

FOCUS

Volume 8, Number 2

THE NEWSLETTER OF THE MATHEMATICAL ASSOCIATION OF AMERICA

March-April 1988

AMS Celebrates 100th Anniversary

This year the American Mathematical Society (AMS) will celebrate its 100th anniversary with the help of the Mathematical Association of America. The last 100 years have witnessed an unprecedented growth in mathematical research and will surely be known as one of the golden ages of mathematical history. Throughout the past century, the AMS has pursued, through many diverse activities, its aim of furthering mathematical scholarship and research.

You are invited to participate in the Centennial of the AMS. And you are encouraged to read the article "The Centennial of the AMS: 1888–1988" in the January issue of the NOTICES of the AMS, which explains what the celebration is all about. The article begins with a historical perspective on the Society's activities and accomplishments, including the history of its journals. In addition, the AMS has instituted a new quarterly journal, the JOURNAL OF THE AMERICAN MATHEMATICAL SOCIETY, which will contain research articles of the highest quality in all areas of pure and applied mathematics. The first issue will appear in January 1988, to celebrate the Centennial year.

The NOTICES article cited above includes a history of the Society's various prizes and awards. Also, in commemoration of the AMS Centennial, the National Academy of Sciences has established a major new prize in mathematics. Entitled the NAS Award in Mathematics, the prize will be given every four years for excellence of published research in the mathematical sciences within the past ten years. The prize is made possible by generous gifts from two longtime Society members and will be sponsored by the AMS. The first award will be made to Robert Langlands on April 25, 1988 at the National Academy's Annual Meeting.

The AMS Centennial Celebration will be held August 8–12, 1988, in Providence, Rhode Island, the home of the Society's headquarters. For the details see the program in this issue of FOCUS. This meeting will be

(continued on page 6) Also see Center Section



Leonard Gillman leads 2,000 mathematicians in singing birthday greetings to the AMS at the meeting banquet in Atlanta, January 1988.

Furor over Fermat

About 1637 Fermat wrote a marginal note in an edition of Diophantus to the effect that $a^n + b^n = c^n$ has no positive integer solutions if the exponent is greater than 2. This set mathematicians on a 350-year treasure hunt leading to riches that would overflow the entire book in which Fermat wrote by many, many times—let alone the margin that he said was too small to contain the marvelous proof that he had discovered. And still today no proof of this elusive "Last Theorem" is before us despite a flurry of recent reports in the press.

The conjecture itself is deceptively simple; the suggestion that Fermat had a simple proof is tantalizing. Partly for these reasons and partly for the depth of the mathematics developed to attack this problem, Fermat's Last Theorem has commanded public interest as well as the efforts of many mathematicians over the years.

The simplicity of this conjecture's statement belies its depth. The methods that seem most likely to lead to a proof are so abstruse that most mathematicians, even those close to the specialties involved, consider it reasonable to spend weeks or months in working through a proof—if a valid proof were at hand.

The article by Barry Cipra in this issue of FOCUS outlines one attack on the Fermat conjecture based on elliptic curves and modular functions. This approach has its origins in work of G. Frey in Diophantine geometry, as does the approach so recently reported in the news media.

We give the barest sketch of that alternative approach. It takes off from observations in a paper of A.N. Parshin's now circulating as a preprint. In this, Parshin observes that proving the arithmetic-surface analog of the 1977 Miyaoka-Yau inequality for Chern classes of vector bundles would yield a proof of the Fermat conjecture for all "sufficiently large" exponents n . Now the Fermat conjecture is already known to hold if n is less than 150,000. With luck "sufficiently large" would turn out to be easily less than 150,000, and this would prove Fermat's conjecture.

The frontier is ahead of the open literature. However, A.N. Parshin's work has circulated as a preprint and was the subject of Lucien Szpiro's seminar in Paris, proceedings of which will be available as early as this fall through Asterisque. Parshin's arguments have also been given in a 60 page appendix to the Russian translation of Serge

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Center Section: Summer Meetings
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Lang's DIOPHANTINE GEOMETRY—this appendix written by Yu. G. Zarhin and A.N. Parshin.

As with the approach Barry Cipra writes about in this issue of **FOCUS**, proof of Fermat's conjecture would be only the best-known but far from the most significant consequence of establishing an arithmetic-surface analog of the Miyaoka-Yau inequality. Probably the most dramatic consequence of this work would be establishing effective bounds for the Mordell conjecture, itself only recently proven by G. Faltings.

A recent announcement that Yoichi Miyaoka, working at the Max Plank Institute in Bonn, had succeeded in carrying his work from geometric surfaces to arithmetic ones stirred intense interest. However, the delicacy and intricacy of these arguments preclude any quick judgement of this work. Nonetheless, the fascination of the topic drives both the popular and scientific press to attempt to give readers a sense of these developments. Later articles will give us a clearer and more detailed view of what this approach can achieve.

Fermat's Last Corollary?

Barry A. Cipra

Three hundred years ago, the amateur mathematician Pierre Fermat remarked that the margin of his book was too narrow for a certain proof. Mathematicians have still not widened that margin all the way, but a new result by Gerhard Frey and Ken Ribet has taken Fermat's remark and put it into a whole new book, whose margins are very wide indeed.

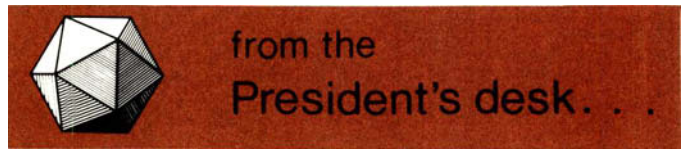
Fermat's remark pertains of course to the conjecture known (prematurely) as Fermat's Last Theorem, which says that the equation $x^n + y^n = z^n$ has no positive integer solutions if the exponent n is greater than 2. Fermat's Last Theorem has attracted generations of mathematicians and cranks. So far it has stymied the mathematicians.

The new result of Frey and Ribet is a proof that Fermat's Last Theorem follows as a corollary (but what a corollary!) to another, more recent conjecture usually known as the *Weil-Taniyama conjecture*. The Weil-Taniyama conjecture relates the theory of elliptic curves to the theory of modular forms. It would seem far removed from the realm of Fermat's Last Theorem. That may be what will make the approach succeed.

An elliptic curve, in its most elementary arithmetic form, is the solution set of a cubic equation in two variables with rational coefficients. By various transformations, any such equation can be coaxed into the form $y^2 = x^3 + Ax^2 + Bx + C$, where A , B , and C are integers. It is also important to the theory that the polynomial $x^3 + Ax^2 + Bx + C$ have distinct roots α , β , τ ; then the *discriminant*, $\Delta = (\alpha - \beta)^2(\beta - \tau)^2(\tau - \alpha)^2$, is a non-zero integer.

The fundamental arithmetic problem for elliptic curves is to find their *rational points*—solutions (x, y) with both x and y rational. One of the most powerful techniques for studying this problem is to "reduce" an elliptic curve modulo p , where p is a prime number, and look for solutions in the finite field $\mathbf{Z}/p\mathbf{Z}$ the number of solutions mod p gives a clue—albeit a distant one—as to the overall abundance of rational points on the curve.

(continued on page 6)



Leonard Gillman The University of Texas, Austin

The College Teaching Scandal

In an article in last September's **FOCUS**, I deplored the scandalous situation in calculus—students are unprepared (thanks largely to hours of television that have trained them not to concentrate); textbooks are too fat; the existence of computers is under-recognized; standards are too low; grades are inflated; topics not easily adapted to quizzes are omitted, as are searching questions that require thoughtful responses and equally thoughtful, time-consuming grading; classes are too large, inhibiting students' questions and ruling out the meaningful give and take between teacher and student that make teaching and learning enjoyable and worthwhile, as well as ruling out a host of delicate intangibles, such as the little ways the instructor has of responding to a question, which can make a lasting impression on students and shape their attitudes. (All this proved remarkably difficult for a number of people. According to one speaker at the October conference, my article asserted that things are all right with calculus: "Why fix what isn't broke?")

In addition to implicitly recommending a nationwide conversion to small classes, I proposed explicitly that computers handle the drill and that we enforce the prerequisites. (To **THE CHRONICLE OF HIGHER EDUCATION**, this meant that I consider radical changes in calculus instruction to be unnecessary.) There are additional problems, such as the attitude of many university professors toward their classes. Several have admitted to me that they never look at the text. "The course outline says now do the Mean-Value Theorem. I know how to do the Mean-Value Theorem." (Maybe we should be thankful for small blessings: at least they look at the course outline.) One need hardly point out that our shaky students need every assurance they can get, not the professor's pet proof or personal notation. In the current movement for reform, I sense an overemphasis on curriculum. It is a seductive rallying cry. Everyone is an expert on curriculum; writing course outlines is fun (I've done it); the activity makes good press copy; and foundation support rolls in. (And then there was the new math.)

THE LARGE CLASSES Mathematics enrollments leaped during the 1950s (following the return of the Korean War veterans) and it was not long before university administrators made explicit decisions to let calculus classes grow. Once classes reached 100, they argued that they might as well be 200, what's the difference? (In fact, there is a significant difference, because of new mass phenomena. A slight distraction that elicits only a giggle from a class of 100 may truly disrupt a class of 200.) Today these same administrators or their clones, faced with unsatisfactory results of their own folly, accuse us of doing a poor job of teaching.

They are greedy too. I know of a private university, apparently typical, where French is taught in classes of 12—but calculus in sections of 150: the professor lectures four times per week, there are no recitation sections, and homework is not graded nor even looked at. At this school, which relies heavily on tuition, the portion ascribable to mathematics courses adds up to \$3.5 million, while the department budget (including 35% for overhead) comes to only \$2 million; in most other departments, tuition income falls short of the budget. Thus the mathematics department is compelled to mess up its calculus teaching in order to fatten the budgets of other university departments. According to remarks at the national meetings of department heads, this situation is not uncommon.

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A. B. Willcox of the MAA presides at the Atlanta banquet. Left to right: Ivar Stakgold, Phillip A. Griffiths, Reba and Leonard Gillman, A. B. Willcox, George D. Mostow, Shirley A. Hill



Business Meeting in Atlanta

by Kenneth A. Ross, Secretary

The 1988 Award for Distinguished Service to Mathematics was made to Murray S. Klamkin of the University of Alberta. The 1988 Chauvenet Prize went to Stephen Smale of the University of California at Berkeley.

Eileen Poiani presented the following resolution which passed unanimously: The Mathematical Association of America urges the Citizens' Stamp Advisory Committee to approve the issuance of a United States postage stamp to honor the field of mathematics.

Alice T. Schafer made the following motion on behalf of the Joint AMS-ASA-IMS-MAA-NCTM-SIAM Committee on Women in the Mathematical Sciences: Be it resolved that the Planning Committee of the 75th Anniversary of the MAA make special efforts to assure that women and minorities are represented as major speakers in the areas of mathematical research, mathematical history, and mathematical education. The motion passed unanimously.

The Secretary reported that the voting on some bylaw changes, originally scheduled for this meeting, has been deferred until the next Business Meeting in Providence, Rhode Island on August 9, 1988.

Results of the membership-wide election held last year were announced. At the meeting of the Board of Governors on January 5, 1988, three people were elected to the Board. Marjorie L. Stein of the U.S. Postal Service and John A. Dossey at Illinois State University were elected as Governors-at-Large. In addition, John W. Kenelly of Clemson University was elected to the Finance Committee. He replaces our new President-Elect, Lida K. Barrett.

The most interesting business of the Board of Governors concerned the location of our headquarters. The increasing costs of maintaining an older building in the high rent district of Washington, D.C. has led the Executive and Finance Committees to consider moving outside D.C., perhaps to a brand new building in Alexandria, Virginia. These committees found very good reasons for staying (excellent location in a charming building) and very good reasons for moving (new, nearly maintenance-free building with lower annual costs). They concluded that they couldn't settle this important decision without knowing more about what is involved in staying Washington. Two hours of the Board meeting were devoted to explaining the building situation. At the end a straw vote of the Board showed that its members agreed with the Executive and Finance Committees: they didn't know what to do either. The officers of the Association will study the situation further until they can make a definitive recommendation to the Board. The current choices are: stay in Washington and renovate the building, or move to Alexandria.

Members of the Association were encouraged to attend the summer meeting in Providence and help the American Mathematical Society celebrate its centennial. See the center section in this issue.

Are your dues overdue? Members who have not yet paid their 1988 dues are now being removed from our mailing lists. Send your payment in now to avoid interruptions. Call 1 800 33 11 MAA if you have any questions.

FAMU Math Club Visits Atlanta

The Florida A & M University Mathematics Club attended the mathematics meetings in Atlanta, January 6–10. Seven members accompanied by their advisor, Dr. Don Hill, joined more than 3200 mathematicians for the joint annual meetings of the American Mathematical Society (AMS), the Mathematical Association of America (MAA), the National Association of Mathematicians (NAM), and the Association for Women in Mathematics (AWM).

The students heard scholarly presentations about mathematics, as well as panel discussions on the status of the profession. They were introduced to the general membership at the MAA and NAM business meetings. They were warmly welcomed at the AWM reception. They attended the NAM banquet in honor of the first two Black women to receive Ph.D.'s in research mathematics. (Both in 1949: Marjorie Lee Browne from the University of Michigan and Evelyn Boyd Granville from Yale.) On Sunday they attended the Ebenezer Baptist Church worship services at the Martin Luther King, Jr. National Historical Site.

According to Professor Hill, the benefits of attending the annual meetings were immense for both the club and the individual members. The students heard good mathematics described by leaders in the field. They also learned that there was more to being a mathematician than just a knowledge of the mathematics in a book as they listened to presentations such as "Forces for Change in Mathematics Education," "Celebrating Mathematics," "Mathematics, Minorities, and the MAA—How Do They Fit Together?" and "Applications and Implications of Computer Algebra Systems in Mathematics Instruction." The students were bonded together by the fundraising activities for the trip as well as by being together as a group at the meetings. Finally, they learned that the MAA and the other groups are composed of many warm-hearted members who were interested in them and welcomed them into the mathematical community.

For further information about taking undergraduate groups to the annual meetings, contact Dr. Hill at Florida A & M University in Tallahassee, Florida 32307; phone (904) 599-3595.



MAA President Leonard Gillman (left) greets the Florida A & M University Math Club and their adviser, Dr. Don Hill. Left to right are members Veronica Major, Gina Verela, Janice Hughes, Lorie Roach, Chandra Fleming, Renell Blackwell, and Vicki Feacher. The club attended the New Orleans meeting two years ago and is now making plans to attend the Louisville meeting in 1990.

MAA Seeks New Secretary

Professor Leonard Gillman, President of the Mathematical Association of America, has appointed a Nominating Committee whose task is to nominate an MAA Secretary to succeed the present Secretary, Kenneth A. Ross, effective January 1990. The committee consists of James W. Daniel (chair), Joseph D.E. Konhauser, Doris Schattschneider, Lynn A. Steen, Marcia P. Sward, and Alan C. Tucker. Persons interested in being considered for this nomination and persons wishing to recommend other candidates are urged to notify the Committee. The Committee wishes to identify candidates as soon as possible, although applications will be accepted through June 5, 1988.

The MAA has created a new position of Associate Secretary, effective January 1990, which will essentially halve the responsibilities of the Secretary. The Committee is nominating Kenneth A. Ross for this new position. This will provide continuity and simplify the new Secretary's task of learning the job.

As one of only two officers with indefinitely renewal appointments, the Secretary provides essential stability and leadership in all activities of the Association. In particular, the Secretary is one of the four officers serving on both the Executive and Finance Committees, the two most influential Association committees. In addition, the Secretary: has custody of Association records; manages the election of officers and others; serves on, prepares agendas for, and keeps the minutes of the Board of Governors, the Executive Committee, and the Finance Committee; and assists the President in making committee appointments, creating committees, and disestablishing committees. The new Associate Secretary will have overall responsibility for arranging national meetings of the Association, relieving the Secretary of this burden starting in 1990.

The MAA pays a summer salary (two-ninths the nine-month salary) for the Secretary and provides a half-time secretary; it is not expected that the new Secretary will require released time from teaching. Comparable arrangements would be made for candidates in an industrial or other setting.

The Nominating Committee needs help in identifying suitable people who might fill this important MAA position. Send names of such people or encourage them to inquire or apply soon to:

Professor James W. Daniel
Mathematics Department
University of Texas at Austin
Austin, TX 78712

(tel: 512/471-7168 office. ARPANET electronic mail:
daniel @ emx.cc.utexas.edu.arpa)

Student MAA Chapters to Begin in January, 1989

The MAA Board of Governors has approved a plan to develop Student Chapters of the MAA for the purpose of attracting students to careers in the mathematical sciences and encouraging membership in the MAA. MAA Student Chapters will be formed at individual universities, and the members of the Student Chapters will be regarded as members of the MAA Section associated with their university. It is anticipated that there will be activities for Student Chapter members both at the university and the section level. "Interest" is the primary qualification for membership. Academic record or other criteria that would tend to make a chapter an "honorary" group will not be considered. Ten students and a faculty advisor will be required to form an MAA Student Chapter. It is expected that many universities will simply affiliate an existing Math Club with the MAA to form a Student Chapter. Other universities will have to develop a Student Chapter as a new organization.

Student members will receive FOCUS and must select at least one other journal: MATHEMATICS MAGAZINE, The COLLEGE MATHEMATICS JOURNAL, or the AMERICAN MATHEMATICAL MONTHLY. The dues will be \$10 per year plus charges for journal subscriptions: \$5 per year for THE COLLEGE MATHEMATICS JOURNAL or MATHEMATICS MAGAZINE, and \$10 for the AMERICAN MATHEMATICAL MONTHLY.

The MAA expects to support numerous activities for Student Chapters. Some possibilities are: films, speakers, minicourses, career information, financial help for special activities, and discounts on MAA books. Brochures and application materials are now being developed by the MAA Committee on Student Chapters. It is anticipated that a letter announcing MAA Student Chapters will be mailed in April to MAA departmental representatives, MAA Section presidents, and Section newsletter editors. A brochure and membership application forms will be mailed in September, and the first Student Chapters will begin their activities in January of 1989.

The members of the MAA Committee on Student Chapters are: Charles A. Cable, Allegheny College; Milton D. Cox, Miami University of Ohio; Robert C. Eslinger, Hendrix College; Samuel W. Hahn, Wittenberg University; Aparna W. Higgins, University of Dayton; Alfred B. Willcox, MAA Executive Director; Howard Anton, Drexel University (Committee Chairman).

If you have any questions about Student Chapters, please write to Howard Anton, 304 Fries Lane, Cherry Hill, New Jersey 08003.

Calculus Watch

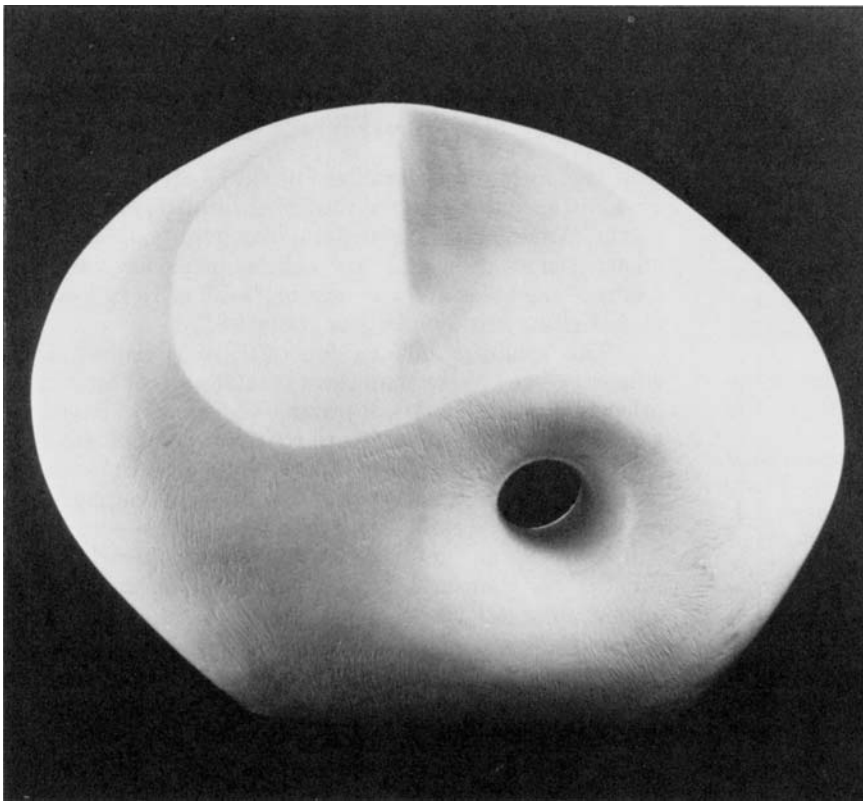
Eastern Pennsylvania and Delaware Section, Messiah College, Grantham, Pennsylvania, June 20–24, 1988. V. Frederick Rickey of Bowling Green State University will conduct a short course entitled "History of the Calculus." For more information, contact Professor Marvin Brubaker, Messiah College, Grantham, Pennsylvania 17027; (717) 766–2511.

Texas Section Meeting, Trinity University, San Antonio, Texas, April 15. The Section's Calculus Study Committee will report on the Calculus for a New Century Symposium and related developments. Manuel Berriozabal of the University of Texas at San Antonio will lead a panel discussion on "Mathematics Enrichment Programs for Underrepresented Groups in the Mathematical Professions." For more information, contact Professor Charles R. Deeter, Texas Christian University, Fort Worth, Texas 76129.

The Michigan Calculus Network is being formed. For information write to John Masterson, Michigan State University, East Lansing, Michigan, 48824.

Illinois Section Meeting, Bradley University, Peoria, Illinois, April 29–30. Lida K. Barrett of Mississippi State University will speak on the Calculus for a New Century Symposium at the Section's banquet on April 29. Neale R. Radden, ISMAA Chair, will preside. For more information, contact Carole Bauer, Trinton College, River Grove, Illinois 60171; (312) 456–0300.

