environment for teaching. Here was a body of students with a rather high mean SAT math score (now around 700). Believing that they would be a better audience (despite the large class size), I felt that I could comfortably blend into the style that had emerged from my years as assistant professor some of my ideals about teaching calculus to science-oriented students. However, as years went by I started to feel increasing resistance—balking—on the part of a large portion of my class. Since I also felt that my presentation was getting clearer, I became correspondingly irritated over their apparent refusal to take the course seriously. And when I took part in the student-run course evaluation survey a few years ago, I discovered that the class as a whole rated me only “satisfactory.” What was going on? It took a poke from my department chair and a couple of years of exertion on my part to arrive at the conclusion that I now hold. The answer is so obvious that it is embarrassing.

The fundamental problem is that most of our current high school graduates don’t know how to learn or even what it means to learn (a fortiori to understand) something. In effect, they graduate high school feeling that learning must come down to them from their teachers. That may be suitable for the goals of high school, but it is unacceptable at the university level. The students must also learn on their own, outside the classroom, is the main feature that distinguishes college from high school.

My contention is that it is possible to get college freshman to learn calculus fairly well, without resorting to utopian tricks such as enforced group projects. All we have to do is get the student to accept that learning is something that will take place mostly outside of class; that is, just insist that they grasp the underlying premise of college education. You may wish to ask yourself where, when, and how freshmen at your university get this message.

It seems to me that the right way to do things is to put a little effort into explicitly and imme-

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diately bringing the students’ expectations up to university level. I have tried this in the first week of my own course (Calculus II for Physical Science and Engineering, fall semester ’95—I taught the same course in fall ‘93 and fall ‘94) with much success, despite the inevitable dilution of effort that results from our first-semester freshman pass-fail. It helped that my message was reinforced by my department’s new “Survival Guide”, which was passed out in all basic courses at the beginning of the semester. The class did rather well on exams that were deemed difficult—I prefer “thorough”—by my colleagues. We should be putting our effort into reforming the students, not the calculus! My personal attempt at orientation was based on a collection of handouts. At the end of the semester, I saw that I could write up their effective content on one page; it is appended to this article.

I’m told by students that during that first week, most of the class was thinking “Strange. Why was our professor going on like that??” It eventually dawned on me that this sort of academic orientation should have been getting carried out by the organizers of Orientation Week, who now put all of their efforts only into making students socially at ease the week before classes begin. After all, isn’t how to study in college something important that most freshmen don’t know when they arrive? Still, they will be expected to have figured it out by the end of the academic year (not necessarily without pain). Why is this important piece of wisdom concealed from our entering students? And why do serious educators have to endure the consequences of receiving a batch of students with expectations at the high school level?

When college students act as though they are still in high school, they rate their professors accordingly. If it is even suspected that the ratings will be taken nearly at face value, as I fear they too often are these days, a prudent instructor will then be tempted to make his or her courses more like high school. A serious instructor with ambition will probably end up absorbing the consequences of mediocre ratings. Thus, the teaching of basic university mathematics at the college level becomes the thankless task of the idealist. We must hold the system responsible for encouraging the behavior that it rewards and ourselves for allowing such a system to persist.

We let them stay in high school for several reasons. One is the fear of negative teaching evaluations! It’s a vicious circle. To get good evaluations, one can simply give the students what most of them (think they) want: a course where the material moves slowly and can be picked up largely in the classroom, exams that reflect a predetermined list of problem types. Careful preparation and a few drops of avowed concern completes this recipe for an “A” rating with students. And I’ve never heard more than a handful of students complain that a course was too easy!

Another reason for letting them stay in high school is that we may opt to take the path of least resistance. It takes a lot of time and energy on the instructor’s part to prepare and deliver lectures and to make up and grade suitable exams that will help the students attain the goal of command of the material. And it requires emotional strength to hold one’s stance when some of the students show signs of strain while at the same time giving help to the students during office hours and beyond. In short, it is pragmatic to teach so as to keep one’s ratings up and to leave the standard near the high school level.

I used to be hoodwinked by the notion that it was unfair to test the students on anything I didn’t “go over” in class, even when problems were assigned in the homework. I feel now that it was an unwarranted concession to their intent to stay in high school. Why are we rewarding their resistance? At Hopkins one of our finest graduate student teaching assistants taught calculus in the summer session. One of her students had the gall to assert in the course evaluation survey that he or she could not recommend her; the TA had had the effrontery to ask the class to pick up one of the last topics on their own.

One of my basic tenets is that the students have no right to know what an upcoming exam is going to look like. (However, exams from previous years are on file at the library.) I aim to prepare them for any reasonable exam I might come up with. That is, I’m asking them to aspire for command of the material of the course and not any particular subset of it. Some students think this is “unfair”—it wasn’t like that in high school—when in actuality asking for a sneak preview of the exam is nothing but attempted cheating. When the instructor helps them cheat, the students reward him or her with higher marks on the evaluation survey for giving “fair” exams and “relevant” lectures, and the community ends up with the impression that the instructor is a good teacher. I think I’ve made a good case that such people should be reprimanded, not lauded, for they contribute to the undermining of education at the college level. (The reader may be able to anticipate the corollary that one cannot measure the level of a course just by looking at the exams: an exam that looks “hard” may cease to be so if the students had been told by the instructor to expect those problems or ones just like them.)

Naturally, an instructor who plans the lectures carefully and delivers them well will rate better than one who does not; that is appropri-
ate. I'm only trying to enunciate a point that every math professor surely knows, at least subconsciously: other things being equal, an easy course will rate higher than a demanding one. This factor is not treated in most course evaluations. (Indeed, I doubt that a reliable measurement of learning can be achieved by simply polling the students at the end of the semester.) Students, especially freshmen, can and do declare that an instructor is hard to follow just because the material is not presented and reinforced completely in the lectures, even when the students who keep up with their share of the work assert that the material is being explained very clearly.

In conclusion, I think I have illustrated how the issues of academic orientation, the serious evaluation of teaching, and the "calculus crisis" are linked, at least at selective universities like Johns Hopkins. Of course, the way in which mathematics education in any particular college or university can be improved depends on the composition of its student body. The overall theme should be the same though. Students must be told immediately that they are about to face a big jump in level from high school. Most high school teaching is justifiably set to the needs of the least talented students in the class; the better students often become convinced by habit that this level is right for them too. They should be helped to recognize that the change is both appropriate and manageable. It is not necessary for their teachers to "program" them, for they are quite capable of monitoring their own learning. It is not necessary for them to grasp things at once from the classroom presentation alone, for many things require time and effort for attainment of the level of understanding we would like them to achieve. And most of that can take place only outside of the classroom.

**Academic Orientation for Fall Semester Freshman Lecture Courses**

What follows is what an entering freshman should hear about the academic side of university life. It is distilled from what I've learned and written concerning the need for academic orientation as a result of having been the instructor of 110.109 (Calculus II: Physical Sciences) in the fall semester for three consecutive years.

The underlying premise, whose truth is very easy to demonstrate, is that most students who are admitted to a university like JHU were being taught in high school well below their level. The intent here is to reduce the time it takes for the student to appreciate this and to help him or her adjust to the demands of working up to level.

1. **You are no longer in high school.** The great majority of you, not having done so already, will have to discard high school notions of teaching and learning and replace them by university-level notions. This may be difficult, but it must happen sooner or later, so sooner is better. Our goal is more than just getting you to reproduce what was told to you in the classroom.

2. Expect to have material covered at **two to three times** the pace of high school. Above that, we aim for greater command of the material, especially the ability to apply what you have learned to new situations (when relevant).

3. Lecture time is at a premium, so it must be used efficiently. You cannot be "taught" everything in the classroom. **It is your responsibility to learn the material.** Most of this learning must take place outside the classroom. You should be willing to put in two hours outside the classroom for each hour of class.

4. The instructor's job is primarily to provide a framework, with **some** of the particulars, to guide you in doing your learning of the concepts and methods that comprise the material of the course. It is not to "program" you with isolated facts and problem types nor to monitor your progress.

5. You are expected to read the textbook for comprehension. It gives the detailed account of the material of the course. It also contains many examples of problems worked out, and these should be used to supplement those you see in the lecture. The textbook is not a novel, so the reading must often be slow-going and careful. However, there is the clear advantage that you can read it at your own pace. Use pencil and paper to work through the material and to fill in omitted steps.

6. As for **when** you engage the textbook, you have the following dichotomy:

   a. [**recommended for most students**]
   
   Read for the first time the appropriate section(s) of the book **before** the material is presented in lecture. That is, come prepared for class. Then the faster-paced college-style lecture will make more sense.

   b. If you haven't looked at the book beforehand, try to pick up what you can from the lecture (absorb the general idea and/or take thorough notes) and count on sorting it out later while studying from the book outside of class.
Views on High School Mathematics Education

This is the first of a series of articles composed from responses of mathematicians, mathematics educators, and teachers of mathematics to a set of questions on secondary education in mathematics. These are the questions:

1. When you consider what high school graduates should understand about mathematics, what do you care about most?
2. What do you think should be essential features of every high school mathematics curriculum?
3. How would we know when high school mathematics education is working well?
4. What do you think is most important in the mathematical background, attitude towards mathematics, and pedagogical approaches of high school mathematics teachers?
5. What first attracted you to mathematics?

The respondents were chosen from those known to us or suggested to us as having dedicated some effort and thought to this subject. We also aimed at obtaining the widest possible set of views and recommendations. All respondents answered all questions, and we have selected those responses for publication which cover the breadth of opinion and ideas presented. Our sense is that rapport among educators of mathematics at all levels is essential to the coherence and success of the enterprise, and fundamental to that rapport is openness of dialogue.

The articles are inspired by the efforts of Al Cuoco and Wayne Harvey of Education Development Center, Inc., to increase the involvement of mathematicians in high school mathematics education. Their work has resulted in a project funded by the National Science Foundation and entitled "Building on Strengths: Stimulating Cooperation among Mathematicians and Mathematics Educators." The highlight of the project is a national meeting, to be held next spring, which will bring together mathematicians, mathematics educators, and K-12 teachers who have strong and differing opinions on basic questions like the ones posed in these articles. After the conference, follow-up activities will be held at regional and national meetings of professional organizations. For further information on the project, visit the Website http://www.edc.org/LTT/805/.

The next installment will appear in the September 1996 issue of the Notices. Apart from these two articles, future articles are planned in which high school teachers will respond to a similar set of questions. The full text of all the responses will be posted on the education home page on e-MATH, at the URL http://www.ams.org/committees/education/.

The names of the respondents and their affiliations are: Susan Addington, California State University, San Bernardino; George Andrews, Pennsylvania State University; Richard Askey, University of Wisconsin, Madison; William Barker, Bowdoin College; Hyman Bass, Columbia University, chair, AMS Committee on Education; Curtis Bennett, Bowling Green State University, member, AMS Committee on Education; David Cox, Amherst Col-
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—Allyn Jackson and Hugo Rossi

1. When you consider what high school graduates should understand about mathematics, what do you care about most?

ARNOLD ROSS: We fail to acknowledge fully the destructive power of boredom. Let us note that “boredom” is not the opposite of the common parlance expression of “having fun”.

Curiosity is a prevalent (and happy) human trait. It encourages the transition from “look” to “see”. In bringing up the very young we must encourage their urge to explore. We must nurture their capacity to observe, to experiment, to project their experience adventurously (conjecture!).

Also we must nurture their capacity to communicate. Here we must recognize that experience comes first and the appropriate language comes second and not vice-versa. Thus we must provide early hands-on experience. The more common bon mot “mind-on” is more suggestive.

Computers may enter naturally and fruitfully only after youngsters understand and master important algorithms. In the beginning computers should be programmed by the student for each algorithm. Then the computer will be appreciated as a tool of extracting incredibly more information out of each procedural invention.

Learning appropriate intelligent use of computers early is very desirable in our computer oriented environment. In particular it provides a basis for mastering the ever more sophisticated uses of computers in science and technology.

WILLIAM BARKER: I care most about their understanding of mathematics as a process for analyzing and solving problems of consequence in the natural and social sciences. In particular I want students not to approach mathematics as a “content-free” exercise in manipulating symbols via memorized rules. I will gladly trade some manipulative skill to have students who approach mathematics as a discipline that requires understanding of the concepts and creative thinking to apply those concepts in the solution of problems that matter. Students should not freeze when confronted by a question that goes beyond the “template problems” of their textbooks. They should view mathematics as a toolbox and be able to select intelligently among their tools. (This is closely related to the “Rule of Three”: the analysis of problems graphically, numerically, and symbolically.)

There are, of course, basic manipulative skills that high school graduates should have. Most mathematicians would probably put together pretty much the same list and in the same order of priority; the primary differences would be in the lengths. My list would be among the shortest, but with the requirement that students understand these topics well. When it comes to skills, real ability with a small collection of tools is far better than superficial acquaintance with a large collection.

H. WU: (a) They all must understand that every true statement in mathematics can be logically explained in terms of other true statements and that nothing is ever true just because some higher authority decrees it to be so. This is the basic spirit of openness in any rational discourse, and if math education does not succeed in inculcating this spirit, then school education as a whole has failed miserably.

(b) Concomitant with (a), students must be able to distinguish clearly between what they know and what they don’t know to be true. In mathematics and perhaps only in mathematics this sharp distinction can be drawn, and students should profit from it. They should not confuse a heuristic (but incomplete) argument with a conclusive proof. By the same token, once they have learned the proof of something in mathematics, they should be able to savor the satisfaction of unshakable conviction. The possible failure to achieve this goal in school math education is what worries me the most in the present math education reform.

(c) Students should appreciate that mathematics is a language of precision. As a language the mastery of math must include fluency. They must therefore strive for this fluency. Thus certain basic techniques should always be available at their fingertips. In addition, the characteristic feature of precision of this language automatically excludes the kind of vagueness and
ambiguity in everyday life. If students really understand this, then they would know that questions such as “What is best?” or “Is this fair?” (which are common in the mathematical problems of the current reform) have no place in any mathematical discussion until these loaded words have been precisely defined.

(d) The purpose of a math education lies not just in teaching students how to solve everyday problems (as some reformers would have us believe) but also in teaching them how to think precisely, logically, and abstractly. The utilitarian aspect of the subject must also be tempered with an appreciation of its cultural aspects: its internal structure and its aesthetic appeal.

GEORGE ANDREWS: Recently Cal Moore, writing on educational reform in California, began as follows:

While reforms are gradually taking hold, the majority of classrooms still rely on a traditional mathematics curriculum, that, as one cynical observer remarked, is largely composed of eight years of 15th century arithmetic, two years of 17th century algebra, and one year of 3rd century B.C. geometry.

I would suggest that if students really have mastered these subjects, they will have no difficulty with anything thrown at them in college.

Unfortunately, beguiled by ever fancier calculators and computers, teachers appear less and less able to produce students who are masters of these basic topics.

National leadership only muddies the waters. Listen to the NCTM (National Council of Teachers of Mathematics) on technology:

…the ability of teachers to use the tools of technology to develop, enhance, and expand students’ understanding of the curriculum is crucial. These tools include computers, appropriate calculators (scientific, graphing, programmable, etc.), videodisks, CD-ROM, telecommunications networks by which to access and share real-time data, and other emerging educational technologies. Exploration of the perspectives these tools provide on a wide variety of topics is required by teachers.

All that’s missing are strobe lights and a D.J. The simple, very old-fashioned lesson that “math class is hard” and requires hard work and lots of homework cannot help but get lost in the glitz of gimmicks.

2. What do you think should be essential features of every high school mathematics curriculum?

WILLIAM BARKER: The essential feature of every high school mathematics curriculum should be the existence of a mathematical environment which instills the attitudes cited [in my response to question 1]. Courses should not emphasize the memorization of manipulative rules and their regurgitation on template-problem exams. Students must realize that mathematics is thinking, not mental gymnastics. Time should be taken for real applications. Better yet, real applications should be used to motivate the need for certain mathematical techniques. For example, trigonometric functions should be introduced, not solely to “manipulate stuff with triangles”, but as the primary tool for dealing with repetitive, periodic phenomena. Analytic geometry should be stressed, not simply as a collection of skills to master, but as a profound link between algebraic problems and geometric problems. (Perhaps I missed it, but I don’t recall these viewpoints in my high school education. My current students certainly do not come equipped with them.)

I think that high schools need to be very careful about instruction in calculus—I do not think it should always be the capstone goal for their best students. Getting to calculus in high school often means rushing students through the foundational material and developing a “template-problem” mentality to all of mathematics due to shaky understanding of the basics.

Emphasis on varied and effective pedagogical techniques needs to be given as much attention as the curricular content. It is my understanding that great strides have been made in this area in recent years. “Chalk-and-talk” is no longer the only teaching format in the high school arsenal. That’s absolutely critical. “Telling is not teaching, hearing is not learning” is a phrase to live by. Collaborative learning situations, both in-class and out-of-class projects emphasizing multi-step problems, discovery learning through calculator or computer labs, written reports—all of these instructional methods should be part of the high school experience. The shift must be towards more opportunities for active learning rather than passive.

Examinations must put more emphasis on conceptual questions and problems requiring thinking, not just template problem memorization. I know this is hard. I have been wrestling with this problem for years at the college level. But the cliché that “exams define the course” is true and cannot be ignored.

H. WU: The answer [I gave] to 1 is a statement of the goals of a school math education. The
school math curriculum should therefore focus on the attainment of these goals. One cannot hope to set forth in a few sentences how such a complicated task can be accomplished. The following are at best vague statements. An overall comment is that during the last two or three years of high school, the curriculum for students who expect to be quantitative majors in college should differ from that for students who don’t in terms of the technical nature of the instruction. In general:

(a) Abstractions should be introduced early (in grade school) but in small doses. Students have to learn to handle abstract thinking; and the more they are shielded from abstractions in the early grades, the harder it would be for them to learn it later. For example, if fractions are taught properly (with the requisite amount of abstract reasoning), then fifth graders would already get to see the essence of mathematics at work.

(b) Informal reasoning for every mathematical statement should be given from the beginning. By the time of junior high, formal proofs should begin to make their appearance, if only in moderation. In the eleventh and twelfth grades, formal proofs should become routine (at least for students who will be quantitative majors in college).

(c) The applications in school mathematics should not overwhelm the curriculum, especially not those arising exclusively from everyday life. The power of mathematics is best demonstrated when it is seen to be essential for the formulation of far-reaching scientific principles rather than just the solution of picayune, mundane problems.

(d) Mathematics is precise. For this reason, the possible ambiguity in the solution of real-life problems must be clearly traced to the inherent ambiguity in the interpretation of the real-life problems and not be blamed on mathematics itself. The sermon that “there is always more than one correct answer to a math problem,” so often preached in the math education reform, should be laid to rest for good.

KENNETH MILLET: A high school mathematics curriculum should present mathematics as an interconnected whole. It should include the study of functions, algebra, geometry, statistics and probability, discrete mathematics, logic, reasoning and communication, applications of mathematics, and numbers (integers, rationals, real and complex numbers, as well as other number systems). Thinking of these as strands of mathematics, a good visual image is of mathematics as a tapestry whose beauty and strength requires the artful interweaving of the strands. Such a high school curriculum is best understood when viewed from a distance so that the unity and proper proportional relationships come into view. The curriculum should be less hierarchical and more multidimensional, with “advanced” issues suggested early on and with “elementary” topics revisited frequently at greater and greater depth. The use of credible mathematical models, problem solving (including the development, use, and analysis of algorithmic approaches), mathematical communication (in all its manifestations and translations between forms), exploration, conjecturing or guessing, and the development of explanations (arguments or “proofs”) should be part of the overall experience. A deep conceptual introduction to the mathematics of change is important, but a formal course in calculus is not necessary. Most importantly, thinking about mathematics and reflection on what has been learned should be central to every student’s experience in high school. Accuracy and depth of understanding are more important than speed in carrying out narrowly prescribed operations.

ALAN TUCKER: There are core topics in algebra that every student should know. Beyond that, I am at a bit of a loss. The process of rigorous mathematical thinking and exploration can be undertaken in many ways. I tend to believe that the mathematical learning process is more important than specific content learned. I think that the NCTM Standards is a reasonable beginning for one version of a good high school mathematics curriculum, although it needs to go further for more talented students.

3. How would we know when high school mathematics education is working well?

JUDITH ROITMAN: When kids talked mathematics intelligently, as naturally as they talk anything else, whenever mathematics is appropriate. When kids want to talk mathematics.

FERN HUNT: When public debate on issues involving quantitative reasoning are more informed. When more people are comfortable using mathematics in their jobs and in the rest of life.
ROGER HOWE: One way would be for there to be an increased acceptance of mathematics as part of normal dialogue. In the book *Mathematics Tomorrow*, edited by Lynn Steen, there is an article by Neal Koblitz called "Mathematics as Propaganda." It starts with an article about someone from Zero Population Growth talking about environmental impact as being proportional to population. This was on the Johnny Carson show, I think. The guy wrote a linear equation, $D = cP$, $D$ being damage and $P$ being population. Koblitz's point was, writing this equation was an intimidating thing to do. My reaction was to be depressed that something so basic and simple should be perceived as intimidating by the broad public. If we could reach a state where this kind of thing was an accepted and understood part of normal discourse, that would be a positive thing. But I guess that won't happen in the short term. I think the practical short-term answer is to recognize first that "working" will always be a relative term; one can always wish for more, and things could always be worse. Given that, the answer becomes technical: one must have standardized tests which reflect a consensus view of what needs to be known, and [one must] measure progress on these tests. There is another criterion, in terms of manpower: are the math skills offered on the market adequate to the jobs available? But this is a much more contingent criterion, reflecting much more than U.S. education. For example, there is currently a Ph.D. math supply glut. But these supernumerary Ph.D.s are not U.S. citizens.

RICHARD ASKEY: We have many problems in our schools, and mathematics education is only one. However, many of these problems are related, and I do not think we can solve one in isolation. Thus, rather than try to say when I think the whole problem of school mathematics has been fixed and is working well, I think it is sufficient to look at one problem there and see when it has been solved.

The one which is easiest to look at is the problem students taking calculus have with algebra. For far too many, their lack of skills in algebra makes it very hard and, for many, impossible for them to learn calculus. Some have tried to attack this problem by redefining calculus, just as they have tried to attack the problem of poor arithmetical skills causing problems in algebra by changing what algebra is. Neither of these will work, and we need to go back to fundamentals and solve these problems directly. Elementary school is the most important.

In the book *The Shopping Mall High School* (Houghton Mifflin, 1985) the author of Chapter 2, Arthur Powell, describes a treaty between many teachers and many of their students. In short, it is: I will not force you to learn anything in this class if you do not cause any trouble. While this is not true universally, I am afraid it is an accurate description of far too many classes. Many calculus students have told me that they wish they had studied in high school, but no one else did, so they did not either. Some of this talk is for show, but far too much of it is accurate. When students no longer say this, then significant progress will have been made.

HYMAN BASS: We first need to achieve some consensus on the aims of that education. They are multiple—cultural and intellectual (college performance), economic (workplace performance and employability), and social (informed and responsible citizenry). We need some agreement on what balance of priorities these are given and on whether and how the student population should be aggregated in delivering that education. Once we have some semblance of consensus, including a good and collaborative articulation between high school education and college and the workplace, then we can go beyond the current system of national exams—which value and relevance are conditioned by the extent to which what they measure conforms with the educational aims of the system—and do longitudinal studies of performance of high school graduates in college and the workplace, not only in terms of course grades, but even of their remaining engaged with scientific and technical subjects.

4. What do you think is most important in the mathematical background, attitude towards mathematics, and pedagogical approaches of high school mathematics teachers?

HAN SAH: Most important: know a lot of basic techniques, content, and the proper use of mathematics in the quantitative sciences and the improper use of mathematics in the more qualitative sciences.

Love of teaching and learning as a calling and then love of mathematics as a part of this.

Be aware of a variety of pedagogical approaches rather than being dogmatic about a particular approach. Keep in mind that teaching is not for the convenience of the teacher but for the future of the students. Know the background preparation of the students and their tentative goals beyond the immediate present.

JOHN B. CONWAY: Appreciation of the need for theory (instead of fear of it), willingness to get their hands dirty (instead of thinking everything must be so simple), excitement for what mathematics is (instead of boredom), an appreciation of the fact that mathematics is not an assortment of algorithms.
RAYMOND JOHNSON: I believe that a variety of pedagogical approaches can be successful. I suspect that the most important thing is the attitude the teachers bring to mathematics. I know my son suffered from a number of teachers who insisted that mathematics was about right answers and that there was only one way to do a mathematics problem correctly. I think there is a big difference between "only one correct answer" and "only one way to get the answer". My feeling for a strong math background for teachers is based on my belief that the better the math background, the more flexible the teacher is likely to be about mathematical work.

LEON HENKIN: By way of mathematical background, it is most important that high school teachers have a good understanding of the parts of algebra, geometry, and analysis into which high school math will flow when students continue to study math in college. They must also be familiar with a wide spectrum of applications of math that can be made in high school science courses and in nonacademic fields where many high school students may seek jobs after graduation, including the use of computers.

By way of attitude, teachers should enjoy mathematics, let their students see this, and help them to achieve it for themselves. This is much more important than ensuring that the students learn some body of facts in class, for if they truly enjoy working with mathematics, they will go on learning long after leaving the class. Teachers must be sensitive to the fact that students are only learning to use language in the same way as the teachers themselves. Hence, a student may be trying to express a correct idea in words that sounds incorrect to the teacher, and if there is a wrong idea in the student's mind, it may have arisen from a natural misinterpretation of the teacher's words. By way of pedagogical methods, teachers should elevate to first place the use of praise—not only for correct answers, but also for brave guesses even when they turn out wrong.

5. What first attracted you to mathematics?

GEORGE ANDREWS: In high school I was completely unaware of the possibility of being a mathematician. The only really exciting life I could imagine was suggested by the Sherlock Holmes novels. Here was a character, albeit fictional, whose entire career depended on adroit reasoning. Since such a career seemed to be pure fantasy, I decided to become a patent attorney because I was good at science and math and found the law to be something involving some (I hoped) adroit reasoning.

In college at Oregon State my life was transformed by Harry Goheen. He obviously loved mathematics with passionate enthusiasm, and he proselytized vigorously for math majors. He was able to rekindle in me the dream of a career built on the life of the mind. This began in his trigonometry course. By the end of his calculus course, I was a math major.

RICHARD ASKEY: The story my mother tells is of me in a high chair doing a follow-the-dot puzzle and asking for a calendar, since I had finished with the clock. I always liked mathematics, and in high school met a second cousin who had M.A. degrees in mathematics and physics who told me that it was possible to do mathematics. Before then I had wanted to be a physicist.

WILLIAM BARKER: I liked playing with mathematics—doing it—and was good enough that I received a lot of encouragement and recognition in high school. Although my high school experience was with a standard curriculum using standard teaching techniques (i.e., lectures), I had teachers who cared about mathematics, were knowledgeable, and showed a real excitement about the subject. Although my instructional preferences might belie it, I am not an applied mathematician. My area is Lie theory, a topic that I love because of its inherent beauty and its ties to so many branches of mathematics.

A criticism often leveled against the instructional reorientation I recommend is that it will not appeal to those students who, "like us", will become interested in mathematics for its own sake and who would languish under a "less rigorous" curriculum. Not so. I wish my own secondary education had been oriented more to conceptual understanding and applications; I think I would have achieved a healthier and more comprehensive foundational view of mathematics and would have ultimately developed as a mathematician much faster. My experience with teaching beginning-level mathematics majors confirms these beliefs. Take the time to set the right foundational attitudes and all our students benefit.

HYMAN BASS: I always enjoyed math at school but had little sense of its scope until my brother, Manuel, in a Navy officers' training program in WWII, came home on leaves and gave me enthusiastic tutorials on the science and engineering courses he was taking. He continued this later as a student at Caltech. When I attended Princeton as an undergraduate, the honors calculus course was run by E. Artin, with Lang and Tate among the instructors. The excitement of that environment won many of us over to mathematics.
JOHN B. CONWAY: Euclidean geometry. Then the power of calculus. Then the elegance of basic analysis.

LEON HENKIN: As a schoolboy I saw that I could be certain, entirely on my own, that I had arrived at a problem solution that was perfectly correct—in mathematics. This set math apart from all my other studies. When teachers and family gave praise for such successes, I was encouraged to go further. But it was only the marvelous depth of mathematics that suddenly opened before me when the deductive method appeared as the core of upper-division college courses that was the decisive component in getting me to consider seriously a career built around mathematics.

ROGER HOWE: I was identified as “good at math” long before I had any idea of a career related to it. A fifth grade teacher told me I would be a mathematician, and my (private) reaction was, “You’re crazy, lady.” In sixth grade I rejected a proposal to study math beyond grade level. In tenth grade several things happened. I read a popular book about quantum mechanics. It had some mathematical symbols (line integrals) in it, and I had no idea what they meant, so I started to study on my own in order to understand them. For a long time after, through much of college, mathematical physics was a big motivation for learning math. Also in tenth grade I took geometry, which I thought was hard, and I didn’t understand a lot in them, but they showed a completely different world from high school math.

FERN HUNT: An algebra course in the ninth grade and a Saturday course on elementary abstract algebra were the drawing cards for me.

RAYMOND L. JOHNSON: Arithmetic. I started to do well in mathematics when it was arithmetic, and since I continued to do well in high school, I assumed that mathematics was the major for me. If I had known what mathematics was, I might have chosen another major.

KENNETH MILLET: I was first attracted to mathematics by my experiences in high school mechanical drawing (a vocational course) and Euclidean geometry. The first course involved figuring out the three-dimensional nature of objects from limited visual information and the production of perspective and other drawings. The second course was a traditional “two-column” proof course, during which I experienced the challenges of finding language to “prove the obvious” and the fun of working with my class-

mates trying to solve problems for which there might not be a solution or which were several levels more challenging than the standard homework. In both courses the teachers provided a rich, challenging curriculum and an environment that encouraged creative thinking, questioning every detail, as well as being respectful to all students and their efforts. Mistakes were seen as opportunities to learn, not a measure of lack of ability. In mathematics I learned the difference between understanding and not understanding. And understanding, once gained, was forever. There was, of course, the sense of adventure. The exploration of unknown intellectual worlds, the exhilaration of discovery, and the fun of sharing these discoveries with others. I felt a greater opportunity to chart new frontiers, to have something of the experience of being the first human to walk on the moon. Mathematics was, and still is, a grand adventure taking me to unexplored places.

JUDITH ROITMAN: The proof that the real numbers are uncountable, encountered in seventh grade. No kidding.

ARNOLD ROSS: I was encouraged to do much reading from a very early age. We made use of a subscription library at the age when the public library was at its infancy. My interests covered all of science, and I did amateur astronomy in my early teens. My early heroes were Faraday and Pierre Curie. I was fortunate to have an early opportunity to study mathematics under mathematicians who were charismatic teachers.

HAN SAIH: When I was an undergraduate lab assistant in a physics accelerator lab, I found that I could not understand the purpose of the nuclear physics experiment. I decided to read up on quantum mechanics in the library. To my frustration, I discovered that I could not understand the mathematics used in the texts. Not long after, I asked my best friend in college (a math major) what he was studying in mathematics. I was shocked to find that I could not read past the first few pages of his book with the esoteric title Theory of Groups. Since my physics teachers had told me that I had already overdosed on mathematics, I decided to ask my math prof about the propriety of beginning to study some pure math. (I had in mind the vague idea of spending most of my fourth college year to that end.) His answer was, “It is too late to begin studying pure math at the age of 19.”

Two weeks later I pigheadedly decided to graduate early and applied to the math department to try studying math full time. I did have a back-up. My chemistry teacher had mentioned during my freshman year, “If you ever get tired of physics, come see us. Our door is always open.”
Not long after, as warned by my science teachers, I was firmly seduced by "useless" mathematics. At the same time I retained my interests in science and engineering, and slowly tried to understand the more difficult and fascinating endeavors in the humanities. One does not have to be a genius to become a mathematician. Hard work and an open mind are, however, necessary. What I had found was that my early exposure to science and engineering enabled me to carry out useful collaborations and to discover interesting connections.

ALAN TUCKER: I came from a mathematical family, and when I was three years old, I "knew" I loved mathematics and wanted to get a Ph.D. in mathematics.

H. WU: I had a terrible math education in grade school (in China) and consequently flunked every math course but one up to the seventh grade. Nothing was ever explained to me, and everything was done by fiat. I felt I could never penetrate the secret code used in math. Then in the seventh grade, I had a great teacher. From the first day, he solved every problem in class by reasoning out loud. It then dawned on me that there was no secret code, just the kind of ordinary reasoning that I could do myself. Soon after that, we started on proofs in Euclidean geometry, and this experience consolidated my feeling that math was a learnable subject. I have had little trouble after that.
Ferran Sunyer i Balaguer Prize Awarded

The Institut d'Estudis Catalans has awarded the fourth Ferran Sunyer i Balaguer Prize to V. KUMAR MURTY of the University of Toronto and M. RAM MURTY of McGill University for their monograph, *Non-vanishing of L-functions*.

According to the citation for the prize, the book brings together a collection of results on the non-vanishing of $L$-functions and a wide variety of mathematical problems arising in different contexts. The book covers such topics as Artin $L$-functions, Deligne's prime number theorem, modular $L$-functions, the Sato-Tate conjecture on the distribution of Fourier coefficients of modular forms, average values of $L$-functions, etc. The citation also notes that the authors have made significant contributions to this area.

The prize consists of 1,800,000 pesetas (approximately $14,500). The book will be published in Birkhäuser Verlag's "Progress in Mathematics" series.

The Ferran Sunyer i Balaguer Prize is awarded each year to an expository monograph in an active area of mathematical research in which the author(s) have made important contributions. The prize honors the self-taught Catalan mathematician Ferran Sunyer i Balaguer (1912-1967), who, in spite of a serious physical disability, was very active in research in classical analysis and gained an international reputation. For information on how to submit a manuscript for consideration for the prize, see the For Your Information section of this issue of the Notices.

—*from announcement of Institut d'Estudis Catalans*

CAREER Awards Made

The National Science Foundation has announced the names of awardees in a new program designed to encourage scientists and engineers to integrate their research and education efforts earlier in their careers. The Faculty Early Career Development (CAREER) program grants are awarded to junior-level university faculty. Out of 1,735 proposals submitted, 337 were awarded grants, including 4 in the mathematical sciences. The 3-5 year grants range from $70,000 to $300,000.

TASSO KAPER, Boston University, Dynamical systems theory motivated by bubbles, accelerators and split-operator numerical schemes; BONNIE RAY, New Jersey Institute of Technology, Nonparametric methods for time series analysis with environmental and economic applications; PETER SMEREKA, University of Michigan, Deriving effective equations for bubbly fluids using kinetic theory and developing mathematics classes for engineers; and KAREN SMITH, University of Michigan, Interactions of commutative algebras with analysis, geometry and computer science.

—NSF Announcement

AMS Menger Awards at Science and Engineering Fair

For the ninth time, the AMS has presented the Karl Menger Memorial Awards at the International Science and Engineering Fair (ISEF).
This year's ISEF was held May 5-11, 1996, in Tucson, Arizona, with 1,007 projects distributed over sixteen categories of science and engineering. Prizes ranged over plaques, certificates, T-shirts, books, magazine/journal subscriptions, organization memberships, and cash prizes totaling over $200,000. In addition to ISEF recognition, there were special awards made by representatives from 66 groups, including professional organizations, industry, and branches of the military.

Each student entry qualified by winning a state, regional, or (in the case of some foreign students) national competition to reach the finals at ISEF. The AMS judging panel considered 48 projects, including all projects entered in mathematics and one in physics involving an innovative application of mathematics. Each panel member inspected each project, and each student was interviewed by at least one member of the panel. Winners (one first place, two second place, four third place) were given cash prizes, and they and honorable mention students were given copies of What's Happening in the Mathematical Sciences by Barry Cipra and a short biography of Karl Menger, for whom the awards are named. The prize winners were as follows.

First place ($1,000): Davesh Maulik, junior, Roslyn High School, Roslyn Heights, New York, “Polynomial Automorphisms of Splitting Fields”. Maulik has distinguished himself by winning first place for an unprecedented third year.


Honorable Mention: Ryan Thomas Hebert, junior, Catholic High School, New Iberia, Louisiana, “Coordinates, Equations, and Area in Non-perpendicular Coordinate Systems”; Kendrick Norris Kay, sophomore, Lakeside High School, Evans, Georgia, “Pick’s Theorem in Three Dimensions and Beyond”; Scott Nicholas Sanders, junior, Ely High School, Pompano Beach, Florida, “Finite, Orthogonal, Binary Wavelet Set for Multiresolution Analysis and Data Compression”; Claus Mazanti Sorensen, senior, Aarhus University, Aarhus, Denmark, “On the Factorization of n! A Hypothesis of Selfridge and the Equation n! = x^n + y^n”; and Yvette Karen Wood, senior, Oxon Hill Science and Technology Center, Oxon Hill, Maryland, “Do Cardiac Arrhythmias Have Chaotic Tendencies?”

As the titles indicate, the projects were remarkable for their breadth and for the quality of the work by the students. It should also be noted how many of the awards went to sophomores and juniors.

This year’s AMS panel consisted of seven mathematicians: John D. Brillhart and David Gay, both of the University of Arizona; Jerome Goldstein, Louisiana State University; Fred Martens, Marius Nkashama, and Peter V. O’Neil (chair), all of the University of Alabama at Birmingham; and Julian Palmore, University of Illinois.

The Society’s participation in ISEF is supported in part by income from the Karl Menger Fund, which was established by the family of the late Karl Menger. For more information about this program, contact Timothy Goggins, AMS Development Officer, by e-mail (tjg@ams.org) or by telephone (401-455-4110).

—Peter V. O’Neil

NSF Minority Graduate Fellowships Announced

The National Science Foundation has announced awards in its Minority Graduate Fellowship Program. This program provides support for minority students pursuing doctoral study in all areas of science and engineering.

Two awards were made to students in the mathematical sciences: ALFONSO FERNANDEZ AGNEW, an undergraduate from California State University, Fullerton, plans to universit...
attend Oregon State University; and MONICA MARIA ROMEO, an undergraduate from Tulane University, plans to attend Brown University. [Editor's note: The institutions of graduate study listed here are from the students' original application forms. In some cases, students may have switched institutions by the time the fellowship tenure begins.]

—NSF Announcement

NSF Graduate Fellowships Announced

The National Science Foundation has announced awards in its Graduate Fellowship Program. This program provides support for students pursuing doctoral study in all areas of science and engineering. Listed below are the names of the 1996 awardees in the mathematical sciences, followed by their undergraduate institutions (in parentheses), and the institution at which they plan to pursue graduate work. [Editor's note: The institutions of graduate study listed here are from the students' original application forms. In some cases, students may have switched institutions by the time the fellowship tenure begins.]

JARED EMERY ANDERSON (University of Victoria) Princeton University; ELIZABETH CAROL AYER (Duke University) Cornell University; MANJUL BHARGAVA (Harvard University) Princeton University; JOHN MEYER BOSSERT, (Princeton University) Massachusetts Institute of Technology; RUTH ALEXANDRA BRITTO-PACUMIO (Massachusetts Institute of Technology) Harvard University; DANIEL GREGORY BROWN (Massachusetts Institute of Technology) Cornell University; DANNY CORNELIUS CALEGARI (University of Melbourne, Australia) University of California, Berkeley; MARY PATRICIA CAMPBELL (North Carolina State University) Massachusetts Institute of Technology; DAWN MARIE CHAMBERLAIN (Massachusetts Institute of Technology) Cornell University; AMY KRISTINE DARKE (University of Washington) University of Illinois at Urbana-Champaign; YEVENIY DODIS (New York University) Massachusetts Institute of Technology; MARINA A. EPELMAN (Cornell University) Massachusetts Institute of Technology; DAVID LAWRENCE FARNLEY (Brigham Young University) University of Oxford, England; WUNG-KUM FONG (University of California, Berkeley) Massachusetts Institute of Technology; KIRAN SRIHARA KEDLAYA (Harvard University) Princeton University; JASON MICHAEL KLINE (Vanderbilt University) Massachusetts Institute of Technology; PAUL LI (Harvard University) University of Illinois at Chicago; JOHN REDDINGTON LOCKWOOD (Duke University) Carnegie-Mellon University; ADAM JEFFERSON MERSEREAU (Princeton University) Cornell University; JESSICA LYNN MILLAR (University of Illinois at Chicago) Harvard University; BENJAMIN JAMES MORRIS (University of California, Berkeley) University of California, Berkeley; LENHARD LEE NG (Harvard University) Princeton University; NEHAL MANHAR PATEL (Massachusetts Institute of Technology) University of California, Berkeley; SEAN T. PAUL (University of Oklahoma) State University of New York at Stony Brook; THOMAS PIETRAHO (University of Illinois at Chicago) Massachusetts Institute of Technology; RYAN CHAUNCY SIDERS (University of Minnesota) Princeton University; JASON MICHAEL STARR (University of California, Berkeley) Harvard University; ERIC ALAN STONE (University of Florida) Harvard University; JENNIFER SUN (Harvard University) Massachusetts Institute of Technology; JOHN HUNTER TART (Wake Forest University) University of Wisconsin, Madison; DYLAN PAUL THURSTON (Harvard University) University of California, Berkeley; JESSICA A. WACHTER (Harvard University) Massachusetts Institute of Technology; THOMAS CRAWFORD WATSON (Rice University) Princeton University; JOHN LLOYD WEATHERWAX (University of Missouri, Columbia) Brown University; and THOMAS ALEXANDER WESTON (Massachusetts Institute of Technology) Harvard University.

—NSF Announcement

USA Olympiad Winners Announced

Eight high school students who earned top scores in the 1996 USA Mathematical Olympiad (USAMO) have been named as team members and alternates for the 1996 International Mathematical Olympiad.

The first-place winner of the USAMO is CHRISTOPHER CHANG of Palo Alto, California, who is in his third year as a top-scorer in the competition. Another USAMO veteran who placed among the top-scorers this year is JOSH P. NICHOLS-BARRER of Newton Center, Massachusetts. The other winners are CARL J. BOSLEY of Topeka, Kansas, NATHAN G. CURTIS of Alexandria, Virginia, MICHAEL R. KORN of Arden Hills, Minnesota, CARL A. MILLER of Silver Spring, Maryland, ALEXANDER H. SALTMAN of Austin, Texas, and DANIEL A. STRONGER of New York, New York.

The winners were honored in a ceremony held June 3 at the National Academy of Sciences in Washington, DC. After four weeks of intensive training at the University of Nebraska at Lincoln, the US Olympiad Team will compete with teams from seventy countries in Bombay, India, between July 7 and 17.

—from MAA News Release

1996 Alice T. Schafer Prize Winner Named

JOANA DUMITRIU, a first year student at New York University's Courant Institute of Mathematical Sciences, is the winner of the seventh annual Alice T. Schafer Mathematics Prize. The Schafer Prize is awarded to an undergraduate woman in recognition of excellence in mathematics and is sponsored by the Association for Women in Mathematics (AWM). Dumitriu will receive a cash prize of $1,000.
The Schafer Prize was established in 1990 by the executive committee of the AWM and is named for former AWM president and one of its founding members, Alice T. Schafer, who has contributed a great deal to women in mathematics throughout her career. The criteria for selection includes, but is not limited to, the quality of the nominees' performance in mathematics courses and special programs, exhibition of real interest in mathematics, ability to do independent work, and if applicable, performance in mathematical competitions.

The 19-year-old Dumitriu came from Romania for her undergraduate studies and immediately began taking graduate-level courses. Her professors describe her as "truly exceptional", "extremely impressive", "absolutely brilliant", and a student "whose mathematical instincts, talent, and knowledge are apparent almost from the beginning." They also remark on her exceptional problem solving abilities and "great independence of thought and originality". This was confirmed when she won this year's Elizabeth Lowell Putnam Prize for her performance in the Putnam Competition. As one letter states, "There is no doubt that Ioana will become a mathematician, the only question is whether she will be a world class mathematician. I can't think of anyone whose chances are better."

KAREN BALL, a senior at Grinnell College and WUNGKUM FONG, a senior at the University of California, Berkeley, were declared runners-up and will each receive $150. AWM also awarded an Honorable Mention citation to TARAS S. HOLM from Dartmouth College. The prize presentation will be held July 22, 1996, in conjunction with the Annual Meeting of the Society for Industrial and Applied Mathematics, July 22-26, 1996, in Kansas City.

"There were many outstanding nominees this year, each with her own style and her own strengths," stated Ruth Charney of Ohio State University, chair of the 1996 Schafer Prize Committee. "It was very difficult to choose a winner. We are pleased to be able to recognize these four exceptional young women." Also serving on the committee were Emma Previato of Boston University and Janet C. Talvacchia of Swarthmore College.

The Alice T. Schafer Mathematics Prize is funded by an endowment with continuing contributions from AWM members and others. For further information, contact AWM, 4114 Computer and Space Sciences Building, University of Maryland, College Park, MD 20742-2461.

---from AWM News Release---

Deaths

WYLLIS BANDLER, professor at Florida State University, died on December 22, 1995. Born on July 3, 1916, he was a member of the Society for 11 years.

ESTHER A. COMPTON, retired senior professor at Cumberland College, Williamsburg, Kentucky, died on October 12, 1995. Born on March 28, 1908, she was a member of the Society for 33 years.

CARL H. DENTOW, professor emeritus of Ohio University, died on August 6, 1994. Born on December 13, 1911, he was a member of the Society for 58 years.

LAWRENCE G. DEYSACH, resident fellow at Northeastern Illinois University, died on December 3, 1995. Born in July, 1936, he had been a member of the Society for 5 months.

KARL-HEINZ HELWIG, professor at Technical University of Munich, Germany died on February 2, 1996. Born on June 24, 1936, he was a member of the Society for 31 years.

ALBERT JAQUA, of Los Angeles, California, died on March 31, 1996. Born on December 31, 1922, he was a member of the Society for 37 years.

WILLIAM L. LAYTON, professor emeritus of Newberry College, Newberry, South Carolina, died on April 19, 1996. Born on September 26, 1913, he was a member of the Society for 44 years.

EDMONTS G. LINAMEGI, of Elkhart, Indiana, died on June 6, 1995. Born on September 29, 1942, he was a member of the Society for 21 years.

JAMES E. MARTIN, of Banning, California, died on November 15, 1995. Born on April 13, 1918, he was a member of the Society for 47 years.

CESAR DACORSO NETTO, of Rio de Janeiro, Brazil, died on April 25, 1996. Born on November 6, 1910, he was a member of the Society for 47 years.

KIYOSHI NAKA, professor at Kanazawa University, Kanazawa, Japan, died on September 29, 1995. Born on January 9, 1941, he was a member of the Society for 28 years.

JEFFREY S. REITMEYER, of Pennsylvania State University, died on February 19, 1996. Born on September 25, 1974, he was a member of the Society for 1 year.

SWARUPCHAND M. SHAH, professor emeritus of the University of Kentucky, died on April 21, 1996. Born on December 30, 1905, he was a member of the Society for 61 years.

RICHARD G. STONEHAM, professor emeritus of City College (CUNY). Born in February 1920, he was a member of the Society for 52 years.

GYORGY SZABO, of the Institute of Mathematics and Informatics, Kossuth Lajos University, Debrecen, Hungary, died on January 20, 1996. Born on April 6, 1952, he was a member of the Society for 2 years.

ROBERT W. THOMASON, of C.N.R.S., Paris, France, died in October 1995. Born on November 5, 1952, he was a member of the Society for 22 years.

JOHN B. WILKER, professor at Scarborough College, University of Toronto, died on October 10, 1995. Born on April 23, 1943, he was a member of the Society for 27 years.
AAAS Issues Science Funding Report

In May the American Association for the Advancement of Science (AAAS) issued a forecast of science funding over the next several years, based on a budget proposed by the House of Representatives and by the administration. The AAAS analysis of the budget data indicates that both plans would lead to a reduction of about 25% in funding for nondefense research and development by 2002.

Last year the AAAS formulated a similar forecast that predicted a cut of one-third in the science funding budget by 2002. The reason for the difference between that projection and the more recent one is largely a matter of a lower anticipated rate of inflation.

The decline projected on the basis of the administration's plan (24.4%) is virtually the same as that based on the Congressional plan (24.5%). However, the two are markedly different when it comes to the National Science Foundation (NSF). The administration's plan would result in a cut of 23.5% for the NSF, while the Congressional plan would mean only a 6.8% cut.

It is impossible to tell whether such dramatic decreases will become reality. In its online Bulletin of Science Policy News, the American Institute of Physics quoted presidential science adviser John Gibbons as saying that, "2002 might as well be a century away for all our ability to accurately predict the details of federal spending that far out." He also said that he is far more worried about what will happen in fiscal 1997 than in 2002.

Nevertheless, supporters of scientific research, such as Representative George Brown, are urging the scientific community to get involved. "The scientific community needs to step up to the challenge or live with the consequences," Brown told the American Institute of Physics (AIP).

For further information, see the AAAS Web page http://www.aaas.org/spp/dspp/rd/rdwwwpg.htm.

— Allyn Jackson

Ferran Sunyer i Balaguer Prize

The Ferran Sunyer i Balaguer Prize is awarded each year by the Institut d'Estudis Catalans to an expository monograph in an active area of mathematical research in which the author(s) have made important contributions. The prize honors the self-taught Catalan mathematician Ferran Sunyer i Balaguer (1912–1967), who, in spite of a serious physical disability, was very active in research in classical analysis and gained an international reputation.

The prize competition is open to all mathematicians. Monographs must be in English and of at least 150 pages. In exceptional cases, manuscripts in other languages may be considered. Monographs should be typeset in \LaTeX, and a hard copy and two disks with .dvi and PostScript files must be submitted.

The prize consists of 1,800,000 pesetas (approximately $14,500). The winning monograph will be published in Birkhäuser Verlag’s "Progress in Mathematics" series.

On the prize selection committee are: Friedrich Hirzebruch, Max-Planck Institute; Paul Malliavin, University of Paris VI; Joseph Oesterlé, University of Paris VI; Joan Solà Morales, Polytechnic University of Catalunya; and Alan Weinstein, University of California, Berkeley.

To make a submission, or for more information, contact: Institut d’Estudis Catalans, Apartat 50, 08193 Bellaterra, Spain; e-mail crm@crm.es.

— from announcement of Centre de Recerca Matemàtica, Institute d’Estudis Catalans
AMS Establishes Fiske Society

Recently, the Executive Committee and Board of Trustees established the Thomas S. Fiske Society, named after the founder of the American Mathematical Society, to honor those who have included the AMS in their estate plans.

It is this type of long-term support which provides assurance that the Society can continue and improve its ability to communicate and transmit mathematical discovery.

If you have provided for the Society in your will, personal trust, or some other planned-giving vehicle, please let us know so that we can acknowledge your generosity and welcome you as a charter member of the Fiske Society.

To join the Fiske Society or learn more about making a planned or estate gift, please contact Tim Goggins at 1-800-321-4-AMS or tjg@ams.org.

— Tim Goggins, AMS Development Officer

Call for Nominations for AAAS Awards

The American Association for the Advancement of Science (AAAS) confers a number of awards to honor individuals for their contributions to science, technology, and society.

Among the awards are the AAAS Mentor Awards, which recognize those who during their careers have demonstrated extraordinary leadership to increase the participation of underrepresented groups, including women and the disabled. Two mathematicians have won in recent years: Abdulalim A. Shabazz of Clark-Atlanta University (1992), and Mary W. Gray of American University (1994).

Other awards recognize contributions to arms control and international security, scientific freedom and responsibility, public understanding of science and technology and other science-related activities. There are also a number of awards for outstanding science journalism.

The deadline for nominations is generally August 1. For further information, consult the AAAS Web page http://www.aaas.org/AAAS/awards.html, or contact: Awards Coordinator, AAAS, 1333 H Street, NW, Room 1149, Washington, DC 20005.

— AAAS

Nonacademic Careers Web Site

The Nonacademic Careers Web Site is a joint project of the AMS and the Society for Industrial and Applied Mathematics. This site offers a number of services to help job seekers. One of the highlights is a set of profiles of mathematical scientists who work outside academia. The profiles describe how they use mathematics in their work, what it's like to work in a nonacademic setting, and how to land a nonacademic job.

The Web site was launched late last year, and since then a number of new profiles have been added. Currently there are twenty-four profiles posted, and several more will be added in the coming months. Those profiled work for organizations ranging from the National Institute for Standards and Technology to IBM to CNA Insurance. In addition to reading the posted profiles, one can also send questions to the people profiled, and the questions and answers are posted on the Web site.

The URL for the Nonacademic Careers Web Site is http://www.ams.org/careers/mccb.html.