"Revitalizing Calculus Instruction and the Mathematical Curriculum," Montclair State College, Upper Montclair, New Jersey, April 18, 1988. For more information, contact Andrew Demetropoulos, Montclair State College, Upper Montclair, New Jersey 07043.



SUMMER MEETING

August 8–12,
1988

Providence,
Rhode Island

Torus with Cross-cap and Vector Field.
A sculpture by Helaman Ferguson
given to the AMS by the MAA, 1988.

The Centennial Celebration of the American Mathematical Society will be held August 8–12, 1988 (Monday–Friday). Sessions will take place in the Providence Performing Arts Center (PPAC), the Omni Biltmore Hotel, the Holiday Inn–Providence Downtown, and the Johnson & Wales Academic Center.

The members of the Centennial Committee are Felix E. Browder, Rutgers University; Harold M. Edwards, Courant Institute of Mathematical Sciences, New York University; Andrew M. Gleason, Harvard University, former President of the American Mathematical Society; George Daniel Mostow, Yale University, President of the American Mathematical Society; and Everett Pitcher, Chairman, Lehigh University.

The Centennial Committee was assisted by a number of subcommittees:

The members of the Centennial Program Committee are Hyman Bass, Columbia University; Felix E. Browder, Chairman; Phillip A. Griffiths, Duke University; John W. Milnor, Institute for Advanced Study; Cathleen S. Morawetz, Courant Institute of Mathematical Sciences, New York University. Frank T. Birtel of Tulane University is in charge of the AMS contributed paper sessions.

The members of the Centennial Public Information Committee are John W. Addison, Jr., University of California, Berkeley; Yousef Alavi, Chairman, Western Michigan University; William G. Chinn, San Francisco, California; Ronald R. Coifman, Yale University; Ronald L. Graham, AT&T Bell Laboratories; Peter J. Hilton, SUNY at Binghamton; Don R. Lick, Eastern Michigan University; Jean J. Pedersen, Santa Clara University; and Clifford Taubes, Harvard University.

The members of the Committee on Travel Grants for the AMS Centennial are Richard W. Beals, Chairman, Yale University; John W. Bunce, University of Kansas; Anthony W. Hager, Wesleyan University; William F. Lucas, Claremont Graduate School; P. Emery Thomas, University of California, Berkeley; and Frank Uhlig, Auburn University.

The Society wishes to thank the Mathematical Association of America for relinquishing its usual summer meeting program

in deference to the expanded requirements of the Society on this special occasion. Sessions of the Association will be held August 6 and 7 (Saturday–Sunday), for the most part.

The Society is pleased to continue the tradition of joint invited addresses with the Association. The members of the Joint AMS-MAA Program Committee are Hugh L. Montgomery, Chairman, University of Michigan, Ann Arbor; M. Susan Montgomery, University of Southern California; Ivan Niven, University of Oregon; and Richard S. Palais, Brandeis University.

On Monday, August 8, there will be a private ceremony at the Society's headquarters office at which the officers of the Association will formally present a gift of sculpture to the Society on the occasion of its Centennial. This 547 pound sculpture of Carrara marble titled *Torus with cross-cap and vector field* is by Helaman Rolfe Pratt Ferguson, mathematician and sculptor, of Provo, Utah.

The sculpture resides in the lobby of the Society's headquarters building, and can be viewed during the hours set aside

IMPORTANT DEADLINES

AMS Abstracts	
Of contributed papers	May 19
Centennial Preregistration and Housing	June 1
MAA Minicourse Preregistration	June 1
Motions for AMS Business Meeting	July 12
Clambake cancellations (50% refund)	until July 25
MAA and IIME Banquets (50% refund)	until July 25
Preregistration cancellations (50% refund)	until August 4
Airport transfer cancellations (50% refund)	after August 4
Changes to residence hall packages	after August 4
Housing cancellations (90% refund)	until August 4
Housing cancellation penalty (10% plus one night)	after August 4
Tours (50% refund)	until August 4

for Open House, described later in this announcement. Also, the sculpture is depicted on a commemorative poster available for purchase at the Souvenirs Section of the Centennial Registration Desk.

The Centennial Committee thanks the National Science Foundation for its support of the symposium on *Mathematics into the twenty-first century* (Grant #DMS8716887) and the Department of Energy (DE-FG02-88ER25056) for its grant supporting travel and subsistence for young mathematicians attending the Centennial. Further support by other granting agencies for the latter endeavor is anticipated.

The Centennial Committee acknowledges with thanks the assistance of Thomas F. Banchoff of Brown University in the design of the Centennial logo.

Some very special things have occurred in connection with the Centennial that participants may find of interest. First, the National Academy of Sciences Award in Mathematics, sponsored by the Society in commemoration of its Centennial, in the amount of \$5,000, has been awarded for the first time in 1988 and will be awarded every four years hereafter. More information on this prize can be found in the first article in the April issue of *Notices*.

Also, in recognition of the Centennial Celebration of the Society, the Council has approved changing the name of the research fellowship program to the American Mathematical Society Centennial Research Fellowship.

Opening Ceremonies

The Opening Ceremonies will take place from 9:00 a.m. to 10:30 a.m. on Monday, August 8, in the PPAC. Representatives from the London Mathematical Society, the Mathematical Association of America, the Society for Industrial and Applied Mathematics, Brown University, city and state government, will address the assembly. A brief oral history of the Society will be presented by the Secretary. President Mostow will serve as Master of Ceremonies.



Edward E. David, Jr.,
Keynote
Speaker

Keynote Address

Edward E. David, Jr., President of EED, Inc. and former Science Advisor to the President of the United States, will speak at 11:15 a.m. on Monday, August 8, on *Renewing U.S. mathematics: An agenda to begin the second century*. Dr. David will be introduced by George Daniel Mostow.

Symposium on Mathematics into the Twenty-First Century

This symposium was organized by the Centennial Program Committee and is directed toward the future, not the past, of the American mathematical community, toward the creative innovation and new achievements foreseeable in terms of the ideas and the ongoing work of the generation of American mathematicians active today.

The speakers include four Fields Medalists, three winners of the Waterman Award, and several winners of other major mathematical prizes. The speakers have been asked to give talks of a nature that can be understood by a general mathematical audience, surveying the motives, paradigms, and prospects of major areas of contemporary mathematical research. It is hoped that this symposium will provide an active stimulus toward developing a broader consciousness among American mathematicians of the unifying trends of mathematical research uniting not only the classical central areas of pure mathematics, but uniting them as well with some of the most vital concerns of mathematical applications.

The names of the speakers, their affiliations, the titles, and the times and days of their talks can be found on the next four pages.

91st Summer Meeting of the AMS

August 8 – 12, 1988

Prizes

The 1988 Leroy P. Steele Prizes will be awarded at 3:15 p.m. on Friday, August 12.

Contributed Papers

There will be sessions for contributed papers on Monday, Tuesday, Wednesday, and Friday afternoons.

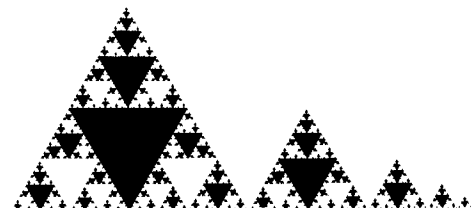
Council Meeting

The Council of the Society will meet at 5:00 p.m. on Sunday, August 7.

Business Meeting

The Business Meeting of the Society will take place immediately following the award of the Steele Prizes at 3:15 p.m. on Friday, August 12.

AMS Short Course



The American Mathematical Society will present a Short Course, *Chaos and Fractals: The mathematics behind the computer graphics*, on Saturday and Sunday, August 6 – 7. Organizers are Robert L. Devaney, Boston University, and Linda Keen, Lehman College, CUNY. Other speakers include: Philip J. Holmes, Cornell University; James A. Yorke, University of Maryland; Bodil Branner, Technical University of Denmark; Virginia Harrison, University of



MICHAEL ASCHBACHER
 Professor of Mathematics
 California Institute of
 Technology
 Ph.D., University of
 Wisconsin, 1969

2:00 p.m.
 Monday, August 8

Representations of finite groups as permutation groups

The classification of the finite simple groups in 1981 changed the landscape of finite group theory and led to an increased effort to describe the structure and representations of the simple groups. Together with the classification, this effort has made possible unexpected applications of finite group theory in other branches of mathematics.

Introduced by DANIEL GORENSTEIN.



LUIS A. CAFFARELLI
 Professor of Mathematics
 Institute for Advanced
 Study
 Ph.D., University of
 Buenos Aires, 1972

3:15 p.m.
 Monday, August 8

The geometry of solutions to nonlinear problems

This talk will discuss geometric techniques to study the shape and regularity of solutions to nonlinear elliptic equations and their level surfaces.

Introduced by LOUIS NIRENBERG.



PERSI DIACONIS
 Professor of Mathematics
 Harvard University
 Ph.D., Harvard University,
 1974

8:30 a.m.
 Tuesday, August 9

Sufficiency as statistical symmetry

To judge what parts of a data set are worth saving, statisticians have developed a useful tool called *sufficiency*, which can be seen as an extension of the invariants of a group. Sufficiency allows a unified construction of statistical models, sheds light on the factorization of generating functions in combinatorics, and provides the underpinnings for recent work in statistical mechanics. This talk will explain the concept of sufficiency and survey these applications.

Introducer to be announced.



CHARLES L. FEFFERMAN
 Professor of Mathematics
 Princeton University
 Ph.D., Princeton University,
 1969

9:45 a.m.
 Tuesday, August 9

Problems from mathematical physics

This talk will cover two problems in mathematical physics. The first is from quantum mechanics and concerns the question of how large numbers of electrons combine with large numbers of protons to form large numbers of atoms. The second is from general relativity and concerns a proof that some small initial disturbance will not concentrate and become a black hole.

Introduced by FELIX E. BROWDER.



MICHAEL H. FREEDMAN
 Charles Lee Powell
 Chair Professor
 University of California,
 San Diego
 Ph.D., Princeton University,
 1973

2:00 p.m.
 Tuesday, August 9

Working and playing with the two-dimensional disk

The conformal structure of the disk is useful in studying the topology of (real) surfaces. A more combinatorial-topological study of maps of a disk has illuminated the study of three-dimensional manifolds. This talk will briefly survey the role of the disk in the theory of high dimensional manifolds, and go on to address the special problems of a disk mapped into a four-dimensional manifold. This is the point at which the topological and smooth theories diverge, and some discussion of the disparities between them will be given.

Introduced by WILLIAM BROWDER, President-Elect of the AMS.



HARVEY M. FRIEDMAN
 Professor of Mathematics
 Ohio State University
 Ph.D., Massachusetts
 Institute of Technology,
 1967

3:15 p.m.
 Tuesday, August 9

The incompleteness phenomena

By 1922, the formalization of mathematics in terms of axiomatic set theory had emerged. The axioms and rules of inference of this formalism are collectively known as Zermelo Frankel set theory with the axiom of choice (ZFC). The incompleteness phenomena—assertions which cannot be proved or refuted with ZFC—have not yet necessitated a reassessment of ZFC, but the twenty-first century may see debate on which axioms and rules of inference should be allowed. This talk will provide a historical perspective on the incompleteness phenomena.

Introduced by SAUNDERS MAC LANE, former President of the AMS.



BENEDICT H. GROSS
Professor of Mathematics
Harvard University
Ph.D., Harvard University,
1978

8:30 a.m.
Wednesday, August 10

Modular forms and elliptic curves

This talk will survey some major developments in the theory of elliptic curves. The theory of elliptic functions and modular forms, created in the 19th century, concerns the real and complex solutions of cubic equations and their moduli. In the last fifty years, the original arithmetic viewpoint has once again emerged. The problem of counting the number of solutions (mod p) to equations with integral coefficients is related to certain Fourier expansions in the classical theory of modular forms. This relationship has led to some progress on the problem of constructing rational points.

Introduced by JOHN T. TATE.



JOSEPH HARRIS
Visiting Scholar in
Mathematics
Harvard University
Ph.D., Harvard University,
1977

9:45 a.m.
Wednesday, August 10

Developments in algebraic geometry

One of the oldest branches of mathematics, algebraic geometry is concerned with the geometry of curves, surfaces and higher-dimensional objects defined by polynomial equations—conic sections, quadric surfaces, and so on. Over the last two centuries, algebraic geometry has undergone a series of transformations in which its basic objects of study were redefined, the most recent being the introduction of the concept of “schemes.” This

talk will describe these stages in the evolution of the subject and indicate how they arose as outgrowths of classical problems.

Introduced by PHILLIP A. GRIFFITHS.



ROGER E. HOWE
Professor of Mathematics
Yale University
Ph.D., University of
California, Berkeley, 1969

2:00 p.m.
Wednesday, August 10

A century of Lie theory

The subject called Lie theory (the study of Lie groups, Lie algebras, algebraic groups, and their applications) is, like the AMS, just about one hundred years old. In that century, Lie theory has established itself as a central area of mathematics, using tools from many sources and having implications for many other fields. This talk will attempt to give a feeling for the diversity of applications of Lie theory and for the rich internal structure that supports the applications.

Introduced by GEORGE MACKEY.



VAUGHAN F. R. JONES
Professor of Mathematics
University of California,
Berkeley
Ph.D., Université de
Genève, Switzerland, 1979

3:15 p.m.
Wednesday, August 10

*A von Neumann algebra excursion:
From quantum theory to knot theory and back*

A surprising result in von Neumann algebras suggested representations of the braid group into an abstract algebra discovered in statistical mechanics. The result allows one to associate to each braid a number which turns out to depend only on the knot obtained by closing the braid. The resulting new knot invariant stimulated the discovery of many more such invariants. These invariants are being used to study the way enzymes “untie” knotted strands of DNA in the process of replication.

Introduced by JOAN S. BIRMAN.



VICTOR G. KAC
Professor of Mathematics
Massachusetts Institute
of Technology
Ph.D., Moscow State
University, 1968

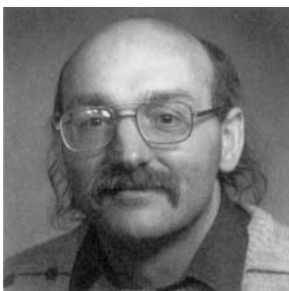
4:30 p.m.
Wednesday, August 10

continued

Modular invariance in mathematics and physics

This talk will focus on some beautiful, recently discovered connections between the representation theory of infinite dimensional Lie algebras and the theory of modular functions, and on related progress in theoretical physics. Three basic examples will be covered: the oscillator algebra; an affine Kac-Moody algebra, the Lie algebra of the loop group of a compact Lie group; and the 248-dimensional exceptional Lie group, the basic representation of which is an important component of one of the most promising models in string theory.

Introduced by NATHAN JACOBSON, former President of the AMS.



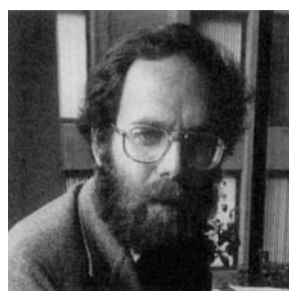
ANDREW J. MAJDA
Professor of Mathematics
Princeton University
Ph.D., Stanford
University, 1973

8:30 a.m.
Thursday, August 11

Mathematical fluid dynamics: The interaction of nonlinear analysis and modern applied mathematics

The rapid evolution of applied mathematics through large-scale computation reveals new fluid flow phenomena that are far beyond the capability of experimental measures. To explain and control these complex phenomena, new mathematical ideas from nonlinear analysis, differential equations, probability theory, and geometry must interact with computational methods and more traditional tools of applied mathematics. This talk will present a survey of several examples of this new mode of interdisciplinary research in mathematical fluid mechanics.

Introduced by PETER D. LAX, former President of the AMS.



CHARLES S. PESKIN
Professor of Mathematics
Courant Institute of
Mathematical Sciences,
New York University,
Ph.D., Albert Einstein
College of Medicine, 1972

9:45 a.m.
Thursday, August 11

Mathematics and computing in physiology and medicine: Examples from the past, present, and future

The examples considered are the Hodgkin-Huxley equations for the nerve impulse, computed tomography, a mathematical model for blood flow in the heart, and the robotics of large biological molecules. Computation is a key ingredient in all of these examples, and future success is tied to the development of large-scale computers and efficient numerical algorithms.

Introduced by CATHLEEN S. MORAWETZ.



DENNIS P. SULLIVAN
Professor of Mathematics
Graduate School and
University Center,
City University
of New York,
Ph.D., Princeton
University, 1966

2:00 p.m.
Thursday, August 11

Progress on the renormalization conjectures in dynamical systems

Computation has led theoretical physicists to the discovery that, in certain dynamical systems, the geometrical structure at successively smaller scales is asymptotically constant. Moreover, the structure is universal in the sense that inequivalent systems have the same limiting structure. This talk will summarize the progress in the theoretical understanding of this numerical discovery.

Introduced by STEPHEN SMALE.



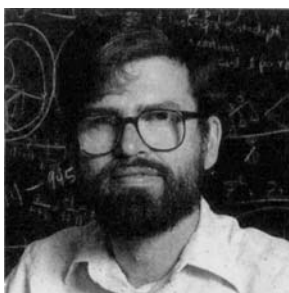
ROBERT E. TARJAN
James S. McDonnell
Distinguished University
Professor of Computer
Science
Princeton University and
Distinguished Member
of Technical Staff
AT&T Bell Laboratories
Ph.D., Stanford University,
1972

8:30 a.m.
Friday, August 12

Mathematics in computer science

This talk will explore the interdependencies between mathematics and computer science as illustrated in the variety of mathematical ideas used to derive results in computer science theory and the use of computation in the proof of mathematical theorems.

Introduced by RONALD L. GRAHAM.



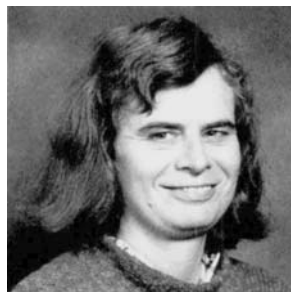
WILLIAM P. THURSTON
Professor of Mathematics
Princeton University
Ph.D., University of
California, Berkeley, 1972

9:45 a.m.
Friday, August 11

Three-dimensional geometry and topology

Three dimensions is the crossroad for geometry and topology. In dimensions higher than 3, topology becomes much more arbitrary, while geometry becomes much more restricted and rigid. In dimensions lower than 3, topology is more limited, while geometric constructions are more flexible. This talk will describe several instances of the close match between the geometry and topology of 3-dimensional objects, including the theory of polyhedra, the theory of knots, and the theory of 3-dimensional manifolds.

Introduced by LIPMAN BERS, former President of the AMS.



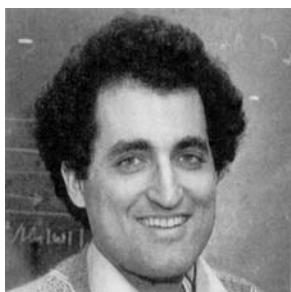
KAREN K. UHLENBECK
Professor of Mathematics
University of Texas
at Austin
Ph.D., Brandeis
University, 1968

11:00 a.m.
Friday, August 12

Instantons and their relatives

Instantons are geometric objects which were discovered by theoretical high energy physicists as a result of failed attempts to understand strong interactions. The instanton equation—of which instantons are solutions—derives from the nonlinear version Maxwell's equations formulated by Yang and Mills in 1954. The importance of the instanton equation in mathematics was recognized only in the past decade. Vortices and monopoles are only two of the many related geometric objects having elegant, interesting, and useful mathematical properties. This talk will attempt to describe some of the more colorful properties and uses of instantons and some conjectures for the future.

Introduced by SHIING S. CHERN.



EDWARD WITTEN
Professor of Physics
Institute for Advanced
Study
Ph.D., Princeton
University, 1976

2:00 p.m.
Friday, August 12

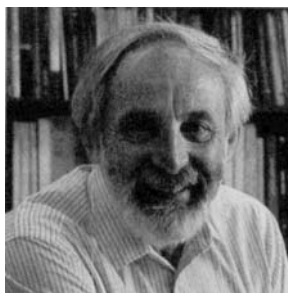
Quantum field theory and Donaldson polynomials

When Simon Donaldson initiated a program of using the self-dual Yang-Mills equations to study smooth four-manifolds, the relationship of his work to physical ideas was something of an enigma. Since then, it has become clear that relativistic quantum field theory provides a very natural setting for understanding Donaldson theory and its relationship to Floer theory, elliptic cohomology, conformal field theory, and possibly to other subjects, including string theory and the Jones polynomial. This talk will survey some of these developments.

Introduced by CLIFFORD TAUBES.

AMS-MAA Invited Addresses

By invitation of the AMS-MAA Joint Program Committee, the following speakers will speak on the history and development of mathematics.



RAOUL H. BOTT
William Caspar Graustein
Professor of Mathematics
Harvard University
D.Sc., Carnegie Institute
of Technology, 1949

11:00 a.m.
Tuesday, August 9

The topological constraints on analysis

This topic has been at the center of one of the two great American schools of topology. Some of its achievements during this century will be discussed.

Introduced by ANDREW M. GLEASON.



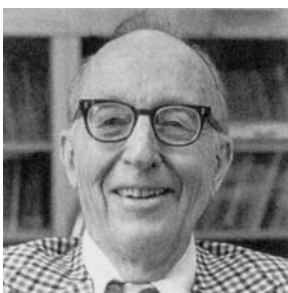
PETER D. LAX
Professor of Mathematics
Courant Institute of
Mathematical Sciences,
New York University,
Ph.D., New York
University, 1949

11:00 a.m.
Wednesday, August 10

Mathematics: Applied and pure

In this century, some have viewed mathematics as separated into pure and applied. Today more and more mathematicians realize that mathematics does not "trickle down" to application areas, but is an equal partner with other sciences. Modern computers have linked mathematics with other sciences.

Introduced by GEORGE DANIEL MOSTOW.