— Allyn Jackson

Notices Wins Award

The Notices has won the 1996 SNAP EXCEL Award for General Excellence in a Scholarly Journal. The award is given by the Society of National Association Publications (SNAP). The awards were presented during the SNAP meeting in Washington, DC, in May.

Each year SNAP presents awards to association publications in a wide variety of forms, including scholarly journals, newsletters, newspapers, magazines, direct mail vehicles, buyers' guides, meetings schedules, and so on. Altogether there were 909 entries for SNAP awards, twenty-nine of them in the General Excellence in a Scholarly Journal category. The entries to this category were judged on writing, content, graphic design, and overall packaging. The judges praised the Notices for its elegant design, the way it makes the most of black and white graphics, and its interesting blend of scholarly articles and service pieces. The Notices won the gold medal, the highest award in its category. Silver and bronze medals were also given.

Under the Scholarly Journals category, SNAP also makes awards for an outstanding feature article and for an outstanding editorial or column in an association publication. The National Council of Teachers of Mathematics won a silver medal for a feature article in its journal The Mathematics Teacher, a silver medal for an editorial/column in Mathematics Teaching in Middle School, and a bronze medal for an editorial/column in Teaching Children Mathematics.

— Allyn Jackson
List of Candidates for 1996 AMS Election

These are the candidates' names that were available as the August issue went to press in June.

**Vice-President**
- H. Blaine Lawson
- Ruth J. Williams

**Trustee**
- Richard E. Ewing
- Andy R. Magid

**Member-at-Large of the Council** (There will be ten candidates on the 1996 ballot.)
- Francis Bonahon
- William G. Dwyer
- Frederick P. Gardiner
- Peter A. Perry
- Gail Ratcliff
- Joel H. Spencer
- Karen Vogtmann

**Editorial Boards Committee** (There will be four candidates on the 1996 ballot.)
- Eric D. Bedford
- Richard S. Palais
- Ronald J. Stern

**Nominating Committee** (There will be six candidates on the 1996 ballot.)
- Efraim P. Armendariz
- Hermann Flaschka
- James Stasheff

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The articles describe many cutting-edge areas of modern pure and applied mathematical research, yet they are written at a level that can be understood and appreciated by anyone with a high-school mathematical background. The author, Barry Cipra, is a well-known scientific journalist and mathematical expositor who is a contributing correspondent for *Science* magazine and writes for *SIAM News* and *American Mathematical Monthly*. In reading these articles, you will also get a feeling for the beauty and the universality of mathematics.

1996; 111 pp.; Softcover; ISBN 0-8218-0355-7; List $12; Order code HAPPENING3NA

Also available from the AMS...

*What's Happening in the Mathematical Sciences, vol. 2,*
1994; 51 pp.; Softcover; ISBN 0-8218-8998-2; List $8; Order code HAPPENING2NA

*What's Happening in the Mathematical Sciences, vol. 1,*
1993; 47 pp.; Softcover; ISBN 0-8218-8999-0; List $7; Order code HAPPENING1NA

All prices subject to change. Charges for delivery are $3.00 per order or for air delivery outside of the continental U.S., please include $6.50 per item. Prepayment required. Order from American Mathematical Society, P.O. Box 500, Providence, RI 02900-0801. Or for credit card orders, fax (401) 331-3842 or call toll free 800-321-4AMS (4267) in the U.S. and Canada. Residents of Canada, please include 7% GST.
Reference

The Reference section of the Notices is intended to provide the reader with frequently sought information in an easily accessible manner. New information is printed as it becomes available and is referenced after the first printing. As soon as information is updated or otherwise changed, it will be noted in this section.

Upcoming Deadlines
August 1, 1996: Deadline for nominations for AAAS Mentor Awards. For further information, consult the AAAS Web page http://www.aaas.org/AAAS/awards.html or contact: Awards Coordinator, AAAS, 1333 H St., NW, Room 1149, Washington, DC 20005.


September 1, 1996: Application deadline for AWM Workshops for Women Graduate Students and Postdoctoral Mathematicians at the San Diego Joint Meetings, January 11, 1996. For information, telephone 301-405-7892 or via e-mail at awm@math.umd.edu.

November 1, 1996: Deadline for applications for NSF International Research Awards. For information contact: Division of International Programs, National Science Foundation, 4201 Wilson Boulevard, Arlington, VA 22230; telephone 703-305-1706; fax 703-305-0474; TDD 703-306-0090; e-mail sparris@nsf.gov; World Wide Web http://www.nsf.gov:80/sbe/int/start.htm/.
Mathematics Calendar

August 1996

* 20–23 ISIS: Information, Statistics and Induction in Science, Melbourne, Australia.
  Contact: D. L. Dowe, Dept. of Computer Science, Monash Univ., Clayton, Victoria 3168, Australia; e-mail: dld@cs.monash.edu.au.

  Program: In the last years discriminant spaces played an important role in the topological classifications of knots, links, and other objects of any nature. One considers the infinite-dimensional space of objects under consideration, including generic objects as well as degenerate objects. The discriminant hypersurface divides this infinite-dimensional space into parts. Each connected component of the discriminant hypersurface consists of objects with the same discrete topological type. The study of the structure of the discriminant has been very important for defining invariants. Here methods from singularity theory are related to discrete, combinatorial, and categorical ideas. This general approach has been very successful in the work of knot invariants but has more potential applications. The intention is to make a coherent program on the subject, which is useful for graduate students and staff members who are not experts in the field. Each lecturer will give at least two lectures, one elementary and one more advanced. There will be a very restricted possibility for additional expert talks.
  Lecturers: S. Chmutov, M. Kazarian, S. Lando, A. Sossinsky, V. Vassiliev, D. Yetter.
  Participation: All interested mathematicians are invited to participate. Those who are interested should send a message to discriminant@math.ruu.nl.
  Financial Arrangements: The workshop has no separate budget for supporting lodging and travel.
  Accommodation: Accommodation can be arranged in hotels in or near Utrecht. E-mail: discriminant@math.ruu.nl.
  Sponsors: NWO (Netherlands Organization for Scientific Research), MRI (Mathematical Research Institute in The Netherlands), CWI (Centrum voor Wiskunde en Informatica), INTAS (International Association for Scientific Cooperation with Scientists from the independent states of the former Soviet Union).

September 1996

  Topics: Topics of this year's conference are: 1) iterative solution methods for highly nonsymmetric systems of equations, 2) numerical algorithms for transport equations.
  Invited Speakers: Theme 1: P. A. Forsyth (Univ. of Waterloo, Ontario), T. Huckle (TU München), Y. Saad (Univ. of Minnesota); Theme 2: R. Jeltsch (ETH Zürich), B. P. Leonard (The Univ. of Akron, Ohio); D. L. Williamson (NCAR, Boulder).
  Contributed Presentations: The program allows incorporation of about four contributed presentations by participants, relevant to either of the conference topics.
  Information: For all information see the conference WWW page, URL: http://www.cwi.nl/~jankok/woudschoten.html or contact the secretary of the organizing committee: J. Kok, CWI-Centrum voor Wiskunde en Informatica, P. O. Box 94079, NL 1090 GB Amsterdam; tel: +31 20 592 4107; fax: +31 20 592 4199; e-mail: Jan.Kok@cwi.nl.

* 27–28 Workshop in Algebra (Lie and Finite-Dimensional Algebras), Ottawa-Carleton Institute of Mathematics and...
January 1997

6-11 Stochastic Partial Differential Equations and Applications, Grand Hotel Bellavista, Levico Terme (Trento), Italy.

Scientific Organizers: G. Da Prato (Pisa) and L. Tubaro (Trento).

Provisional List of Lecturers: P. Baxendale (Los Angeles), D. Blount (Tempe), E. Bolthausen (Zürich), A. Chojnowska-Michalik (Lodz), P.-L. Chow (Detroit), H. Cramel (Saarbrücken), M. Dozzi (Nancy), F. Fagnola (Genova), F. Flandoli (Bologna), I. Ibragimov (St. Petersburg), G. Jona-Lasinio (Roma I), R. Manthey (Jena), B. Maslowski (Prague), S. Meleard (Paris VI), J. L. Menaldi (Detroit), S. A. Molchanov (Charlotte), C. Muller (Rochester), S. Peszat (Hull), E. Presutti (Roma II), M. Röckner (Bielefeld), F. Russo (Paris XIII), M. Sanz (Barcelona), J. Seidler (Prague), R. Sowers (Urbana), A.-S. Sznitman (Zürich), O. Zeitouni (Haifa).

Deadline: for applications: October 31, 1996.

Information: For further information please contact A. Michelelli, Centro Internazionale per la Ricerca Matematica, Istituto Trentino di Cultura, 38050 Povo (Trento), Italy; tel: +39-461-881628; fax: +39-461-810629; e-mail: michele@science.unitn.it.

March 1997


Invited Speakers: R. Bott (Harvard), P. Lax (Courant), J. Serrin (Minnesota) and R. Stanley (MIT).

Format: There will be four 1-hour invited plenary talks by distinguished mathematicians; two special sessions, each comprising four invited half-hour talks in each of the following four broad categories: 1. Algebra, number theory, geometry, topology (organizer: P. Hilton); 2. Analysis (organizers: P. Mikusinski and A. Zayed); 3. Applied mathematics (organizers: J. Cannon and R. Choudhury); 4. Combinatorics, graph theory, theoretics computer science (organizer: B. Brigham); and four contributed paper sessions for 20-minute talks.

Sponsor: The conference is sponsored by the University of Central Florida and Calcutta Mathematical Society.

Fee: Because state funds cannot be used for food and refreshments, there will be a $50 registration fee payable to Calcutta Mathematical Society by December 15, 1996. The registration fee will be used for one banquet dinner (Friday, March 14) and refreshments during the conference.

Information: Those wishing to attend are asked to send correspondence to the conference secretary: J. Wingler, Dept. of Mathematics, Univ. of Central Florida, Orlando, FL 32816-1364; tel: 407-823-2478; fax: 407-823-6253; e-mail: njimm@pegasus.cc.ucf.edu.

July 1997

30-August 3 Topics in Number Theory, Penn State University, University Park, Pennsylvania.

Focus: This four-day conference will feature invited speakers who are leading researchers in additive number theory, arithmetic geometry, combinatorics, computational number theory, automorphic forms, and q-series.

Information: For further information, please visit the conference Website: http://www.cde.psu.edu/C&I/NumTheory/.

The following new announcements will not be repeated until the criteria in the next to the last paragraph at the bottom of the first page of this section are met.

August 1997

1-4 Relativism: Science, Religion and Philosophy, Calcutta, India.

Sponsor: The Society for Indian Philosophy & Religion.

Program: The theme can be addressed critically, reflectively, and creatively by the philosophical, religious, and scientific traditions of the world’s great civilizations. The program will include plenary addresses, volunteered papers, invited papers, and panel discussions. Registered participants who are members of professional associations or societies are encouraged to submit proposals for holding meetings during the conference on behalf of their associations or societies. The organizers are committed to upholding the highest academic standards, with emphasis on the exchange of ideas and face-to-face dialogues among thinkers drawn from a wide range of the world’s cultural traditions and movements.

Fee: The advance registration fee for the conference is $40 and the on-site registration fee is $60. The registration fee covers special events and an Indian dinner. Arrangements have been made for airline tickets at substantial discounts and a seven-day trip inside India. Interested parties should contact the organizers. Hotel reservations during the conference have also been made.

Advisory Board: K. Bhattacharyya (India), K. K. Chakrabarti (USA), O. Flanagan (USA), J. Garfield (Australia), M. Krausz (USA), S. Laycock (USA), V. Machin (USA), W. McBride (USA), J. N. Mohanty (USA), C. Myers (USA), K. Potter (USA), J. Powers (Australia), N. Saha (India), S. Saha (India), J. L. Shaw (New Zealand), M. Siderits (USA), J. Sullivan (USA).

Information: For further information contact C. Chakrabarti, CB 2336, Elon College, Elon College, N.C. 27244; e-mail: chakraba@numen.elon.edu; tel: 910-538-2705. Information will also be available on line at http://www.elon.edu/users/f/chakraba/. Please send proposals (150-200 words) by September 30, 1996.
New Publications Offered by the AMS

Contemporary Mathematics

Mathematical Problems in the Theory of Water Waves
F. Dias, J.-M. Ghidaglia, J.-C. Saut, Editors

The proceedings featured in this book grew out of a conference attended by 40 applied mathematicians and physicists which was held at the International Center for Research in Mathematics in Luminy, France, in May 1995. This volume reviews recent developments in the mathematical theory of water waves. The following aspects are considered: modeling of various wave systems, mathematical and numerical analysis of the full water wave problem (the Euler equations with a free surface) and of asymptotic models (Korteweg-de Vries, Boussinesq, Benjamin-Ono, Davey-Stewartson, Kadomtsev-Petviashvili, etc.), and existence and stability of solitary waves.

Features:
• The latest developments in the theory of water waves.
• Rigorous and formal results.
• Papers from world-renowned experts in the field.

Contents (Preliminary)

M. I. Weinstein, Asymptotic stability of nonlinear bound states in conservative dispersive systems.

1991 Mathematics Subject Classification: 76B15, 35Q53, 35Q51, 76B25
Individual member $33, List $55, Institutional member $44
To order, please specify CONM-DIASN

Hamiltonian Dynamics and Celestial Mechanics
Donald G. Saari and Zhihong Xia, Editors


The symbiotic relationship of these two topics creates a natural combination for a conference on dynamics. Topics covered include twist maps, the Aubrey-Mather theory, Arnold diffusion, qualitative and topological studies of systems, and variational methods, as well as specific topics such as Melnikov's procedure and the singularity properties of particular systems.

As one of the few books that addresses both Hamiltonian systems and celestial mechanics, this volume offers emphasis on new issues and unsolved problems. Many of the papers give new results, yet the editors purposely included some exploratory papers based on numerical computations, a section on unsolved problems, and papers that pose conjectures while developing what is known.

Features:
• Open research problems
• Papers on central configurations

Contents
J. M. Cors and J. Llibre, Qualitative study of the parabolic collision restricted three-body problem; D. G. Saari and Z. Xia, Singularities in the Newtonian n-body problem; P. H. Rabinowitz, A variational approach to multibump solutions of differential equations; C. Robinson, Melnikov method for autonomous Hamiltonians; N. P. K. Swami, Exponentially small transversality in the rapidly forced pendulum; S. R. Kaplan, The collinear one-bumper two-body problem; P. W. Lindstrom, Limiting mass distributions of minimal
potential central configurations; A. Albouy, The symmetric central configurations of four equal masses; E. Perez-Chavela, D. G. Saari, A. Susin, and Z. Yan, Central configurations in the charged three-body problem; M. Kummer, Reduction in the rotating Kepler problem and related topics; M. Falconi and E. A. Lacombe, Asymptotic behavior of escape solutions of mechanical systems with polynomial potentials; Q. Wang, More on the heteroclinic orbits for the monotone twist maps; T. R. Young, Transition maps of homoclinic orbits and resonances near bifurcations of circle maps; X. Liao, D. G. Saari, and Z. Xia, Resonance transition and instabilities; A numerical study of the restricted three-body problem; S. R. Kaplan, R. Cushman, S. Hu, J. Llibre, C. McCord, D. G. Saari, and Z. Xia, Directions of Hamiltonian dynamics and celestial mechanics.

1991 Mathematics Subject Classification: 70Fxx, 70Hxx, 58Fxx
Individual member $543, List $72, Institutional member $58
To order, please specify CONM-SAARIN

Crossed Products with Continuous Trace
Siegfried Echterhoff
Volume 123, Number 586
The importance of separable continuous trace C*-algebras arises from the following facts: Firstly, their stable isomorphism classes are completely classifiable by topological data and, secondly, continuous trace C*-algebras form the building blocks of the more general type I C*-algebras. This memoir presents an extensive study of strongly continuous actions of abelian locally compact groups on C*-algebras with continuous trace. Under some natural assumptions on the underlying system (A, G, α), necessary and sufficient conditions are given for the crossed product A×αG to have continuous trace, and some relations between the topological data of A and A×αG are obtained. The results are applied to investigate the structure of group C*-algebras of some two-step nilpotent groups and solvable Lie groups.

For readers' convenience, expositions of the Mackey-Green-Kieff machine of induced representations and the theory of Morita equivalent C*-dynamical systems are included. There is also an extensive elaboration of the representation theory of crossed products by actions of abelian groups on type I C*-algebras, resulting in a new description of actions leading to type I crossed products.

Features:
- The most recent results on the theory of crossed products with continuous trace.
- Applications to the representation theory of locally compact groups and structure of group C*-algebras.
- An exposition on the modern theory of induced representations.
- New results on type I crossed products.

Contents
Abstract: Introduction; Preliminaries and basic definitions; Morita equivalent twisted actions and duality; Representations of type I abelian twisted systems; Subgroup crossed products; Crossed products with continuous trace; Applications and examples; Some concluding remarks; References.
September 1996, 134 pages (softcover), ISBN 0-8218-0563-0, LC 96-21893, ISSN 0065-9266
1991 Mathematics Subject Classification: 46L40, 22D25, 22D30
Individual member $23, List $39, Institutional member $31
To order, please specify MEMO/128/586N
Wavelet Methods for Pointwise Regularity and Local Oscillations of Functions
Stéphane Jaffard and Yves Meyer
Volume 123, Number 587

Currently, new trends in mathematics are emerging from the fruitful interaction between signal processing, image processing, and classical analysis.

One example is given by "wavelets", which incorporate both the know-how of the Calderon-Zygmund school and the efficiency of some fast algorithms developed in signal processing (quadrature mirror filters and pyramidal algorithms.)

A second example is "multi-fractal analysis". The initial motivation was the study of fully developed turbulence and the introduction by Frisch and Parisi of the multi-fractal spectrum. Multi-fractal analysis provides a deeper insight into many classical functions in mathematics.

A third example—"chirps"—is studied in this book. Chirps are used in modern radar or sonar technology. Once given a precise mathematical definition, chirps constitute a powerful tool in classical analysis.

In this book, wavelet analysis is related to the 2-microlocal spaces discovered by J. M. Bony. The authors then prove that a wavelet based multi-fractal analysis leads to a remarkable improvement of Sobolev embedding theorem. In addition, they show that chirps were hidden in a celebrated Riemann series.

Features:
- Provides the reader with some basic training in new lines of research.
- Clarifies the relationship between pointwise behavior and size properties of wavelet coefficients.

Contents

Introduction; Modulus of continuity and two-microlocalization;
Singularities of functions in Sobolev spaces; Wavelets and lacunary trigonometric series; Properties of chirp expansions; Trigonometric chirps; Logarithmic chirps; The Riemann series; References; Index; Notations.

September 1996, 196 pages (softcover), ISBN 0-8218-0475-8, LC 96-21892, ISSN 0065-9266
1991 Mathematics Subject Classification: 11E
Individual member $26, List $44, Institutional member $35
To order, please specify MEMO/123/588N

Degree 16 Standard L-function of $GSp(2) \times GSp(2)$
Dihua Jiang
Volume 123, Number 588

Automorphic L-functions, introduced by Robert Langlands in the 1960s, are natural extensions of such classical L-functions as the Riemann zeta function, Hecke L-functions, etc. They form an important part of the Langlands Program, which seeks to establish connections among number theory, representation theory, and geometry.

This book offers, via the Rankin-Selberg method, a thorough and comprehensive examination of the degree 16 standard L-function of the product of two rank two symplectic similitude groups, which includes the study of the global integral of Rankin-Selberg type and local integrals, analytic properties of certain Eisenstein series of symplectic groups, and the relevant residue representations.

Contents

Introduction; Degree 16 standard L-function of $GSp(2) \times GSp(2)$; Poles of Eisenstein series of $Sp(n)$; Residue representations of Eisenstein series; Local theory of Rankin-Selberg convolution; Bibliography; Index.

September 1996, 196 pages (softcover), ISBN 0-8218-0476-6, LC 96-21897, ISSN 0065-9266
1991 Mathematics Subject Classification: 11E
Individual member $26, List $44, Institutional member $35
To order, please specify MEMO/123/589N

Higher Multiplicities and Almost Free Divisors and Complete Intersections
James Damon
Volume 123, Number 589

In this book, the author considers a general class of nonisolated hypersurface and complete intersection singularities called "almost free divisors and complete intersections", which simultaneously extend both the free divisors introduced by K. Saito and the isolated hypersurface and complete intersection singularities. They also include discriminants of mappings, bifurcation sets, and certain types of arrangements of hyperplanes, such as Coxeter arrangements and generic arrangements.

Topological properties of these singularities are studied via a "singular Milnor fibration" which has the same homotopy properties as the Milnor fibration for isolated singularities. The associated "singular Milnor number" can be computed as the length of a determinantal module using a Bezout-type theorem. This allows one to define and compute higher multiplicities along the lines of Teissier's $\mu^*$-constants.

These are applied to deduce topological properties of singularities in a number of situations including: complements of hyperplane arrangements, various nonisolated complete intersections, nonlinear arrangements of hypersurfaces, functions on discriminants, singularities defined by compositions of functions, and bifurcation sets.

Features:
- Treats nonisolated and isolated singularities together
- Uses the singular Milnor fibration with its simpler homotopy structure as an effective tool
- Explicitly computes the singular Milnor number and higher multiplicities using a Bezout-type theorem for modules

Contents

Introduction; Almost free divisors; Linear and nonlinear arrangements; Almost free complete intersections; Topology of compositions and nonREALizability; Bibliography.

September 1996, 113 pages (softcover), ISBN 0-8218-0481-2, LC 96-21896, ISSN 0065-9266
1991 Mathematics Subject Classification: 32S30, 14B05, 58C10
Individual member $22, List $36, Institutional member $29
To order, please specify MEMO/123/589N
Translations of Mathematical Monographs

Knots, Links, Braids and 3-Manifolds. An Introduction to the New Invariants in Low-Dimensional Topology
V. V. Prasolov and A. B. Sossinsky
Volume 154

This book is an introduction to the remarkable work of Vaughan Jones and Victor Vassiliev on knot and link invariants and their recent modifications and generalizations, including a mathematical treatment of Jones-Witten invariants. It emphasizes the geometric aspects of the theory and treats topics such as braids, homeomorphisms of surfaces, surgery of 3-manifolds (Kirby calculus), and branched coverings. This attractive geometric material, interesting in itself yet not previously gathered in book form, constitutes the basis of the last two chapters, where the Jones-Witten invariants are constructed via the rigorous skein algebra approach (mainly due to the Saint Petersburg school).

Unlike several recent monographs, where all of these invariants are introduced by using the sophisticated abstract algebra of quantum groups and representation theory, the mathematical prerequisites are minimal in this book. Numerous figures and problems make it suitable as a course text and for self-study.

Contents
Knots, links, and ribbons; Knot and link invariants; Braids; 3-manifolds; Homeomorphisms of surfaces; Surgery of 3-manifolds; Branched coverings; Skein invariants of 3-manifolds; Invariants of links in 3-manifolds; Appendix; Solutions; References; Index.

October 1996, approximately 250 pages (hardcover), ISBN 0-8218-0588-6, ISSN 0065-9282
1991 Mathematics Subject Classification: 53Mxx
Individual member $59, List $99, Institutional member $79
To order, please specify MMONO/154N

AMS Publications Not in Series

On Being a Department Head, a Personal View
John B. Conway

For years, higher education prospered. It loudly proclaimed that college graduates command far greater lifetime incomes. Ample funding followed. We produced. But that argument has begun to sour. A college degree has lost since stopped being a guarantee of prosperity or even job security. Society has begun to question its support of universities. In this environment, mathematicians and all academics must begin to change, compete, and seek resources that will be used with greater care. It is the only solution if we hope to maintain the integrity of the enterprise...

I want to offer advice to department heads out there. I want to try to educate the rank and file about a variety of aspects of the job of being a department head. I also want to tell you my opinion about this job and perhaps also a little about love, death, and the vagaries of the human condition.

—from the Preface

This unique book presents a witty, well-written personal view about the experience of being a department head. Those in academia will profit from the author’s inside view, and other department heads and chairs—new and old—will benefit from the experiences of this keenly observant colleague.

Contents
Contemplating the prospect of being a head; Setting the stage; Personnel matters; Day-to-day business; When should you quit.
1991 Mathematics Subject Classification: 00A20
All AMS members $19, List $24
To order, please specify AHEADN

Bolyai Society Mathematical Studies

Extremal Problems for Finite Sets
P. Frankl, Z. Füredi, G. Katona, and D. Miklós, Editors
Volume 3

This volume is the result of the first conference entirely devoted to this area. The conference, “Extremal Problems for Finite Sets”, was organized by the János Bolyai Mathematical Society in Visegrád (Hungary) in June 1991.
There were 29 talks given by mathematicians from 10 countries. This volume is an extended version of those talks with a few shorter contributions, and new results were added. Open problems are included.

Bolyai Society Mathematical Studies is published by János Bolyai Mathematical Society, and distributed worldwide, except in Eastern and Western Europe, by the AMS.

Contents
D. M. Acketa, On the maximal number of edges of a digital star-shaped polygon with a given diameter; R. Ahlswede and N. Cai, On sets of words with pairwise common letter in different positions; N. Alon, Probabilistic methods in extremal finite set theory; S. L. Bezrukov, Isoperimetric problems in discrete spaces; J. Bierbrauer, Small Islands; A. Blokhuis, Extremal problems in finite geometries; A. Bollobas, Y. Kohayakawa, and T. Luczak, Katz, On the evolution of random Boolean functions; A. R. Calderbank, Algebraic invariants for codes and designs; D. de Caen, The current status of Turán's problem on hypergraphs; J. Demetrovics and H. Nam Son, Database, closure operations and Spener families; A. Derbala and K. Engel, Algorithmic investigation of the weighted extremal set problem; P. Erdős, Problems and results on set systems and hypergraphs; P. Frankl and N. Tokushige, The
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V. Kharlamov, University Louis Pasteur, Strasbourg Cedex, France, A. Korchagin, Brooklyn, NY, G. Polotovskii, Gorky State University, Russia, and O. Viro, University of California, Riverside, CA, Editors

This book contains papers written by friends, students, and collaborators of the Russian mathematician, D. A. Gudkov. It is devoted mainly to the areas where he made important contributions in the topology of real algebraic varieties. Several papers include new results on the topology of real plane algebraic curves (the Hilbert 16th problem).


Tight Closure and Its Applications
Craig Huneke, Purdue University, West Lafayette, IN

Contents are based on ten talks given at a CBMS conference held at North Dakota State University in June 1995.