SAUNDERS MAC LANE
Professor Emeritus,
University of Chicago
Ph.D., University of
Göttingen, 1934

11:00 a.m.
Thursday, August 11

Some major research departments of mathematics

In the last century, the development of mathematics has been led by a number of outstanding research departments. The tradition was developed in the U.S. by Moore, Birkhoff, Veblen, Stone, and others. This talk will describe several mathematics research departments.

Introduced by LEONARD GILLMAN, President of the MAA.

California, Berkeley; and Michael F. Barnsley, Georgia Institute of Technology. Special event: an evening session on computer graphics and computer generated films.

Activities of Other Organizations

Association for Women in Mathematics (AWM)

The AWM Membership Meeting will take place at 7:30 p.m. on Tuesday, August 9. AWM will sponsor a panel discussion at 8:00 p.m. on Tuesday, on *Centennial reflections on women in American mathematics*. The panel will be moderated by Jeanne LaDuke, DePaul University and Judy Green, Rutgers University, Camden. An open reception is being planned by AWM to follow the panel.

Joint Policy Board for Mathematics (JPBM)

The JPBM Committee for Mathematics Department Heads has organized a National Meeting of Department Heads at 7:00 p.m. on Wednesday, August 10. This session will feature a panel being organized by Samuel M. Rankin, III, Worcester Polytechnic Institute, on *MS2000 Panel on courses and curricula for mathematics master's degrees*. This will be followed at 8:00 p.m. by Birds-of-a-Feather sessions on *Academic employment of master's degree mathematicians in larger departments* moderated by Donald F. Reynolds, Indiana State University. Panelists include Alphonse H. Baartmans, West Virginia University; Alberto R. Galmarino, Northeastern University; and Donald R. Whitaker, Ball State University. The second concurrent session is on *Academic employment of master's degree mathematicians in smaller departments*, moderated by David W. Ballew, Western Illinois University. Panelists include Ronald M. Davis, Northern Virginia Community College and Karen L. Whitehead, South Dakota School of Mines. The third concurrent session is on *Industrial employment of master's degree mathematicians* moderated by Tom Trotter, Arizona State University.

67th Summer Meeting of the Mathematical Association of America (MAA)

•Minicourses (Form on Page xxx)

Seven Minicourses are being offered by the MAA, to be held on Saturday and Sunday, August 6 and 7. The names and affiliations of the organizers, the topics, the dates and times of their meetings, and the enrollment limitations of each are as follows:

Minicourse #1: *EXP, EXP Test, and the creation of testbanks* is being organized by Peter Frisk, Rock Valley College. Part A is scheduled from 8:00 a.m. to 10:00 a.m. and Part B from 2:00 p.m. to 4:00 p.m. on Saturday, August 6. Enrollment is limited to 30.

The scientific word processor, **EXP**, easily produces complex mathematical and scientific expressions, making it ideal for writing examinations in mathematics. A related program, **EXPTEST**, enables instructors to create, edit, and print examinations created by selecting questions from prepared testbanks. This workshop will discuss the basics of **EXP** itself, including its editing commands, special fonts and mathematical symbols, and keyboard

macros. This is basic to the full discussion of **EXPTEST**, which will include the creation of testbanks, the writing of various types of questions those banks may contain, and the automatic generation of different, but equivalent, tests.

Minicourse #2: *Contributions of algebraic coding theory to finite geometry* is being organized by E. F. Assmus, Jr., Lehigh University and J. D. Key, who is Emmy Noether Lecturer at Bryn Mawr and on leave from the University of Birmingham. Part A is scheduled from 8:00 a.m. to 10:00 a.m. and Part B from 2:00 p.m. to 4:00 p.m. on Saturday, August 6. Enrollment is limited to 80.

After the appearance of Shannon's fundamental paper in 1948 engineers and mathematicians set to work to implement the ideas by constructing, via algebraic methods, so-called "error-correcting codes." Some of the very first attempts used certain geometries over finite fields to construct codes. During the next three decades an increasingly sophisticated body of results was fashioned and the theory became known as "algebraic coding theory." Late in the 1960s it became apparent that this theory could repay its debt to pure mathematics by making significant contributions to the field of finite geometry, which will be the subject of this Minicourse.

Although a most exciting aspect of this inter-relationship is the one deriving from the Goppa codes and their generalizations, that area requires a rather deep knowledge of algebraic geometry. The course will restrict itself to those aspects of the subject that can be comprehended with only minimal knowledge of group theory and finite geometry, but with a strong background in linear algebra, and a firm acquaintance with finite fields. After a brief historical introduction, the course will develop the necessary material from coding theory and finite geometry and conclude with a detailed description of some of the contributions of coding theory to finite geometry.

Minicourse #3: *A survey of educational software* is being organized by David P. Kraines, Duke University and Vivian Kraines, Meredith College. Part A is scheduled from 10:30 a.m. to 12:30 p.m. and Part B from 4:30 p.m. to 6:30 p.m. on Saturday, August 6. Enrollment is limited to 30.

The variety and the quality of software for IBM compatible computers has been increasing steadily. The objective of this Minicourse is to allow the participants to experiment with a representative collection of the better programs in calculus, linear algebra, differential equations, and other mathematical subjects. A variety of classroom applications will be demonstrated from a number of different computer packages. At the end of each two hour session, the participants will have the opportunity for "hands-on" use of some of these programs. Handouts will provide information on other educational software on the market or under development. No computer experience is required.

Minicourse #4: *Coloring and path following algorithms for approximating roots and fixed points* is being organized by William F. Lucas, Claremont Graduate School. Part A is scheduled from 10:30 a.m. to 12:30 p.m. and Part B from 4:30 p.m. to 6:30 p.m. on Saturday, August 6. Enrollment is limited to 80.

Cayley (1879) found that Newton's method for approximating *complex* roots of a polynomial equation could lead to complications. (See *Science News*, February 28, 1987, regarding regions with chaotic boundaries.) H. W. Kuhn (1974) has provided an elementary path following algorithm in the plane for finding such roots. The roots are triple points in a simple three coloring of the plane as was already evident in a geometric view provided in Gauss' thesis (1799).

The fundamental combinatorial lemmas by E. Sperner (1928) and A. W. Tucker (1946) for labeling (or coloring) the vertices of an n -simplex or n -octahedron are the discrete analogues of the Brouwer fixed point theorem and Borsuk-Ulam antipodal points theorems, respectively. These provide the basis for the path following algorithms of Scarf (1967) and others for finding approximate fixed points. Applications include the computing of equilibrium points or prices in game theory and economics.

These topics can be included at various levels in undergraduate courses on discrete mathematics, and do not assume any specialized prerequisites.

Minicourse #5: *Teaching calculus with an HP-28 symbol manipulating calculator* is being organized by John W. Kenelly, Clemson University. Part A is scheduled for 8:00 a.m. to 10:00 a.m. and Part B from 2:00 p.m. to 4:00 p.m. on Sunday, August 7. Enrollment is limited to 40.

After briefly surveying the capabilities of currently available graphic calculators, the Minicourse will introduce participants, hands on, to the HP-28. Graphing, symbol manipulating, differentiation, equation solving, Taylor polynomials and (time permitting) matrix operations will be viewed.

There will be a discussion of the use of the HP-28 in calculus instruction, of how its use will change the treatment of current topics and how it will make possible the introduction of new topics in calculus.

Minicourse #6: *An introduction to MATLAB* is being organized by David R. Hill, Temple University. Part A is scheduled from 10:30 a.m. to 12:30 p.m. and Part B from 4:30 p.m. to 6:30 p.m. on Sunday, August 7. Enrollment is limited to 30.

MATLAB is an interactive software package that has wide application for mathematics instruction and student use. Originally developed at a MATrix LABoratory, the software has evolved into a versatile environment for use in linear algebra, numerical analysis, calculus, discrete mathematics, and statistics. The availability of easily accessible graphics in two and three dimensions, a rich set of powerful commands, and the easy development of your own extensions provide a flexible tool for instruction and problem solving.

This course will provide: 1) An introduction to MATLAB's command set. 2) A "hands-on" opportunity to explore topics including solving linear systems, plotting, interpolation, least squares, and elementary statistics. 3) Examples of courseware for student self-practice. The format will be informal and self-paced with opportunities for discussion and an exchange of ideas. No formal prerequisites.

Minicourse #7: *Groups, graphs, and computing* is being organized by Eugene M. Luks, University of Oregon. Part A is scheduled from 10:30 a.m. to 12:30 p.m. and

Part B from 4:30 p.m. to 6:30 p.m. on Sunday, August 7. Enrollment is limited to 80.

This Minicourse will explore exciting applications of group theory in theoretical computer science. Some central issues in computational complexity theory are illuminated in an exploration of problems that require manipulation of large permutation groups. Rubik's cube alone suggests both easy ("polynomial-time") and probably-hard ("NP-complete") problems. But it inspires, as well, problems that have defied such categorization. We shall discuss divide-and-conquer algorithms that underlie the best-known approach to such problems. These algorithms also provide the machinery behind the most efficient attacks on the important computational problem of testing isomorphism between graphs.

Participants interested in attending any of the MAA Minicourses should complete the MAA Minicourse Pre-registration Form and send it directly to the MAA office at the address given on the form so as to arrive prior to the June 1 deadline. DO NOT SEND THIS FORM TO PROVIDENCE. Please note that these MAA Minicourses are NOT the AMS Short Course.

Please note that prepayment is required. Payment can be made by check payable to MAA (Canadian checks must be marked "in U.S. funds") or VISA or MASTERCARD credit cards. (Form on Page xxx.)

●Prize Session and Business Meeting

The MAA Prize Session and Business Meeting is scheduled from 4:30 p.m. to 5:30 p.m. on Tuesday, August 9. The 1988 Carl B. Allendoerfer, Lester R. Ford, and George Pólya Awards will be presented. Certificates of Meritorious Service will also be presented. Some bylaw changes will be submitted to the membership. This meeting is open to all members of the Association.

●Board of Governors

The MAA Board of Governors will meet at 8:30 a.m. on Sunday, August 7. This meeting is open to all members of the Association.

●Section Officers

There will be a Section Officers' meeting at 4:30 p.m. on Monday, August 8.

●MAA Banquet

The MAA is planning its thirteenth annual banquet for individuals who have been members of the Association for twenty-five years or more. The banquet will be held in the Garden Room of the Omni Biltmore on Wednesday, August 10. Dinner will be served at 7:00 p.m.

Please note that all tickets for this banquet must be purchased through preregistration, since a guarantee must be given to the caterer. Tickets are \$21 each; the price includes gratuity. The menu includes consomme royale, spinach salad, roast leg of veal dijon, potato and vegetable, warm Stanford rolls and butter, strawberries Romanoff, coffee, tea, and decaffeinated coffee. There will be a cash bar. Interested participants should complete the appropriate section of the Preregistration/Housing Form and include appropriate payment. In the event of cancellations, a 50% refund of the amount paid for the ticket will be made if notification is received in Providence by July 25. After that date, no refund can be given.

Pi Mu Epsilon (ΠME)

ΠME will hold its annual meeting on Tuesday and Wednesday, August 9 and 10. The Council will meet at noon on Tuesday, August 9. On Wednesday, August 10, the Dutch Treat Breakfast will be at 6:30 a.m. There will also be sessions for contributed papers on Tuesday evening.

J. Sutherland Frame Lecture

The J. Sutherland Frame Lecture will be given at 8:30 p.m. on Wednesday, August 10, by Doris W. Schattschneider, Moravian College, on *You, too, can tile the Conway way*. Professor Schattschneider will be the first woman mathematician to deliver this distinguished lecture.

Banquet

The ΠME Banquet will take place on Wednesday, August 10, at 6:30 p.m. The banquet will be held in the Conference Room in the Chamber of Commerce Center in the Union Station Complex.

Please note that all tickets for this banquet must be purchased through preregistration, since a guarantee must be given to the caterer. Tickets are \$8 each; the price includes gratuity. The menu includes boneless breast of chicken with fresh tomato and basil, creamy baked pasta, summer green salad, crusty Italian bread, fresh fruit compote, brownies, coffee and punch. Interested participants should complete the appropriate section of the Preregistration/Housing Form and include appropriate payment. In the event of cancellations, a 50% refund of the amount paid for the ticket will be made if notification is received in Providence by **July 25**. After that date, no refund can be given.

Other Events of Interest

Book Sales

Books published by the AMS and MAA will be sold at discounted prices somewhat below the cost for the same books purchased by mail. **These discounts will be available only to registered participants wearing the official meeting badge.** VISA and MASTERCARD credit cards will be accepted for book sale purchases at the meeting. The book sales will be open the same days and hours as the exhibits and are located in the Grand Ballroom in the Omni Biltmore.

AMS Members' Information Booth

Please visit the AMS Membership booth in the Grand Ballroom of the Omni Biltmore exhibit area during the Centennial Celebration. Complimentary coffee and tea will be served for Centennial participants. Carol-Ann Blackwood, the Head of the Membership & Sales Department of the Society, will be at the membership booth to meet members personally and distribute a special gift. Bring Mrs. Blackwood your comments and compliments about member services.

Special Exhibits

An exhibit of selected materials from the archives of the Society, featuring memorabilia from the Semicentennial Celebration held at Columbia University in 1938, will be on display in the lobby of the John D. Rockefeller, Jr. Library at Brown University on Sunday, August 7, noon to 5:00 p.m.; Monday through Thursday, August 8–11, 9:00 a.m. to 9:00 p.m.; Friday, August 12, 9:00 a.m. to 5:00 p.m.; and Saturday, August 13, 10:00 a.m. to 5:00 p.m.

An exhibit of selected mathematical drawings by Royal Vale Heath (author of *Mathemagic*, 1932) will be mounted in the Bell Gallery in the List Art Building at Brown University. The drawings, which make up the bulk of the collection donated to Brown by Miss Gloria Heath, include magic squares, polyhedrons, stars, and solids. This exhibit can be viewed Monday through Friday, August 8–12, from 9:00 a.m. to 5:00 p.m.

There will be a display of rare mathematical books in the John Hay Library at Brown University Monday through Friday, August 8–12, 9:00 a.m. to 5:00 p.m.

Commercial Exhibits

The book and educational media exhibits will be located in the Grand Ballroom in the Omni Biltmore, and will be open Monday through Friday, August 8–12. The hours they will be open are 1:00 p.m. to 5:00 p.m. on Monday, 9:00 a.m. to 5:00 p.m. Tuesday and Wednesday, 9:00 a.m. to 1:30 p.m. on Thursday, and 9:00 a.m. to noon on Friday. All participants are encouraged to visit the exhibits during the meeting.

How to Preregister

Preregistration for these meetings must be completed by June 1, 1988.

The importance of early preregistration cannot be overemphasized. Some of the benefits of early preregistration are assignment to hotels with the lowest rates, inclusion in the alphabetical list of preregistrants displayed in the registration area, reduced waiting time at the AMS Centennial Celebration Registration Desk, and registration at fees considerably lower than the fees that will be charged for registration at the meeting.

It is essential that the Preregistration/Housing Form (found on page xxxii) be completed fully and clearly. In the case of several preregistrations from the same family, **each** family member who is preregistering should complete a separate copy of the Preregistration/Housing Form, but all preregistrations from one family may be covered by one payment. Please print or type the information requested, and be sure to complete all sections. Absence of information (missing credit card numbers, incomplete addresses, etc.) causes a delay in the processing of preregistration for that person.

Please provide your nickname if you wish this information to be printed on your badge.

Modes of payment which are acceptable, provided they are payable in U.S. dollars to the order of the American Mathematical Society, are U.S. Postal Money Orders, certified U.S. bank checks, U.S. bank money

orders, personal checks drawn on a U.S. bank, or credit card (Visa or MasterCard only).

Receipt of the Preregistration/Housing Form and payments will be acknowledged by the Mathematics Meetings Housing Bureau. Participants are advised to bring a copy of this acknowledgement with them to Providence.

The Centennial registration fees at the meeting will be 30% higher than the preregistration fees listed below.

Centennial Celebration

Member of AMS, AWM, CMS, MAA, IME, SIAM	\$ 71
Emeritus Member of AMS, MAA, SIAM	\$ 25
Nonmember	\$104
Student/Unemployed	\$ 25

AMS Short Course

Student/Unemployed	\$ 10
All Other Participants	\$ 35

MAA Minicourses

(if openings available)

Minicourses # 2, 4, 5, 7	\$ 30
Minicourses # 1, 3, 6,	\$ 50

A \$5 charge will be imposed for all invoices prepared when preregistration forms are submitted without accompanying check(s) for the preregistration fee or are accompanied by an amount insufficient to cover the total payments due. Preregistration forms received well before the deadline of June 1 which are not accompanied by correct payment will be returned to the participant with a request for resubmission with full payment. This will, of course, delay the processing of any housing request.

An income tax deduction is allowed for education expenses, including registration fees, cost of travel, meals and lodging incurred to (i) maintain or improve skills in one's employment or trade or business or (ii) meet express requirements of an employer or a law imposed as a condition to retention of employment, job status, or rate of compensation. This is true even for education that leads to a degree. However, the Tax Reform Act of 1986 has introduced significant changes to this area. In general, the deduction for meals is limited to 80% of the cost. Unreimbursed employee educational expenses are subject to a 2% of adjusted gross income floor. However, there are exceptions to these rules. Therefore, one should contact one's tax advisor to determine the applicability of these provisions.

There is no extra charge for members of the families of registered participants, except that all professional mathematicians who wish to attend sessions must register independently.

All **full-time** students currently working toward a degree or diploma qualify for the student registration fees, regardless of income.

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

Persons who qualify for emeritus membership in either the Society or the Association or SIAM may register at the emeritus member rate. The emeritus status refers to any person who has been a member of the AMS, MAA, or SIAM for twenty years or more, and is retired on account of age from his or her latest position.

Nonmembers who preregister or register at the meeting and pay the nonmember fee will receive mailings from AMS and MAA, after the meeting is over, containing information about a special membership offer.

How to Obtain Hotel Accommodations

The use of the services offered by the Mathematics Meetings Housing Bureau requires preregistration for the AMS Centennial Celebration. All hotel reservation requests must be received in writing and be processed through the Housing Bureau. Telephone requests cannot be accepted. **Please do not contact the hotels directly, since they will refer callers back to the Housing Bureau. Also, should the hotel give you a room directly there is no obligation on its part to extend the special convention rate.** Preregistrants will receive an acknowledgement of their hotel reservation from the Housing Bureau; however, confirmation of the reservation will come directly from the hotel to which the participant is assigned.

Participants desiring confirmed reservations in one of the hotels offered by the Housing Bureau should read carefully the section on **Hotels** below and then choose the hotel in which they wish their reservations to be made. This information, as well as the type of occupancy required, should be indicated clearly in the Housing Section of the Preregistration/Housing Form. All hotel reservations must be guaranteed. You may do this by including a check for \$50 payable to the AMS or you may provide a credit card number (Visa, MasterCard, or American Express) on the Preregistration/Housing Form. **Please note that American Express cards can be used only to guarantee hotel reservations and cannot be used to pay registration or other fees. Please note that your hotel reservation cannot be processed until your room guarantee is received.** Participants should be sure to read carefully the information on the rights that accrue when a reservation is guaranteed by a deposit in advance, which occurs in the section on **Hotels**.

Participants planning to share a hotel room should provide the name(s) of the person(s) with whom they plan to occupy the room. Each participant should, however, complete a separate Preregistration/Housing Form. Parties planning to share rooms should send their forms together in the same envelope, if possible; **however, only one person should submit the room guarantee. A reservation cannot be made until a completed form from the party guaranteeing the room has been received.**

Hotel deposits will be sent to your assigned hotel on your behalf. Please note that preregistration fees do not represent an advance deposit for housing.

Hotels

Participants desiring confirmed reservations for the following hotels must make the reservations through the Mathematics Meetings Housing Bureau **prior to the June**

1, 1988 deadline. Reservations at these hotels cannot be made by calling the hotel directly until after July 15, 1988. After July 15, 1988, the rates below may not apply. It is imperative that both hotels listed on the back of the preregistration form be numbered in order of preference to ensure satisfactory hotel assignments.

In all cases "single" refers to one person in one bed; "double" refers to two persons in one bed; "twin" refers to two persons in two twin beds; and "twin double" refers to two persons in two double beds. A rollaway cot for an extra person can be added to a room; however, not all hotels are able to do so and for those that do, the number of cots available is limited and given on a first-come, first-served basis. Any special requests or needs should be indicated on the back of the preregistration form.

Participants should be aware that it is general hotel practice in most cities to hold a nonguaranteed reservation until 6:00 p.m. only. When one guarantees a reservation by paying a deposit or submitting a credit card number as guarantee in advance, however, the hotel usually will honor this reservation up until checkout time the following day. If the individual holding the reservation has not checked in by that time, the room is then released for sale, and the hotel retains the deposit or applies one night's room charge to the credit card number submitted.

If you hold a guaranteed reservation at a hotel, but are informed upon arrival that there is no room for you, there are certain things you can request the hotel do. First, they should provide for a room at another hotel in town for that evening, at no charge. (You have already paid for the first night when you made your deposit.) They should pay for taxi fares to the other hotel that evening, and back to the meetings the following morning. They should also pay for one telephone toll call so that you can let people know you are not at the hotel you expected. They should make every effort to find a room for you in their hotel the following day, and if successful, pay your taxi fares to and from the second hotel so that you can pick up your baggage and bring it to the first hotel. Not all hotels in all cities follow this practice, so your request for these services may bring mixed results, or none at all.

Please make all changes to or cancellations of hotel reservations with the Mathematics Meetings Housing Bureau in Providence **before August 4, 1988**. The telephone number in Providence is 401-272-9500 (extension 290). After that date, changes should be made directly with the hotel. **Cancellations must be made directly with the hotel 48 hours prior to date of arrival in order to receive refunds of deposits.**

The hotels listed below accept American Express, MasterCard, Visa, Carte Blanche, and Diners' Club credit cards, personal checks with identification, and travelers' checks as payment for room charges. Rates are subject to a 10% state and room tax. Rates quoted are firm.