CBMS Regional Conference Series in Mathematics, Volume 88; 1996; 137 pages; Softcover; ISBN 0-8218-0412-X; List $29; All Individuals $23; Order code CBMS/88NA

Representation Theory of Algebras
Raymundo Bautista, Roberto Martínez-Villa, and José Antonio de la Peña, UNAM, Mexico City, Mexico, Editors

The ICRA VII was held at Cocoyoc, Mexico, in August 1994. Most papers in this volume are in final form with complete proofs, with the only exception being the paper of Leszczynski and Skowronski. Auslander algebras of tame representation type, that the editors thought useful to include.

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Conference Proceedings, Canadian Mathematical Society, Volume 19; 1996; 404 pages; Softcover; ISBN 0-8218-0396-4; List $95; Individual members $57; Order code CMSAMS/19NA

Sources of Hyperbolic Geometry
John Stillwell, Monash University, Clayton, Victoria, Australia

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J. Amorós, I-UPC, ETSEIB, Barcelona, Spain, M. Burger, Université de Lausanne, Switzerland, K. Corlette, University of Chicago, Chicago, IL, D. Kotschick, Universität Basel, Switzerland, and D. Toledo University of Utah, Salt Lake City

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Mathematical Surveys and Monographs, Volume 44; 1996; 140 pages; Hardcover; ISBN 0-8218-0496-7; List $39; All AMS members $31; Order code SURV/44NA

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George M. Bergman, University of California, Berkeley, and Adam O. Hausknecht, University of Massachusetts at Dartmouth

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Mathematical Surveys and Monographs, Volume 45; April 1996; 388 pages; Hardcover; ISBN 0-8218-0495-2; List $77; Individual members $47; Order code SURV/45NA

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D. Miklós, Hungarian Academy of Science, Budapest, and T. Szőnyi, Eotvos Lorand University, Budapest, Hungary, Editors

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Bolyai Society Mathematical Studies is published by János Bolyai Mathematical Society, and distributed worldwide, except in Eastern and Western Europe, by the AMS.

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Volume 1: 1999; 527 pages; ISBN 963-8022-74-4; List $85; Individual member $51; Order code BSMS/1NA
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Set: 1044 pages; ISBN 963-8022-73-6; List $139; Individual member $85; Order code BSMSSET/1/2NA

Dynamics of Small Neural Populations

John Milton, University of Chicago, IL

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CRM Monograph Series, Volume 7; 1996; 125 pages; Hardcover; ISBN 0-8218-0458-8; List $35; All AMS members $28; Order code CRMM/7NA

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W. H. Kliemann, Iowa State University, Ames, W. E. Langford, University of Guelph, ON, Canada, and N. S. Namachchivaya, University of Illinois, Urbana, Editors

This volume contains the proceedings of the International Symposium on Nonlinear Dynamics and Stochastic Mechanics held at The Fields Institute for Research in Mathematical Sciences from August–September (1993) as part of the 1992–1993 Program Year on Dynamical Systems and Bifurcation Theory.

Fields Institute Communications, Volume 9; 1996; 238 pages; Hardcover; ISBN 0-8218-0257-7; List $74; Individual member $44; Order code FIC/9NA

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Wei Cai, Zhongci Shi, Chuwang Shu, and Jinchao Xu, Editors

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1995; 296 pages; Hardcover; ISBN 1-880132-15-x; List $45.45; Order code NAMASNA

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26 Finite differences and functional equations
27 Sequences, series, summability
28 Approximations and expansions
29 Fourier analysis
30 Abstract harmonic analysis
31 Integral transforms, operational calculus
32 Integral equations
33 Functional analysis
34 Operator theory
35 Calculus of variations and optimal control; optimization
36 Geometry
37 Convex and discrete geometry
38 Differential geometry
39 General topology
40 Algebraic topology
41 Manifolds and cell complexes
42 Global analysis, analysis on manifolds
43 Probability theory and stochastic processes
44 Statistics
45 Numerical analysis
46 Computer science
47 Mechanics of particles and systems
48 Mechanics of solids
49 Fluid mechanics
50 Optics, electromagnetic theory
51 Classical thermodynamics, heat transfer
52 Quantum theory
53 Statistical mechanics, structure of matter
54 Relativity and gravitational theory
55 Astronomy and astrophysics
56 Geophysics
57 Economics, operations research, programming, games
58 Biology and other natural sciences, behavioral sciences
59 Systems theory; control
60 Information and communication, circuits
Membership Categories

Please read the following to determine what membership category you are eligible for, and then indicate below the category for which you are applying.

For ordinary members whose annual professional income is below $45,000, the dues are $90; for those whose annual professional income is $45,000 or more, the dues are $120.

The CMS cooperative rate applies to ordinary members of the AMS who are also members of the Canadian Mathematical Society and reside outside of the U.S. For members whose annual professional income is $45,000 or less, the dues are $77; for those whose annual professional income is above $45,000, the dues are $102.

For a joint family membership, one member pays ordinary dues, based on his or her income; the other pays ordinary dues based on his or her income, less $20. (Only the member paying full dues will receive the Notices and the Bulletin as a privilege of membership, but both members will be accorded all other privileges of membership.)

Minimum dues for contributing members are $180.

For either students or unemployed individuals, dues are $30, and annual verification is required.

The annual dues for reciprocity members who reside outside the U.S. and Canada are $60. To be eligible for this classification, members must belong to one of those foreign societies with which the AMS has established a reciprocity agreement, and annual verification is required. Reciprocity members who reside in the U.S. or Canada must pay ordinary member dues ($90 or $120). The annual dues for category-S members, those who reside in developing countries, are $16. Members can choose only one privilege journal. Please indicate your choice below.

Members can purchase a multi-year membership by prepaying their current dues rate for either two, three, four, or five years. This option is not available to category-S, unemployed, or student members.

1996 Dues Schedule (January through December)

<table>
<thead>
<tr>
<th>Membership Category</th>
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<tr>
<td>Ordinary member</td>
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<tr>
<td>CMS Cooperative rate</td>
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<tr>
<td>Joint family member (full rate)</td>
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<tr>
<td>Joint family member (reduced rate)</td>
<td>$70, $100</td>
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<tr>
<td>Contributing member (minimum $180)</td>
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</tr>
<tr>
<td>Student member (please verify)</td>
<td>$30</td>
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<tr>
<td>Unemployed member (please verify)</td>
<td>$30</td>
</tr>
<tr>
<td>Reciprocity member (please verify)</td>
<td>$80, $90, $120</td>
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<tr>
<td>Category-S member</td>
<td>$16</td>
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<tr>
<td>Multi-year membership</td>
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1 Student Verification (sign below)

I am a full-time student at ................................................................. currently working toward a degree.

2 Unemployed Verification (sign below) I am currently unemployed and actively seeking employment. My unemployment status is not a result of voluntary resignation or of retirement from my last position.

3 Reciprocity Membership Verification (sign below) I am currently a member of the society indicated on the right and am therefore eligible for reciprocity membership.

Signature

4 □ send NOTICES        □ send BULLETIN

Reciprocating Societies

- Allahabad Mathematical Society
- Asociación Matemática Española
- Australian Mathematical Society
- Azerbaijan Mathematical Society
- Berliner Mathematische Gesellschaft e.V.
- Calcutta Mathematical Society
- Croatian Mathematical Society
- Dansk Matematikforening
- Deutsche Mathematiker-Vereinigung e.V.
- Edinburgh Mathematical Society
- Egyptian Mathematical Society
- Gesellschaft fur Angewandte Mathematik und Mechanik
- Glasgow Mathematical Association
- Hellenic Mathematical Society
- Indian Mathematical Society
- Irish Mathematical Society
- Israel Mathematical Union
- János Bolyai Mathematical Society
- Korean Mathematical Society
- London Mathematical Society
- Malaysian Mathematical Society
- Mathematical Society of Japan
- Mathematical Society of the Philippines
- Mathematical Society of the Republic of China
- Mongolian Mathematical Society
- Nepal Mathematical Society
- New Zealand Mathematical Society
- Nigerian Mathematical Society
- Norsk Matematikk Forening
- Österreichische Mathematische Gesellschaft
- Polskie Towarzystwo Matematyczne
- Punjab Mathematical Society
- Ramanujan Mathematical Society
- Real Sociadad Matematica Española
- Saudi Association for Mathematical Sciences
- Sociedad Colombiana de Matemática
- Sociedad de Matemática de Chile
- Sociedad Matemática de la República Dominicana
- Sociedad Matemática Mexicana
- Sociedade Brasileira de Matemática
- Societatea Matematicienilor din Romania
- Société de Mathématiques Appliquées et Industrielles
- Société Mathématique de Belgique
- Société Mathématique de France
- Société Mathématique Suisse
- Society of Mathematicians, Physicists, and Astronomers of Slovenia
- South African Mathematical Society
- Southeast Asian Mathematical Society
- Suomen Matemaattinen Yhdistys
- Svenska Matematikersamfundet
- Union Mathematica Argentina
- Union of Bulgarian Mathematicians
- Union of Czech Mathematicians and Physicists
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❑ corporate
❑ institutional associate

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Change of Address

Members of the Society who move or change positions are urged to notify the Providence Office as soon as possible.

Journal mailing lists must be printed four to six weeks before the issue date. Therefore, in order to avoid disruption of service, members are requested to provide the required notice well in advance.

Besides mailing addresses for members, the Society's records contain information about members' positions and their employers (for publication in the Combined Membership List). In addition, the AMS maintains records of members' honors, awards, and information on Society service.

When changing their addresses, members are urged to cooperate by supplying the requested information. The Society's records are of value only to the extent that they are current and accurate.

If your address has changed or will change within the next two or three months, please fill out this form, supply any other information appropriate for the AMS records, and mail it to:

Customer Services
AMS
P.O. Box 6248
Providence, RI 02940

or send the information on the form by e-mail to:

amsmem@math.ams.org or cust-serv@math.ams.org

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Customer code _______________________

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New mailing address


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please supply the following informations:

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Telephone number ______________________

e-mail ________________________________

Recent honors and awards


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Providence, RI 02940-9943

Fold here

Staple here
C*-Algebras by Example
Kenneth R. Davidson, University of Waterloo, ON, Canada

The subject of C*-algebras received a dramatic revitalization in the 1970s by the introduction of topological methods through the work of Brown, Douglas, and Fillmore on extensions of C*-algebras and Elliott's use of K-theory to provide a useful classification of AF algebras. These results were the beginning of a marvelous new set of tools for analyzing concrete C*-algebras.

This book is an introductory graduate level text which presents the basics of the subject through a detailed analysis of several important classes of C*-algebras. These notes were compiled during the author's participation in the special year on C*-algebras at the Fields Institute of Mathematics during the 1994–1995 academic year. The field of C*-algebras touches upon many other areas of mathematics such as group representations, dynamical systems, physics, K-theory, and topology. The variety of examples offered in this text expose the student to many of these connections. A graduate student with a solid course in functional analysis should be able to read this book. This should prepare them to read much of the current literature. This book is reasonably self-contained, and the author has provided results from other areas when necessary.

Customers in India, Sri Lanka, Bangladesh, and Pakistan, please contact Hardesta Book Agency (India), 17 U B Jauhar Nagar, Delhi 110 007, India.

Fields Institute Monographs, Volume 6; 1996; 309 pages; Hardcover; ISBN 0-8218-0599-1; List $59; All AMS members $47; Order code FIM/6NA

DNA Based Computers
Richard J. Lipton, Princeton University, NJ, and Eric B. Baum, NEC Research Institute, Princeton, NJ, Editors

This volume presents the proceedings of a conference held at Princeton University in April 1995 as part of the DIMACS Special Year on Mathematical Support for Molecular Biology. The subject of the conference was the new area of DNA based computing.

DNA-based computing is the study of using DNA strands as individual computers. The concept was initiated by Leonard Adleman's paper in Science in November 1994.


Research in Collegiate Mathematics Education. II
Jim Kaput, University of Massachusetts at Dartmouth, Alan H. Schoenfeld, University of California Berkeley, and Ed Dubinsky, Purdue University, West Lafayette, IN, Editors

...could evolve into an important scholarly journal where both mathematicians and mathematics educators actively seek to publish. The editors have carefully stated the ground rules for submissions so as to allow this to occur. Future developments will be of great interest.

—from a review for Research in Mathematics Education. I

This second volume in Research in Collegiate Mathematics Education begins with a paper that attends to methodology and closes with a list of questions. The lead-off paper describes a distinctive approach to research on key concepts in the undergraduate mathematics curriculum. This approach is distinguished from others in several ways, especially its integration of research and instruction. The papers in this volume exhibit a large diversity in methods and purposes, ranging from historical studies, to theoretical examinations of the role of gender in mathematics education, to practical evaluations of particular practices and circumstances.

This series is published in cooperation with the Mathematical Association of America.

CBMS Issues in Mathematics Education, Volume 6; 1996; 215 pages; Softcover; List $17; All individuals $22; order code CBMATH/6NA

Some Questions of Differential Geometry in the Large
E. V. Shikin, Moscow State University, Russia, Editor

This collection contains articles that present recent results by geometers in Russia and the Ukraine. Papers in the collection deal with various questions related to the structure, symmetries, and embeddings of submanifolds in Euclidean and pseudo-Euclidian spaces. This collection offers a review of the challenges facing specialists in geometry in the large and features current research in the field.

This volume is published in cooperation with MIR Publishers (Moscow).

The Canadian Mathematical Society and the University of Western Ontario cordially invite researchers, educators and students to the 1996 Winter Meeting of the Canadian Mathematical Society. The scientific programme will take place at the Radisson Hotel London Centre, 300 King St., London, Ontario, from Saturday, December 7 to Monday, December 9, 1996.

**Plenary Speakers:**

- **Nigel Higson** (Penn State University), **Dinakar Ramakrishnan** (California Technical University), **J. Cuntz** (Heidelberg University), **Laszlo Lempert** (Purdue University), **Dick Ewing** (Texas A&M University).

**Symposia and Preliminary List of Speakers:**

- **Complex Analysis and Geometry** (Org: **F. Larusson**, University of Western Ontario); John S. Bland (Toronto), Daniel M. Burns (Michigan), Bruce Gilligan (Regina), Steven Shin-Yi Lu (Waterloo) Evgeny A. Poletsky (Syracuse), Mohan Ramachandran (SUNY at Buffalo), Thomas Ransford (Laval), Berit Stensones (Michigan).

- **Joint Fields Institute/CMS Session on Cyclic Homology and its Applications** (Org: **M. Khalkhali**, University of Western Ontario); P. Baum (Pennsylvania State), J. Brodzki (Durham), G. Elliott (Toronto), I. Emmanouil (Ann Arbor), J. Kaminker (IU PUI), M. Karoubi (Paris VII), H. Moscovici (Ohio State), R. Nest (Copenhagen), V. Nistor (Penn State), J. Phillips (Victoria), M. Puschnigg (Heidelberg), B. Tsygan (Pennsylvania State), F. Wu (Kansas State).

- **Environmental Mathematics** (Org: **R.V. Moody**, University of Alberta and **S. Shen**, University of Alberta); Roger Daley (Atmospheric Environment Service Ontario), Michel Delfour (Université de Montréal), John Zhou (Alberta Research Council), Gabi Hegerl (Max Plank Institute, Hamburg), Gordon Swaters (Alberta), Ben Kedem (Maryland), Ian MacNeil (Western), George Boers (Canadian Climate Center).

- **Number Theory** (Org: **R. Murty**, McGill University); Henri Darmon (McGill), Chantal David (Concordia), David Dorman (Middlebury), David Dummit (Vermont), John Friedlander (Toronto), Hershy Kisilevsky (Concordia), Jan Mináč (Western), Kumar Murty (Toronto), Alberto Perelli (Genoa), Damien Roy (Ottawa), J. Sands (Vermont), Cameron Stewart (Waterloo), F. Thaine (Concordia).

- **Education** (Org: **D. Poole**, Trent University).

**Coxeter-James Lecture:** The Coxeter-James Lecture will be given by **Nigel Higson** (Penn State).

**Contributed Papers:** Contributed papers of 15 minutes duration are invited. Abstracts for CMS contributed papers should be prepared as specified below. For an abstract to be eligible, the abstract must be received before October 15, 1996. The abstract must be accompanied by its contributor's registration form and appropriate fees.

**Submission of Abstracts:** The CMS publishes abstracts for all scheduled talks. Abstracts for Plenary Speakers, Prize Lecturers and Invited Special Session Speakers for the scientific and education programme will appear in the November issue of the *CMS Notes*. Abstracts for Contributed Papers will appear in the December issue of the *CMS Notes*. All abstracts will also be available on the Canadian Mathematical Electronics Services (CAMEL).

**Plenary Speakers, Prize Lecturers and Invited Special Session Speakers for the scientific and education programme:** These speakers are asked to submit their abstracts to the CMS as instructed by their organizers. Abstracts may be sent electronically, following instructions given below. Abstracts may also be prepared on the standard CMS form available from the session organizer or the CMS office in Ottawa. Abstracts should be sent to the Abstracts Coordinator, CMS Executive Office, 577 King Edward, P.O. Box 450, Station A, Ottawa, Ontario CANADA K1N 6N5, so as to arrive by the invited speaker deadline of September 15, 1996.

**Contributed Papers:** Those submitting contributed papers may submit their abstracts electronically, following instructions given below, or by using the standard CMS form available from the CMS office in Ottawa or in the September issue of the *CMS Notes*. Abstracts should be sent to the Abstracts Coordinator, CMS Executive Office, 577 King Edward, P.O. Box 450, Station A, Ottawa, Ontario CANADA K1N 6N5, so as to arrive by the contributed papers deadline of October 15, 1996. Abstracts for contributed papers, are then evaluated by the Programme Committee which is responsible for scheduling all talks and confirming with the contributor.
Electronic submission of abstracts: This service is available only to those who use the TeX typesetting system. Files should include the speaker's name, affiliation, complete address, title of talk and the abstract itself. Files may be sent by e-mail to the Abstracts Coordinator at: abstracts@cms.math.ca Please note the appropriate deadline given above for the submission of your abstract. Please note that we cannot accept abstracts sent by FAX.

Social Events: A number of social events are planned. These include a cash-bar welcoming reception during evening registration, Friday, December 6, 7:00 - 9:00 p.m. in the West Ballroom of the Radisson. A banquet will be held in the West Ballroom of the Radisson on Sunday, December 8, at 7:00 p.m. Tickets are available at $50 each and must be purchased separately. Coffee will be available during the scheduled breaks.

Exhibits: Exhibits will be open on Saturday from 12:00 noon to 5:00 p.m. and Sunday from 9:00 a.m. to 5:00 p.m. Don't forget to visit the Canadian Mathematical Electronic Services Booth and check out new services. The CMS exhibit will be open throughout the course of the meeting.

Registration: Forms are available from the CMS Executive Office, 577 King Edward, Suite 109, PO Box 450, Station A, Ottawa, Ontario, CANADA K1N 6N5 Tel: 613-562-5702, FAX: 613-565-1539, e-mail: meetings@cms.math.ca

Rates quoted are in Canadian dollars. Payment for preregistration may be made by cheque, or by VISA or MasterCard. Although registration fees are given in Canadian dollars, delegates may send cheques in US dollars by contacting their financial institution for the current exchange rate. Speakers should contact their organizers for special speaker rates. Check out our web site to see the latest information on meetings and other CMS activities: http://www.camel.math.ca/

(*) The fee includes a copy of Volume 2 of the 50th Anniversary Series

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<th>Before Oct 15</th>
<th>After Oct 15</th>
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<tr>
<td>CMS/AMS/MAA members with grants (*)</td>
<td>$240</td>
<td>$305</td>
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<tr>
<td>CMS/AMS/MAA members without grants (*)</td>
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<td>165</td>
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<tr>
<td>Non-members with grants (*)</td>
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<tr>
<td>Non-members without grants (*)</td>
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<td>235</td>
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<tr>
<td>One-day fee (*)</td>
<td>135</td>
<td>165</td>
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<tr>
<td>Teachers/students/postdocs/retired/unemployed</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>Sunday night Banquet</td>
<td>50</td>
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Accommodation: It is recommended that those attending the conference book early to avoid disappointment. A block of rooms has been reserved at the Radisson and will be held until November 4, 1996. Reservations not in by that date will be on a request only, space available basis. Attendees should make their own reservations. These will be held until 6:00 p.m. on the arrival day only, unless guaranteed by a major credit card. The conference rate is extended up to two days pre and post convention. Rates quoted are in Canadian dollars.

Radisson Hotel London Centre
300 King Street, London, Ontario, K6B 1S2 Check-in: 3:00 pm
Reservation Deadline: November 4, 1996
Room rate: $79.00 single occupancy, $89.00 double occupancy
Applicable taxes: 5% PST + 7% GST
Phone: (519) 660-2700 Fax:(519) 439-9672 Toll free reservations: 1-800-333-3333
Please mention that you are participating in the CMS Winter Meeting.

Travel: The London International Airport is located just seven miles from downtown. It is served by four carriers: Air Ontario, Canadian Airlines International, Northwest Airlink, and USAir Express. Ground transportation is available to and from Toronto's Pearson International Airport by Robert Q's Airbus. London operates the third busiest passenger rail terminal in Canada. It is located right downtown for easy access to major hotels. The city is served by VIA Rail and Amtrak. Coach service is available, with arrivals and departures to numerous Canadian and American cities at the Greyhound Bus Terminal, located downtown.

Programme Committee: J.F. Jardine (Western) - Chair, Complex Analysis and Geometry - F. Lárusson (Western), Cyclic Homology and its Applications - M. Khalkhali (Western), Environmental Mathematics - R.V. Moody (McGill) and S. Shen (Alberta), Number Theory - R. Murty (McGill), Education - D. Poole (Trent), G.P. Wright (CMS) - Ex-officio.

Local Arrangements Committee: A. Boivin (Western) - Chair, R. Kane (Western), M. Bouchard (CMS) - Ex-officio.
Meetings & Conferences of the AMS

Seattle, Washington

University of Washington

August 10–12, 1996

Meeting #913
Seattle Mathfest, including the 98th Summer Meeting of the American Mathematical Society (AMS), the 74th summer meeting of the Mathematical Association of America (MAA), and the summer meetings of the Association for Women in Mathematics (AWM) and Pi Mu Epsilon (PME).

Associate secretary: Susan Friedlander

Announcement issue of Notices: May 1996
Program issue of Notices: August 1996
Issue of Abstracts: None

Program Updates
Note the titles of these invited addresses: Robert Moses, Reflections on mathematics reform, mathematics literacy, and citizenship; Karen E. Smith, Calculus mod p; and Alan C. Tucker, Influences on graph theory from computing and mathematical sciences.

How Can You Defend Your Graduate Program In Mathematics?: Saturday, 4:00 p.m. Panelists include John B. Conway, University of Tennessee; William H. Jaco, Oklahoma State University; and William Rundell, Texas A&M University.

SUMMA Special Presentation: Monday, 4:00 p.m. to 5:30 p.m. This presentation on intervention projects for minority precollege students is being organized by William A. Hawkins, director of SUMMA (Strengthening Underrepresented Minority Mathematics Achievement). Presenters include Celestino G. Mendez, Metropolitan State College of Denver, and David R. Scott, University of Puget Sound. There will be ample time for questions and discussion.

BREAKTHROUGH—The Changing Face of Science in America—A Delicate Balance: This hour-long video, initially aired during Mathematics Awareness Week (MAW) 1996 on PBS stations nationwide, will be shown in the MAA Student Hospitality Center on a schedule to be announced. It features mathematicians Freda Porter-Locklear and Richard Tapia. More information about the program and series can be found on the MAW web site http://forum.swarthmore.edu/maw/.

Governance Meetings
The MAA Section Officers Meeting has been moved from Friday to Saturday, 4:00 p.m. to 6:00 p.m.

Other Events
AMS and MAA Book Sales and all exhibits by commercial exhibitors will close at 2:00 p.m. on Monday.

Registration at the Mathfest
Registration fees only partially cover the expenses of holding meetings. All mathematicians and students who wish to attend sessions are expected to register and should be prepared to show the Mathfest badge, if so requested. Badges are required to obtain discounts at the AMS and MAA Book Sales. If advance registrants should arrive too late in the day to pick up their badges, they may show the acknowledgment received from the Mathematics Meetings Service Bureau (MMSB) as proof of registration.

All registrants must pick up the final program, badges, and tickets for social events at the Mathfest Registration Desk in Rooms 209 A&B in the HUB. Participants who have not yet registered should read the information in the May, June, and July issues of the Notices for details. The additional information below is to assist those who will register at the Mathfest. Letters verifying attendance at the Mathfest can be obtained on site from the Mathfest cashier.

Registration Dates, Times, and Locations: Seattle Mathfest and MAA Minicourses (until filled), Rooms 209 A&B, HUB, Friday, August 9, noon to 4:00 p.m.; Saturday and Sunday, August 10 & 11, 8:00 a.m. to 4:00 p.m.; Monday, August 12, 8:00 a.m. to noon.
Registration Fees: Registration fees may be paid at the Mathfest by cash, personal check (Canadian checks must be marked "in U.S. funds"), traveler’s checks, VISA, MasterCard, Discover, or American Express. Fee categories are:

- Member of AMS, MAA, PME, Canadian Mathematical Society: $166
- Nonmember: $262
- Emeritus Member of AMS, MAA, Graduate Student, Unemployed, Librarian, High School Teacher, Third-World Country Participant: $45
- Temporarily Employed: $120
- Undergraduate Student: $26
- High School Student: $5
- One-day Member: $91
- One-day Nonmember: $144
- Guest: $5

MAA Minicourses (if openings available):

- Minicourse #5: $65
- Minicourses #1, 2, 3, 4, 6: $45

**Full-time students**: Those currently working toward a degree or diploma, regardless of income. Students are asked to determine whether their status can be described as graduate (working toward a degree beyond the bachelor’s), undergraduate (working toward a bachelor’s degree), or high school (working toward a high school diploma).

**Unemployed**: Any person currently unemployed, actively seeking employment, and not a student. It is not intended to include any person who has voluntarily resigned or retired from his or her latest position.

**Emeritus**: Persons who qualify for emeritus membership in either the Society or the Association. The emeritus status refers to any person who has been a member of the AMS or MAA for twenty years or more and who is retired on account of age or on account of long-term disability from his or her latest position. This rate is also extended to any CMS member who has retired from his or her position.

**High school teacher**: Any person whose primary employment is teaching in any high school or secondary school.

**Librarian**: Any librarian who is not a professional mathematician.

**Third-world country participant**: Those participants from the third world where salary levels are radically noncommensurate with those in the U.S.

**Temporarily employed**: Any mathematician currently employed but who will become unemployed by June 1, 1996, and who is actively seeking employment, or any mathematician in a postdoctoral position.

**Nonmembers** who register at the nonmember fee will receive mailings after the meeting is over containing special membership offers from AMS and MAA.

**Guest**: Any family member or friend who is not a mathematician and who accompanies a Mathfest participant. Official guests will receive a badge and may attend all sessions as well as the exhibits.

Participants should check with their tax preparers for applicable deductions for education expenses as they pertain to this meeting.

Miscellaneous Information

**Accommodations**: Participants who did not reserve a room at the residence halls by July 16, 1996, must seek alternate accommodations; residence hall rooms are no longer available.

Those who would like hotel accommodations should refer to the list of hotels on page 624 in the May issue of the Notices and call directly for reservations. We regret that the MMSB cannot guarantee availability of rooms.

**Food Service**: A limited number of meals will be available on a cash basis.

**Travel**: USAir has been selected as the official airline for the meeting for its generally convenient schedule to Seattle. Given the volatility in airfares because of “fare wars”, we cannot guarantee that these are the lowest fares. However, we strongly urge participants to make use of this special deal if at all possible, since the AMS and MAA can earn complimentary tickets on these carriers. These tickets are used to send meetings’ staff (not officers or other staff) to Mathfests, thereby keeping the costs of the meeting (and registration fees) down.

The following specially negotiated rates are available only for the period August 7–15: 5% discount off first class and any published USAir promotional round-trip fare, or 10% discount off unrestricted coach fares with seven-day advance reservations and ticketing required. These discounts are valid providing all rules and restrictions are met and are applicable for travel from the continental U.S., Bahamas, Canada, and San Juan. F.R. Discounts are not combinable with other discounts or promotions. Additional restrictions may apply on international travel. For reservations call (or have your travel agent call) 800-334-8644 between 8:00 a.m. and 9:00 p.m. Eastern Daylight Time. Refer to Gold File Number 41380077.

Travel from the airport: A taxi from the Sea-Tac Airport to the campus costs approximately $30–$35. The Super Shuttle (206-622-1424) costs approximately $25 each way.

Automobile approaches to campus: Seattle is easily accessible via Interstate 5; exit at NE 45th St. and head east. For Terry-Lander Hall, turn right (south) onto Roosevelt Way NE, and proceed approximately four blocks. Turn left onto NE Campus Parkway (signage to NE Campus Parkway and UW Visitor Information). Terry-Lander Hall will be immediately to the right once you are on NE Campus Parkway.

**By train**: Please call AMTRAK directly for schedules and price information (800-872-7245). Taxi fare from the Seattle AMTRAK station to campus is approximately $15–$20. The Super Shuttle (206-622-1424) costs approximately $41 each way.

Parking: Overnight parking is available on a first-come, first-served basis. Current daily rate (includes in/out privileges) is $5 Monday–Friday, $2.50 on Saturday, and free on Sunday. Rates are subject to change without notice.

You will be required to purchase a daily parking permit on entrance to the campus. Commuters will be directed to com-
Lawrenceville, New Jersey

Rider University

October 5–6, 1996

Meeting #914

Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: August 1996
Program issue of Notices: October 1996
Issue of Abstracts: Vol. 17, Issue 3

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: Expired

Invited Addresses
Louis J. Billera, Cornell University, Ithaca, Enumeration of faces in convex polytopes, spheres, and hyperplane arrangements.
Fred I. Diamond, University of Cambridge, United Kingdom, Title to be announced.
Nicole Tomczak-Jaegermann, University of Alberta, Geometric and linear structures in infinite-dimensional Banach spaces.
Karen E. Smith, Massachusetts Institute of Technology, Title to be announced.

Special Sessions
Algebraic K-theory, Charles A. Weibel, Rutgers University, New Brunswick.
Automorphic Forms, Henri Rene Darmon, McGill University, and Fernando Rodriguez Villegas, Princeton University.
Combinatorial and Computational Geometry, William Steiger, Rutgers University, New Brunswick, and Ileana Streinu, Smith College.
Commutative Algebra, Karen E. Smith, Massachusetts Institute of Technology, and Irena Swanson, New Mexico State University.
Elliptic Surfaces, William L. Hoyt, Rutgers University, New Brunswick, and Charles Freund Schwartz, Rider University.
Geometric Functional Analysis, Edward Odell, University of Texas, Austin, and Nicole Tomczak-Jaegermann, University of Alberta.

Geometric Topology, Norman J. Levitt, Rutgers University, New Brunswick, and Georgia Triantafillou, Temple University.
Homotopy Theory, Martin Bendersky, Hunter College, City University of New York, and Donald M. Davis, Lehigh University.
Invariants of Smooth 4-manifolds, John W. Morgan, Columbia University, and Frank S. Quinn, Virginia Polytechnic Institute and State University.
Mirror Symmetry and Toric Varieties, Ciprian S. Borcea, Rider University, and Sylvain E. Cappell, Courant Institute of Mathematical Sciences, New York University.
Moduli Spaces of Vector Bundles Over Curves With or Without Additional Structure, Hans Ulysses Boden, Max Planck Institute for Mathematics, Germany, and McMaster University, and Emma Previato, Boston University.
Operads, Hopf Algebras, and Categories, Arthur M. Dupre, Rutgers University, New Brunswick, and James D. Stasheff, University of North Carolina, Chapel Hill.
Partial Differential Equations in Geometry, Thomas Patrick Branson, University of Iowa, and Robert C. McOwen, Northeastern University.
Radon Transforms and Tomography, Andrew G. Markoe, Rider University, and Eric Todd Quinto, Tufts University.

Accommodations
Participants should make their own arrangements directly with the hotel of their choice and state that they will be attending the AMS meeting. All rooms will be on a space available basis after the deadline given. The AMS is not responsible for rate changes or for the quality of the accommodations. Taxi service is available on a limited basis between the hotels and the campus.

McIntosh Inn, 3270 US Route 1, Lawrenceville NJ 08648; 609-896-3700 or 800-444-2775; fax: 609-896-2544; $47-52/single or double; about three miles from campus. Cite Group #3084, American Mathematical Society. Deadline for reservations is September 6, 1996.

Red Roof Inn, 3203 Brunswick Pike, Lawrenceville, NJ 08648; 609-896-3388; fax: 609-896-4919; $37.99/single, $44.99/regular or king double or king single; about two miles from campus. You must cite Block #B11RIDER. Deadline for reservations is September 20, 1996.

Howard Johnson, 2995 US Route 1, Lawrenceville, NJ 08648; 609-896-1100; fax: 609-895-1325; $55/single or double; complimentary breakfast included; about one mile from campus. Deadline for reservations is September 18, 1996.

Those interested in Bed-and-Breakfast-style accommodations should call 609-924-3189 for the central registry in the Princeton area.

Food Service
Rider University is pleased to provide complimentary pastry to meeting participants on Saturday and Sunday morn-
ings in the Student Center, courtesy of the Department of Mathematics and the Science Division. Student Center Snack Bar: open 11:00 a.m. to 2:00 p.m. provides complete meals.

Other Activities

AMS Book Sale: Examine the newest titles from AMS! Most books will be available at a special 50% discount offered only at meetings. Participants can discuss membership opportunities as well. Complimentary coffee will be served, courtesy of AMS Membership Services.

Joint Books, Journals, and Promotional Materials Exhibit: This exhibit will be open the same hours as the registration desk and will provide participants with the opportunity to order publications and other materials from various commercial publishers not represented at the meeting.

Parking

Enter Rider from the South Gate and proceed to the Visitor’s Parking Lot; there is no charge.

Registration and Meeting Information

Registration is in the Cavalla Room of the Student Center: Saturday, October 5th, 8:00 a.m. to 5:00 p.m.; and Sunday, October 6th, 8:00 to 1:00. Registration fees (payable on site only): $30/AMS members; $45/nonmembers; and $10/emeritus members, students, or unemployed mathematicians. Fees are payable by cash, check, VISA, Mastercard, Discover, or American Express.

Invited addresses: Student Center; other sessions: Memorial Hall and Science Hall.

Social Event

The Local Arrangements Committee for this meeting has arranged a special concert by Canadian soprano Lorna MacDonald, accompanist Gait Sirguey and clarinettist Robert Annis in a program of song featuring Schubert’s “Shepherd on the Rock” at Rider’s Westminster Choir College in Princeton at 8:30 on Saturday evening. Tickets are $10 and will be available at the Meeting Registration Desk and at the door (if any remain). Tickets also may be reserved with Mastercard or VISA by phoning The Westminster Concerts Office at 609-921-7100, ext. 308 (there is a surcharge of $1 for this service).

Transportation

Rider University in Lawrenceville, NJ, is located about five miles southwest of Princeton. The closest large airports are in Newark and Philadelphia. Mercer County Airport, a small, regional airport five miles from campus, features inexpensive flights from Boston and Greenville, NC, on Eastwinds Airlines. It’s about a $15 taxi ride from there to the hotels.

USAir has been selected as the official airline for the meeting for its generally convenient schedule. The following specially negotiated rates are available: 5% discount off first class and any published USAir promotional round-trip fare, or 10% discount off unrestricted coach fares with seven-day advance reservations and ticketing required.

These discounts are valid providing all rules and restrictions are met and are applicable for travel from the continental U.S., Bahamas, Canada, and San Juan, P.R. Discounts are not combinable with other discounts or promotions. Additional restrictions may apply on international travel. For reservations call (or have your travel agent call) 800-334-8644 between 8:00 a.m. and 9:00 p.m. Eastern Daylight Time. Refer to Gold File Number 41380077.

Train service is provided between Newark/New York and Princeton Junction (a 45- to 60-minute trip one way) by New Jersey Transit. Call 201-762-5100 for fares and schedules. The Princeton Airporter shuttle service from Newark and JFK airports stops at IAS and several Princeton hotels. The cost is $19 one way for the one- to two-hour trip (depending on pickup point); call 609-586-6600 for reservations. A taxi is necessary to get to the Lawrenceville hotels.

The Philadelphia airport is about a 55-minute ride by car to the campus. Commuter train transportation to Trenton is provided by SEPTA; call 215-580-7800 for fares and instructions. A taxi is necessary to get to the Lawrenceville hotels from Trenton.

Driving directions:

From the north: NJ Turnpike south to exit 9. Take Rt. 18 North 1/4 mile to Rt. 1 South (Rt. 1 is also reached via the Garden State Parkway South); continue on Rt. 1 for about 20 miles until the I95 junction. Bear right at the junction (following signs to I95 south to Pennsylvania). Continue to exit 7A (Rt. 206 South, Trenton). Rider is 1/4 mile on your right.

From the south: I295 North to I95 south to exit 7A and follow directions above.

From the east: I195 West until you pick up I295 North and follow as above.

From the west: Pennsylvania Turnpike to exit 28 (Philadelphia) and follow signs for I95 North, crossing the Scudders Fall Bridge into New Jersey. Take exit 7A (Rt. 206 South, Trenton). Rider is 1/4 mile on your right.

Weather

You should expect mild East coast fall weather between 65 and 75 degrees; cooler at night.

Chattanooga, Tennessee

University of Tennessee, Chattanooga

October 11–12, 1996

Meeting #915

Southeastern Section

Associate secretary: Robert J. Daverman
Announcement issue of Notices: August 1996
Program issue of Notices: October 1996
Issue of Abstracts: Vol. 17, Issue 3
Participants should make their own arrangements directly with the hotel of their choice and state that they will be attending the AMS southeastern meeting. All rooms will be on a space available basis after the deadline given. The AMS is not responsible for rate changes or for the quality of the accommodations. All hotels are downtown about one mile from campus.

Day's Inn Rivergate, 901 Carter St., Chattanooga, 423-266-7331; $55/single or double includes free parking and continental breakfast. Deadline for reservations is September 10, 1996.

Radisson Read House Hotel, M. L. King at Broad St., Chattanooga, 423-266-4121 or 800-333-3333; $55/single or double, cite Group Code 10c-UTC MA; parking is $4/day. Free shuttle from airport. Deadline for reservations is September 10, 1996.

Clarion Hotel, 407 Chestnut St., Chattanooga; 423-756-5150; $55/single or double; parking is $4/day. Deadline for reservations is September 26, 1996.

Food Service
The University Center, open 7:30 a.m. to 6:30 p.m. on Friday, and 10:00 a.m. to 6:30 p.m. on Saturday, features some fast food franchises and a cafeteria with complete, inexpensive meals. A list of restaurants will be available at the three hotel registration desks cited above.

Local Information
Please visit the Web site maintained by the University of Tennessee, Chattanooga, at http://www.utc.edu.

Other Activities
AMS Book Sale: Examine the newest titles from AMS! Most books will be available at a special 50% discount offered only at meetings. AMS representatives will be on hand to demonstrate and discuss the newest electronic journals, the preprint server, and other products and member services available on e-MATH. Complimentary coffee will be served, courtesy of AMS Membership Services.

Joint Books, Journals, and Promotional Materials Exhibit: This exhibit will be open the same hours as the registration desk and will provide participants with the opportunity to order publications and other materials from various commercial publishers not represented at the meeting.

Parking
Free parking on campus is in Lots 32, 33, and 34 accessible from East Fourth St. near the Arena.

Registration and Meeting Information
Registration will take place on the ground floor of University Center from 8:00 a.m. to noon and 1:00 p.m. to 5 p.m. Friday, and 8:00 a.m. to noon on Saturday. All lectures will take place in University Center.

Social Event
The Department of Mathematics invites you to an all-you-can-eat Taco Buffet just after the last lectures on Friday, October 11, in the University Center. Tickets are $7 and also include a soft drink. You must reserve your ticket by sending e-mail to hmiller@utcvm.utc.edu no later than Oc-
tober 1 (be sure to include TACO and your name in your
e-mail message). Payment should be made at registration.

Travel

USAir has been selected as the official airline for the
meeting for its generally convenient schedule. The fol-
lowing specially negotiated rates are available: 5% discount
off first class and any published USAir promotional round-
trip fare, or 10% discount off unrestricted coach fares with
seven-day advance reservations and ticketing required.
These discounts are valid providing all rules and restric-
tions are met and are applicable for travel from the contin-
ental U.S., Bahamas, Canada, and San Juan. P.R. Discounts
are not combinable with other discounts or promotions.
Additional restrictions may apply on international travel.
For reservations call (or have your travel agent call) 800-
334-8644 between 8:00 a.m. and 9:00 p.m. Eastern Daylight
Time. Refer to Gold File Number 41380077.

Mercury Cab (624-1084) charges $12 for one person
from the airport to downtown.

Directions to Campus: From Interstate 75 (north or
south) connect to Interstate 24 to Tennessee State High-
way 27. From Rt. 27 take exit 1C, marked as Tennessee
Aquarium, Downtown Chattanooga. This will put you on
4th Street, a one-way Street going east. Go eleven blocks
to the UTC Arena (a very large, round building on your right,
hard to miss). Continue east on 4th Street until you arrive
at Lots 32, 33, and 34 for free parking right by the Arena.

Weather

Average high and low temperatures in mid-October in
Chattanooga are 74 degrees F. and 50 degrees F. respec-
tively

Columbia, Missouri

University of Missouri

November 1–3, 1996

Meeting #916

Central Section

Associate secretary: Susan J. Friedlander

Announcement issue of Notices: September 1996

Program issue of Notices: November 1996

Issue of Abstracts: Vol. 17, Issue 4

Deadlines

For organizers: Expired

For consideration of contributed papers in Special Ses-
sions: Expired

For abstracts: July 31, 1996

Invited Addresses

Alejandro Adem, University of Wisconsin, Madison, Recent
developments in the cohomology of finite groups.

David E. Barrett, University of Michigan, Ann Arbor, Title
to be announced.

Patricia E. Bauman, Purdue University, West Lafayette,
Title to be announced.

Ya S. Soibelman, Kansas State University, Title to be an-
nounced.

Special Sessions

Algebraic Geometry (Code: AMS SS J1), Dan Edidin and Qi
Zhang, University of Missouri.

Banach Spaces and Related Topics (Code: AMS SS K1), Peter
G. Casazza and N. J. Kalton, University of Missouri, COLUM-
BIA.

Classifying Spaces and Cohomology of Finite Groups (Code:
AMS SS H1), Alejandro Adem, University of Wisconsin, and
Stewart B. Priddy, Northwestern University.

Commutative Algebra (Code: AMS SS E1), Steven Dale
Cutkosky and Hema Srinivasan, University of Missouri, COLUM-
BIA.

Differential Equations and Dynamical Systems (Code: AMS
SS D1), Carmen C. Chicone and Yuri D. Latushkin, Uni-
versity of Missouri, Columbia.

Differential Geometry (Code: AMS SS C1), John Kelly Beem
and Adam D. Helfer, University of Missouri, Columbia.

Gauge Theory and Its Interaction With Holomorphic and
Symplectic Geometry (Code: AMS SS F1), Stamatis A.
Dostoglou, University of California, Santa Barbara, and Jan
Segert and Shuguang Wang, University of Missouri, COLUM-
BIA.

Harmonic Analysis and Probability (Code: AMS SS B1),
Nakhle Habib Asmar and Stephen John Montgomery-
Smith, University of Missouri, Columbia.

Lie Groups and Physics (Code: AMS SS I1), Victor A.
Ginzburg, University of Chicago, and Ya S. Soibelman,
Kansas State University.

Partial Differential Equations and Mathematical Physics
(Code: AMS SS A1), Mark S. Ashbaugh, University of Missi-
ouri, Columbia.

Spectral Theory and Completely Integrable Systems
(Code: AMS SS G1), Fritz Gesztesy, University of Mis-
ouri, Columbia.

Pasadena, California

California Institute of Technology

November 16–17, 1996

Meeting #917

Western Section

Associate secretary: William A. Harris, Jr.

Announcement issue of Notices: September 1996

Program issue of Notices: November 1996

Issue of Abstracts: Vol. 17, Issue 4
Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: August 6, 1996

Invited Addresses
Rafe Mazzeo, Stanford University, Geometric microlocal analysis and its applications.

Zinovy Reichstein, Oregon State University, Essential dimension of reductive groups.

Roberto Henrique Schonmann, UCLA, The Ising model in recent years: Wulff droplets, metastability and strong mixing properties.

Maciej Wojtkowski, University of Arizona, Unbounded energy growth in time.

Special Sessions
Analysis on Singular and Noncompact Spaces. (Code: AMS SS A1), Xianzhe Dai, University of Southern California, and Rafe R. Mazzeo, Stanford University.

Dynamical Systems (Code: AMS SS B1), Rafael de la Llave, University of Texas at Austin, and Maciej P. Wojtkowski, University of Arizona.

Group Actions and Noncommutative Algebra (Code: AMS SS C1), Zinovy Reichstein, Oregon State University, and Nikolaus Vonessen, University of Southern California.

History of Mathematics (Code: AMS SS D1), Shawnee L. McMurran and James J. Tattersall, Providence College.

Hopf Algebras and Their Representations (Code: AMS SS E1), Davida Fischman, California State University, San Bernardino, and M. Susan Montgomery, University of Southern California.

Probability (Code: AMS SS F1), Thomas M. Liggett, University of California, Los Angeles.

San Diego, California
San Diego Convention Center
January 8–11, 1997

Meeting #918
Joint Mathematics Meetings, including 103rd Annual Meeting of the AMS, 80th Annual Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM), the National Association of Mathematicians (NAM), and winter meeting of the Association for Symbolic Logic (ASL).

Associate secretary: Lesley M. Sibner
Announcement issue of Notices: October 1996
Program issue of Notices: January 1997
Issue of Abstracts: Volume 18, Issue 1

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: August 7, 1996
For abstracts: October 2, 1996
For summaries of papers to MAA organizers: Sept. 5, 1996

Early Registration Opportunity
For the convenience of participants who would like to register early for this meeting, the advance registration/housing form has been included at the back of this issue. Note that the full announcement for the meeting will appear in the October issue.

Invited Addresses
Daniel W. Stroock, MIT (AMS Colloquium Lectures).
Edward Bierstone, University of Toronto, Title to be announced.

Persi Diaconis, Harvard University, Title to be announced. (AMS Josiah Willard Gibbs Lecture)

Solomon Feferman, Stanford University, Does mathematics need new axioms? (AMS-MAA Invited Address)

Jorge A. Ize, University Nacional Autonoma de Mexico, Title to be announced. (AMS-SMM Invited Address)

Nancy J. Kopell, Boston University, Networks of neurons as dynamical systems: Biophysics and geometry.

Cathleen Morawetz, Courant Institute of Mathematical Sciences, New York University, Mathematics to the rescue: Some personal recollections. (AMS Retiring Presidential Address)

Mikhail Shubin, Northeastern University, Title to be announced.

Mary Silber, Northwestern University, Title to be announced.

William T. Trotter, Arizona State University, Title to be announced.

Special Sessions
Algebraic Combinatorics (Code: AMS SS V1), Adriano M. Garsia and Jeffrey B. Remmel, University of California, San Diego.

Analysis, Diffusions and PDEs on Fractals (Code: AMS SS M1), Jun Kigami, Kyoto University, Kyoto, Japan, and Michel L. Lapidus, University of California, Riverside.

Banach Algebras (Code: AMS SS S1), John Duncan, University of Arkansas, and Michael M. Neumann, Mississippi State University.

Commutative Algebra (Code: AMS SS S1), Roger A. Wiegand and Sylvia Margaret Wiegand, University of Nebraska.

Computational Algebraic Geometry (Code: AMS SS A1), Reinhard Laubenbacher, New Mexico State University, and Donal B. O'Shea, Mount Holyoke College.

Dynamics of Networks and Neurons (Code: AMS SS B1), Nancy J. Kopell, Boston University, and David H. Terman, Ohio State University.
Finsler Geometry (Code: AMS SS N1), David Bao, University of Houston, S. S. Chern, University of California, Berkeley, and Zhongmin Shen, Indiana University-Purdue University at Indianapolis.

Geometric Function Theory in One and Several Complex Variables (Code: AMS SS P1), Carl H. FitzGerald, University of California, San Diego, Ian Graham, University of Toronto, and David Minda, University of Cincinnati.

History of Mathematics (Code: AMS SS L1), Karen H. Parshall, University of Virginia, and James J. Tattersall, Providence College.

Homotopy Theory (Code: AMS SS J1), Paul G. Goerss, University of Washington, and James P. Lin, University of California, San Diego.

Interactions Between Ergodic Theory and Number Theory, I (Code: AMS SS O1), Lawrence W. Baggett, University of Colorado, Herbert Antonio Medina, Loyola Marymount University, and Kathy Donovan Merrill, Colorado College.

Mathematics and Education Reform (Code: AMS SS F1), William Henry Barker, Bowdoin College, Jerry L. Bona, University of Texas at Austin, Naomi Fisher and Philip D. Wagner, University of Illinois at Chicago, Harvey B. Keynes, University of Minnesota, and Kenneth C. Millett, University of California, Santa Barbara.


Noncommutative Geometry and Applications, I (Code: AMS SS U1), Carla E. Farsi, Jeffrey Stephen Fox, and Guoliang Yu, University of Colorado.


On the Contributions of John F. Nash, Jr., I (Code: AMS SS C1), William F. Lucas, Claremont Graduate School, John E. Morrill, DePauw University, and Joel Spruck, Johns Hopkins University.


Recent Advances in Set Theory (Code: AMS SS E1), Matthew D. Foreman, University of California, Irvine.

Recent Developments in C* Algebras and Operator Spaces (Code: AMS SS W1), Haixin Lin, University of Oregon, Zhong-Jin Ruan, University of Illinois, and S. Zhang.


Research in Undergraduate Mathematics Education (Code: AMS SS X1), M. Kathleen Heid, Pennsylvania State University, and David M. Mathews, Central Michigan University.

Spectral Geometry for Noncompact Manifolds (Code: AMS SS G1), Leonid Friedlander, University of Arizona, and Mikhail A. Shubin, Northeastern University.

Stochastic Modelling (Code: AMS SS D1), Raisa Epstein Feldman and Glen H. Swindle, University of California, Santa Barbara.

Wavelets, Multi Wavelets and their Application (Code: AMS SS R1), EnBing Lin, University of Toledo.

Call for MAA Contributed Papers

This preliminary announcement is designed to alert participants about the MAA's Contributed Paper Sessions. Please note that the days scheduled for these sessions remain tentative. The organizers listed below solicit contributed papers pertinent to their sessions; papers should be directed to the organizer whose name is followed by an asterisk (*). For additional instructions, see the Submissions Procedures at the end of the listing of the sessions.

Presentations are generally limited to ten minutes, but selected participants may extend their contributions up to 20 minutes. Each session room contains an overhead projector and screen; blackboards will not be available. You may request one additional overhead projector, a 35mm slide projector, or a 1/2 inch or 3/4 inch VHS VCR with one color monitor. Persons needing additional equipment should contact, as soon as possible, but prior to October 24, 1996: Donovan H. Van Osdol, Department of Mathematics, University of New Hampshire, Durham, NH 03824, e-mail: dvanosdo@math.maa.org.

The Uses of History in the Teaching of Mathematics, Saturday morning and Saturday afternoon. Florence Fasanelli*, Mathematical Association of America, 1529 Eighteenth Street, N.W., Washington DC 20036-1348; 800-741-9415, fax: 202-265-2384; e-mail: ffasane@maa.org; Victor J. Katz, University of the District of Columbia; and V. Frederick Rickey, Bowing Green State University.

An NSF-supported MAA Institute on the History of Mathematics and Its Use in Teaching has dealt, for two summers, with the history of mathematics, how it can be used in the classroom, and how to teach history of mathematics courses. To continue the theme of this Institute, this session invites contributions from individuals who have taught history of mathematics in innovative ways or who have used history in their classes to support current changes in curricula, pedagogy, and the mathematical preparation of teachers.

Teaching the Practice of Statistics at All Levels, Friday morning and Saturday morning. K. L. D. Gunawardena*, University of Wisconsin-Oshkosh, Department of Mathematics, Oshkosh WI 54901-86311; 414-242-1056, fax: 414-242-7317; e-mail: gunaward@vaxa.cis.uwosh.edu; Anne D. Sevin, Framingham State College; and Chitra Gunawardena, University of Wisconsin Center-Fox Valley.