Omni Biltmore (Headquarters)

Kennedy Plaza

Providence, RI 02903

Telephone: 401-421-0700

Single occupancy	\$ 70
Double occupancy	\$ 80
Triple occupancy	\$ 80
Triple occupancy w/cot*	\$ 95
Quadruple occupancy	\$ 80
Quadruple occupancy w/cot*	\$ 95
Suites	\$150

* Number of cots is limited.

Full service hotel. Restaurants, lounge, free parking. Children 18 years and younger are free in same room as parents. All major credit cards accepted.

Holiday Inn

21 Atwells Avenue

Providence, RI 02903

Telephone: 401-831-3900

Single occupancy	\$ 65
Double occupancy	\$ 65
Triple occupancy	\$ 65
Triple occupancy w/cot*	\$ 71
Quadruple occupancy	\$ 65
Quadruple occupancy w/cot*	\$ 71
Suites	\$135

* Number of cots is limited.

Full service hotel. Indoor swimming pool, jacuzzi, free parking, restaurant, and lounge. Children 18 years and younger are free in same room as parents. All major credit cards accepted.

How to Obtain Residence Hall Accommodations

The use of the services offered by the Mathematics Meetings Housing Bureau requires preregistration for the AMS Centennial Celebration. All reservation requests for university accommodations must be received in writing and be processed through the Housing Bureau. Telephone requests cannot be accepted. **Please do not contact the university directly, since they will refer callers back to the Housing Bureau.** Preregistrants will receive an acknowledgement of their room assignment from the Housing Bureau, which will also serve as a confirmation.

Participants desiring confirmed reservations in Brown University residence halls should read carefully the section on **University Housing** and then choose preferred accommodations. This information should be indicated clearly in the Housing Section of the Preregistration/Housing Form, and the form submitted with the appropriate payment in full **so as to arrive no later than June 1, 1988.**

Participants who are able to do so are urged to share a room whenever possible. This procedure can be economically beneficial. The housing form should be fully completed to ensure proper assignment of rooms. Participants planning to share accommodations should provide the name of the person with whom they plan to occupy a room. Each participant should, however, complete a separate Preregistration/Housing Form. Parties planning to share rooms should send their forms together in the same envelope, if possible. **If two participants arriving on different days plan to share a double room, each participant must submit the per person amount due applicable to his or her particular choice.**

Housing payments for residence hall accommodations will be forwarded to Brown University on your behalf.

University Housing

Centennial participants may occupy residence hall rooms at Brown University during the period August 5 to August 13 only. **All must check out by noon on August 13. All rooms on campus are offered through a room/board package only.** Only a very limited number of rooms on campus will be available for those participants who do not preregister but plan on attending the Centennial and registering on site. These rooms will be assigned at the Brown check-in desk where participants will be given a housing slip which should be taken to the Housing Section of the Centennial Registration Desk and payment made at the participant's earliest convenience. These payments can be made **only** during the hours the registration desk is open and can be made via personal checks, travelers' checks, or credit cards (Visa and MasterCard only).

Participants requesting housing on the Brown University campus will be assigned to one of six residence halls: Wayland Hall, Harkness Hall, Olney Hall, Diman Hall, Hegemann Hall, or the Graduate Center. (Please refer to the section below titled **Room and Board Rates**.)

Families with children will be allowed to stay in the dormitories; however, there is a maximum of one child per room. Sleeping bags for children staying with **both** parents will be permitted free of charge as long as the room is occupied to full bed capacity. Children occupying a bed will be charged the full room and board rate; however, children **under** seven years of age will be charged half-price for the meal portion of the package. (See section on **Hotels** above for alternate housing for families.)

Residence halls at Brown University have either three or four floors and no elevators or ramps. They are not accessible to the handicapped. All single rooms have a single bed, bureau, one closet, one chair, one desk, linen, a blanket and an overhead light. In addition to bed linen, pillow, and a blanket, participants will receive two towels, soap, and a disposal glass (exchangeable upon request at the check-in desk). **One** towel can be exchanged daily at a designated area. Participants are advised to bring their own washcloths and hangers. Rooms will be prepared for occupancy in advance; however, there is no daily maid service. There are no cots or cribs available. (See the section on Crib Rental.) In Wayland Hall, Harkness Hall, Olney Hall, Diman Hall, and the Graduate Center, there is one bathroom for each gender on each floor; all showers are open. Hegemann Hall is comprised of suites containing two or three bedrooms, a living room, and a bathroom with a private shower. Each hall is equipped with washers (50 cents) and dryers (50 cents). Vending machines are available in "Machine City," located in Keeney Quad, for candy, popcorn, soda, juice, coffee, and cigarettes.

Pets are not allowed in the residence halls.

There will be designated nonsmoking sleeping areas. The rooms are equipped with smoke alarms; the hallways are equipped with smoke alarms and heat detectors. Please note that none of the residence halls are air-conditioned.

Check-In Location and Times

There will be one main check-in desk for Brown residence halls located at a central location (to be determined at a later date) which will be staffed from 8:00 a.m. to 11:00 p.m.

Telephone numbers to call for assistance will be posted for those participants arriving after 11:00 p.m. when the check-in desk is closed. Parking stickers for nearby university lots may be purchased at the Brown check-in desk at an estimated daily rate of \$1.50.

At the time of check-in, participants assigned rooms through the Mathematics Meetings Housing Bureau will present their receipt which will enable them to receive two keys (one for the outside door and one for the room) and meal tickets at the Brown check-in desk. Those participants being assigned a room directly by the Brown check-in desk will be required to fill out a housing form, thus enabling them to receive keys. Spouses desiring a room key must follow this procedure also. **Please note that, although there is no deposit required for keys, a penalty of \$2 will be imposed for each key lost or not returned.** It is the responsibility of the Mathematics Meetings Housing Bureau to collect this penalty. Therefore, it is requested that proper caution be exercised to avoid this charge. At checkout, all keys must be returned to the Brown check-in desk. Should the clerk not be present, please ensure that your name is left at the Brown check-in desk with the key.

Room and Board Rates

Room and board rates for residence hall accommodations at Brown University can be found in a chart elsewhere in this announcement. Please note that there is no room tax applicable to these rates.

Should a family with two children request accommodations, two rooms would be required and the double rate (with appropriate adjustments for children under seven years of age) applies in each case. A family of three would require one double room at the double rate plus a second room for the third occupant at the single rate (with appropriate adjustments for children under seven years of age).

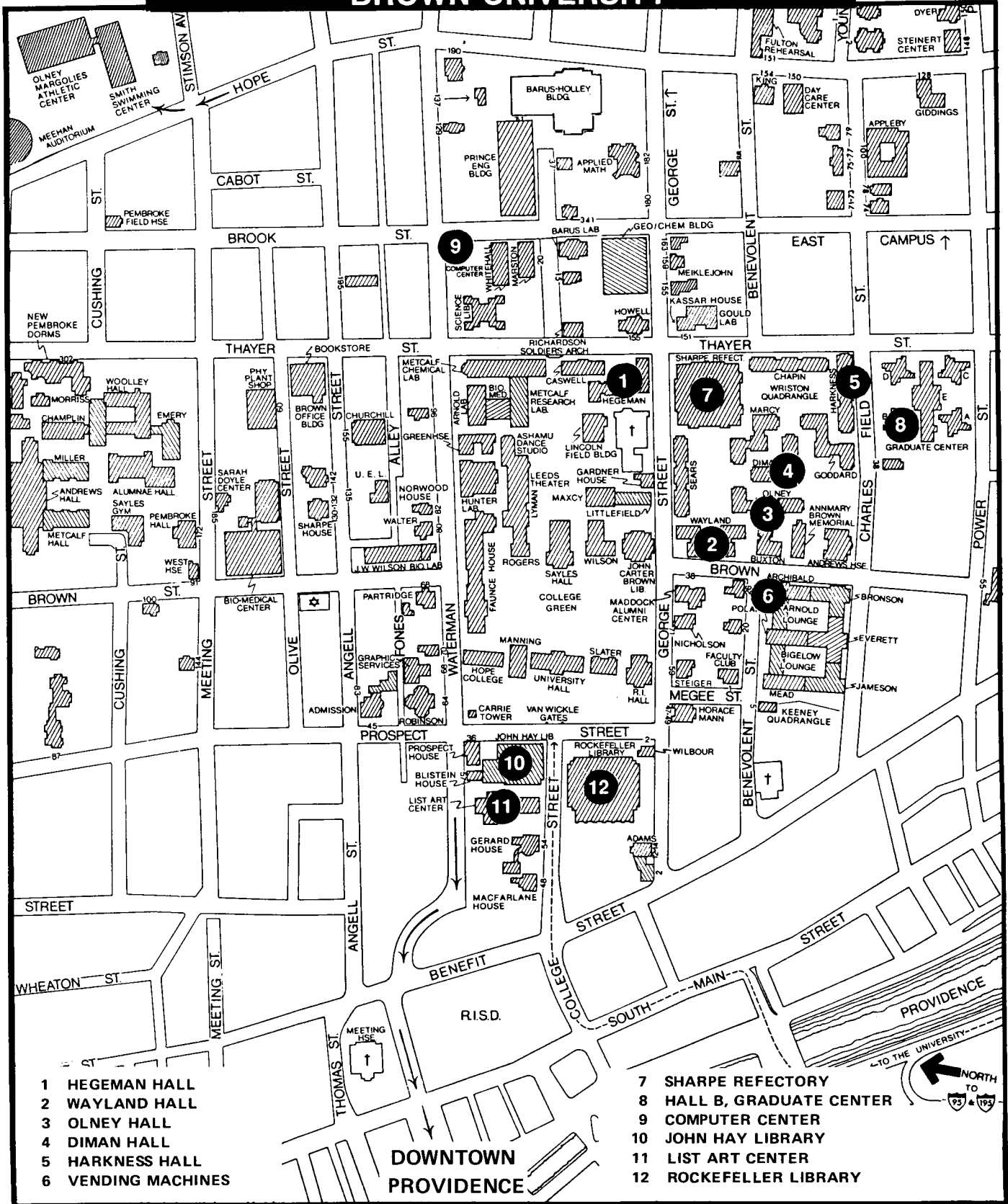
Please note that after August 4 no adjustment can be made to the room and board package price should the participant arrive later than the original date given when reservation was made, or leave earlier than the original departure date. Since no breakfast will be served on August 6, 7 and 13, there is no charge for breakfast included in the room rate for the previous nights. The cost of breakfast for children under seven years of age is half-price; there is no charge for babies in arms. **Meal tickets are nonrefundable.**

Food Services

The Sharpe Refectory located on the Brown University campus offers a variety of choices for breakfast. Breakfast is served cafeteria-style and **will not be available on a cash basis.** Breakfast will be served between 6:30 a.m. and 9:00 a.m. A typical breakfast menu is:

- Mushroom or Mozzarella Cheese Omelette
- Scrambled or Fried Eggs
- Boiled Eggs
- Grilled Ham

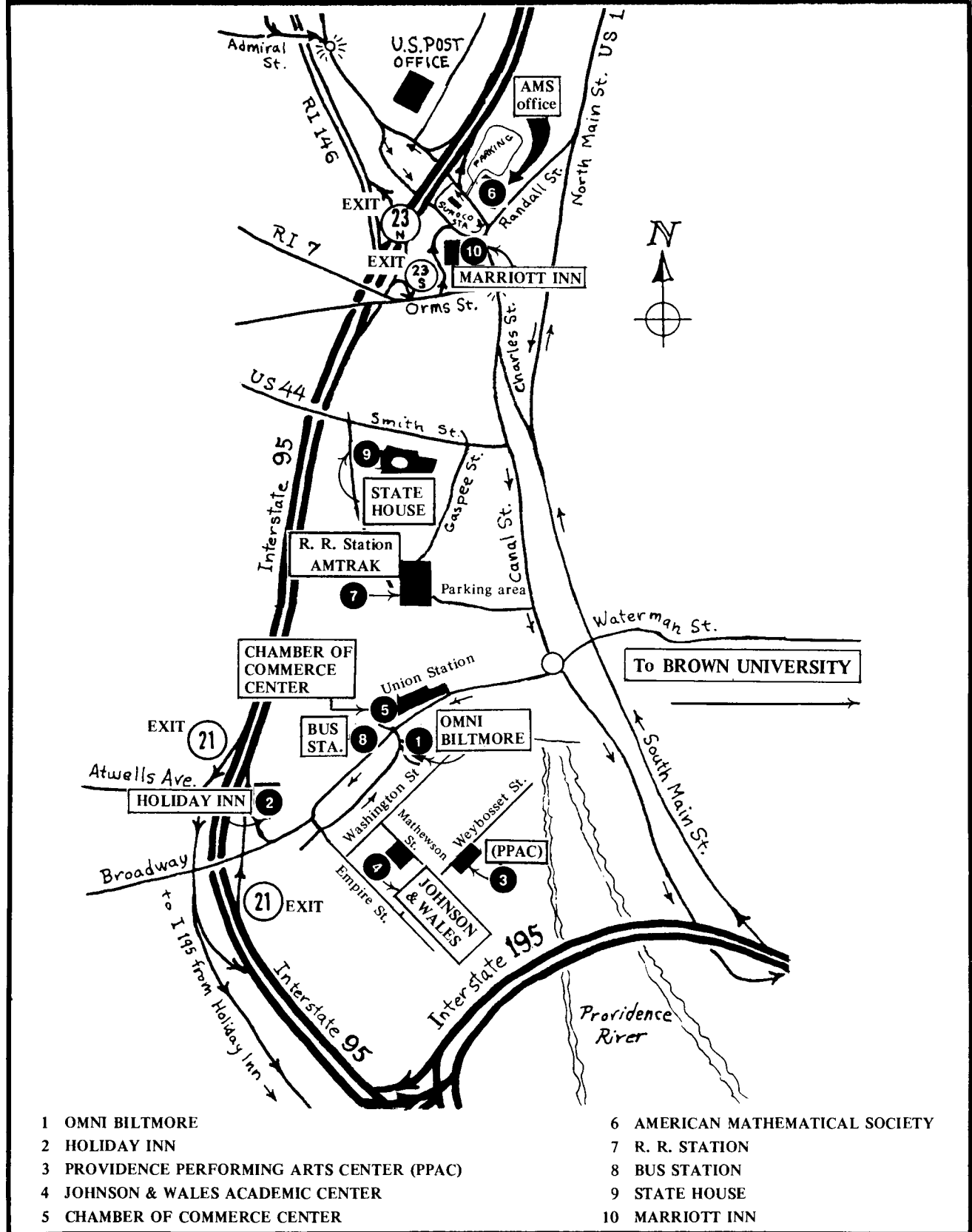
BROWN UNIVERSITY



MAP OF BROWN UNIVERSITY

DOWNTOWN PROVIDENCE

MAP OF DOWNTOWN PROVIDENCE



- | | |
|--|---------------------------------|
| 1 OMNI BILTMORE | 6 AMERICAN MATHEMATICAL SOCIETY |
| 2 HOLIDAY INN | 7 R. R. STATION |
| 3 PROVIDENCE PERFORMING ARTS CENTER (PPAC) | 8 BUS STATION |
| 4 JOHNSON & WALES ACADEMIC CENTER | 9 STATE HOUSE |
| 5 CHAMBER OF COMMERCE CENTER | 10 MARRIOTT INN |

- Pancakes or French Toast
- Lyonnais Potatoe
- Grits
- Danish Pastry
- Choice of Beverage
- Choice of Cereal

Servings are generous; unlimited seconds are offered on most.

As mentioned above, breakfast at Sharpe Refectory is included in the room and board package. Unfortunately, however, it will not be possible for participants to purchase either lunch or dinner at the Refectory on a cash basis.

There are several restaurants and specialty eating establishments within the immediate vicinity of Brown University. They range from Italian, French, and Japanese full course meals to pizza, homemade ice cream, and unusual sandwiches.

Changes, Cancellations and Refunds

If written notice of cancellation is received by the Housing Bureau by **August 4, 1988**, 50% of the preregistration fee and the cost of the tours, 90% of the residence

hall package, 100% of the airport transfer and poster prices will be refunded. (100% refunds can be made for student, unemployed, and emeritus participants.) After August 4, 90% minus one night's stay will be refunded on residence hall packages, and 50% of the airport transfer and poster prices. It is regretted that no refunds of the preregistration fee or the cost of the tours can be made after August 4.

If written notice of cancellation is received by the Housing Bureau by **July 25**, 50% of the cost of the tickets for the MAA and IIME banquets and clambake will be refunded. After July 25, no refunds will be possible.

Please make all changes to or cancellations of hotel reservations and residence halls with the Housing Bureau in Providence **before July 15, 1988**. The telephone number in Providence, Rhode Island, is 401-272-9500 (extension 290), the E-mail address is PONY%“MEET@SEED.AMS.COM”, or Telex 797192. After that date, changes should be made directly with the hotel and residence halls. Most hotels will refund the \$50 deposit **if notice of cancellation is received by them 48 hours prior to arrival**. All applicable refunds for residence housing will be issued by the Housing Bureau.

Brown University Room/Board Rates (per person)

	Adults	Children * under 7 years in bed	Child 7 years and older in sleeping bag	Child under 7 years in sleeping bag
8/5	\$22.20 single \$17.70 double	\$22.20 single \$17.70 double	No charge	No charge
8/6	\$22.20 single \$17.70 double	\$22.20 single \$17.70 double	No charge	No charge
8/7	\$27.00 single \$22.50 double	\$24.60 single \$20.10 double	\$4.80 single \$4.80 double	\$2.40 single \$2.40 double
8/8	\$27.00 single \$22.50 double	\$24.60 single \$20.10 double	\$4.80 single \$4.80 double	\$2.40 single \$2.40 double
8/9	\$27.00 single \$22.50 double	\$24.60 single \$20.10 double	\$4.80 single \$4.80 double	\$2.40 single \$2.40 double
8/10	\$27.00 single \$22.50 double	\$24.60 single \$20.10 double	\$4.80 single \$4.80 double	\$2.40 single \$2.40 double
8/11	\$27.00 single \$22.50 double	\$24.60 single \$20.10 double	\$4.80 single \$4.80 double	\$2.40 single \$2.40 double
8/12	\$22.20 single \$17.70 double	\$22.20 single \$17.70 double	No charge	No charge

* There is no charge for infants in arms.

The Housing Bureau is unable to refund amounts less than \$1.

Registration at the Meeting

Meeting preregistration and registration fees only partially cover expenses of holding meetings. All mathematicians who wish to attend sessions are expected to register. The fees for Centennial registration at the meeting listed below are 30% more than the preregistration fees.

Centennial Celebration

Member of AMS, AWM, CMS, MAA, IME, SIAM	\$ 89
Emeritus Member of AMS, MAA, SIAM	\$ 30
Nonmember	\$132
Student/Unemployed	\$ 30

AMS Short Course

Student/Unemployed	\$ 15
All Other Participants	\$ 45

MAA Minicourses

(if openings available)

Minicourses # 2, 4, 5, 7	\$ 30
Minicourses # 1, 3, 6,	\$ 50

Please read the section on **How to Preregister** for definitions of the various registration categories and other relevant information.

Registration Dates, Times, and Locations

AMS Short Course

Outside Garden Room, Omni Biltmore Hotel
Saturday, August 6 8:00 a.m. to 2:30 p.m.

Centennial Celebration

Grand Ballroom, Holiday Inn
Sunday, August 7 3:00 p.m. to 7:00 p.m.
Monday, August 8
through 7:30 a.m. to 4:00 p.m.
Wednesday, August 10
Thursday, August 11 7:30 a.m. to 1:30 p.m.
Friday, August 12 7:30 a.m. to 1:00 p.m.

MAA Minicourses (until filled)

Thomas J. Watson, Sr. Center for Information Technology, Brown University
115 Waterman Street (corner of Waterman and Brook)
Saturday, August 6 7:00 a.m. to 3:00 p.m.
Sunday, August 7 7:00 a.m. to 3:00 p.m.

Registration Desk Services

Assistance, Comments, and Complaints

A log for registering participants' comments or complaints about the meeting is kept at the Transparencies section of the registration desk. All participants are encouraged to use this method of helping to improve future meetings. Comments on all phases of the meeting are welcome. If a

written reply is desired, participants should furnish their name and address.

Participants with problems of an immediate nature requiring action at the meeting should see the Director of Meetings, who will try to assist them.

Audio-Visual Assistance

A member of the AMS staff will be available to advise or consult with speakers on audio-visual usage.

Rooms where contributed paper sessions will be held are equipped with an overhead projector and screen. **Blackboards will not be available.**

Baggage and Coat Check

Baggage and coats may be left in the Centennial registration area in Grand Ballroom of the Holiday Inn **only** during the hours that registration is open. The staff cannot, however, take responsibility for lost or stolen articles.

Check Cashing

The Centennial cashier will cash personal or travelers' checks up to \$50, upon presentation of the official meeting registration badge, provided there is enough cash on hand. Canadian checks must be marked for payment in U.S. funds. It is advisable that participants bring travelers' checks with them. When funds are low the meetings cashier will not be able to cash checks and travelers' checks can be easily cashed at local banks, restaurants, or hotels.

Daily Newsletter

A newsletter containing program changes and information of general interest to participants will be available each morning, August 8-12 at the registration desk. Participants should plan to pick up a copy every day.

Local Information

This section of the desk will provide information on local transportation, attractions, and events of interest.

Lost and Found

See the Centennial cashier.

Mail

All mail and telegrams for persons attending the meetings should be addressed as follows: Name of Participant, c/o Centennial Celebration, American Mathematical Society, P. O. Box 6887, Providence, Rhode Island 02940. Mail and telegrams so addressed may be picked up at the mailbox in the registration area during the hours the registration desk is open. U.S. mail not picked up will be forwarded after the meeting to the mailing address given on the participant's registration record.

Special Postal Cancellation

The U.S. Postal Service has agreed to set up an official substation in the Centennial registration area Monday through Friday, August 8 to 12, from 11:00 a.m. to 3:00 p.m., with the exception of Thursday, August 11, when it will close at 1:30 p.m. Stamps may be purchased and items mailed. A special cancellation will be used at this substation, offering participants an opportunity to obtain a pictorial cancellation for philatelic purposes which will identify the AMS Centennial. The Providence Postmaster has agreed to continue this special offer for 60 days after the Centennial. Interested parties should send their self-addressed material with proper postage to be cancelled to the Providence Post Office, 24 Corliss Street, Providence, Rhode Island 02904, Attention: Manager of Technical Sales and Service.

Personal and Telephone Messages

Participants wishing to exchange messages during the meeting should use the mailbox mentioned above. Message pads and pencils are provided. It is regretted that such messages left in the box cannot be forwarded to participants after the meeting is over.

A telephone message center is located in the registration area to receive incoming calls for participants. **The center is open from August 7 through 12, during the hours that the Centennial registration desk is open only.** Messages will be taken and the name of any individual for whom a message has been received will be posted until the message has been picked up at the message center. Once the registration desk has closed for the day there is no mechanism for contacting participants other than calling them directly at their hotel or residence hall. The telephone number of the message center will be announced later.

Transparencies

Speakers wishing to prepare transparencies in advance of their talk will find the necessary materials and copying machines at this section of the registration desk. A member of the staff will assist and advise speakers on the best procedures and methods for preparation of their material. There is a modest charge for these materials.

Visual Index

An alphabetical list of registered participants, including local addresses and arrival and departure dates, is maintained in the registration area.

Miscellaneous Information

Athletic Facilities

The facilities at the YMCA (available to current Y members; please check at membership window) at 160 Broad Street include an indoor pool; indoor track; basketball, handball and racquetball courts; universal weights; sauna; aerobics classes.

Tennis courts for public use are available at Nathan Bishop Junior High School on Sessions Street (off Elm-grove), and at Hope High School on Hope Street.

Any participant can use the Brown University athletic facilities at a cost of \$2.75 per person per day or \$7 per

person per week. This includes the basketball court, outdoor tennis courts (indoor courts are an additional charge), weight room, jogging track, squash, swimming pool, sauna, and sun deck.

Book Stores

The Brown University Bookstore at 244 Thayer Street is open Monday - Saturday from 9:00 a.m. to 6:00 p.m.

The College Hill Bookstore at 252 Thayer Street is open Monday - Thursday from 9:00 a.m. to 11:00 p.m., on Friday & Saturday from 9:00 a.m. to midnight, and on Sunday from 10:00 a.m. to 11:00 p.m.

Camping

There are thirteen state or municipally owned campgrounds, offering a variety of facilities. Some accept reservations; others do not. There are many more private campgrounds, most of which encourage reservations. Because the Centennial takes place during a Rhode Island holiday weekend (V-J Day is Monday), space may be at a premium. The closest campground is a forty-minute drive from Providence. Overnight camping in rest/picnic areas, on public highways, in non-camping state/municipal parks, state/municipal beaches and their parking lots is prohibited. Please contact the Mathematics Meetings Housing Bureau at 401-272-9500, extension 290, or the RI Department of Economic Development, 401-277-2601, for more information.

Child Care

There are several registered day care facilities in Providence. Very few, however, have openings during the week of the Centennial, and many also require that the child be enrolled for a full week. The following have indicated that they are willing to accommodate Centennial participants:

Carter Day Nursery, 239 Public Street, Providence, RI, 401-751-9752. Contact Sister Mercain Hassett. Ages 3-5 years, certified kindergarten. Rates: \$50/week, no daily or hourly rates available. Please call well in advance to make arrangements.

Brown Fox Point Day Care & Family Center, 150 Hope Street, Providence, RI, 401-521-5460. Contact Pam McGinn. Ages 3-5 years. Part-time five mornings or three afternoons per week, or full week. Rates: \$35-\$45/part-time; full-time \$45-\$75. Please call two weeks in advance to make arrangements.

Mt. Hope Day Care Center, Inc., 421 Hope Street, Providence, RI, 401-521-7252. Contact Elizabeth Adam. Ages 3-6 years. Rates: \$40 per week for half days, \$55 per week for full days. Please make reservations by the end of June.

The following commercial babysitting services are available:

We Sit Better of RI, 1005 Fleet National Bank Building, Providence, RI. 401-421-1213. Referral service for babysitters. Members of the National Association of Referral Services.

Both the Biltmore and the Holiday Inn have babysitting referral services.

There will be a list of local babysitters available at the Local Information Section of the Centennial Registration Desk during the meeting.

In addition, a Parent-Child Lounge will be located adjacent to the Centennial registration area in the Grand Ballroom of the Holiday Inn. It will be furnished with casual furniture, a crib, a television set, and VCR. Appropriate videotapes and cartoons will be available at the Telephone Message Center. Any child using this lounge **MUST** be accompanied by a parent (not simply an adult) who must be responsible for supervision of the child. This lounge will be unattended and parents assume all responsibility for their children. This lounge will only be open during the hours of registration and all persons must leave the lounge at the close of registration each day.

Crib Rental

A very limited number of portable cribs are available for rent from Rent It All, 738 N. Broadway, East Providence, RI 02914 (telephone 401-434-8479) for \$4 per day or \$20 per week (five days and over). There is a \$18 charge each way for pickup and delivery. The cribs have mattresses, but linens are not provided. Participants renting these cribs for use in the university residence halls should notify the Brown check-in desk of the expected delivery. Payment may be made by VISA or MasterCard credit cards.

Participants not staying on campus will find portable cribs available on a first-come, first-served basis from the hotels.

Handicapped

The Brown University housing facilities are **not** accessible to the handicapped; however, most (not all) classrooms used for the MAA Minicourses are. Participants with special requests or questions regarding handicapped access at the university should contact Pat Henry, Conferences, 401-863-3500.

All hotels are accessible to the handicapped. Participants with special requirements should keep this in mind when requesting housing for the Centennial.

Participants with special questions regarding handicapped access in the city should contact The Governor's Commission on the Handicapped, 401-277-3731.

Libraries

The following libraries are within walking distance of the hotels and residence halls:

Brown University Sciences Library, Corner of Thayer & Waterman Streets, Monday - Thursday 9:00 a.m. - 9:00 p.m., Friday 9:00 a.m. - 5:00 p.m., Saturday 10:00 a.m. - 5:00 p.m.

Rockefeller Library, Brown University campus (same hours as Sciences Library)

John Hay Library (special collections), Brown University campus, Monday - Friday, 9:00 a.m. - 5:00 p.m.

John Carter Brown Library (early Americana collection), Monday - Friday, 9:00 a.m. - 5:00 p.m.

Providence Public Library, 150 Empire Street, Monday, Tuesday, and Thursday, 9:30 a.m. - 9:00 p.m.; Friday and Saturday, 9:30 a.m. - 5:00 p.m.

Providence Athenaeum (rare books), 251 Benefit Street, Monday - Friday, 8:30 a.m. - 5:00 p.m.

Local Information

In August, Providence is on Eastern Daylight Saving Time.

Participants should be aware that Monday, August 8, (Victory over Japan Day) is celebrated as a legal holiday in Rhode Island. There is no delivery of mail by the U.S. Post Office, and all banks and state offices are closed, as are many businesses.

All sessions during the period August 8-12 will be held in downtown facilities. Sessions scheduled to be held on Saturday and Sunday, August 6-7 will take place on College Hill (also known as the East Side), where Brown University is located. Both of these areas are very walkable, but the difficulty involved is in traveling between them. College Hill is not a misnomer, and, although picturesque, it is fairly steep. Fortunately several buses run regularly between Kennedy Plaza downtown and Thayer Street, the "main street" of College Hill. Taxis in Providence are not usually in evidence, except around hotels and bus and train stations, but it is easy to telephone for them. A trip from the Holiday Inn to the Brown campus would cost between \$3 and \$4. A small green trolley, called the Downtown Free Loop, circles around central Providence approximately every twelve minutes, and will stop just about anywhere on its route if the driver is given enough notice. Principal stops include the State House, First Baptist Church, Kennedy Plaza, and Davol Square. If this trolley is still in operation at the time of the Centennial, it is hoped that arrangements can be made for this trolley to drop participants off at the AMS headquarters office. In addition, the Society has arranged for a free shuttle service to and from Brown University that will run daily during the meeting. Although this free shuttle is primarily intended to provide transportation for participants staying in the Brown residence halls, participants staying in the downtown hotels may also utilize this shuttle to visit the Brown University area, including the special mathematical exhibits described in the section on Special Events.

Other than the steep climb, the walk through Providence to Brown University is very short, and many of Providence's more interesting sights happen to be along the way. The Art Deco Fleet National Bank, which faces Kennedy Plaza, is one such sight. It was once New England's most prominent skyscraper, and it is still an integral part of Providence's skyline. The myth persists that it is the original "Daily Planet" building of Superman fame. On the other side of the bank (which can be walked through) is the Arcade, America's first shopping mall, built in 1828. This exquisite, glass-roofed, Greek Revival building contains three floors of specialty shops, food shops, and small restaurants.

Providence possesses an extraordinary number of eighteenth and nineteenth century buildings, both public and private, and College Hill is a pleasant place to enjoy a remarkable collection of them. Benefit Street attracts national attention as the longest street of original colonial architecture in the country. Known as Providence's mile of history, it includes colonial, Federal, and Victorian

residences, meticulously restored. Although most are private homes, there are two house museums on Benefit Street. One, the John Brown House, was referred to by John Quincy Adams as "the most magnificent and elegant mansion that I have ever seen on this continent." The more modest Stephen Hopkins House is a small, red, colonial once owned by Hopkins, a former Governor of Rhode Island and a signer of the Declaration of Independence. Another building of special interest is the Athenaeum, one of the oldest library companies in America; here Edgar Allan Poe courted Sarah Helen Whitman, a resident of Benefit Street. The First Baptist Church, with its back to Benefit Street, is the home of the first Baptist congregation in America, founded by Roger Williams and his followers in 1636. The church itself was built in 1775. The very fine Museum of Art of the Rhode Island School of Design is also located on Benefit Street. It contains over 60,000 holdings in sculpture, painting, graphics, textiles, and the decorative arts.

Theatregoers will enjoy the summer comedies and musicals presented by the Tony Award-winning Trinity Square Repertory Company in downtown Providence.

If one is in search of greenery, Providence's parks include tiny Prospect Terrace on the East Side, which features a statue of Rhode Island's founding father, Roger Williams, and an excellent, breezy view of Providence, including the beautiful dome of the State House. The visitor center of the Roger Williams National Memorial and a four-and-one-half acre park is located at Smith Street and North Main Street. This is the site of the founding of Providence by Roger Williams in 1636. Families may enjoy Roger Williams Park and Zoo, not far away on Elmwood Avenue. It is an elegant urban park of approximately 450 acres, with a lake, paddleboats, and a merry-go-round. The zoo is newly renovated. There is a small Museum of Natural History on the grounds.

Clusters of restaurants, most in close proximity to shopping areas, are located along Thayer Street, Wickenden Street, South and North Main Streets, in downtown Providence, and on Federal Hill. There is a great diversity of cuisines and cultures to be found in Providence's restaurants. One can find particularly good Italian food in the Federal Hill (Atwells Avenue) section of the city. There are several French-inspired restaurants; Mexican restaurants exist, and the city's eastern offerings include Indian, Chinese, and Japanese cuisines. Usually one can find lunch for under \$5; dinner prices range from inexpensive to moderately expensive.

An advantage of the state's small size is that there is no place in Rhode Island more than an hour's drive from Providence. With its more than 400 miles of coastline, Rhode Island offers dozens of high quality public beaches on both sides of Narragansett Bay and along the Atlantic as far south as Watch Hill. Lists of beaches and information on boating, fishing, and other activities will be available at the Local Information Section of the Centennial Registration Desk.

One of the oldest and most famous seaside resorts in the country, Newport is barely an hour away from Providence. The beautiful and opulent city was the location of the America's Cup Races until recent years. During the summer the Tall Ships can frequently be seen in the harbor. Newport is also known for its sumptuous

summer "cottages," built around the turn of the century by wealthy industrialists and social leaders, among them the Vanderbilts and the Astors.

Medical Services

Participants requiring medical assistance should refer to the following:

Rhode Island Hospital, large multi-service teaching facility, open 24 hours, 593 Eddy Street, Emergency telephone: 277-4000

Women & Infants, offering obstetric and neonatal care, at Rhode Island Hospital

Miriam Hospital, all services except psychiatric and obstetric, 164 Summit Avenue

Veterans Administration Hospital, Davis Park, Providence

Brown's Health Services, 13 Brown Street, open Monday-Friday, 8:00 a.m. - 3:30 p.m. A physician is on duty during these hours. The University police and security people are Emergency Medical Technicians and may be called when health services are closed. They will transport to a nearby hospital if necessary.

Parking

Street parking is allowed in metered areas for 25 cents per hour. Meter time ranges from 30 minutes to 10 hours depending on location. Most meters have a two hour limit. There is no overnight street parking. Meter maids are frequent and plentiful.

There is no charge for parking in the hotel's facility for overnight guests staying at the Omni Biltmore or Holiday Inn.

There is a variety of parking garages and lots in the downtown area. Several have "early bird" rates of about \$4.50 if you are in the lot by 9:00 a.m. and out by 6:00 p.m. Otherwise, you should expect to pay this much for a two-and-one-half hour period. Rates are fairly standard, with most charging a maximum of \$7.50 per day. The Parkade (associated with the Biltmore) is the most expensive with a maximum of \$12.50 per day, but it is the only one to allow overnight parking (free to overnight guests who have their ticket validated at the hotel front desk). There is a lot near the bus station that is more economical and allows overnight parking for \$7.50, but it is unprotected. The following lots fall within the described rate structure:

Meyers Park, across from the Performing Arts Center

Outlet Parking Garage, on Pine Street behind the Performing Arts Center

Majestic Parking Garage, on Fountain Street, around the corner from the Holiday Inn (also near the Providence Public Library)

Parkade, behind the Omni Biltmore

Brown University has on-campus parking spaces available in overnight lots at an estimated cost of \$1.50 per day. Parking permits will be sold at the check-in desk for the Brown residence halls.

Smoking

Please note that smoking is not allowed in any of the session rooms in the PPAC, Biltmore, Holiday Inn, or Johnson & Wales Academic Center.

There are designated nonsmoking sleeping rooms in the residence halls as well as hotels. People requiring nonsmoking rooms should make this clear when submitting housing requests.

Special Events

AMS Open House

The Society invites all Centennial participants to visit its headquarters office at 201 Charles Street. Guided tours will be given daily from 1:00 p.m. to 3:00 p.m. Tuesday through Thursday, August 9-11. Advance reservations must be made by either completing the appropriate section on the Preregistration/Housing Form or by signing up at the Tickets/Tours Section of the Centennial Registration Desk. There is no charge for these tours which will be conducted by the various department and division heads of the AMS staff.

As previously mentioned, if the Downtown Free Loop trolley is still operating in August, plans are to have it drop off participants at the AMS office.

To get to the Society's headquarters from I95 North, take exit 23, State Offices. Turn left onto Orms Street at the end of the exit. Go left at the light at the bottom of the hill onto Charles Street. The Society is located in a one-story dark brown building about 200 yards on the right. From I95 South, take exit 23, Charles Street. Bear right because traffic is one way at this point. Bear to the left and around V.F. Liquors to reverse direction. Continue about 300 yards and bear left around the Sunoco station. The Society's entrance is directly across from the Sunoco station on Charles Street.

Opening Reception

All Centennial participants are invited to attend the Opening Reception on Monday, August 8, at 7:00 p.m. at the Rhode Island State House. Free transportation will be provided. This predinner function features light hors d'oeuvres and beverages. Music will be provided by Musica Camera, a chamber music ensemble led by Ernest Nordman, recently retired from the Society's staff after 25 years of service.

The State House was built in 1900 of white Georgia marble. It has the third largest unsupported marble dome in the world, surpassed only by the Taj Mahal and St. Peter's Cathedral in Rome. Among the many historical artifacts housed in this building is a full length portrait of George Washington by Gilbert Stuart, a native Rhode Islander.

At the Semicentennial in 1938, all participants gathered on the steps of the Low Memorial Library at Columbia University for a group photograph. In an attempt to duplicate this feat, all participants are requested to gather on the front steps of the State House at 6:30 p.m., just prior to the Opening Reception. Copies of this photograph will be on sale later in the week at the Souvenirs Section of the Centennial Registration Desk.

Clambake

On Thursday afternoon, August 11, a traditional New England clambake will take place at Francis Farm in Rehoboth, Massachusetts. Transportation will be provided. The clambake was originated by native Indians who cooked their clams on large, hot stones and covered the food with seaweed and hay. Francis Farm has replaced the stones with heated iron ingots, since, unlike rocks, they can be reheated. The same family has continued this tradition for 115 years. The "all-you-can-eat" menu includes chowder and crackers, clamcakes, clams hot from the bake with drawn butter, fresh fish, white and sweet potatoes, onions, sweet corn, sausage, brown bread, hard butter, pickles, watermelon, and coffee. Participants may substitute chicken for fish by so indicating on the Preregistration/Housing Form.

Musical entertainment will be provided by the Old Fiddlers' Club of Rhode Island, whose repertoire includes all the old familiar songs.

The farm has facilities and equipment for volleyball, basketball, softball, and horseshoes. Entertainment will be provided for the children, including face-painting.

Tickets are \$23 for adults and \$15 for children ages 6 through 12. There is no charge for children under 6 years of age. However, if bringing a child under 6 years of age, please indicate on the Preregistration/Housing Form. Tickets may be purchased through preregistration by completing the appropriate section of the Preregistration/Housing Form, and enclosing the proper payment with the preregistration fees. Please note that a 50% refund can be made on clambake tickets **until July 25**. After July 25, no refunds are possible.

Happy Hour

On Tuesday and Wednesday, August 9-10, from 5:30 p.m. to 7:30 p.m., a no-host cash bar will operate in the Cafe on the Terrace of the Omni Biltmore Hotel. Free dry snacks will be provided. Participants are encouraged to use this occasion to spend some time with old and new friends.

Souvenirs

Photographs

A copy of the group portrait of Semicentennial participants will be on display in the registration area. Orders for reproductions of this photograph will be taken at the Souvenirs Section of the Centennial Registration Desk. The price for these reproductions has not yet been determined, but should be modest.

Copies of the group photograph taken on Monday, August 8, at the Opening Reception will also be on sale at the Souvenirs Section of the Centennial Registration Desk.

Commemorative Poster

The Society has prepared a poster commemorating its Centennial featuring a photographic reproduction of the sculpture Torus with Cross-Cap and Vector Field by Helaman Rolfe Pratt Ferguson of Brigham Young University. The sculpture is a gift from the Mathematical Association of America to the Society on the occasion of its Centennial. This striking poster is printed on museum quality

glossy paper. The sculpture is white and photographed on a rich, blue background. These posters are on sale at the Souvenirs Section of the Centennial Registration Desk for \$10 each. They may be purchased through preregistration for the same price by completing the appropriate section of the Preregistration/Housing Form and including the \$10 with the payment of the preregistration fee. Those who purchase the poster through preregistration may pick up their copy at the Souvenirs Section. Please note that a 100% refund can be made on posters **until August 4**. After August 4, only 50% can be refunded.

Tours

Tour of Historic Providence

Architectural historians regard the buildings of Providence's "East Side" as one of America's best examples of 18th century America. Homes from the colonial period to the contemporary cover every period of architectural importance in American Life. This area of Providence is not a recreated showplace; these homes have been lived in continuously since before the Revolutionary War. Benefit Street was created "for the common benefit of all" in the 1760s to relieve congestion on Providence's Main Street. Benefit Street followed a path along existing gardens, orchards, and family burial plots, and now has brick paved sidewalks lined with charmingly restored colonial, federal, Greek revival, and Victorian homes. Its rescue from blight was a triumph for historic preservation, turning it into one of New England's most beautiful residential areas. On this tour you will learn of Providence's rich history as a colonial capital, a bustling China Trade seaport, and an early center of industrial development as you view 18th century buildings on the city's waterfront. Included in this tour will be a visit to one of the private homes in this area that has undergone restoration to its original beauty. This tour is offered twice daily on Tuesday, August 9, and Thursday, August 11, departing from the front of the Omni Biltmore at 9:00 a.m. and 11:00 a.m. and returning at 11:00 a.m. and 1:00 p.m. Tickets are \$12 for adults, \$10 for children age 12 or under. There is no charge for infants not occupying a seat on the bus. Tickets may be purchased through preregistration by completing the appropriate section of the Preregistration/Housing Form, and enclosing the proper payment with the preregistration fees. Please note that a 50% refund can be made on tour tickets **until August 4**. After August 4, no refunds are possible.

Living History Tour of Newport

A costumed character from Rhode Island history will serve as the guide for this bus tour of the colonial and Victorian city of Newport. Settled in the 18th century, Newport is home to the first synagogue and first Quaker meeting house in America. Newport is perhaps best known as the home of the "summer cottages" of the country's wealthiest families, such as the Vanderbilts and the Rockefellers. The highlight of the afternoon is a visit to Beechwood, the summer home of the Astor family. Here, instead of roped-off displays and security guards, one finds a lively recreation of life in the 1890s. Mrs. Astor's guests and servants are portrayed in Newport's only living history tour. This tour is offered on Monday,

August 8, Wednesday, August 10, and Friday, August 12, departing from the front of the Omni Biltmore at 1:00 p.m. and returning at 5:00 p.m. Tickets are \$15 for adults, \$12 for children age 12 or under. There is no charge for infants not occupying a seat on the bus. Tickets may be purchased through preregistration by completing the appropriate section of the Preregistration/Housing Form, and enclosing the proper payment with the preregistration fees. Please note that a 50% refund can be made on tour tickets **until August 4**. After August 4, no refunds are possible.