This session will present papers related to teaching the practice of statistics at all levels especially in courses beyond the introductory course. For this session, the organizers invite papers which focus on teaching statistics to mathematics majors, use of technology in statistics courses, and innovative teaching techniques. Submission of proposals via e-mail is preferred by the organizers.

Interdisciplinary Courses—Integrating Mathematics and Other Disciplines, Saturday afternoon. Agnes M. Rash*, St.
Joseph’s University, 5600 City Ave., Department of Mathematics and Computer Science, Philadelphia PA 19131-1395; 610-660-1562; fax: 215-473-0001; e-mail: arash@sju.edu; and Sandra Fillebrown, St. Joseph’s University.

The mathematical community is being challenged to make mathematics more relevant to students in other disciplines and to make explicit the ways in which mathematics can be of use in other fields of study. Integration of mathematical knowledge with other disciplines is one way to enhance learning. This session invites papers on experiences in teaching courses that fully integrate mathematics with another discipline. Of particular interest would be papers on courses team-taught with members of other departments. Papers detailing course syllabi, readings, assignments and projects would be welcome.

Environmental Mathematics—Getting It into the Curriculum, Thursday and Friday afternoons. Ben Fusaro*, Florida State University, Department of Mathematics, Box 3027, Tallahassee FL 32306; 904-644-9717; fax: 904-644-4053; e-mail: fusaro@math.fsu.edu; and Patricia Kenschaft, Montclair State University.

We invite presentations that apply mathematics to the environment. We seek papers that can serve as the basis for classroom modules, and precalculus modeling is especially welcome. Our goal is to develop materials that will appeal to the environmental awareness of our students and convince them that mathematics is effective in solving problems that they, and the society at large, believe are important. (Sponsored by the Committee on Mathematics and the Environment.)

Needed Connections: Preparation of Teachers K-12, Friday morning and Saturday afternoon. M. M. Lindquist*, Columbus College, Department of Mathematics, 14 Seventh St., Columbus GA 31901-5465; 706-568-2255; fax: 706-323-6531; e-mail: Lindquist_Mary@cc.csg.peachnet.edu; C. Patrick Collier, University of Wisconsin-Oshkosh; and Albert D. Otto, Illinois State University.

There are many types of connections needed to prepare students to become mathematics teachers: connections among many stakeholders—the schools, the mathematics and education departments, and the community as they plan and implement programs; connections within mathematical topics, between mathematics and other disciplines, and with applications; connections between initial preparation, induction, and continued professional development. Papers should address programs that are taking a new look at connections.

Innovations in Teaching Linear Algebra, Wednesday and Friday afternoons and Thursday evening. David C. Lay*, University of Maryland, Department of Mathematics, College Park MD 20742; 301-405-5136; e-mail: lay@math.umd.edu; and Steven J. Leon, University of Massachusetts at Dartmouth.

This session will focus on: (1) geometric visualization in linear algebra; (2) use of technology in the course; and (3) instructional strategies. Papers may treat more than one of these areas, if appropriate. Talks on visualization should show how to introduce, motivate, or develop a topic (or topics) using transparencies, physical models or other visual aids, or computer/supercalculator activities. Instructional strategies should be innovative and successful methods for organizing or presenting the course.

Establishing and Maintaining Undergraduate Research Programs in Mathematics, Wednesday and Friday mornings. Emelie Kenney*, Siena College, Department of Mathematics, Loudonville NY 12211-1462; 518-783-2440; e-mail: kenney@siena.edu; and Joseph Gallian, University of Minnesota-Duluth.

In recent years, there has been a growing interest in undergraduate research in mathematics. We seek papers that address successes and difficulties in establishing, maintaining, funding, and assessing undergraduate research programs of all kinds, especially academic year programs. Descriptions and analyses of any efforts that support and encourage the involvement of students in mathematics research, including: informal programs, mentoring individual students, conferences and meetings involving students, REU programs, and non-REU formal programs are welcome.

Innovations in Teaching Abstract Algebra, Wednesday morning and Friday afternoon. Al Hibbard*, Central College, Department of Mathematics/Computer Science, Pella IA 50219-1902; 515-628-5133; fax: 515-628-5316; e-mail: hibbarda@ac.central.edu; Ellen Maycock Parker, Depauw University; and Krystina Leganza, Ball State University.

The purpose of this session is to provide a forum for sharing innovations in teaching abstract algebra. Although any talks fitting this description are encouraged, those which address one or more of the following categories are particularly solicited: use of models or visualization; use of computer software; and successful pedagogical techniques. Where appropriate, each presenter is encouraged to provide the context, tools, method, and effect of the innovation being discussed.

Innovations in Courses Before Calculus: Implementing the Crossroads Standards, Thursday and Saturday afternoons. Ray E. Collings*, Dekalb College Central Campus, Department of Mathematics, 555 N. Indian Cr., Clarkston GA 30021-2396; 404-299-4162; fax: 404-298-3836; e-mail: rcolling@dekalb1b.de.peachnet; and Janet Ray, Seattle Central Community College.

In 1995 the American Mathematical Association of Two-Year Colleges (AMATYC) released its “Crossroads” standards. Papers should present standards-based course content, methods, and student performance resulting from faculty efforts consistent with Crossroads philosophy. (Co-sponsored by AMATYC and the MAA Committee on Two-Year Colleges.)

Development Programs That Work, Thursday and Saturday afternoons. Mercedes McGowen*, William Rainey Harper College, Mathematics-1200 W. Algonquin Road, Palatine IL 60067-7398; 847-925-6526; fax: 847-925-6049; e-mail: mmgcowen@harper.cc.il.us; and Jacqueline B. Giles-Giron, Houston Community College.

In many colleges and universities, developmental algebra courses constitute a significant portion of the course offerings. Substantial revisions in precalculus and calculus courses, coupled with the recently published AMATYC
Standards, have spurred efforts to rethink the developmental mathematics curriculum as well. We invite papers describing significant changes in content and/or pedagogy in the teaching of developmental mathematics courses. Project directors who have implemented reform developmental algebra courses are encouraged to share key aspects of their programs and results to date. Submission of proposals via electronic mail is preferred by the organizers.

Research in Undergraduate Mathematics Education, Wednesday and Friday mornings. M. Kathleen Heid*, The Pennsylvania State University, 171 Chambers Building, University Park PA 16802-3205; 814-865-2430; fax: 814-863-7602; e-mail: IK8@psu.edu; and David M. Mathews, Central Michigan University.

Research papers are solicited which address questions concerning the teaching and learning of undergraduate mathematics. Both theoretical and empirical investigations utilizing qualitative or quantitative methodologies are welcome. To the greatest extent possible, reports should be situated in and advance understandings about the teaching and/or learning of mathematics, and should be set within appropriate theoretical frameworks. We are especially interested in reports on completed studies. (Sponsored by the AMS-MAA Committee on Research in Undergraduate Mathematics Education (CRUME).)

The Use of Hand-held Technology in the Teaching and Learning of Mathematics, Thursday morning and Saturday afternoon. Marcelle Bessman*, Jacksonville University, Department of Mathematics, Jacksonville FL 32211; 904-745-7300; fax: 904-745-7573; e-mail: mbessma@junix.ju.edu; V. J. Ramamurthy, Northern Florida State University; and Bert K. Waits, The Ohio State University.

Computers and graphing calculators can be used as tools for exploration of mathematical concepts and constructs as well as for "discovery of mathematical truths". Through integrated use of this technology the classroom becomes a laboratory for instruction and learning. For this session the organizers invite papers which focus on uses of hand-held technology in the mathematics classroom. (Sponsored by the MAA Committee on Computers in Mathematics Education.)

Assessment for Better Learning: Assessing Teaching and Learning in a Climate of Change, Thursday morning and Saturday afternoon. Bonnie Gold*, Wabash College, Department of Mathematics, Crawfordsville IN 47933; 317-361-6306; e-mail: goldb@wabash.edu; Annalisa Crannell, Franklin & Marshall College; and Ahmed Zayed, University of Central Florida.

As we experiment with new ways of teaching, we need to find new and more effective ways to assess how well our students are learning, and, correspondingly, how well we are doing as teachers. This session will discuss methods of evaluation which go beyond traditional examinations and evaluation forms. Especially welcome are papers which directly use this assessment to improve teaching and student learning. (Sponsored by the Committee on Teaching Undergraduate Mathematics.)

New Directions in Student Assessment, Wednesday and Thursday afternoons. Richard Vandervele*, Hope College, Department of Mathematics, Holland MI 49422-9000; 616-395-7123; e-mail: vandervelde@hope.cit.hope.edu; and Jay M. Jahangiri, Kent State University.

Many students develop math anxiety as a result of the old fashioned exams which are "do or die" situations. Assessing students’ performances with respect to critical thinking, mathematical communication skills and the use of technology demands assessment techniques dramatically different from those many institutions and instructors have traditionally relied on. We invite contributed talks from persons regarding new (and old) innovative evaluation techniques which are effective in this new environment.

How Mathematics Departments and Upper Level Administrators Work Effectively, Wednesday morning and Friday afternoon. Lida K. Barrett*, United States Military Academy, Mathematical Sciences Department, West Point NY 10996-1786; 914-938-2559; fax: 914-938-2409; e-mail: barrett@euler.math.usma.edu; Calvin C. Moore, University of California at Berkeley; and Morton Lowengrub, Indiana University.

Reform activities in mathematics departments have led to changes in curriculum, in equipment needs, sometimes in staffing, and hopefully in how and what mathematics students learn. How do administrators see these changes? What are their roles and responsibilities in relation to these changes? What are a department’s responsibilities in informing the administration? Presentations are sought from mathematician-administrators and from chairs or faculty who have been successful in their efforts with administrators.

Submission Procedures for MAA Contributed Papers

After you have selected a session to which you wish to contribute a paper, forward the name(s) and address(es) of the author(s) and a one-page summary of your paper directly to the organizer indicated above with an asterisk (*). The summary should enable the organizer(s) to evaluate the appropriateness of your paper for the selected session. Consequently, you should include as much detailed information as possible within the one-page limitation.

Your summary must reach the designated organizer by Friday, September 5, 1996.

The organizer will acknowledge receipt of all paper summaries. If the organizer accepts your paper, you will receive information on how to submit an abstract electronically to be published in the booklet of abstracts for the meeting in San Diego. All abstracts must be submitted by Thursday, October 2, 1996. Abstracts received after the deadline will not be published in the booklet distributed at the meeting.

930 NOTICES OF THE AMS VOLUME 43, NUMBER 8
Memphis, Tennessee
University of Memphis
March 21-22, 1997

Meeting #919
Southeastern Section
Associate secretary: Robert J. Daverman
Announcement issue of Notices: January 1997
Program issue of Notices: March 1997
Issue of Abstracts: Volume 18, Issue 2

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: October 19, 1996
For abstracts: December 14, 1996

Invited Addresses
Keith Ball, Texas A&M University.
Nikolai I. Chernov, University of Alabama at Birmingham.
Richard Martin Hain, Duke University.
Allen R. Tannenbaum, University of Minnesota.

Special Sessions
Approximation in Mathematics (Code: AMS SS A1),
George A. Anastassiou, University of Memphis.
Complex Analysis in One and Several Variables (Code: AMS SS F1),
Dmitry Khavinson, University of Arkansas.
Convergence and Recurrence in Ergodic Theory. (Code: AMS SS E1),
James T. Campbell and Mate Wierdl, University of Memphis.

Dynamical Systems and Fractal Geometry (Code: AMS SS C1),
Fernanda Botelho, University of Memphis.
Harmonic Analysis and Convexity (Code: AMS SS G1),
Eric A. Carlen, Georgia Institute of Technology, Erwin Lutwak,
Polytechnic University, and Elisabeth Werner, Case Western Reserve University.

Invariants of 3-Manifolds (Code: AMS SS H1),
Stavros Garoufalidis, Brown University, and Richard Martin Hain and
Jun Yang, Duke University.

Numerical Solutions for Partial Differential Equations (Code: AMS SS D1),
Xiaobing Feng and Ohannes Karakashian, University of Tennessee.
Symbolic Dynamics (Code: AMS SS B1), Paul B. Trow, University of Memphis.

College Park, Maryland
University of Maryland, College Park
April 12-13, 1997

Meeting #920
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: February 1997
Program issue of Notices: April 1997
Issue of Abstracts: Volume 18, Issue 2

Deadlines
For organizers: July 12, 1996
For consideration of contributed papers in Special Sessions: November 18, 1996
For abstracts: January 13, 1997

Invited Addresses
Lisa Claire Jeffrey, McGill University, Title to be announced.
Alexandre Kirillov, University of Pennsylvania, Title to be announced.
Jian-Shu Li, University of Maryland, College Park, Title to be announced.
Richard Pollack, Courant Institute of Mathematical Sciences, New York University, Title to be announced.

Special Sessions
Algorithms for Real Algebraic Geometry (Code: AMS SS A1),
Richard Pollack, Courant Institute of Mathematical Sciences, New York University, and Marie-Françoise Roy, University of Rennes I, France.

Corvallis, Oregon
Oregon State University
April 19-20, 1997

Meeting #921
Western Section
Associate secretary: William A. Harris, Jr.
Announcement issue of Notices: February 1997
Program issue of Notices: April 1997
Issue of Abstracts: Volume 18, Issue 3

Deadlines
For organizers: July 12, 1996
For consideration of contributed papers in Special Sessions: November 18, 1996
For abstracts: January 13, 1997
Meetings & Conferences

Detroit, Michigan
Wayne State University
May 2-4, 1997

Meeting #9220
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: March 1997
Program issue of Notices: May 1997
Issue of Abstracts: Volume 18, Issue 3

Deadlines
For organizers: August 2, 1996
For consideration of contributed papers in Special Sessions: December 9, 1996
For abstracts: February 3, 1997

Invited Addresses
Harold P. Boas, Texas A & M University
Carlos E. Kenig, University of Chicago
Ernest E. Shult, Kansas State University
A. L. Volberg, Michigan State University

Special Sessions
C* Algebras (Code: AMS SS H1), Jerry Kaminker, Indiana University-Purdue University at Indianapolis, and Claude L. Schochet, Wayne State University.
Differential Geometry and Its Applications (Code: AMS SS C1), Daniel S. Drucker and Chorng-Shi Houh, Wayne State University.
Homotopy Theory (Code: AMS SS D1), Robert R. Bruner and David Handel, Wayne State University.
Recent Advances in Noncommutative Ring Theory (Code: AMS SS F1), Peter Malcolmson and Frank Okoh, Wayne State University.
Representation Theory of Finite Groups and Related Topics (Code: AMS SS B1), David Howard Gluck, Wayne State University.
Stochastic Processes in Finance and Control (Code: AMS SS G1), Raoul LePage, Michigan State University, and Bert M. Schreiber, Wayne State University.

Montreal, Quebec
Canada
University of Montreal
September 26-28, 1997
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: August 1996
Program issue of Notices: October 1996
Issue of Abstracts: Volume 18, Issue 3

Deadlines
For organizers: December 20, 1996
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Invited Addresses
Jonathan B. Goodman, Courant Institute of Mathematical Sciences, New York University
Dieter Kotschick, University of Basel
Francois Lalonde, University of Quebec at Montreal
I. Moerdijk, University of Utrecht, Netherlands

Atlanta, Georgia
Georgia Institute of Technology
October 10-12, 1997
Southeastern Section
Associate secretary: Robert J. Daverman
Announcement issue of Notices: August 1997
Program issue of Notices: October 1997
Issue of Abstracts: To be announced

Deadlines
For organizers: January 10, 1997
For consideration of contributed papers in Special Sessions: May 7, 1997
For abstracts: July 9, 1997

Special Sessions

Milwaukee, Wisconsin
University of Wisconsin
October 24-26, 1997
Central Section
Baltimore, Maryland

Baltimore Convention Center

January 7-10, 1998

Joint Mathematics Meetings, including the 104th Annual Meeting of the AMS, 81st Annual Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM), and the winter meeting of the Association for Symbolic Logic (ASL).

Associate secretary: Robert J. Daverman
Announcement issue of Notices: October 1997
Program issue of Notices: January 1998
Issue of Abstracts: To be announced

Deadlines
For organizers: April 10, 1997
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
For summaries of papers to MAA organizers: To be announced

Invited Addresses
Edward Witten, Institute for Advanced Study (Josiah Willard Gibbs Lecture)

Louisville, Kentucky

University of Louisville

March 20-21, 1998
Southeastern Section
Associate secretary: Robert J. Daverman
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Special Sessions
Combinatorics and Enumerative Geometry (Code: AMS SS A1), Kequan Ding, University of Illinois, Urbana-Champaign, and Chi Wang, University of Louisville.
Combinatorics and Graph Theory (Code: AMS SS B1), Andre E. Kezdy, Grzegorz Kubicki, and Jenoe Lehel, University of Louisville.
Discrete Mathematics, Classification Theory and Consensus (Code: AMS SS C1), Robert C. Powers, University of Louisville.

Oaxaca, Mexico

Oaxaca, Mexico

December 4-7, 1997

Third Joint Meeting of the American Mathematical Society and the Sociedad Mathematica Mexicana.
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Special Sessions
Combinatorics and Enumerative Geometry (Code: AMS SS A1), Kequan Ding, University of Illinois, Urbana-Champaign, and Chi Wang, University of Louisville.
Combinatorics and Graph Theory (Code: AMS SS B1), Andre E. Kezdy, Grzegorz Kubicki, and Jenoe Lehel, University of Louisville.
Discrete Mathematics, Classification Theory and Consensus (Code: AMS SS C1), Robert C. Powers, University of Louisville.

Meetings & Conferences
Meetings & Conferences

Fractal Geometry and Related Topics (Code: AMS SS D1), Ka-Sing Lau, University of Pittsburgh, and Weibin Zeng, University of Louisville.

Functional Equations and Inequalities (Code: AMS SS E1), Thomas Riedel and Prasanna Sahoo, University of Louisville.

Harmonic Analysis and Prediction Theory (Code: AMS SS F1), Raymond Cheng, University of Louisville.

Real Analysis (Code: AMS SS G1), Udayan B. Darji and Lee Larson, University of Louisville.

Semigroups, Algorithms, and Universal Algebra (Code: AMS SS H1), Ralph N. McKenzie, Vanderbilt University, and Steven Seif, University of Louisville.

The Use of the History of Mathematics and Science in the University and School Classroom (Code: AMS SS I1), Richard M. Davitt, University of Louisville.

Manhattan, Kansas

Kansas State University

March 27-28, 1998

Central Section

Associate secretary: Susan J. Friedlander
Announcement issue of Notices: January 1998
Program issue of Notices: March 1998
Issue of Abstracts: To be announced

Deadlines

For organizers: June 26, 1997
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Special Sessions


Philadelphia, Pennsylvania

Temple University

April 4-5, 1998

Eastern Section

Associate secretary: Lesley M. Sibner
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines

For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
For summaries of papers to MAA organizers: To be announced

Washington, District of Columbia

Sheraton Washington Hotel and Omni Shoreham Hotel

January 19–22, 2000

Joint Mathematics Meetings, including the 106th Annual Meeting of the AMS, 83rd Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM).

Associate secretary: William A. Harris, Jr.
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines

For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
For summaries of papers to MAA organizers: To be announced

New Orleans, Louisiana

New Orleans Marriott and ITT Sheraton New Orleans Hotel

January 10–13, 2001

Joint Mathematics Meetings, including the 107th Annual Meeting of the AMS, 84th Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM).

Associate secretory: Lesley M. Sibner
Announcement issue of Notices: October 2000
Program issue of Notices: January 2001
Issue of Abstracts: To be announced

Deadlines

For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
For summaries of papers to MAA organizers: To be announced
Presenters of Papers

Seattle, Washington: August 10-12, 1996

Numbers following the name indicate the speaker's position on the program.

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Program of the Sessions
Seattle, Washington, August 10-12, 1996

Thursday, August 8

MAA CRAFTY Workshop on Calculus, I
NOON - 5:00 PM
The dynamics of change.
Organizers: Wayne Roberts, Macalester College
Donald B. Small, U. S. Military Academy

MAA Board of Governors
9:00 AM - 5:00 PM

Joint Meetings Registration
NOON - 4:00 PM

AMS Council
1:00 PM - 6:00 PM

Preparing Ourselves and Our Students for Careers in Mathematics
3:00 PM - 6:00 PM
Organizer: Annalisa Crannell, Franklin & Marshall College
3:00 PM AMS career resources (information session).
(1) Annalisa Crannell, Franklin & Marshall College
3:20 PM Experience and advice from recent graduates.
(2) Margaret Holen*, Lehman Brothers, and Francis Edward Su*, Harey Mudd College

Friday, August 9

MAA CRAFTY Workshop on Calculus, II
9:00 AM - 5:00 PM
The dynamics of change.
Organizers: Wayne Roberts, Macalester College
Donald B. Small, U. S. Military Academy

MAA-PME Student Reception
5:30 PM - 6:30 PM

Opening Banquet/Prizes
6:30 PM - 10:00 PM

Saturday, August 10

Joint Meetings Registration
8:00 AM - 4:00 PM

AMS-MAA Invited Address
8:30 AM - 9:20 AM
(5) Influences on graph theory from computing and mathematical sciences.
Alan Tucker, State University of New York, Stony Brook

Exhibits and Book Sales
9:00 AM - 5:00 PM

MAA Student Hospitality Center
9:00 AM - 5:00 PM

Optional Tour: Seattle City Highlights
9:00 AM - NOON

4:15 PM Preparing for academic careers.
(3) Anita Solow*, Grinell College, and Ray E. Collings*, DeKalb College
5:10 PM Preparing for non-academic careers.

The time limit for each talk within sessions varies. To maintain the schedule, time limits will be strictly enforced.
For papers with more than one author, an asterisk follows the name of the author who plans to present the paper at the meeting.
Papers flagged with a solid triangle (•) have been designated by the author as being of possible interest to undergraduate students.
Earle Raymond Hedrick Lectures: Lecture I

9:35 AM - 10:30 AM

(6) Some of the history of the binomial theorem and its extensions.
Richard Askey, University of Wisconsin, Madison

AMS-MAA Invited Address

10:40 AM - 11:30 AM

(7) Casting about: About casting.
Colin C. Adams* and Edward B. Burger*, Williams College

AMS Business Meeting

11:40 AM - 12:10 PM

AMS-MAA Research Session on Commutative Algebra Special Address

12:15 PM - 12:45 PM

(8) Some open questions in commutative algebra.
Craig L. Huneke, Purdue University

PME Council

12:15 PM - 2:50 PM

MAA Minicourse #1: Part A

1:00 PM - 2:50 PM

Low cost visualization training for multivariable calculus: Drawing.
Organizers: Caspar R. Curjel, University of Washington
Rose L. Pugh, Bellevue Community College

MAA Minicourse #2: Part A

1:00 PM - 2:50 PM

Computability and computational complexity: What is this all about?
Organizer: William A. Marion, Valparaiso University

AMS-MAA Session on A Tour through Applications to the Social Sciences, I

1:00 PM - 2:50 PM

Organizer: Robin Forman, Rice University

1:00PM Spatial models of voting power and voting outcomes.
Philip D. Straffin, Jr., Beloit College

1:40PM On the median procedure for group decisionmaking.
Fred S. Roberts, Rutgers University

2:20PM Multicandidate voting systems: Design, strategy, and equilibrium.
Samuel Merrill, III, Wellesley College

AMS-MAA-SIAM Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student Lecturer

1:00 AM - 1:30 PM

1:00PM Title to be announced.
K. Soundararajan, Princeton University

AMS-MAA Graduate Student Session on Combinatorics, I

1:00 PM - 2:55 PM

Organizer: Andrew J. Radcliffe, University of Nebraska

AMS-MAA Graduate Student Session on Commutative Algebra, I

1:00 PM - 2:55 PM

Organizer: Roger T. Wiegand, University of Nebraska

AMS-MAA Graduate Student Session on Group Representation Theory, I

1:00 PM - 2:55 PM

Organizers: Benjamin J. Ford, University of Washington
George J. McNinch, University of Oregon

1:00PM U(3, q) and analogues of classical Gauss sums.
Julianne Rainbolt, University of Illinois at Chicago

1:25PM Calculating a modular character table on the example of the sporadic simple group of O’Nan.
Anne Henke, University of Heidelberg

1:50PM Determining structure constants with domino tableaux. Preliminary report.
Brian Hopkins, University of Washington

2:15PM The rank of the derivative of the quotient map for \( \delta \)-group actions. Preliminary report.
Craig Tingey, University of Oregon

2:40PM Discussion

AMS-MAA Graduate Student Session on Optimization, I

1:00 PM - 2:35 PM

Organizer: Paul Y. Tseng, University of Washington

1:00PM Examples of convex programming.
Jonathan Borwein, Simon Fraser University

1:40PM Finding support in Hilbert space.
Heinz Bauschke, Simon Fraser University

2:00PM Global convergence of collinear scaling algorithms under inexact line searches.
Negash Begashaw, Washington State University

2:20PM Title to be announced.
Mark Coodey, University of California, Santa Barbara
Program of the Sessions - Seattle, WA, Saturday, August 10 (cont’d.)

MAA Session on Innovative Teaching in First-Year College Mathematics, I

1:00 PM - 2:35 PM

Organizers: Howard L. Penn, U. S. Naval Academy
            Aaron I. Stucker, Washburn University of Topeka

1:00 PM  Problem solving in college algebra. Preliminary report.

1:20 PM  Geometric models, history, and art in a liberal arts mathematics course.
        (28)   Geometric models, history, and art in a liberal arts mathematics course.

1:40 PM  Teaching college algebra & trigonometry using cooperative learning groups.
        (29)   Teaching college algebra & trigonometry using cooperative learning groups.

2:00 PM  The system of lessons as an alternative to combined lessons.
        (30)   The system of lessons as an alternative to combined lessons.

2:20 PM  Using undergraduates to teach remedial courses.
        (31)   Using undergraduates to teach remedial courses.

MAA Session on Reformed Calculus in Performance: What Works, What to Fix, I

1:00 PM - 2:50 PM

Organizers: Walter Gill Kelley, University of Oklahoma
            Curtis C. McKnight, University of Oklahoma

1:00 PM  Welcome and Introduction

1:10 PM  Calculus and Mathematica in its seventh year: Lessons learned.
        (32)   Calculus and Mathematica in its seventh year: Lessons learned.

1:30 PM  Calculus reform methods in the large classroom.
        (33)   Calculus reform methods in the large classroom.

1:50 PM  Identifying difficulties in a comprehensive implementation of reformed calculus.
        (34)   Identifying difficulties in a comprehensive implementation of reformed calculus.