Travel

By Air

For some years now, the AMS-MAA Joint Meetings Committee has engaged a travel agent for the January and August meetings in an effort to ensure that everyone attending these meetings is able to obtain the best possible airfare. This service is presently being performed by Meetings, Incentives, Conventions of America, Inc. (MICA); their advertisement can be found elsewhere in this meeting announcement. Although any travel agent can obtain Supersaver or other such published promotional fares, only MICA can obtain the special additional 5% discount over and above these fares, and the 35-40% off regular coach fare. The latter, of course, is financially beneficial only when one does not qualify for one of the promotional fares. Participants should pay particular attention to the cancellation policies stated in the ad.

Airport Transfers

Theodore Francis Greene Airport lies about nine miles south of Providence and is served by most major carriers. Cabs are metered, with a typical fare to the downtown area averaging \$15.

The Society has made arrangements with the Airport Limousine to provide ground transfers to and from the Providence airport, the hotels, and the residence halls at Brown University. The cost one way is \$5.75 per person (no charge for infants on parent's lap) or \$11.50 round trip. Participants wishing to purchase these transfers through preregistration should complete the appropriate section of the Preregistration/Housing Form and include payment with their preregistration fee. It is mandatory that participants purchasing these transfers provide accurate airline flight information. These transfers will be valid from Friday, August 5, through Monday, August 15. Transfers will be mailed to each participant with the acknowledgement of preregistration. A 100% refund can be made for airport transfers cancelled by August 4. After August 4 only 50% can be refunded.

Return transfers should be reconfirmed at the Travel/Tours Section of the Centennial Registration Desk during the meeting. Return transfers can also be purchased at this desk.

There will be a desk in the lobby of the airport for the purpose of welcoming Centennial participants and dispensing information on transportation to and from the airport. A comfortable area has been set aside for those who must wait for the airport limousine or for outgoing flights.

Participants staying at the Holiday Inn-Providence Downtown should be aware that the Inn has a courtesy van that runs between the airport and the hotel between the hours of 6:00 a.m. and 11:00 p.m. When arriving in Providence, please use the green telephone in the baggage claim area to contact the van. Although the van runs until 11:00 p.m., the last time it can be called is 10:30 p.m.

There are several rental car companies located at the airport or directly across the street. Expect to pay \$30 per day for a compact car and \$35 per day for an intermediate size car, which includes free mileage for the first 75 miles each day. Hertz rates are \$10-\$15 higher. It may be less expensive to contract for a week if you intend to use the car for five days. Weekly rates start at about \$133 for a compact car (Dollar Rent-a-Car). All accept most major credit cards. The following are at the airport or across the street (businesses with an asterisk have toll free numbers to make reservations; consult your local yellow pages):

*Avis, 738-5800

Budget Car & Truck Rental, 739-8900 (also has office at Omni Biltmore)

*Dollar Rent A Car, 739-8450

*Hertz, 738-7500 (also has office at Omni Biltmore)

*National Car Rental, 737-4800 (also has office at Omni Biltmore)

*Thrifty, 739-8660

By Auto

Interstate Route 95 (I95) goes through the center of Providence. If arriving from the South (as if from the airport) take I95 north to exit 21 (Broadway), at the second set of lights, take a right, and the Holiday Inn will be on the left side. To get to the Omni Biltmore, follow the previous directions but pass the Holiday Inn and take

a left at the next light. Follow the road as it curves to the right, but bear left onto Fountain Street. Go through two sets of lights, and take a right at the third set onto Dorrance Street. The hotel will be on your right, across from Kennedy Plaza.

If arriving from the north on I95 South, take exit 21, Atwells Avenue, and go left at the light at the end of the exit. The Holiday Inn will be on your left. For the Omni Biltmore, go by the Holiday Inn and take a left at the traffic light. Follow the directions in the previous paragraph, bearing left onto Fountain Street.

Brown University is most easily accessible from I195 East (which merges with I95 North and South in the center of Providence). Take the Wickenden Street exit (#2). Cross Wickenden Street at the end of the exit but take an immediate left, following the signs to Benefit Street. Travel up Benefit Street about three-quarter miles to George Street. Take a right on to George Street, which leads to the residence halls. See campus map for exact location of these halls.

By Train

Amtrak provides regular train service from New York City and Washington, DC to the new Providence Train Station. This Northeast Corridor route connects with others nationwide.

By Bus

The Bonanza Bus terminal is also located downtown and has frequent service from New York City and Logan Airport in Boston.

Videotapes

The Society plans to videotape the eighteen lectures in the symposium *Mathematics into the Twenty-First Century* and the three AMS-MAA Joint Invited Addresses as a

AIRLINE INFORMATION

SPECIAL AIRFARES 1-800-888-MICA

MICA, Inc., the official travel management firm for the AMS Centennial Celebration to be held in Providence, August 8 - 12, 1988, has arranged for special discounts aboard American Airlines and USAir.

Save 5% off published promotional fares, meeting all restrictions, or 35-45% off regular roundtrip coach fares, with a 7 day advance purchase, (American Airlines even provides 5% off the non-refundable fares). Only through MICA can you receive these substantial discounts on American Airlines and USAir. It may be possible to receive an even lower airfare depending upon your individual circumstances.

The lowest promotional fares require a Saturday night stay, are subject to an airline change/cancellation penalty and must usually be purchased at least 30 days prior to departure.

Make your reservations today! **For reservations on all airlines**, call MICA directly on their nationwide toll-free number: 1-800-888-MICA. MICA reservationists will advise you of the most convenient flights and lowest airfares available. You may pay by credit card or ask to be invoiced. Your airfare is guaranteed when your ticket is written!

MICA wishes to take this opportunity to congratulate the American Mathematical Society on the occasion of its Centennial, and to extend its best wishes for continued success during its next 100 years.



Call Today: 1-800-888-MICA And Save!
Monday - Friday, 9:00 a.m. - 6:00 p.m. EST



Meetings, Incentives, Conventions of America, Inc. (MICA, Inc.)
Suite 303, 195 Farmington Avenue, Farmington, CT 06032
(203) 678-1040

record of the Centennial Celebration. It is anticipated that the videotapes will be available for distribution later in 1988.

Weather

The normal daytime high in the city is 80 degrees F. The normal nighttime low is 61 degrees F. Average daytime humidity is 82%; nighttime is 54%. Record high temperature is 104 degrees F., while the low is 40 degrees F. Light sweaters or jackets are recommended for cool evenings, while natural fiber clothing such as cotton is advised for warm, humid days. Average rainfall for the month of August is 3.9 inches; however, August can bring frequent and heavy thunderstorms where several inches of rain can fall in a very short period of time. The highest rainfall for August on record is 7.92 inches.

**Everett Pitcher, Chairman
Centennial Committee**

Refunds for Atlanta Meeting

Individuals who preregistered for the January 1988 Joint Mathematics Meetings in Atlanta, Georgia but who were prevented from attending the meeting because the Atlanta airport was closed due to inclement weather may request a refund of 50 percent of the meeting preregistration fee by writing to the Mathematics Meetings Housing Bureau, Post Office Box 6887, Providence, Rhode Island 02940. The AMS-MAA Joint Meetings Committee is granting this exception to the usual refund policy because of the unusual weather circumstances in Atlanta, but this will in no way prejudice the application of the usual policy for future meetings. (For information, the usual policy is that a 50 percent refund can be made if notice of cancellation is received before the start of the meeting. After the start of the meeting, no refunds can be made.)

Focus Employment Advertisements

The advertising rates in FOCUS have been raised as of the November-December 1987 issue to reflect increased circulation (now over 28,000) and costs and design changes that will give our advertisers more words per running inch. Standard advertisements carried forward from previous issues will be charged at the old rates.

Rates for FOCUS Employment Ads are: 50 words or less: \$37.50. More than 50 words: \$45.00 per inch.

There is a 15% discount for the same ad in 3 consecutive issues (with contract in advance). An insertion order on institutional letterhead will be considered a contract. Charges will be billed after the first occurrence specified in the contract.

Anyone wishing to place an employment ad in FOCUS should write to: FOCUS Employment Ads, Mathematical Association of America, 1529 Eighteenth Street, N.W., Washington, D.C. 20036. Or for more information, call the MAA Washington Office at (202) 387-5200.

Deadline for September 1988 issue is July 29.

BETHEL COLLEGE, MATH & COMPUTER SCIENCE DEPT. 3900 BETHEL DRIVE, ST. PAUL, MN 55112

Bethel College has two full-time, tenure-track positions in the seven-member department of Math and Computer Science. One is for a Ph.D. in mathematics education, the other for a Masters or Ph.D. in computer science or related field. Candidates must be strongly committed to the educational mission and evangelical Christian orientation of the college. Write to: Dr. Dwight Jessup, Vice President for Academic Affairs.

One year position, Mathematics. Teach introductory and advanced undergraduate mathematics courses. Master's required; further training preferable. Teaching experience desirable. Salary dependent on training and experience. Send vita and three letters of reference to: Dr. Stanley Caine, Vice President for Academic Affairs, Hanover College, Hanover, Indiana 47243.

INSTRUCTOR WRIGHT STATE UNIVERSITY DEPARTMENT OF MATHEMATICS & STATISTICS DAYTON, OHIO 45435

One or more instructorships are anticipated for Fall 1988. These are one-year non-tenure track positions which may be renewed annually, for up to five years. These positions offer competitive salaries and excellent benefits. The teaching load is 12-16 contact hours per quarter, mainly in service courses. Masters degree in mathematics or statistics required. Previous full-time teaching experience preferred. Please send resume, graduate transcript(s) and three letters of reference to: Faculty Search Committee. Closing date: February 15, 1988, then every two weeks until selection or August 1, 1988. WSU is an AA/EOE.

Instructor or Assistant Professor of Mathematics, beginning September 1988. Tenure track position. Salary competitive, dependent upon qualifications. Ph.D. or ABD in Mathematics required. Ability to teach Computer Science courses necessary. Commitment to quality undergraduate education at a liberal arts college essential. Send vita and three letters of reference to Dr. William C. Dunning, Chairman, Mathematics Department, Simpson College, 701 North C Street, Indianola, Iowa 50125-1297.

UNIVERSITY OF GUAM MATHEMATICS DEPARTMENT

Tenure-track position, instructor-associate professor, beginning August 1988. Ph.D. in mathematics preferred. U.S. citizenship or permanent residence and strong commitment to undergraduate teaching required. Send application, vita, transcripts, three letters of recommendation to Dr. Gail Mullen, Division of Science and Mathematics, University of Guam, UOG Station, Mangilao, Guam 96923.

Math Instructor—tenure track. Comprehensive community college math program. Includes developmental, technical, transfer courses. Master's required. Preference given to those with previous college teaching experience and ability to teach programming languages. \$18,016-\$41,264 for two semesters. Begins August 18, 1988. Contact V.P. Academic Services, Lincoln Land Community College, Springfield, IL 62708. EOE/AA

UNIVERSITY OF MINNESOTA

Applications invited for up to 3 anticipated mathematics positions at Instructor or Assistant Professor level. One year appointments to begin 16 Sept. 1988, possibility of renewal. To teach 7–10 credit hrs/qtr lower division mathematics/elementary statistics. One appointee to teach Methods of Teaching Math in Secondary School. Salary negotiable. Minimum qualifications include M.A. or M.S., strong undergraduate teaching commitment, teaching experienced required. Send application, resume, transcript, 3 recommendation letters by April 30, 1988 to: Dr. James M. Olson, Chair, Division of Science and Mathematics, University of Minnesota, Morris, MN 56267. The University of Minnesota is an equal opportunity educator and employer and specifically invites and encourages applications from women and minorities.

**So. Illinois U. at Edwardsville
Mathematics and Statistics
Edwardsville, Illinois 62026–1653**

SIUE, a state university 20 miles from downtown St. Louis, MO., a major cultural and educational center, invites applications for an anticipated tenure-track position as an asst. prof. beginning Sept. 1988. Only applicants who have a doctorate or equivalent experience, or will complete Ph.D. requirements by Sept. 1, 1988, will be considered. We seek applicants with excellent research accomplishments/potential and a strong commitment to teaching Math. and possible Elem. Stat. Salary is competitive and based on qualifications and experience. Direct inquiries to Mathematics Search. SIUE is an AA/EEO Employer.

**SOUTHEASTERN LOUISIANA UNIVERSITY
DEPARTMENT OF MATHEMATICS**

Applications are invited for two tenure-track positions at the Assistant Professor level beginning August, 1988. A Ph.D. in mathematics or mathematics education is required. Excellence in teaching and continued scholarly activity are expected. Teaching load is twelve hours of undergraduate mathematics per semester. Vita, graduate and undergraduate transcripts, and three letters of recommendation should be sent to Lawrence H. Davis, P.O. Box 687, University Station, Hammond, Louisiana 70402. Application deadline: March 18, 1988 or until positions are filled EO/AA employer.

**BOWDOIN COLLEGE
Brunswick, Maine 04011**

Visiting position, Mathematics Department, rank open, starting September, 1988. Two-year terminal position. Ph.D. expected. Normal teaching load 6 hours per week. Candidates with record of effective undergraduate teaching of statistics preferred. Send resume and 3 letters of recommendation by April 1, 1988 to J.E. Ward, Chairman, Department of Mathematics, Bowdoin College, Brunswick, ME 04011. Bowdoin College is committed to Equal Opportunity through Affirmative Action.

University of South Carolina at Spartanburg (USCS)

USCS is accepting applications for a tenure-track teaching position at the rank of assistant professor starting Fall 1988 (pending funding). Salary competitive. USCS is committed to excellence in teaching. Ph.D. in mathematics preferred, teaching experience desirable. Applicants in statistics, numerical analysis or differential equations are especially encouraged to apply. Send letter of application, curriculum vita, official grad and undergraduate transcripts, and three letters of recommendation. The search will continue until the position is filled. Send to: Mathematics Search Committee, Office of the Dean, School of Humanities and Sciences, Box D, University of South Carolina at Spartanburg, Spartanburg, SC 29303. Currently 40% of the faculty of the School of Humanities and Sciences are women and 6% represent minority groups. Women and minorities are encouraged to apply. An Affirmative Action/Equal Opportunity Employer.

**STONE HILL COLLEGE
Department of Mathematics**

Tenure Track Position in Mathematics-Computer Science available Sept. 1988. Qualified candidate will be able to teach some of the following courses: Numerical Analysis, Probability, Mathematical Statistics and Assembly Language. Ph.D. (or near completion) is expected. Excellence in undergraduate teaching and scholarly activity are required. Salary is competitive. Stonehill College, located 20 miles south of Boston, is a liberal arts college with an enrollment of 1800 students. The Mathematics Department offers degrees in Mathematics and Computer Science. Computing facilities include a VAX 8350, numerous IBM PC workstations and several Macintosh systems. Send resume and three letters of recommendation to: Ralph Bravaco, Chair, Dept. of Mathematics, Stonehill College, No. Easton, MA 02357. An Equal Opportunity Employer.

Mathematical Science

New building . . . new equipment . . . growing student population. Join a dynamic university with a commitment to Mathematical Sciences. Tenure track position at Assistant or Associate Professor level requiring Ph.D. in Mathematics. Salary negotiable, excellent fringes. Position open until filled. Send letter of application, resume, transcripts and three letters of recommendation to: Mr. Larry Fitzpatrick, Director of Personnel, Saginaw Valley State University, University Center, MI 48710. SVSU is an equal opportunity/affirmative action employer.

**CHRISTIAN BROTHERS COLLEGE
DEPARTMENT OF MATHEMATICS
AND COMPUTER SCIENCE
MEMPHIS, TN 38104**

Applications are being accepted for three positions—starting date Fall 1988. The first is a tenure-track position in the teaching of undergraduate mathematics. A Ph.D. in mathematics is required. The second is a tenure-track position in computer science. A Ph.D. in any academic discipline with at least a Masters in computer science is sought, although candidates with multiple Masters—one in computer science—will be considered. A third position is that of Mathematics Laboratory Director. (Funding for this position is pending.) Applicants should possess at least a Masters Degree in Mathematics and have some experience in developmental programs. Knowledge of computers, an authoring language, and video is a plus. Applications will continue to be accepted until the positions are filled.

Christian Brothers College is a co-ed institution administered by the Catholic Order of the Christian Brothers, an Order with a 300 year world-wide tradition of excellence in teaching. The college enrollment is 1700. Degrees are offered in engineering, business, the sciences, and the arts. Recently, the college has expanded its degree program to the Masters level, with its first graduate degrees in Telecommunications and Information Systems.

Send a letter of application, resume, transcript of graduate credits and three letters of recommendation, to Dr. Lawrence Gulde, Head. At least two letters should address teaching effectiveness. EOE/AE.

**UTICA COLLEGE OF SYRACUSE UNIVERSITY
UTICA, NY 13502**

Assistant Professor of Mathematics, tenure track position, starting Fall 1988. Ph.D. in mathematics required. Advanced ABD considered. Ability or interest in Actuarial Mathematics desirable. Strong candidates in any field will be considered. Strong commitment to undergraduate education necessary. Scholarship expected and encouraged. Salary negotiable and commensurate with experience. Applications considered until position is filled. Send vita and three letters of recommendation to: Dr. Gian Carlo Mangano, Department of Mathematics, Utica College of Syracuse University, Utica, NY 13502. AA/EOE

The Department of biometrics and Computing is seeking to fill a vacant faculty position in Biostatistics/Mathematics.

START DATE: July 1988

Candidate must possess a Ph.D., in either Statistics, Biostatistics or Mathematical Statistics. The position is expected to begin at the Assistant Professor level. Qualifications include excellent teaching and research capabilities, a thorough knowledge of Fortran, and BASIC. A working knowledge of SAS, SPSS, and BMDP is also necessary.

Teaching in all three schools of the University will be required which includes the College of Allied Health, Graduate School, and Medical School. Research and Biostatistical/Mathematical consulting will also be required.

Salary is highly competitive and commensurate with qualifications.

Send C.V. and Names/addresses of three references, immediately to:

DR. H. KUSHNER, CHAIRMAN
DEPARTMENT OF BIOMETRICS & COMPUTING
HAHNEMANN UNIVERSITY
RM. 712 SAHP, M.S. 550
PHILADELPHIA, PA 19102.

MATHEMATICS DEPARTMENT FACULTY POSITIONS: Temporary positions starting Fall 1988 at East Stroudsburg University. One position full-time for one academic year. Other position half-time for one academic year. Master's in mathematics or mathematics education with a strong mathematics component accepted. Ph.D. preferred. Recent teaching experience required. Rank: Assistant Professor. Salary: \$24,200 - 34,052. Teaching load (full time): 24 credit hours per year. Indicate position of interest and send resume, transcripts and three letters of recommendation by April 4 to: Professor Edward Hogan, Chairperson, Search and Screen Committee, Mathematics Department, East Stroudsburg University, East Stroudsburg, PA. 18301. East Stroudsburg University is an affirmative action/equal opportunity employer complying with federal and state laws. Women and minorities are strongly encouraged to apply.

STEPHEN F. AUSTIN STATE UNIVERSITY

The Department of Mathematics and Statistics anticipates filling one or two Assistant Professorships and one Assistant or Associate Professorship beginning with the 1988-89 academic year. Applicants must hold a doctorate in either mathematics or statistics, have a strong interest in teaching, and demonstrate a commitment to continuing research. Salary is competitive. Deadline May 10. Send resume and the names and addresses of three or more references to Chairman, Department of Mathematics and Statistics, Stephen F. Austin State University, P.O. Box 13040, Nacogdoches, TX 75962-3040. AA/EEO employer.

ORAL ROBERTS UNIVERSITY MATHEMATICAL SCIENCES DEPARTMENT

Applications are invited for a tenure-track position teaching calculus and upper level mathematics courses, beginning August 22, 1988. Qualifications include a doctorate in mathematics and a commitment to teaching. Rank is open. Normal teaching loads average 12-13 hours per semester. Oral Roberts University is a charismatic, Christian, liberal arts institution having approximately 4000 undergraduate students. Mathematical Sciences, combining Math and Computer Science, is one of 12 undergraduate departments. To obtain more detailed information, write Verbal Snook, Oral Roberts University, 7777 South Lewis, Tulsa, Oklahoma 74171 or call 918-495-6700.

The University of Massachusetts, Basic Mathematics Program, has a non-tenure-track Lecturer position for Fall, 1988, which provides the opportunity to work in an innovative mathematics instruction program. The position is for 1 to 2 years, and includes teaching and administration of a multi-section mathematics course, with possible opportunities for educational research with the Scientific Reasoning Research Institute. Understanding of constructivist learning principles and the ability to work with students who have difficulty learning math is required. The deadline for application is May 30, 1988. Salary commensurate with qualifications and experience. Send letter of application, vita, and 3 letters of reference to: Search Committee, Basic Mathematics Program, 314 Hasbrouck Lab, University of Massachusetts, Amherst, MA 01003, The University of Massachusetts is an Affirmative Action/Equal Opportunity Employer.

SOUTHERN ILLINOIS UNIVERSITY AT CARBONDALE, DEPARTMENT OF MATHEMATICS, CARBONDALE, IL 62901

Temporary positions are anticipated starting on August 16, 1988 as Lecturer. Masters degree in mathematics or admission to candidacy required; Ph.D. preferred. Applicants should provide evidence of excellence in teaching and foreign applicants should provide evidence of ability to speak English effectively. Preference given to applicants with research interests compatible with those of our faculty. The duties consist of 12 hours of undergraduate mathematics instruction each semester. Closing date May 1, 1988 or until positions are filled. Send applications (including transcripts) to: Temporary Positions; c/o Ronald Kirk, Chairman; Department of Mathematics; Southern Illinois University; Carbondale, IL 62901. SIU-C is an Equal Opportunity/Affirmative Action Employer.

CENTRAL COLLEGE DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE Pella, Iowa 50219

Anticipate a one-year position for the 1988-89 academic year with possibility of renewal. Teach a variety of undergraduate courses in mathematics and/or computer science. Master's degree required, Ph.D. preferred. Normal teaching load is 7 courses over three quarters. Send application, resume, and three letters of reference to W.H. Bearce, Dean of the College. Equal Opportunity Employer.

SCIENCE AND MATHEMATICS

Saint Mary-of-the-Woods College is seeking a full-time faculty member for the Department of Science and Mathematics, beginning August, 1988. Responsibilities include teacher education and introductory level courses in physics, computing and mathematics in both a traditional and non-traditional setting. Master's degree required; doctorate desirable. Elementary and/or secondary teaching experience desirable. Send credentials to Vice President of Academic Affairs, Saint Mary-of-the-Woods College, Saint Mary-of-the-Woods, IN 47876.

Math faculty, Assumption College. Full-time, tenure-track, teaching undergraduates 12 hours (3 preparations). Begins September 1988. Ph.D. and teaching experience preferred, some computer science desirable. Salary and rank negotiable. Excellent benefits. Send letter and resume by April 15 to: Dr. Vincent Cioffari, 500 Salisbury Street, Worcester, MA 01609. AA/EOE employer.

Mathematics. Tenure stream position at the assistant professor level. Applied mathematics major with mathematics education option. Teaching responsibilities include: probability, statistics, discrete mathematics, calculus. Send resume and three letters of recommendation by March 31, 1988, to Dr. Richard Melka, Chair, Mathematics Search Committee, University of Pittsburgh at Bradford, PA 16701. Pitt-Bradford is an affirmative action/equal opportunity employer.

Full-time tenure-track Assistant, Associate, or Full Professor position. Ph.D. in mathematics with interest in mathematics education, or Ph.D. or Ed.D. in mathematics education required; the qualifying degree must be from regionally accredited institution. Position requires a record of research, publications, and success in obtaining grants. Evidence of interest in both pre-service and in-service education, a commitment to quality teaching and a strong research potential are required. Secondary teaching experience is highly desirable. Primary responsibilities include teaching graduate and undergraduate mathematics and mathematics education courses, working closely with the director of the UNC Mathematics and Science Teacher Center, and assisting in maintaining contacts with public schools. In addition, student advising, committee work and continuing scholarship are expected. (STATE POSITION NUMBER 20242.)

Full-time, tenure-track Assistant Professor position. Doctorate from a regionally accredited institution is required. Evidence of teaching experience and ability and potential for continued research must be provided. Primary responsibilities include teaching undergraduate and graduate mathematics courses. Advising, committee work, and continuing scholarship are expected.

By UNC policy, persons with a terminal degree from UNC cannot be considered. Deadline for applications and nominations is April 15, 1988. Letter of application, resume, names, addresses, and telephone numbers of three references, and three letters of recommendation should be mailed to: Dr. William Popejoy, Department of Mathematics and Applied Statistics, UNC, Greely, CO 80639.

Positions contingent upon adequate funding from Colorado Legislature and final approval by the Board of Trustees.

UNC is an AAEO employer.

MATHEMATICS FACULTY POSITION

Master's degree or equivalent in Mathematics. Applicant must be enthusiastic, versatile, and possess the ability to teach a wide range of Mathematics courses from the remedial through college level offered by a comprehensive community college. Previous community college teaching experience preferred. Review of application will begin on January 31, 1988 and continue until the position is filled. Appointment starting Fall 1988. Send letter of application and resume to:

Director of Personnel
MOHAWK VALLEY
COMMUNITY COLLEGE
1101 Sherman Drive
Utica, New York 13501

Mohawk Valley Community College is an
Affirmative Action/Equal Opportunity Employer

AUBURN UNIVERSITY

Department of Algebra, Combinatorics and Analysis

The department expects to make one or more nine-month appointments at the rank of Instructor beginning September 1988. Masters degree in mathematics or closely related area and evidence of good teaching required. Teaching load 15 hours each quarter in freshman courses. Salary competitive. Position is temporary with annual renewal up to six years.

Send resume and arrange for three letters of reference to be sent to James R. Wall, 120 Math Annex, Auburn University, AL 36849.

AUBURN UNIVERSITY IS AN EQUAL OPPORTUNITY AFFIRMATIVE ACTION EMPLOYER.

MATHEMATICAL SCIENCES POSITION

The Department of Mathematical Sciences of Salisbury State College has a tenure-track opening beginning in 1988-89 at the instructor level. Salary will be in the range of \$24,000 to \$28,000. All candidates must possess a Master's degree and have a program plan for the doctorate. In addition, they must have successful full-time teaching experience in a college mathematics department. In their teaching, they must have demonstrated a mathematical-sciences viewpoint (i.e., a blend of pure and classical applied mathematics, statistics, and computer science) and an ability to teach courses in intermediate statistics and mathematics for prospective teachers. Finally, they must be able to teach successfully students with diverse backgrounds (this includes the ability to communicate effectively in English, both orally and in writing). Non-U.S. citizens must have U.S. Immigration and Naturalization authorization to accept employment in this country.

Initial screening will be based on each applicant's academic background and teaching experience as supported by recommendations. Final selection will be made on the basis of the foregoing, a personal interview, and a formal lecture on a topic of the candidate's choice.

Salisbury is a small city in a rural area, close to ocean beach and the Chesapeake Bay.

Send letter of application, resume, and three letters of recommendation to:

Search Committee
Department of Mathematical Sciences
Salisbury State College
Salisbury, Maryland 21801

The deadline for receipt of applications is April 1, 1988.

Salisbury State College is an Affirmative Action/Equal Opportunity Employer. Women, minorities and the disabled are encouraged to apply.

VALPARAISO UNIVERSITY, DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE, VALPARAISO, IN 46383

If you are interested in contributing to a growing and dynamic undergraduate math program, you are invited to apply for a possible tenure-track position to begin Fall, 1988. Qualifications desired: Ph.D. in Math with expertise in (1) Analysis and or/Math Logic or (2) Operations Research and/or Math Modeling or (3) Secondary Education. Salaries competitive. Rank dependent upon qualifications. Closing date: until position is filled. Valparaiso University is a private university in the Lutheran tradition, and an EO/AA employer. Send letter of application and resume to William Marion, Chairperson.

The Department of Mathematics invites applications for a tenure-track teaching position beginning August 23, 1988. Duties include teaching undergraduate mathematics courses. Doctoral preparation preferred. Master's Degree in Mathematics required. Rank and salary commensurate with experience and education. Applicants should submit a vita, a copy of graduate transcript, and three letters of recommendation no later than April 15, to: Professor Ray Hamlett, Department of Mathematics, East Central University, Ada, Oklahoma 74820. ECU is an EO/AAE.

MATHEMATICS: Full-time, 9 month fresh, soph, teaching position available Sept. 1, 88. Masters in MATH. or STAT. & min. 18 grad. sem. hrs. in math. required. PhD math preferred. Teaching ability in BASIC or FORTRAN. College teaching experience. An Equal Opportunity/Affirmative Action Employer. All application materials should be in by closing of April 15, 88. Date might be extended depending upon applicants credentials. Apply to: Chair., Div. of Nat. Sci. and Math., Macon College, College Station Dr., Macon, GA 31297. (912)471-2700.

OPENING IN TEACHER PREPARATION PROGRAM

Department of Mathematics University of Arizona

The Department of mathematics at the University of Arizona is seeking a person whose major contributions will be to the department's teacher preparation program. Responsibilities in the program include: teaching mathematics and mathematics education courses, developing preservice and inservice programs for mathematics teachers, coordinating liaison and outreach programs with local schools, initiating research and development projects, joining efforts with state and national educational organizations. The position requires sensitivity to teaching and teachers, and a strong commitment to the improvement of mathematics education at all levels. Applicants must have a strong background in graduate mathematics and must have a doctorate in mathematics or in mathematics education. This is a tenure track position and will begin in the fall of 1988. Salary is dependent on qualifications.

An interested candidate should send a resume and a list of at least three references to: Alan Newell, Head, Department of Mathematics, University of Arizona, Tucson, AZ 85721. The closing date for applications is April 1, 1988, or whenever the position is filled.

The University of Arizona is an Equal Opportunity/Affirmative Action Employer.

FORT HAYS STATE UNI., DEPT. OF MATHEMATICS 600 PARK STREET, HAYS, KS 67601

Assistant Professor Tenure track position beginning August, 1988. Duties: Teaching approximately 12 hours/semester in undergrad. and grad. mathematics/computer science, including at least one freshman level course, and usual participation in dept. and university affairs. Qualifications: doctorate in mathematical sciences or mathematics education with strong mathematics component. Position requires a commitment to superior teaching of undergraduate mathematics. Applicants should submit vitae and 3 letters of reference, including evaluations of teaching to Dr. Ron Sandstrom, Search Committee Chairman, above address. Review process begins March 31, 1988, but applications accepted until position is filled. FHSU is an EQ/AA Employer.

MILLSAPS COLLEGE DEPARTMENT OF MATHEMATICS JACKSON, MS 39210

Applications are invited for a tenure track position starting Fall 1988. Candidates must possess a PhD in Mathematics and a dedication to quality teaching. Rank is open and salary will be competitive. Candidates from all areas of mathematics are encouraged to apply. Submit a letter of application, resume, and three letters of recommendation to Dr. Cecil E. Robinson, Jr., Chair, Department of Mathematics, Millsaps College, Jackson, MS 39210. Applications will be considered until the position is filled. Millsaps College is an Equal Opportunity Employer and encourages applications from women and minorities.

LINDENWOOD COLLEGE MATHEMATICS & COMPUTER SCIENCE POSITION

Applications are invited for a tenure-track position at the rank of assistant professor beginning August 1988. Ph.D. in mathematics required. The position requires the teaching of a wide range of undergraduate courses and a strong commitment to liberal arts education. Ability to teach in the computer science program is desirable. Lindenwood is a small private liberal arts college located in St. Charles, Missouri. Send applications, resumes, transcripts, and three letters of recommendation by April 1 to Daniel Keck, Dean of Faculty, Lindenwood College, St. Charles, MO 63301.

University of Delaware Preparatory Math Specialists

Two professional 12 month positions available 7/1/88 with one year renewable contracts. Duties involve teaching/tutoring & curriculum/material development for intermediate algebra, pre-calculus and calculus courses. Requires BA in math or math ed (Master's preferred) and teaching experience with strong commitment to student development. Send resume, transcripts and 3 letters of reference before April 1, 1988 to J. Bergman, Chair Search Committee, Department of Mathematical Sciences, University of Delaware, Newark, DE 19716. The University of Delaware is an affirmative action/equal opportunity employer.

HAMILTON COLLEGE DEPT. OF MATHEMATICS & COMPUTER SCIENCE CLINTON, NY 13323

Temporary leave replacement position, 1 or 2 years. Rank open, Ph.D. and prior teaching experience desirable. Duties involve teaching six courses per year at a small, highly selective, 4-year liberal arts college. Excellence in teaching required. To apply send curriculum vitae and three letters of reference (at least one about teaching) to Larry Knop, Chair. Women and member minorities are encouraged to apply; Hamilton College is an Equal Opportunity Employer.

WELLESLEY COLLEGE WELLESLEY, MASS. 02181

Temporary (or visiting) position for 1988-89 or 1988-90. Requirements include a Ph.D. in Mathematics, excellence in and commitment to mathematical research and undergraduate teaching in a liberal arts environment. Applicants should send a curriculum vitae and at least three letters of recommendation that address both teaching and research. Contact Chair, Department of Mathematics.

Wellesley College is an equal opportunity affirmative action employer and particularly encourages applications from women and minority candidates.

The Department of Mathematics at Ferris State University invites applications for a tenure-track teaching position. Applicants must have a Master's Degree in Mathematics or Mathematics Education, strong course work in mathematics, and demonstrated excellence in college teaching. A doctorate in Mathematics or Mathematics Education is desired. Responsibilities include teaching at most levels of mathematics and advising students in science-oriented curricula. Opportunity exists for development of special interests in areas of applied mathematics, mathematics education, computer science, or pre-college mathematics. Send resume, transcripts, and three letters of reference to: Dr. Robert Kosanovich, Department of Mathematics, Ferris State University, Big Rapids, Michigan, 49307. An Equal Opportunity/Affirmative Action Employer.

MATHEMATICS

Saint Francis College invites applications for the position of Instructor/Assistant Professor of Mathematics. This is a temporary full time position beginning with the fall semester of 1988. Candidates must possess a Master's Degree. Please send letter of application, resume, salary expectations, and names of three references by March 1, 1988 to:

Mr. Peter Skoner
Chair, Department of Chemistry
Mathematical and Physical Sciences
Saint Francis College
Loretto, PA 15940
(814) 472-7000, ext. 358

St. Francis College is an Equal Opportunity Employer.

The University of West Florida

Applications are invited for two positions anticipated for Fall, 1988. Assistant Professor-tenure track. Ph.D. in mathematics/statistics required. Preference given to degrees in applied mathematics. Salary approximately \$27,000. Instructor (non-tenure earning). Master's degree and college teaching experience required. Salary minimum \$20,000. Persons interested in applying for one of these positions should send a vita and three letters of reference to Dr. S.E. Shamma. Search Committee Chairman, Dept. of Math & Statistics, the University of West Florida, Pensacola, FL 32514. Closing date: April 1. UWF is an EO/AA Employer.

PENNSTATE



Harrisburg

The Capital College

MATHEMATICS/STATISTICS FACULTY

Applications are invited for a tenure-track position in Statistics and Mathematics starting in August of 1988. Rank and salary are dependent on qualifications. A Ph.D. in Statistics or in Mathematics is preferred. Duties include undergraduate and graduate teaching and research.

Penn State Harrisburg is the only senior college and graduate center of the University's 22 campus system. Enrollment includes 3,100 junior, senior and graduate students. In addition to Science, Engineering and Technology, academic divisions at this high quality and innovative College include Behavioral Science and Education; Business Administration; Heindel Library; Humanities; and Public Affairs. Located eight miles from the State Capitol, the 218-acre campus is easily accessible to Philadelphia, Baltimore, Washington, D.C., and New York.

Send resume, transcripts and references to: Dr. William A. Welsh, Jr., Head, Division of Science, Engineering and Technology, c/o Robert H. Hamill, Business Office, Box MAA, **The Pennsylvania State University at Harrisburg**, The Capital College, Middletown, PA 17057. Closing date is April 22, 1988, or until position is filled.

The Pennsylvania State University is An Equal Opportunity/Affirmative Action Employer. Women and Minorities are encouraged to apply

ROCKHURST COLLEGE 5225 Troost Avenue KANSAS CITY, MISSOURI

The Mathematics, Computer Science and Physics Department at Rockhurst College announces a full-time tenure track position (teaching up to 12 hours per semester) beginning August, 1988. A person with a strong and varied background in Mathematics and a dedication to teaching is sought. Ph.D. in mathematics preferred. Additional training in computer science or statistics would be highly desirable. Teaching duties will involve teaching mathematics courses in a variety of areas ranging from service courses to advanced undergraduate courses. Department serves both a strong science division and strong business program. Academic computing is done on a VAX 11/750 computer with a variety of languages and software packages available. Rockhurst College, located in a progressive, large metropolitan

area, is a liberal arts, Jesuit college committed to excellence in undergraduate education. Interested candidates should send resume and names of three references to: Professor John G. Koelzer, Chair, Department of Mathematics, Computer Science and Physics. AA/EOE

Math Education

EAST CAROLINA UNIVERSITY'S Mathematics Department is currently accepting applications for tenure-track Assistant/Associate Professors in Mathematics Education beginning August 18, 1988. **REQUIRED:** Ph.D. or EDD in mathematics education or related area, and evidence of ability to engage in research/creative activities. **PREFERRED:** Some elementary/secondary teaching experience, and an interest in the areas of special education, middle grades or elementary school education.

ECU is a growth-oriented institution with a current enrollment of 14,800 students. Our Mathematics Department consists of 37 faculty members in the Statistics, Mathematics, Computer Science and Mathematics Education areas, with 8 faculty members in the Mathematics Education area. ECU is located in Greenville, North Carolina, and offers close proximity to beautiful beaches and mountains, with a low cost of living and high quality of life. We offer competitive salaries, commensurate with qualifications. Candidates should submit resume, official transcripts and three letters of reference to: **Dr. Robert L. Bernhardt, Mathematics Department, EAST CAROLINA UNIVERSITY, Greenville, NC 27858-4353.** As an AA/EEO employer, ECU especially encourages applications from minority Americans and women. Federal law requires proper documentation of identity and employability.



FOCUS

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Printed in the United States of America.

Preregistration/Housing Form, Providence, Rhode Island AMS Centennial Celebration

August 8-12, 1988

Must Be Received in Providence No Later Than June 1, 1988

Please complete this form and return it with your payment to
Mathematics Meetings Housing Bureau

P.O. Box 6887, Providence, Rhode Island 02940 - Telephone: (401) 272-9500, Ext. 290-Telex: 797192

DEADLINES:	Preregistration	June 1, 1988
	Housing Reservations through Housing Bureau	June 1, 1988
	Changes/Cancellations	August 4, 1988
REFUNDS:	50% on Banquets	July 25, 1988 (no refunds after this date)
	50% on Clambake	July 25, 1988 (no refunds after this date)
	50% on Preregistration	August 4, 1988 (no refunds after this date)
	90% on Residence Hall Package	August 4, 1988 (90% minus one night's stay after this date)
	100% on Airport Transfers	August 4, 1988 (50% after this date)
	50% on Tours	August 4, 1988 (no refunds after this date)
	100% on Centennial Posters	August 4, 1988 (50% after this date)

REGISTRATION FEES		
	Preregistration by mail by June 1, 1988	At Meeting

CENTENNIAL CELEBRATION		
Member of AMS, AWM, CMS, MAA, IIME, SIAM	\$ 71	\$ 89
Nonmember	104	132
* Student, Unemployed, or Emeritus	25	30
AMS SHORT COURSE		
Member/Nonmember	35	45
* Student or Unemployed	10	15

(N.B.: A separate form appears in this issue for preregistration for MAA Minicourses)

* All full-time students currently working toward a degree or diploma qualify for the student registration fees, regardless of income. The unemployed status refers to any person currently unemployed, actively seeking employment, and who is not a student; it is not intended to include persons who have voluntarily resigned from their latest position. The emeritus status refers to any person who has been a member of the AMS, MAA, or SIAM for twenty years or more and is retired on account of age from his or her latest position.

PREREGISTRATION SECTION:

Please check the function(s) for which you are preregistering: Centennial Celebration AMS Short Course (August 6-7)

- 1) _____ Telephone: _____
(Please print) Surname First Middle
- 2) _____
(Mailing address)
- 3) Badge information: a) Nickname (optional): _____ b) Affiliation: _____
- 4) I am a student at _____ 5) Emeritus member Unemployed
- 6) Accompanied by spouse _____ Number of children _____ (Enumerate only if accompanying to meeting)
- 7) Member of AMS AWM CMS MAA IIME SIAM Nonmember (Member discount applies only to members of AMS, AWM, CMS, MAA, IIME, or SIAM.)
- 8) Centennial Celebration fee \$ _____ 9) AMS Short Course fee \$ _____ 10) Full payment for residence hall \$ _____
11) Hotel deposit \$ _____ (necessary ONLY if paying deposit by check; room can be guaranteed with credit card)
- 12) _____ IIME Banquet ticket(s) @ \$8 each = \$ _____ 13) _____ MAA 25-Year Banquet ticket(s) @ \$21 each = \$ _____
- 14) _____ Clambake adult ticket(s) @ \$23 each = \$ _____ 15) _____ Clambake child ticket(s) @ \$15 each = \$ _____ (ages 6-12)
_____ Fish dinner(s) requested _____ Chicken dinner(s) requested I will be bringing _____ children under 6 years of age
- 16) _____ Providence Tour adult ticket(s) @ \$12 each = \$ _____ 17) _____ Providence Tour child ticket(s) @ \$10 each = \$ _____ (ages 12 and under)
- 18) _____ Newport Tour adult ticket(s) @ \$15 each = \$ _____ 19) _____ Newport Tour child ticket(s) @ \$12 each = \$ _____ (ages 12 and under)
- 20) _____ One-Way Airport Transfer(s) @ \$5.75 each = \$ _____ 21) _____ Centennial Posters @ \$10 each = \$ _____
- 22) TOTAL AMOUNT ENCLOSED FOR 8 through 21 \$ _____ NOTE: May be paid by check payable to AMS (Canadian checks must be marked "U.S. Funds") or VISA or MasterCard credit cards.

Credit card type: _____ Card number: _____ Expiration date: _____
If this is your credit card, please print your name as it appears on the credit card on the line below as well as sign your name.
If this is not your credit card, please print card holder's name as it appears on the credit card on the line below, and have the card holder sign:

(Printed name)

(Signature)

- YES, I WOULD LIKE TO MAKE _____ RESERVATIONS TO GO ON THE AMS OPEN HOUSE TOUR ON _____ (date)
- PLEASE CHECK HERE IF YOU WILL NOT REQUIRE A ROOM
- PLEASE CHECK HERE IF YOU WILL BE STAYING AT A HOTEL/MOTEL NOT LISTED ON THE REVERSE

Please complete the appropriate sections on the reverse for housing and travel.

PREREGISTRATION AND HOUSING FORMS

HOUSING SECTION:

PLEASE COMPLETE "HOTELS" OR "UNIVERSITY HOUSING" AND TRAVEL SECTIONS BELOW:

HOTELS

Please rank hotels in order of preference by writing 1 or 2 in the spaces at the left on form, and by circling the requested room type and rate. If the rate requested is no longer available, you will be assigned a room in the next hotel. Rates listed below are subject to 10% local tax.

GUARANTEE REQUIREMENTS: \$50 by check **OR** a credit card guarantee with VISA, MasterCard, or American Express (for housing only). No other credit cards will be accepted. **PLEASE SUPPLY THIS INFORMATION ON THE REVERSE,** together with mailing address for confirmation of room reservation.

Order of choice		Single	Double	Twin double	Triple 2 beds	Triple 2 beds w/cot	Quad 2 beds	Quad 2 beds w/cot	Suite
		\$	\$	\$	\$	\$	\$	\$	\$
	Omni Biltmore (Headquarters Hotel)	70	80	80	80	95	80	95	150
	Holiday Inn	65	65	65	65	71	65	71	135

I will arrive on (date) _____ at _____ a.m./p.m., and depart on (date) _____ at _____ a.m./p.m.