2:10 PM  Which way did they go? Which way did they go?
        (35)   Which way did they go? Which way did they go?

2:30 PM  Assessment of appropriate uses of graphing calculators in Calculus I.
        (36)   Assessment of appropriate uses of graphing calculators in Calculus I.

AMS-MAA Joint Panel Discussion

1:00 PM - 2:30 PM

Integrating calculus and physics courses: Three case studies.
Organizer: Phillip L. Zenor, Auburn University
Presenters: Martin A. Jackson, University of Puget Sound
           David B. Johnson, Diablo Valley College

AMS-MAA-SIAM Frank and Brennie Morgan Prize Reception

1:30 PM - 2:30 PM

AMS Committee on Meetings and Conferences Discussion

3:00 PM - 4:00 PM

What makes a good talk?
Organizers: Steven George Krantz, Mathematical Science Research Institute and Washington University
            Jerrold E. Marsden, California Institute of Technology and University of California, Berkeley
            Sylvia M. Wiegand, University of Nebraska

MAA-Mu Alpha Theta Lecture

3:05 PM - 3:50 PM

(37)  The role of secondary schools in calculus reform.
      Deborah Hughes Hallett*, Harvard University, and
      Daniel Kennedy, Baylor School, Chattanooga, Tennessee

MAA Minicourse #3: Part A

4:00 PM - 5:00 PM

Technology, modeling, cooperative learning: Putting it all together.
Organizers: James T. Sandefur, Georgetown University
            Rosalie Dance, Georgetown University

MAA Minicourse #4: Part A

4:00 PM - 5:00 PM

How to test mathematics taught using graphing calculators.
Organizers: Jan J. Vandeveer, South Dakota State University
            Katherine P. Layton, Beverly Hills High School

MAA Session on Innovative Teaching in First-Year College Mathematics, II

4:00 PM - 5:15 PM

Military projects for calculus.
(38)   Military projects for calculus.
        Howard Lewis Penn, U. S. Naval Academy

The mathematics of powered flight.
(39)   The mathematics of powered flight.
        George T. Rubleln, College of William and Mary

An efficient alternative to lecturing.
(40)   An efficient alternative to lecturing.
        Jack Bookman, Duke University

A JUMP START for students ill-prepared but needing calculus. Preliminary report.
(41)   A JUMP START for students ill-prepared but needing calculus. Preliminary report.
        Michael N. Bleicher, University of Wisconsin, Madison

MAA Session on Mathematicians in the K-8 Classroom, I

4:00 PM - 5:05 PM

Organizers: Una M. Bray, Skidmore College
            R. Daniel Hurwitz, Skidmore College

My visits to the K-6 classroom.
(42)   My visits to the K-6 classroom.
        Una Bray, Skidmore College

938  NOTICES OF THE AMS  VOLUME 43, NUMBER 8
4:20PM  My visits to the junior high: Lessons and experiences.
Peter Tannenbaum, CSU at Fresno

4:40PM  I was a volunteer 6th grade math teacher.
Susan Addington, California State University, San Bernardino

5:00PM  New PhDs in school classrooms: The Cleveland Collaborative’s post-doctoral fellows.
Ben Ford, University of Washington

5:20PM  Middle school mathematics: An historical approach.
Arlene Goldblatt, The Foote School

5:40PM  Musings of a vagabond mathematics consultant.
Dan Hurwitz, Skidmore College

MAA Session on Innovations in Mathematics Courses beyond Linear Algebra, I
4:00PM - 5:55PM
Organizers: Janet L. Beery, University of Redlands
Steven W. Morics, University of Redlands

4:00PM  Group activities in abstract algebra.
Steven W. Morics, University of Redlands

4:15PM  Groups for proofs: Using small groups to teach students how to write proofs.
Daniel S. Alexander, Drake University

4:30PM  Teaching students to solve geometry problems using the method of auxiliary circles.
Victor Kutsenok, St. Francis College

4:45PM  Using electronic mail for peer review.
Bryan Smith, University of Puget Sound

5:00PM  Dynamical systems and chaos at the undergraduate level.
Mario Martelli, California State University, Fullerton

5:15PM  Student attitudes toward abstract algebra: A comparative research study.
Clare T. Hemenway, University of Wisconsin-Marathon Center

5:30PM  Cooperatively learning abstract algebra.
Nancy L. Hagelgans, Ursinus College

5:45PM  A unified approach to the study of mathematics.
Catherine Gorini, Maharishi University of Management

MAA Student Papers
4:00PM - 5:50PM

PME Contributed Paper Sessions
4:00PM - 5:50PM

MAA Committee on the Participation of Women Panel Discussion
4:00PM - 5:50PM
Women and mathematics: Case studies of intervention programs.
Moderator: Carole B. Lacampagne, U. S. Department of Education
Organizer: Virginia E. Knight, Meredith College

AMS-MAA Presentation
4:00PM - 5:50PM
The research mathematician as an educator: How do we use the mathematics that we create to motivate students? Part I.
Presenters: William Yslas Velez, University of Arizona
James A. Powell, Utah State University
Nancy Pullman, Logan (Utah) High School
Joseph C. Watkins, University of Arizona

AMS Committee on Education Panel Discussion
4:00PM - 5:40PM
How can you defend your graduate program in mathematics?
Organizer: Harvey B. Keynes, University of Minnesota
Presenters: John B. Conway, University of Tennessee
William H. Jaco, Oklahoma State University
William Rundell, Texas A & M University

MAA Section Officers
4:00PM - 6:00PM

AMS-MAA Research Session on Commutative Algebra, I
4:10PM - 5:50PM
Organizers: Sylvia Margaret Wiegand, University of Nebraska
William J. Heinzer, Purdue University, West Lafayette

4:10PM  Every local ring is dominated by a one-dimensional local ring.
Robert Gilmer, Florida State University

4:35PM  Cofiniteness of local cohomology modules.
Donatella Delfino, Univ. of Michigan

5:05PM  Existence of joint reductions in polynomial rings.
Irena Swanson, New Mexico State University

5:30PM  Coprimely packed Noetherian polynomial rings.
David E. Rush, University of California, Riverside

Luau
6:00PM - 8:00PM

AMS-MAA Invited Address
8:30PM - 9:30PM
(60) Title to be announced.
William J. Perry, Department of Defense

Special Reception
9:30PM - 11:00PM
Sunday, August 11

**Breakfast for MAA Student Chapter Faculty Advisors, Section Coordinators, and PME Advisors**

7:00 AM - 8:20 AM

**Joint Meetings Registration**

8:00 AM - 4:00 PM

**AMS-MAA Invited Address**

8:30 AM - 9:20 AM

(61) Reflections on mathematics reform, mathematics literacy, and citizenship.

Robert Moses, The Algebra Project

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**Exhibits and Book Sales**

9:00 AM - 5:00 PM

**MAA Student Hospitality Center**

9:00 AM - 5:00 PM

**Earle Raymond Hedrick Lectures: Lecture II**

9:35 AM - 10:25 AM

(62) Refined counting and a noncommutative version of the binomial theorem.

Richard Askey, University of Wisconsin, Madison

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**Optional Tour: Cruise the Locks and Seattle Harbor**

10:00 AM - 1:00 PM

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**AMS-MAA Invited Address**

10:40 AM - 11:45 AM

(63) The double bubble conjecture.

Joel Hass, University of California, Davis

Moderator: Frank Morgan, Williams College

Panelists: Jenny Kelley, Rutgers University

Helen E. Moore, Bowdoin College

Jean E. Taylor, Rutgers University

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**AMS-MAA Research Session on Commutative Algebra Special Address**

12:15 PM - 12:45 PM

12:15 PM The Picard group of an affine domain.

Roger A. Wiegand, Univ. of Nebraska

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**MAA Minicourse #5: Part A**

1:00 PM - 2:50 PM

Dynamic geometry lab with Sketchpad.

Organizer: James R. King, University of Washington

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**MAA Minicourse #6: Part A**

1:00 PM - 2:50 PM

Projects for precalculus.

Organizers: Janet Lynn Andersen, Hope College

Todd M. Swanson, Aquinas College

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**AMS-MAA Session on A Tour through Applications to the Social Sciences, II**

1:00 PM - 2:50 PM

Organizer: Robin Forman, Rice University

1:00 PM The price is right: Brouwer's fixed point theorem and economic equilibria. Preliminary report.

Michael Olinick, Middlebury College

1:40 PM Formal approaches to cooperative games. Preliminary report.

James D. Laing, The Wharton School, University of Pennsylvania


R. Duncan Luce, Institute for Mathematical Behavioral Sciences

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**AMS-MAA Graduate Student Session on Combinatorics, II**

1:00 PM - 2:55 PM

Organizer: Andrew J. Radcliffe, University of Nebraska

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**AMS-MAA Graduate Student Session on Group Representation Theory, II**

1:00 PM - 2:55 PM

Organizers: Benjamin J. Ford, University of Washington

George McNinch, University of Oregon

1:00 PM Problems and progress in representation theory of finite groups.

Charles W. Curtis, University of Oregon

1:40 PM Quadratic subspaces of matrices. Preliminary report.

Chris Pappacena, University of Southern California

2:05 PM Complete reducibility and dimensions of representations. Preliminary report.

George McNinch, University of Oregon

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**AMS-MAA Graduate Student Session on Optimization, II**

1:00 PM - 2:35 PM

Organizer: Paul Y. Tseng, University of Washington

1:00 PM On the complexity of an algorithm for convex minimax optimization.

Peilei Jiang, Washington State University

1:20 PM An application of a Levenberg-Marquardt algorithm to a parameter-recovery problem on the real line.

Jennifer Mueller, University of Nebraska at Lincoln

1:40 PM Limited memory quasi-Newton methods in a trust-region framework.

Andreas Wiegmann, University of Washington

2:00 PM Algorithms for box constrained optimization problems.

Song Xu, University of Washington

2:20 PM Self-complementary variable metric algorithms.

Min Zhu, Washington State University

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**MAA Session on Innovative Teaching in First-Year College Mathematics, III**

1:00 PM - 2:35 PM

Organizers: Howard L. Penn, U. S. Naval Academy
Aaron L. Stucker, Washburn University of Topeka

1:00PM Calculus for underprepared students: A just-in-time approach in a variety of settings.
Kay B. Somers, Moravian College

1:20PM A comparison of teaching calculus in USA and China.
Dali Luo*, Cedarville College, Oh, and Jimin Tian, Richland College, Dallas, TX

1:40PM Group projects and a poster session final exam in a 100-level mathematical modeling course.
Melvin A. Nyman*, Alma College, and John S. Berry, University of Plymouth

2:00PM Some methods to find a limit using the graphics calculator TI-85. Preliminary report.
Wenyao Zhang, Union County College

2:20PM Fundamental concepts of calculus on computers. Preliminary report.
Wenzhi Sun, Salem College

MAA Student Papers

MAA Session on Teaching and Learning Mathematics as a Laboratory Science, I

1:00 PM - 3:00 PM
Organizers: Marcelle Bessman, Jacksonville University
David A. Smith, Duke University

1:00PM Is it sixteen?
Herb I. Brown

1:10PM Stochastic modeling of plant growth and tree-like structures.
Anne M. Burns

1:20PM Exploring numerical methods in the computer lab.
Li Chao

1:30PM The impact of object-oriented technology on mathematics software.
Lawrence D'Antonio

1:40PM Diverse spreadsheet applications in mathematics.
Robert S. Fisk

1:50PM An interactive lesson for teaching linear programming.
K.L.D. Gunawardena

2:00PM Learning discrete mathematics with a computer algebra system.
Nancy L. Hagelgans

2:10PM Classrooms as learning laboratories: Mathematics at the United States Coast Guard Academy.
Leonard J. Kelly

2:20PM Centers of triangles of fixed center: Adventures in undergraduate research.
William Mueller

2:30PM Calculator-assisted Fourier analysis.
John D. Neff

2:40PM Groups for hundreds.
Al Shenk

2:50PM A laboratory approach to calculus using interactive features of the World-Wide Web.
Frederick J. Wicklin

AMS-MAA Graduate Student Session on Commutative Algebra, II

1:40 PM - 2:55 PM
Organizer: Roger A. Wiegand, University of Nebraska

1:40PM Coefficient modules over a two-dimensional regular local domain.
Jung-Chen Liu, Purdue University

2:00PM δ-stable ideals and minimal resolutions.
Todd Deery, Queen's University

2:20PM Generators for fat point ideals on P2.
Stephanie Fitchett, University of Nebraska

2:40PM Submodules of the quotient field of a Prufer domain.
Bruce Olberding, Wesleyan University

AMS-MAA Session on Mathematics as Performance Art, Part I

2:00 PM - 2:50 PM
How NOT to excite people about mathematics: A live demonstration.
Presenters: Colin C. Adams, Williams College
Edward B. Burger, Williams College

NAM David Blackwell Lecture

3:05 PM - 3:50 PM
Johnny L. Houston, Elizabeth City State University

MAA Minicourse #1: Part B

4:00 PM - 5:00 PM
Low cost visualization training for multivariable calculus: Drawing.
Organizers: Caspar R. Curjel, University of Washington
Rose L. Pugh, Bellevue Community College

MAA Minicourse #2: Part B

4:00 PM - 5:50 PM
Computability and computational complexity: What is this all about?
Organizer: William A. Marion, Valparaiso University

AMS-MAA Research Session on Commutative Algebra, II

4:00 PM - 6:10 PM
Organizers: Sylvia Margaret Wiegand, University of Nebraska
William J. Heinzer, Purdue University, West Lafayette

4:00PM Birational maps.
Dale Cutkosky, Univ. of Missouri, Columbia

4:25PM Excellent rings with local generic formal fibers.
Susan R. Loemp, Univ. of Nebraska and Williams College

4:55PM An intersection property of the Henselization.
Christel Rotthaus, Michigan State Univ.

5:20PM Can lofty ideals shed light on the Jacobian conjecture? Preliminary report.
Eloise Hamann, San Jose State Univ.
Program of the Sessions – Seattle, WA, Sunday, August 11 (cont'd.)

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>5:00PM</td>
<td>Graphic display of Newton’s interpolation polynomials.</td>
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<td></td>
<td>Wenzhi Sun, Salem College</td>
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<tr>
<td>5:15PM</td>
<td>Computer algebra systems and constructive Galois theory: ideas for a</td>
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<td>new second-semester abstract algebra course.</td>
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<td>John Swallow, Davidson College</td>
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<td>5:30PM</td>
<td>Productive thinking and applications: Computer science oriented graph</td>
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<td>theory.</td>
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<td></td>
<td>Mingshen Wu, University of Wisconsin-Stout</td>
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<tr>
<td>5:45PM</td>
<td>A second semester of discrete mathematics based on computer aided</td>
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<td>student investigations in Ramsey theory</td>
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<td>Daniel Schaal, Clarion University of Pennsylvania</td>
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MAA Session on Teaching and Learning Mathematics as a Laboratory Science, II

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<td>4:00PM</td>
<td>Teaching a project-based differential equations course.</td>
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<td></td>
<td>Robin A. Pennington, Wartburg College</td>
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<td>4:15PM</td>
<td>Envelopes.</td>
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<td>Mark Schwartz</td>
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<td>4:30PM</td>
<td>Teaching probability as a laboratory course.</td>
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<td>Peter Tannenbaum</td>
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<td>Diverse spreadsheet applications in mathematics.</td>
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<td>Robert S. Fisk</td>
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<td>5:00PM</td>
<td>Technology throughout the math curriculum.</td>
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<td>Scott Smith</td>
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<td>Interactive learning of mathematics and computer in a distributed</td>
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<td>laboratory.</td>
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<td>Margret Hof, Harmut Hof and Kevin Burke.</td>
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<td>5:30PM</td>
<td>Problems designed for creating cooperative learning in lab environment.</td>
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<td>Han Jongsok</td>
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<tr>
<td>5:45PM</td>
<td>Using the World Wide Web as a mathematical laboratory tool.</td>
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<td>Thomas LoFaro and Kevin Cooper</td>
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MAA Student Papers

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PME Contributed Paper Sessions

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AMS Presentation

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<tr>
<td>4:00PM</td>
<td>e-MATH on the World Wide Web.</td>
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<td>Organizers: Wendy A. Bucci, American Mathematical Society</td>
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<td>Ralph E. Youngen, American Mathematical Society</td>
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<tr>
<td>4:45PM</td>
<td>Mathematical modeling projects with Mathematica.</td>
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<td>Allan A. Struthers, Michigan Technological University</td>
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MAA CUPM Panel Discussion

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<td>Promoting interdisciplinary activities: Mathematics across the</td>
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<td>Organizer: Frank R. Giordano, Carroll College</td>
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<th>Time</th>
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<tr>
<td>4:00PM</td>
<td>Course questions and topic letters: Writing projects for liberal arts</td>
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<td>students.</td>
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<td>Janet Heine Barnett, University of Southern Colorado</td>
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<tr>
<td>4:20PM</td>
<td>A liberal arts mathematics course.</td>
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<td>Teresa Engel Moore, Ithaca College</td>
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<tr>
<td>5:00PM</td>
<td>A tried and true approach for assigning writing in mathematics.</td>
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<td>Judith A. Silver and Evelyn Mary Pupello-Cody, Marshall University</td>
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MAA Session on Reformed Calculus in Performance: What Works, What to Fix, II

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<tr>
<td>4:00PM</td>
<td>Project CALC at Duke—How do we know if it works?</td>
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<td>Jack Bookman, Duke University</td>
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<td>4:20PM</td>
<td>Teaching calculus with laboratory activities.</td>
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<td>Aihua Li, Loyola University, New Orleans</td>
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<td>4:40PM</td>
<td>Calculus reform against all odds.</td>
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<td>Dora Ahmadi</td>
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<td>5:00PM</td>
<td>Evaluating student learning in the calculus reform movement: A</td>
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<td>comparative study.</td>
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<td>Susan L. Ganter</td>
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<tr>
<td>5:20PM</td>
<td>Differences between instructors and students in perception of</td>
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<td>function representations, using multidimensional scaling.</td>
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MAA Session on Innovations in Mathematics Courses beyond Linear Algebra, II

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<td>Alan Knoerr, Occidental College</td>
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<td>Student projects in real analysis: One model.</td>
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<td>C. Ara Pehlivan, United States Military Academy</td>
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<td>A projects based course in modeling.</td>
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<td>Allan A. Struthers, Michigan Technological University</td>
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5:50PM On the prime spectrum of a Mori domain.
Evan Houston*, University of North Carolina, and Valentina Barucci, University of Rome

MAA Session on Innovative Teaching in First-Year College Mathematics, IV

4:00 PM – 5:35 PM
Organizers: Howard L. Penn, U. S. Naval Academy
Aaron I. Stucker, Washburn University of Topeka

Course questions and topic letters: Writing projects for liberal arts students.
Janet Heine Barnett, University of Southern Colorado

A liberal arts mathematics course.
Barbara Trader Faires, Westminster College

Math & Society: Making mathematics meaningful for non-majors.
Teresa Engel Moore, Ithaca College

A tried and true approach for assigning writing in mathematics.
Annalisa Crannell*, Franklin & Marshall, and Tommy Ratliff, St. Olaf College

Switching from math appreciation to quantitative literacy. Preliminary report.
Judith A. Silver* and Evelyn Mary Pupello-Cody, Marshall University

MAA Session on Reformed Calculus in Performance: What Works, What to Fix, II

4:00 PM – 5:50 PM
Organizers: Walter Gill Kelley, University of Oklahoma
Curtis C. McKnight, University of Oklahoma

Project CALC at Duke—How do we know if it works?
Jack Bookman, Duke University

Teaching calculus with laboratory activities.
Aihua Li, Loyola University, New Orleans

Calculus reform against all odds.
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Graphic display of Newton's interpolation polynomials.
Wenzhi Sun, Salem College

Computer algebra systems and constructive Galois theory: ideas for a new second-semester abstract algebra course.
John Swallow, Davidson College

Productive thinking and applications: Computer science oriented graph theory.
Mingshen Wu, University of Wisconsin-Stout

A second semester of discrete mathematics based on computer aided student investigations in Ramsey theory.
Daniel Schaal, Clarion University of Pennsylvania

MAA Session on Teaching and Learning Mathematics as a Laboratory Science, II

4:00 PM – 5:55 PM
Organizers: Marcelle Bessman, Jacksonville University
David A. Smith, Duke University

Teaching a project-based differential equations course.
Robin A. Pennington, Wartburg College

Envelopes.
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Teaching probability as a laboratory course.
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MAA CUPM Panel Discussion

4:00 PM – 5:50 PM
Promoting interdisciplinary activities: Mathematics across the curriculum.
Organizer: Frank R. Giordano, Carroll College
AMS-MAA Session on Mathematics as Performance Art, Part 2A

4:00 PM - 4:50 PM

Discovering the performer in you: An improv teaching workshop.
Presenters: Colin C. Adams, Williams College
Edward B. Burger, Williams College

AMS-MAA Presentation

4:00 PM - 5:50 PM

The research mathematician as an educator: How do we use the mathematics that we create to motivate students? Part II.
Presenters: William Yslas Velez, University of Arizona
James A. Powell, Utah State University
Nancy Pullman, Logan (Utah) High School
Joseph C. Watkins, University of Arizona

AMS-MAA Session on Mathematics as Performance Art, Part 2B

5:00 PM - 5:50 PM

Discovering the performer in you: An improv teaching workshop.
Presenters: Colin C. Adams, Williams College
Edward B. Burger, Williams College

PME Banquet

6:30 PM - 8:15 PM

PME J. Sutherland Frame Lecture

8:30 PM - 9:30 PM

(129) Nets, sieves, and money: Number theory’s rubber hits the I-way road.
J. Kevin Colligan, National Security Agency

Monday, August 12

Joint Meetings Registration

8:00 AM - NOON

AMS-MAA Invited Address

8:30 AM - 9:20 AM

(130) New geometrical approaches to comparing discrete summation and integration.
Sylvain Cappell, Courant Institute of Mathematical Sciences, New York University

Optional Tour: Whidbey Island

8:30 AM - 5:00 PM

Exhibits and Book Sales

9:00 AM - 2:00 PM

MAA Student Hospitality Center

9:00 AM - 5:00 PM

Earle Raymond Hedrick Lectures: Lecture III

9:35 AM - 10:25 AM

(131) Integral analogues of the binomial theorem, orthogonal polynomials and education.
Richard Askey, University of Wisconsin, Madison

AMS-MAA Invited Address

10:40 AM - 11:30 AM

(132) The many lives of binomial coefficients.
Gian-Carlo Rota, Massachusetts Institute of Technology

MMA Business Meeting

11:40 AM - 12:10 PM

MAA Minicourse #3: Part B

1:00 PM - 2:50 PM

Technology, modeling, cooperative learning: Putting it all together.
Organizers: James T. Sandefur, Georgetown University
Rosalie Dance, Georgetown University

MAA Minicourse #4: Part B

1:00 PM - 2:50 PM

How to test mathematics taught using graphing calculators.
Organizers: Jan J. Vandever, South Dakota State University
Katherine P. Layton, Beverly Hills High School

Innovations in Teaching Introductory Logic and Proof, I

1:00 PM - 2:50 PM

Organizers: Douglas E. Ensley, Shippensburg University
Heather A. Hulett, Miami University

1:00 PM
Essentials of mathematical reasoning.
Aparna W. Higgins, University of Dayton

1:30 PM
A framework for teaching logic and proof.
Susanna S. Epp, DePaul University

2:00 PM
What if they gave a theorem, and no proof came?
Steven George Krantz, Washington University and Mathematical Sciences Research Institute

2:30 PM
Introducing proof techniques using the logical game Mine Hunter.
Allan Alexander Struthers, Michigan Technological University

AMS-MAA Graduate Student Session on Combinatorics, III

1:00 PM - 2:55 PM

Organizer: Andrew J. Radcliffe, University of Nebraska
AMS-MAA Graduate Student Session on Commutative Algebra, III
1:00 PM - 2:55 PM
Organizer: Roger A. Wiegand, University of Nebraska
1:00PM Lifting chains of primes. (137) Steve McAdam, University of Texas
1:30PM Some generalizations of GCD-domains. (138) Roy Quintero, University of Iowa
1:50PM Interplay between complexity and the vanishing of Tor's. (139) Claudia Miller, University of Illinois
2:10PM Multiplicative structures on short resolutions. (140) Srikant Iyengar, Purdue University
2:45PM Euler characteristic and finite injective dimension. (141) Kewen Rao, Northwestern University

AMS-MAA Graduate Student Session on Group Representation Theory, III
1:00 PM - 2:55 PM
Organizers: Benjamin J. Ford, University of Washington
George McNinch, University of Oregon
1:00PM Some aspects of the Kazhdan-Lusztig representations of the symmetric group. Preliminary report. (142) Francis Fung, Princeton University
1:25PM Representation theory of quivers. Preliminary report. (143) Pete Goetz, University of Washington
1:50PM On the cohomology of finite Chevalley groups. Preliminary report. (144) Corneliu G. Hoffman, University of Southern California
2:15PM The noncommutative geometry of enveloping algebras. Preliminary report. (145) Walt Pohl, University of Washington
2:40PM Discussion

AMS-MAA Graduate Student Session on Optimization, III
1:00 PM - 1:35 PM
Organizer: Paul Y. Tseng, University of Washington
1:00PM On optimization problems in signal processing in magnetic recording and digital communications. (146) Andrei E. Vityaev, University of California, San Diego and University of Washington
1:20PM Automatic differentiation and the reverse mode algorithm. (147) Michael Monagan, Simon Fraser University

MAA Session on Innovative Teaching in First-Year College Mathematics, V
1:00 PM - 2:35 PM
Organizers: Howard L. Penn, U. S. Naval Academy
Aaron I. Stucker, Washburn University of Topeka
1:00PM Using the calculator based laboratory in the undergraduate classroom. Preliminary report. (148) Joanne C. Caniglia, Eastern Michigan University
1:20PM Implementing the standards in college algebra. (149) Dennis C. Ebersole, Northhampon Community College
1:40PM A mastery learning format for pre-college mathematics courses at a 4-year college. Preliminary report. (150) D. James Tooke, Eastern Oregon State College
2:00PM An interdisciplinary approach to algebra classes involving technology, writing, and collaborative learning. (151) Scott A. Smith, Columbia College
2:20PM Projects in first year mathematics: The Georgia State College experience. (152) Paul Houston, Schuette, Georgia College

MAA Student Workshop
1:00 PM - 2:50 PM
Matrices—Windows to information and behavior. Presenter: David R. Hill, Temple University

AMS-MAA Panel Discussion
1:00 PM - 1:50 PM
Providing mathematics over the Internet: What's been done? What's to do? Organizers: Gerhard Hans Klotz
Patrick D. F. Ion, Mathematical Reviews

AMS-MAA Session on Mathematics as Performance Art, Part 2C
1:00 PM - 1:50 PM
Discovering the performer in you: An improv teaching workshop. Presenters: Colin C. Adams, Williams College
Edward B. Burger, Williams College

AMS-MAA Session on Mathematics as Performance Art, Part 2D
2:00 PM - 2:50 PM
Discovering the performer in you: An improv teaching workshop. Presenters: Colin C. Adams, Williams College
Edward B. Burger, Williams College

AMS-MAA Poster Session
2:00 PM - 2:50 PM
Providing mathematics over the Internet: What's been done? What's to do? Organizers: Gerhard Hans Klotz
Patrick D. F. Ion, Mathematical Reviews

AWM Invited Lecture
3:05 PM - 3:50 PM
Calculus mod p. (153) Karen E. Smith, Massachusetts Institute of Technology

MAA Student Lecture
4:00 PM - 4:50 PM
The mathematics of card shuffling. (154) Kenneth A. Ross, University of Oregon

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NOTICES OF THE AMS VOLUME 43, NUMBER 8
MAA Minicourse #5: Part B
4:00 PM - 5:50 PM
Dynamic geometry lab with Sketchpad.
Organizer: James R. King, University of Washington

MAA Minicourse #6: Part B
4:00 PM - 5:50 PM
Projects for precalculus.
Organizers: Janet Lynn Andersen, Hope College
            Todd M. Swanson

AMS-MAA Research Session on Commutative Algebra, III
4:00 PM - 6:00 PM
Organizers: Sylvia Margaret Wiegand, University of Nebraska
            William J. Heinzer, Purdue University
4:00 PM The plus closure in mixed characteristic.
     (155) Ray C. Heitmann, University of Texas at Austin
4:25 PM Ideals of reduction number 1 in a two-dimensional regular local ring.
     (156) David Lantz*, Colgate University, and William Heinzer, Purdue University
4:50 PM Seminormalization of Rees rings.
     (157) Marie A. Vitulli, University of Oregon
5:15 PM On multiplicities of Gorenstein ideals.
     (158) Hema Srinivasan, University of Missouri, Columbia
5:40 PM Direct summands and $p^n$-TH root extensions.
     (159) Daniel Katz, University of Kansas

AMS-MAA Session on What's the Focus at DIMACS for 1996-97?
4:00 PM - 5:50 PM
Organizer: Fred Stephen Roberts, Rutgers University
4:00 PM Dr. Roberts Overview of Session
4:05 PM On a combinatorial generalization of some models in statistical mechanics.
     (160) Peter W. Winkler, AT&T Bell Laboratories
4:40 PM Decentralized trust management.
     (161) Joan Feigenbaum, AT&T Research
5:15 PM Error-resilient molecular computation.
     (162) Richard Karp
5:45 PM Discussion

Innovations in Teaching Introductory Logic and Proof, II
4:00 PM - 5:50 PM
Organizers: Douglas E. Ensley, Shippensburg University
            Heather A. Hulett, Miami University
4:00 PM On teaching logic and proof.
     (163) Ed Dubinsky, Purdue University
4:30 PM Non-traditional texts for a first course in proofs.
     (164) Elena A. Marchisotto, California State University, Northridge
5:00 PM Activities in logic and their use in discrete math.
     (165) Jose H. Giraldo, Texas A&M University, Corpus Christi
5:30 PM Counterexamples in teaching proof techniques.
     (166) Douglas E. Ensley, Shippensburg University

6:00 PM What I learned at Potsdam: How to go fast slowly.
     (167) Cheri L. Boyd, Nazareth College

MAA Session on Innovative Teaching in First-Year College Mathematics, VI
4:00 PM - 4:55 PM
Organizers: Howard L. Penn, U. S. Naval Academy
            Aaron I. Stucker, Washburn University of Topeka
4:00 PM Intuitive geometry: A first-year liberal arts mathematics course. Preliminary report.
     (168) Mohammad Salmasi, Framingham State College
4:20 PM Mathematical exploration: Match or no match game.
     (169) Jacqueline E. Barab, California State University, Dominguez Hills
4:40 PM A cooperative learning based pre-calculus course.
     (170) Barney Krinsky, California State University, Dominguez Hills

MAA Session on Mathematicians in the K-8 Classroom, II
4:00 PM - 5:50 PM
Organizers: Una M. Bray, Skidmore College
            R. Daniel Hurwitz, Skidmore College
4:00 PM Connecting with the K-8 classroom: A year-round professional development model.
     (171) Daisy McCoy, Lyndon State College
4:20 PM Professional development in statistics for K-6 teachers and data analysis projects in the classroom.
     (172) Dargan Frierson, Jr., University of North Carolina at Wilmington
4:40 PM Four courses for middle school mathematics teachers.
     (173) Bob Stutts, Columbia College
5:00 PM Teaching and learning: Mathematics. Working with K-8 teachers and students.
     (174) Richard Bisk, Fitchburg State College
5:20 PM An exploration, conjecture, and “proof” course in arithmetic for elementary teachers.
     (175) Donald Hooley, Bluffton College
5:40 PM K-8 mathematics with projects, calculators, and the arithmetic of real numbers.
     (176) Patricia Baggett*, New Mexico State University, and Andrzej Ehrenfeucht, University of Colorado

SUMMA Special Presentation
4:00 PM - 5:30 PM
Intervention projects for minority pre-college students
Organizer: William A. Hawkins
Presenters: Celestino G. Mendez, Metropolitan State College of Denver
            David R. Scott, University of Puget Sound

AMS-MAA Session on Mathematics as Performance Art, Part 2E
4:00 PM - 4:50 PM
Discovering the performer in you: An improv teaching workshop.
Presenters: Colin C. Adams, Williams College
            Edward B. Burger, Williams College
AMS-MAA Panel Discussion and Workshop
4:00 PM - 5:50 PM

Multivariable calculus and industrial applications.
Organizer: Yves Nievergelt, Eastern Washington University

AMS-MAA Session on Mathematics as Performance Art, Part 2F
5:00 PM - 5:50 PM

Discovering the performer in you: An improv teaching workshop.
Presenters: Colin C. Adams, Williams College
Edward B. Burger, Williams College

American Institute of Mathematics-MAA Invited Address
5:05 PM - 6:00 PM

(177) The history of the prime number theorem.
Atle Selberg, Institute for Advanced Study

MAA Reception and Banquet for 25-Year Members
6:00 PM - 9:30 PM

AMS-MAA Session on Computations in Commutative Algebra
7:00 PM - 10:00 PM

Organizer: Donal B. O'Shea, Mount Holyoke College

Wednesday, August 14
AIM-MAA Symposium On the Riemann Hypothesis, II
9:00 AM - 6:45 PM

In celebration of the centenary of the prime number theorem.
Organizers: J. Brian Conrey, Oklahoma State University
Amit Ghosh, Oklahoma State University
Douglas A. Lind, University of Washington
Stephen R. Sorenson, American Institute of Mathematics

Presenters: William D. Duke, Rutgers University
Samuel J. Patterson, University of Gottingen
Henryk Iwaniec, Rutgers University
Alain Connes, Institut des Hautes Etudes Scientifiques
J. Keating, Bristol University
D. Farmer, Bucknell University

Thursday, August 15
AIM-MAA Symposium On the Riemann Hypothesis, III
9:00 AM - 4:00 PM

In celebration of the centenary of the prime number theorem.
Organizers: J. Brian Conrey, Oklahoma State University
Amit Ghosh, Oklahoma State University
Douglas A. Lind, University of Washington
Stephen R. Sorenson, American Institute of Mathematics

Presenters: Peter Sarnak, Princeton University
Nobushige Kurokawa, Tokyo Institute of Technology
Dorian Goldfeld, Columbia University
Roger Heath-Brown, Oxford University
Susan J. Friedlander
AMS Associate Secretary
Chicago, Illinois

Donovan H. Van Osdol
MAA Associate Secretary
Durham, New Hampshire

Tuesday, August 13
Optional Tour: Mount Rainier
8:00 AM - 6:00 PM

AIM-MAA Symposium On the Riemann Hypothesis, I
9:00 AM - 6:30 PM

In celebration of the centenary of the prime number theorem.
Organizers: J. Brian Conrey, Oklahoma State University
Amit Ghosh, Oklahoma State University
Douglas A. Lind, University of Washington
Stephen R. Sorenson, American Institute of Mathematics

Presenters: Andrew M. Odylyzko, AT&T Research
Hugh L. Montgomery, University of Michigan
Michael Berry, University of Bristol
Dennis A. Hejhal, University of Minnesota
James L. Hafner, IBM
K. Soundararajan, Princeton University
Daniel Willis Bump, Stanford University

Susan J. Friedlander
AMS Associate Secretary
Chicago, Illinois

Donovan H. Van Osdol
MAA Associate Secretary
Durham, New Hampshire
AMS Publications in Mathematics Education

Changing the Culture: Mathematics Education in the Research Community
Naomi D. Fisher, University of Illinois at Chicago,
Harvey B. Keynes, University of Minnesota, Minneapolis, and
Philip D. Wagreich, University of Illinois at Chicago, Editors

This volume is an outgrowth of a series of programs organized by the Mathematics Education Reform (MER) Network between 1990 and 1993. The discussions raised many questions and highlighted many insights about the nature of educational reform and how the mathematics research community can contribute to it. The papers in this volume present perspectives on the future of these efforts, varied examples of how individual mathematicians have become involved in educational reform, and case studies of how the community is responding to the need for reform.

This series is published in cooperation with the Mathematical Association of America.

CBMS Issues in Mathematics Education, Number 5; 1995; 214 pp.; Softcover; ISBN 0-8218-0383-2; List $55; All individuals $35; Order code CBMATH5NA

How Computers Have Changed the Way I Teach
John G. Kemeny

One of the developers of the BASIC computer language, Kemeny has, in the last twenty years, explored ways in which computers can be utilized in the mathematics classroom to increase understanding and to stimulate the students' interest. Arguing that computers are essential to teaching mathematics, Kemeny discusses not only how to use computers in the classroom, but also which mathematical topics should be taught in the age of computers.

1966; NTSC format on 1/2-inch VHS videotape; approximately 60 minutes; 0-8218-0819-5; List $51.95; Individual member $51.95; Order code VIDEO01NA

How to Teach Mathematics: a personal perspective
Steven G. Krantz, Mathematical Sciences Research Institute, Berkeley, CA

... an original contribution to the educational literature on teaching mathematics at the post-secondary level. The book is an explicit proof of the author's claim: "Teaching can be rewarding, useful, and fun." —Zentralblatt für Mathematik

Lively and humorous, yet serious and sensible, this book is a practical guide to the teaching of mathematics. Eschewing generalities, Krantz emphasizes specifics—from how to deal with students who beg for extra points on an exam to mastering blackboard technique to how to use applications effectively. In addition, the book also deals with such sensitive subjects as cheating, bribery, and sexual harassment. Those teaching collegiate mathematics for the first time will find Krantz's advice especially helpful, and more experienced instructors will appreciate the book's elucidation of the fine points of excellent teaching.

1993; 76 pp.; Softcover; ISBN 0-8218-0197-X; List $18; All AMS members $12; Order code HT19NA

Pedagogical Peeves and Other Complaints of Age: Crazy AI, Still Teaching Calculus after All These Years
Al Novikoff

Presenting a smorgasbord of specific examples, Novikoff builds his basic point: mathematics makes sense, but textbooks and teachers often don't. His examples not only can help teachers of calculus improve their presentations of particular topics, but also reflect a teaching philosophy that emphasizes responding to students, what they know and what they don't, what makes sense to them and what doesn't. Anyone who teaches mathematics will appreciate this engaging and insightful lecture.

1992; NTSC format on 1/2-inch VHS videotape; approximately 60 minutes; ISBN 0-8218-8671-3; List $49.95; Individual member $29.95; Order code VIDEO75NA

Research in Collegiate Mathematics Education, I
Ed Dubinsky, Purdue University, West Lafayette, IN,
Alan H. Schoenfeld, University of California, Berkeley, and
Jim Kaput, University of Massachusetts at Dartmouth, Editors

The introductory articles, survey papers, and current research that appear in this first issue convey some aspects of the state of the art. The book is aimed at researchers in collegiate mathematics education and teachers of college-level mathematics courses who may find ideas and results that are useful to them in their practice of teaching, as well as the wider community of scholars interested in the intellectual issues raised by the problem of learning mathematics.

This series is published in cooperation with the Mathematical Association of America.

CBMS Issues in Mathematics Education, Number 4; 1994; 229 pp.; Softcover; ISBN 0-8218-9504-1; List $42; All individuals $25; Order code CBMATH4NA

Some Major Research Departments of Mathematics
Saunders Mac Lane

With a blinding wit and an engaging manner, Saunders Mac Lane, elder statesman of the American mathematical community, provides a historical perspective on the development of mathematics research departments in this country in this videotaped presentation. Mac Lane's well-known affinity for verse comes into play as he enlivens the lecture with a number of humorous poems illustrating various themes in his talk.

1989; NTSC format on 1/2-inch VHS videotape; approximately 60 minutes; ISBN 0-8218-8621-7; List $51.95; Individual member $31.95; Order code VIDEO22NA

The Teaching of Calculus: Careful Changes
Gilbert Strang

Well known for his textbooks and his attention to students, Gilbert Strang has some novel ideas about how to teach calculus. In this insightful videotaped lecture, Strang discusses how concepts that commonly confuse students can be used as springboards to better understanding. This videotape is useful to anyone interested in new ways to teach calculus and mathematics in general.

1992; NTSC format on 1/2-inch VHS videotape; approximately 60 minutes; ISBN 0-8218-8658-3; List $49.95; Individual member $29.95; Order code VIDEO72NA

Mathematics Career Resources

Assistantships and Graduate Fellowships in Mathematics, 1996–1997

September 1996; approximately 125 pp.; Softcover; ISBN 0-8218-0189-9; List $20; Individual member $12; Order code ABST09NA

Employment Information in the Mathematical Sciences


Orders should be sent to American Mathematical Society, P.O. Box 6649, Boston, MA 02209-6649. Individual member $162; Add for postage: Surface delivery outside U.S. and India $15; To India $34. Expedited delivery to destinations in North America $32, elsewhere $67.

All prices subject to change. Charges for delivery are $3.00 per order; or for air delivery outside of the continental U.S., please include $6.50 per item. Prepayment required.

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URL: http://www.ams.org/mathscinet/

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Badge Information Affiliation ________________________________
(If you note charge per guest registration below)
Name to appear on badge __________________________
Guest Badge ______________

Registration Fees

Joint Meetings

Member, AMS, ASL, CMS, MAA $140 $182
Nonmember $217 $282
Graduate Student $35 $45
Undergraduate $20 $26
High School Student $2 $5
Unemployed $35 $45
Temporarily Employed $100 $125
Emertius Member of AMS or MAA $35 $45
High School Teacher $35 $45
Librarian $35 $45
One-day Member $109
One-day Nonmember $154
Exhibitor $0
Guest $5 $5

AMS Short Course on Algebraic Geometry

Member, Nonmember $75 $90
Student, Unemployed, Emeritus $35 $45

AMS Short Course on Mathematical Finance

Member, Nonmember $75 $90
Student, Unemployed, Emeritus $35 $45

Employment Register

(Registration for the Joint Meetings is required for participation. Applicant résumé forms and employer job listing forms will be on e-MATH in September and in the October issue.)

Employer—First Table $160 $220
Employer—Second Table $80 $110
Employer—Posting Only $50 $50
Applicant $40 $75

Student Activities

Mathchats (no charge)
MAA Student Workshop (no charge)

MAA Minicourses: See separate form in October issue.

Event Tickets

Event # Tix Price Per Total
AMS Banquet Regular $27
Vegetarian $27
Kosher $27
MER Banquet Regular $46
Vegetarian $46
Kosher $46
NAM Banquet Regular $27
Vegetarian $27
Kosher $27

TOTAL for Event Tickets $ __________

Statistical Information:

□ I am a mathematics department chair.

Total Payment

Category Total
Registration fee(s) ____________________________
Employment Register ____________________________
Event tickets ____________________________
Hotel deposit (only if paying by check) ____________________________

TOTAL Amount Due $ __________

Method of Payment

□ Check. Make checks payable to the AMS. Canadian checks must be marked "U.S. Funds".
□ Credit Card. VISA, MasterCard, AMEX, Discover accepted.
Card Number: ____________________________ Expiration Date: ____________________________
Card Type: ____________________________
Signature: ____________________________
Name on card: ____________________________

Zipcode of your credit card billing address: ____________________________
(Please note that a $5 processing fee will be applied for each returned check or invalid credit card.)

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Mathematics Meetings Service Bureau (MMSB)
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Providence, Rhode Island 02940
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Advance Registration

Room lottery Reservations, listing of résumés/job descriptions in Winter Lists

Reservation changes/cancellations through MMSB
Advance registration, Employment Register, Short Courses, banquets
50% Refund on banquets
50% Refund on advance registration *no refunds after this date

Deadlines

October 31, 1996
November 15, 1996
December 9, 1996
December 20, 1996
December 20, 1996
January 3, 1996*
# Hotel Reservations

Below is the abridged list of hotels at which reservations can be made through the Mathematics Meetings Service Bureau (MMSB) this fall. A more detailed list of rates for these hotels and a list of lower priced hotels that can be called directly will be published in the October issues of Notices and Focus and on the WWW. Reservations at the following hotels must be made through the MMSB to receive the convention rates listed. All rates are subject to a 10.5% sales occupancy tax. **Guarantee requirements:** First night deposit by check (see reverse of form), or a credit card guarantee.

- Yes, I want to reserve a room now based on the information given. I understand it may not be processed until late September 1996.
- Deposit enclosed

**Name of Other Room Occupant**

**Arrival Date**

**Departure Date**

**Order of choice**

**Hotel**

<table>
<thead>
<tr>
<th>Order of choice</th>
<th>Hotel</th>
<th>Single</th>
<th>Double 1 bed</th>
<th>Double 2 beds</th>
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<td>Marriott Hotel &amp; Marina (Headquarters)</td>
<td>Cityview</td>
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<td>Bayview</td>
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<td>Comfort Inn</td>
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**Date and Time of Arrival**

**Date and Time of Departure**

**Name of Other Room Occupant**

**Arrival Date**

**Departure Date**

**Special Housing Requests:**

Priority consideration will be given to all participants with special needs and they will be assigned to properties that are in compliance with the ADA.

If you are not making a reservation, please check off one of the following:

- I plan to make a reservation at a later date.
- I will be making my own reservations at a hotel not listed.
- I live in the area or will be staying privately with family or friends.
- I plan to share a room with who is making reservations.

**Card Number**

**Exp. Date**

**Signature**

**Deposit enclosed**

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**American Mathematical Society**

**ALGEBRA AND ALGEBRAIC GEOMETRY**

Cogroups and Co-rings in Categories of Associative Rings

George M. Bergman, University of California, Berkeley, and Adam O. Hausknecht, University of Massachusetts at Amherst

This book studies representable functors among well-known varieties of algebras. All such functors from associative rings over a fixed ring R to each of the categories of abelian groups, associative rings, Lie rings, and to several others are determined. The book includes a “Symbol index”, which serves as a glossary of symbols used and a list of the pages on the topics so symbolized are treated, and a “Word and phrase index”. The authors have strived—and succeeded—in creating a volume that is very user-friendly.

**Enveloping Algebras**

Jacques Dixmier, Paris, France

For the graduate student, this is a masterpiece of pedagogical writing, being succinct, wonderfully self-contained and of exceptional precision.

---Mathematical Reviews

The above citation is taken from the review of the first English edition of Dixmier's book. The book, which is the first systematic exposition of the algebraic approach to representations of Lie groups via representations of (or modules over) the corresponding universal enveloping algebras, turned out to be so well written that even today it remains one of the main textbooks and reference books on the subject. In 1992, Jacques Dixmier was awarded the Leroy P. Steele Prize for expository writing in mathematics. The Committee's citation mentioned "Enveloping Algebras" as one of Dixmier's "extraordinary books". For the 1996 printing the author updated the status of open problems and added some relevant references.

**Tight Closure and Its Applications**

Craig Huneke, Purdue University, West Lafayette, IN

This monograph deals with the theory of tight closure and its applications. The contents are based on ten talks given at a CBMS conference held at North Dakota State University in June 1995.

**REQUEST for PROPOSALS**

The MAA Committee on Minicourses is soliciting proposals for new minicourses to be given at the 1997 Summer MathFest and 1998 Joint Mathematics Meetings in Baltimore, Maryland. Most minicourses are related to the undergraduate curriculum, although a topic of interest to the MAA membership will be considered. To receive more information on how to submit a proposal, to discuss your idea for a proposal, or to suggest a topic for a course you would like to take, contact James Sandefur, Department of Mathematics, Georgetown University, Washington, DC 20057, (202) 687-6145, sandefur@guvm.georgetown.edu.

The deadline for submission is December 1, 1996.
Meetings and Conferences of the AMS

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The Meetings and Conferences section of the Notices gives information on all AMS meetings and conferences approved by press time for this issue. Please refer to the page numbers cited in the table of contents on this page for more detailed information on each event. Invited Speakers and Special Sessions are listed as soon as they are approved by the cognizant program committee; the codes listed are needed for electronic abstract submission. For some meetings the list may be incomplete. Up-to-date meeting and conference information is available on the World Wide Web via the Internet at URL http://www.ams.org/.

### Meetings:

**1996**
- **August 10-12**: Seattle, Washington p. 920
  - MathFest
- **October 5-6**: Lawrenceville, New Jersey p. 923
- **October 11-12**: Chattanooga, Tennessee p. 924
- **November 1-3**: Columbia, Missouri p. 926
  (See important information on accommodations included in the May issue)
- **November 16-17**: Pasadena, California p. 926

**1997**
- **January 8-11**: San Diego, California p. 927
  - Annual Meeting
- **March 21-22**: Memphis, Tennessee p. 931
- **April 12-13**: College Park, Maryland p. 931
- **April 19-20**: Corvallis, Oregon p. 931
- **May 2-4**: Detroit, Michigan p. 932
- **September 26-28**: Montreal, Canada p. 932
- **October 10-12**: Atlanta, Georgia p. 932
- **October 24-26**: Milwaukee, Wisconsin p. 932
- **December 4-7**: Oaxaca, Mexico p. 933

**1998**
- **January 7-10**: Baltimore, Maryland p. 933
  - Annual Meeting

### Important Information Regarding AMS Meetings

Potential organizers and speakers should refer to the January issue of the Notices for guidelines on participation.

Should your university be interested in hosting an AMS meeting, see the January issue for details.

### Abstracts

Several options are available for speakers submitting abstracts, including an easy-to-use interactive Web form. No knowledge of TeX is necessary to submit an electronic form, although those who use plain TeX, AMS-TeX, LaTeX, or AMS-LaTeX may submit abstracts with TeX coding. To see descriptions of the forms available, visit http://www.ams.org/abstracts/instructions.html or send mail to abs-submit@ams.org, typing help as the subject line, and descriptions and instructions on how to get the template of your choice will be e-mailed to you.

Completed abstracts should be sent to abs-submit@ams.org, typing submission as the subject line. Questions about abstracts may be sent to abs-info@ams.org.

Paper abstract forms may be sent to Abstracts Coordinator, AMS, P.O. Box 6887, Providence, RI 02940. Note that all abstract deadlines are strictly enforced. Close attention should be paid to specified deadlines in this issue. Unfortunately, late abstracts cannot be accommodated.

### Conferences:

**1996**

**1997**
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This book, the first volume in the new series Algorithms and Computation in Mathematics, will quickly become the standard reference for symbolic integration. The author is a leading expert in the area and this is the first comprehensive, in-depth presentation of the topic, including many of the latest results. Numerous algorithms are given in pseudocode and can be readily implemented. The book addresses mathematicians and computer scientists who are interested in symbolic computation, developers and programmers of computer algebra systems, and users of symbolic integration methods.

GUNTER Ewald, University of Bremen, Germany  
COMBINATORIAL CONVEXITY AND ALGEBRAIC GEOMETRY  
This text provides an introduction to the theory of convex polytopes and polyhedral sets, to algebraic geometry and to the fascinating connections between these fields: the theory of toric varieties (or torus embeddings). The first part of the book contains an introduction to the theory of polytopes—one of the most important parts of classical geometry in n-dimensional Euclidean space. Since the discussion here is independent of any applications to algebraic geometry, it would also be suitable for a course in geometry. This part also provides large parts of the mathematical background of linear optimization and of the geometrical aspects in computer science. The second part introduces toric varieties in an elementary way, building on the concepts of combinatorial geometry introduced in the first part. Many of the general concepts of algebraic geometry arise in this treatment and can be dealt with concretely. This part of the book can thus serve as a one-semester introduction to algebraic geometry, with the first part serving as a reference for combinatorial geometry. The treatment assumes a standard knowledge of linear algebra and calculus; almost all proofs are complete with this basis, though the last chapter, which surveys recent results, uses additional prerequisites from appropriate texts. Each section contains exercises, numerous research problems and historical notes.

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1996/APP, 256 PP., HARDCOVER/$49.00 ISBN 3-540-60530-4  
ALGORITHMS AND COMPUTATION IN MATHEMATICS, VOLUME I  
G. ENGELN-MÜLLGES, Aachen, Germany and F. UHLIG, Auburn, AL

Numerical algorithms are computational tools used to perform complex mathematical operations with the use of a computer. Available for C and Fortran, the book/CD-ROM packages contain over 500 computer-ready algorithms for many standard methods of numerical mathematics—many of which are not available elsewhere. Each book describes the principles of the various methods and offers support in choosing the appropriate method for a given task. Some of the topics include: new methods for solving nonlinear equations, methods for solving systems of linear equations for many special matrix structures, the Shepard method for multidimensional interpolation, the Laquerre method for solving algebraic equations, and the McKee algorithm for solving special systems of symmetric equations.

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RICHARD A. HOLMGEN, Allegheny College, Meadville, PA

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1996/APP, 248 PP., 50 ILLUS./HARDCOVER/$29.95 ISBN 3-540-54225-4  
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EDDUBINSKY, Purdue University, West Lafayette, IN and WILLIAM E. FENTON, Bellarmine College, Louisville, KY

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