Please list other room occupants; indicating ages of children.

FULL NAME

ARRIVAL DATE

DEPARTURE DATE

UNIVERSITY HOUSING

NOTE: Full prepayment for room and board is required. Please make checks payable to AMS. Canadian checks must be marked "In U.S. Funds"; VISA and MasterCard credit cards will also be accepted. Confirmation of residence hall reservations will be sent to address indicated on reverse.

Please circle applicable rates (per person) listed below for each day and enter totals in column at far right:

	Adults	Children* under 7 years in bed	Child 7 years and older in sleeping bag	Child under 7 years in sleeping bag	Enter your total rate per day
8/5	\$22.20 single \$17.70 double	\$22.20 single \$17.70 double	No charge	No charge	
8/6	\$22.20 single \$17.70 double	\$22.20 single \$17.70 double	No charge	No charge	
8/7	\$27.00 single \$22.50 double	\$24.60 single \$20.10 double	\$4.80 single \$4.80 double	\$2.40 single \$2.40 double	
8/8	\$27.00 single \$22.50 double	\$24.60 single \$20.10 double	\$4.80 single \$4.80 double	\$2.40 single \$2.40 double	
8/9	\$27.00 single \$22.50 double	\$24.60 single \$20.10 double	\$4.80 single \$4.80 double	\$2.40 single \$2.40 double	
8/10	\$27.00 single \$22.50 double	\$24.60 single \$20.10 double	\$4.80 single \$4.80 double	\$2.40 single \$2.40 double	
8/11	\$27.00 single \$22.50 double	\$24.60 single \$20.10 double	\$4.80 single \$4.80 double	\$2.40 single \$2.40 double	
8/12	\$22.20 single \$17.70 double	\$22.20 single \$17.70 double	No charge	No charge	
*There is no charge for infants in arms.					
Total for Residence Hall Package =					

Please list other room occupants; indicating ages of children.

FULL NAME

ARRIVAL DATE

DEPARTURE DATE

TRAVEL SECTION: Flight information is mandatory for those purchasing airport transfers.

I plan to arrive by plane on _____ (airline/flight#) scheduled to arrive at _____ Airport on _____ (date) at _____ a.m./p.m.

I plan to depart by plane on _____ (airline/flight#) scheduled to leave at _____ Airport on _____ (date) at _____ a.m./p.m. I plan to drive to the meeting I will need a parking sticker for the Brown University campus

For office use only:

Codes:	Options:	Hotel:	Room type:	Dormitory:	Room #:
Dates:	Hotel Deposit	Dormitory Payment	Total Amt. Paid:		
Special Remarks:					

MAA Minicourse Preregistration Form, Providence, Rhode Island

August 8-12, 1988

NOTE: This is not an AMS Short Course Form. Please use the AMS Centennial Celebration Preregistration/Housing Form to preregister for the AMS Short Course.

To register for: MAA Minicourse(s), please complete THIS form and return it with your payment to:

Susan Wilderson
 Mathematical Association of America
 1529 Eighteenth Street, N.W.
 Washington, DC 20036
 Telephone: 202-387-5200

Telephone: _____

(Please print) Surname _____ First _____ Middle _____

Street address _____ City _____ State _____ Zip _____

- Deadline for MAA Minicourse preregistration: June 1, 1988
- Deadline for cancellation in order to receive a 50% refund: August 4, 1988
- Each participant must fill out a separate Minicourse form.
- Enrollment is limited to two Minicourses, subject to availability.
- Please complete the following and send both form and payment to Susan Wilderson at the above address:

I would like to attend 1 Minicourse 2 Minicourses

Please enroll me in MAA Minicourse(s): # _____ and # _____

In order of preference, my alternatives are: # _____ and # _____

• **PAYMENT**

Check enclosed: \$ _____

Credit card type: MasterCard Visa

Credit card # _____ Expiration date: _____

 Your Employing Institution _____ Signature (as it appears on credit card) _____

<u>Minicourse Number and Name</u>	<u>Organized by</u>	<u>Fee</u>
1. EXP. EXPTest, and the creation of testbanks	Peter Frisk	\$50
2. Contributions of algebraic coding theory to finite geometry	E. F. Assmus, Jr. & J. D. Key	\$30
3. A survey of educational software	David P. & Vivian Kraines	\$50
4. Coloring and path following algorithms for approximating roots and fixed points	William F. Lucas	\$30
5. Teaching calculus with an HP-28 symbol manipulating calculator	John W. Kenelly	\$30
6. An introduction to MATLAB	David R. Hill	\$50
7. Groups, graphs, and computing	Eugene M. Luks	\$30

MAA MINICOURSE REGISTRATION

How Mathematics Awareness Week came to be.

Mathematics on Capitol Hill

James Murphy

This report is a brief description of my year as a AAAS Congressional Fellow under the sponsorship of SIAM, MAA, and AMS—the year that gave on Mathematics Awareness Week.

In my year with the congress everything that crossed my desk had some quantitative component. The numbers are there. Opinion polls are readily available on the Legis computer system. The Congressional Budget Office provides critical estimates of cost for every major piece of legislation. Estimates of the number of people affected by the new tax bill or other legislation, or the number of Russian missiles capable of carrying nuclear warheads, or the magnitude of the health risk associated with certain levels of toxic waste are continually being asked for and discussed. Predictions and forecasts about the impact of new legislation are being developed. Yet in all of this activity the professionals whose training makes them the most competent in dealing with polls, models, forecasts, etc. are conspicuously absent. When congressional staff think of modelling, estimates, predictions, etc. they think of econometricians and social scientists and not mathematicians or statisticians.

I applied for the Congressional fellowship in order to find out how policy makers dealt with quantitative data. During the year that I spent in Senator Pete V. Domenici's office, I initiated three pieces of legislation, all of which have now become law. The most original was National Mathematics Awareness Week. The other two concerned extended medicaid coverage for the severely disabled, and changes in federal food stamp regulations to allow homeless individuals to use food stamps to buy prepared meals.

Throughout my entire year, I was impressed with the motivation and expertise of congressional staff whom I met. Many staff people are lawyers, but there are a larger number of Ph.D.s in the physical and natural sciences than I had expected. The general level of mathematical knowledge is what you would expect among well educated nonmathematicians. Quantitative information is handled in a common sense way that is not seen as mathematical. What do these people think of mathematics and of mathematicians? Mathematics is seen as an arcane and irrelevant exercise that has something to do with strange numbers and bizarre spaces and that is practiced by people who are antisocial and can't speak english. Legislators hope that very soon computers will make mathematics unnecessary.

From this, it is clear that formal education, general information, and public relations systems have all failed to convey the richness of mathematics to the general public. I suspect that we have also failed to convey this richness to a large percentage of our own students. Unless we can improve this communication we will find ourselves in an evolutionary *cul de sac*, and we may become an extinct species, at least in the political arena.

The focus of this article is on Congress, but communicating the importance of mathematics must take place on both the federal and the local level. Lobbying efforts can be effective, but ultimately it is constituent concern that motivates Congress. A recent report in SCIENCE indicates that parents in the United States are far more concerned about literacy than about their children's ability to understand mathematical concepts. In Japan, on the other hand, parent's concern is about equal in both of these areas. If we cannot engage constituent interest in what we want to achieve, we will be perceived

as a narrow special-interest group with very little claim on congressional attention.

The long range solution to this problem is education. At the primary and secondary level, we need textbooks and teachers that can teach the problem solving and communication aspects of mathematics as well as the techniques. We must define what a mathematically literate person should know, and make the need for this basic material clearly evident to the public. Then we must see that undergraduate curricula include this material for every college graduate. At the graduate level, quantitative reasoning and mathematics should be a requirement for advanced degrees in the same way that foreign languages are today.

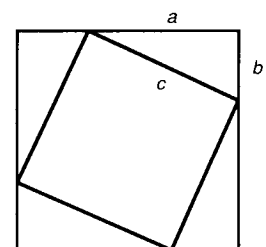
In short term, we need to increase our ability to communicate with congress in order to compete for what will probably be a decreasing supply of funds. On this issue I admit bias, I think that the Congressional Fellows Program is a very effective way of increasing this communication. All of the professional societies that sponsor a fellow reach a stage where they ask about the cost effectiveness of the fellow's program as opposed to a lobbying effort. To date, many societies have found a way to fund both, and I hope that the mathematics societies will not be the exception to this general rule. I think both efforts are needed. Comparing these two programs is very much like comparing the need for basic research with the need for research and development. The lobbying effort is like research and development. It is focused on a specific goal and defined result, establishing communication with congressional staff to further legislation in the interest of the mathematics community. The fellows program is like basic research, it has broader goals—to expand the knowledge of Congress about the various professions represented and to develop a group of professionals who are knowledgeable about the workings of Congress. The fellows program aims at the goal of establishing a long-term communication between Congress and its professional constituents. In terms of giving mathematics a lasting hold on the minds of congresspeople and their constituents, this long-term effort will be the most effective. On occasion, it also produces visible results like National Mathematics Awareness Week. Even congresspeople who don't care at all about mathematics want to know more about any group that could mount a campaign to put something like that together, and this curiosity can be the beginning of communication.

"Proof Without Words" Query

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Knuth, *The Art of Computer Programming*, vol. 1.

The sum of the odd numbers is a square.



The Pythagorean Theorem

The MAA is considering publishing a book(let) of "proofs without words" if enough of the genre can be unearthed. Please send you favorites (and suggestions of other sources) to: Eugene A. Klotz, Department of Mathematics, Swarthmore College, Swarthmore, PA 19081

(continued from page 2)

WE NEED MORE TEACHERS AND SMALL CLASSES The national mathematical community must conduct a concerted, long-range drive to establish small classes as the norm in mathematics. English and foreign-language departments have long since sold administrators on the idea that the nature of their work requires small classes. (See John Fulton's article in *CALCULUS FOR A NEW CENTURY (CNC)*.) Surely the concepts and disciplined thinking necessary to learning mathematics are at least as difficult as those required in learning French. Small classes mean more teachers—dedicated teachers patiently explaining, challenging, and encouraging young minds. So we need a concerted, long-range campaign to increase the number of qualified mathematics teachers. All of us deplore the decline in the number of American students majoring in mathematics or going on to graduate study, but we aren't doing much about it. What is required is a heroic infusion of city, county, state, and federal funds for significantly increased salaries for mathematics teachers in the schools and colleges (sure, let's pay school mathematics teachers more than the other school teachers) and for vast programs of fellowships to attract talented American students to mathematics.

A huge increase in the number of qualified school mathematics teachers, especially high school teachers, is a fundamental need. Students enter college with weak mathematics backgrounds as it is, and the modernized college curriculum promises to be more demanding than the current one. Perhaps it bears repeating that in the Soviet Union, the compulsory mathematics curriculum consists of 6 hours per week in grades 1–8 followed by 5 hours per week in grades 9–10 in a sequence that includes calculus. (There are also mathematical electives throughout grades 7–10.) In addition, all Soviet secondary-school students complete 5 years of physics courses, 4 of chemistry, 2 of biology, 1 of astronomy, and 6 of a foreign language. Our own Mathematical Sciences Education Board is working on recommendations to strengthen mathematics requirements in the U. S. schools (such as by requiring four years of mathematics for every high school student); but without the school mathematics teachers to put them into effect, we will be stuck.

PURPLE PROSE Can we cut down on purple phrases? My September article began with an anecdote to illustrate how constant repetition of a phrase can brainwash others into adopting it; the point being made was that the genius who invented the phrase "crisis in calculus" had succeeded similarly. (This point went right by the one writer in *CNC* who commented on my anecdote.) "Crisis" means an unstable condition or turning point (the patient—or the government—either quickly dies or quickly recovers), but in the rallying cry it is purple. Gratuitous exaggeration dulls clarity and undermines rational discourse, and in our serious situation we need all the clear thinking we can muster. The calculus scene has been execrable for many years, and given the inertia in our profession is quite capable of continuing that way for many more. Hence if "crisis" is to retain a reasonable meaning short of media hype, there is no crisis. (In a letter to me quoted at the October conference, presumably amid howls of glee, a mathematician cited the existence of a popular but lousy calculus text as proof of a crisis in calculus. No—that such a text is popular points up the culpability of adoption committees.)

Another purple one is that only 50% of our calculus students pass the course. A report in *CNC* itself shows the figure to be 50% higher than that. The list of 1986–1987 final exams from colleges around the country includes, in all but one case, the total number of students and the number passing. Setting aside the one case, the three Canadian schools, and the Advanced Placement results, I computed the following passing percentages: 74% in Calculus I (5953 students), 76% in Calculus II (2804 students), and 81% in Calculus III (1903 students). If you want to worry about failure rates, go to Canada: 50% passed in Calculus I (2500 students) and 35% in Calculus II (290 students).

MANY COINS HAVE TWO SIDES Conferences and their proceedings afford valuable avenues for testing ideas. Many coins have two sides. It is easy to criticize multiple choice exams on the grounds that students need to learn to write. But someone has to read and comment on what they write—otherwise they will simply get extra practice in bad writing.

One of the papers in *CNC* deplores the test question to differentiate, $x^{\sin x}$ observing that physicists never encounter the problem in their professional work. But it is an established educational principle that one practices exercises. No football player ever runs through a zigzag of automobile tires in an actual game. Vladimir Horowitz never publicly performs the piano exercises he has devised for himself. It is a fact that many calculus students are hazy about the distinction between the power function and the exponential function, and the question about the derivative is an excellent one for testing their understanding.

Gillman's September article is also in *CNC*, available from the MAA for \$12.50.

In Memoriam

James Baugh, Associate Professor, California State University, Long Beach, died 23 November 1987 at the age of 56. He was an MAA member for 29 years.

Robert Bowden, teacher, San Francisco School District, died 20 February 1986 at the age of 58. He was an MAA member for 4 years.

Isadore Cohen, retired, died 15 December 1987 at the age of 70. He was an MAA member for 1 year.

Hugo T. D'Alarcao, Professor, Bridgewater State College, died 20 September 1987 at the age of 50. He was an MAA member for 29 years.

Ben Goldbeck, retired, died 1 October 1987 at the age of 71. He was an MAA member for 38 years.

Samuel L. Greitzer, Professor Emeritus, Rutgers University, died 22 February 1988 at the age of 82. He was an MAA member for 34 years.

Israel Herstein, Professor, University of Chicago, died 8 February 1988 at the age of 64. He was an MAA member for 25 years.

T. Hoyle Lee, Distinguished Professor Emeritus, University of South Carolina, died 11 April 1987 at the age of 74. He was an MAA member for 39 years.

Leo Sauve, retired, died 19 June 1987 at the age of 65. He was an MAA member for 30 years.

Benjamin Sharpe, retired, died 4 February 1988 at the age of 77. He was an MAA member for 39 years.

John S. Trout, Assistant Professor, St. Edward's University, died 12 May 1987 at the age of 36. He was an MAA member for 1 year.

Lucille P. Zukowski, retired, died 12 October 1987 at the age of 70. She was an MAA member for 24 years.

Word has also been received on the deaths of the following MAA members:

Frances Harshbarger, retired; **Joseph B. Nelson**, retired; **Robert S. Pate**, retired; **Mildred Reigh**, retired; **George Stephenson**, retired.

(continued from page 2)

For a prime p not dividing the discriminant, $c(p)$ denotes the number of solutions modulo p . Mathematicians have found it convenient to embed the numbers $c(p)$ as coefficients of an analytic function. The result, called the L-series of the elliptic curve, is an intentional analogue to the Riemann zeta function, which plays such a key role in analytic number theory.

The plot now thickens. In one of those coincidences that is more than coincidental, the L-series of elliptic curves have forms that are suspiciously similar to another kind of L-series: the L-series of weight-2 modular forms. A modular form is an analytic function on the upper half plane of complex numbers that transforms in a prescribed manner under modular transformations. The modular group consists of all two-by-two integer matrices $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ of a determinant one, also known as the linear group of 2×2 matrices over \mathbf{Z} denoted $SL(2, \mathbf{Z})$. Of particular interest are the congruence subgroups of level N , where N is a positive integer. This congruence subgroup is denoted $\Gamma_0(N)$ defined as the subgroup for which N divides c , the matrix element in the lower left hand corner.

An analytic function f is called a *modular form of weight K and level N* if $f((az + b)/(cz + d)) = (cz + d)^K f(z)$ for all matrices of level N (and all \mathbf{Z} with positive imaginary part). There is also an important technical requirement on the growth of f as one gets close to the "boundary" of the upper half-plane.

Since $\begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix}$ is always of level N , one has $f(z + 1) = f(z)$, so f is periodic and has a Fourier expansion, $f(z) = \sum a(n)e^{2\pi inz}$. The technical requirement alluded to above is equivalent to saying that this sum extends only over the non-negative integers n (otherwise f would "blow up" at infinity) and that the coefficients $a(n)$ grow at most like a polynomial in n . These coefficients often turn out to be recognizable arithmetic functions, such as divisor sums or the number of representations of n by a quadratic form.

The coefficients $a(n)$ (for $n \geq 1$) can be stuck into an "L-series," $\sum a(n)n^{-s}$, again similar to the Riemann function $\sum n^{-s}$. Just as the Riemann zeta function has an "Euler product" form, $\prod (1 - p^{-s})^{-1}$, it turns out that certain modular forms, called *newforms*, have L-series which can be written in product form, and when the weight equals 2, this product looks an awful lot like the series as it is defined for elliptic curves.

This is more than appearance, at least in one direction: if $f = \sum a(n)e^{2\pi inz}$ is a new form of weight 2 and level N (a "new form of level N becomes an "oldform" for any multiple of N) with integer coefficients $a(n)$, then there is an elliptic curve with the exact same L-series. What's more, the level N is equal to a certain invariant of the elliptic curve called the *conductor*. (A conductor is defined for each elliptic curve. It is an integer formed in a somewhat complicated fashion out of the primes dividing the discriminant.) The elliptic curves that arise in this way are known as *Weil curves*.

The Weil-Taniyama conjecture is a simple converse: every elliptic curve is a Weil curve, i.e., every elliptic curve has an L-series identical with that of some newform of weight 2, and the conductor of the curve equals the level of the newform.

There is convincing evidence for the Weil-Taniyama conjecture. It is known to be true for infinitely many elliptic curves, including the family having the important property known as "complex multiplication." Moreover, there is an algorithm for determining whether or not any given elliptic curve is a Weil curve. (This proved useful in the recent work of Gross and Zagier which completed earlier work of Goldfeld on the class number problem of Gauss.) On the other hand, there is equally convincing evidence already for Fermat's Last Theorem.

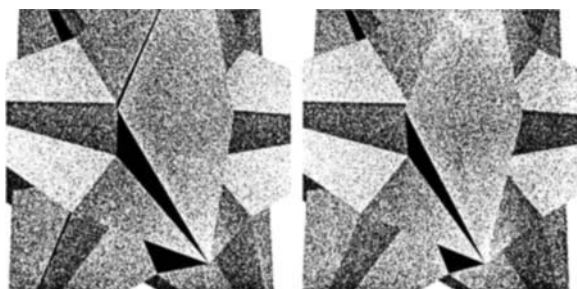
Frey's idea was to study the very special curve $y^2 = x(x - a^p)(x - c^p)$, where $a^p + b^p = c^p$ is presumed to be a counterexample to Fermat's Last Theorem, with p an odd prime. (It is well known that the case of odd prime exponent suffices to prove the general case.) The idea is to prove that this curve cannot have an L-series equal to the L-series of a newform $f(z) = \sum a(n)e^{2\pi inz}$, and hence cannot exist if the Weil-Taniyama conjecture is true. This is what Ribet proved.

Specifically, since the roots of $x(x - a^p)(x - c^p)$ are $0, a^p,$ and c^p the discriminant Δ of Frey's curve is $(abc)^{2p}$. Thus Δ is a p th power. Using this special fact and some deep results from algebraic geometry in characteristic p , Ribet was able to show that the newform f , if it exists, would be congruent modulo p to another newform, $f'(z) = \sum a'(n)e^{2\pi inz}$ (i.e., $a'(n) \equiv a(n) \pmod{p}$ for all n), of smaller level. Continuing in this way, Ribet showed finally that f would have to be congruent modulo p to a newform of weight 2 and level 2. However, it is known from the theory of modular forms that there are no newforms of weight 2 and level 2, so this gives a contradiction. In this way a counterexample to Fermat's Last Theorem becomes a counterexample to the Weil-Taniyama conjecture as well—and experts on elliptic curves doubt that's going to happen.

Acknowledgement: The author would like to thank Larry Washington and Don Zagier of the University of Maryland for their help in explaining Ribet's proof. Editorial note: Much of this work is not yet published. Readers should watch current publications for details or consult standard texts for background material.

Stereo pair of stellated icosahedron.

© Walter Taylor, University of Colorado, used by permission.
Execution based on joint work with Brent Browning.



AMS Centennial (continued from page 1)

the event of the century for the American mathematical community and will feature a rich scientific program exemplifying the brilliant and diverse range of mathematical talent in this country. A festive social agenda will bring the community together to celebrate the accomplishments of the past 100 years and to inaugurate the next century.

The Centennial program contains a range of lectures exceptional in the diversity of their topics and unsurpassed in the distinction of their speakers. The AMS-MAA Joint Invited Addresses will continue the tradition of excellence in expository talks. These addresses not only reflect the highest standards of scholarship, but also represent a tribute to the spirit of cooperation and friendship between the AMS and the MAA. The lectures will be presented by three outstanding mathematicians whose work has profoundly influenced mathematical research in the United States and the world. They are Raoul H. Bott, Harvard University, whose principal areas of interest are topology of Lie groups and differential geometry; Peter D. Lax, New York University-Courant Institute for Mathematical Sciences, with interests in partial differential equations, numerical analysis, and scientific computation; and Saunders Mac Lane, Emeritus, University of Chicago, who will speak on Some Major American Mathematical Centers, 1892–1960.

In addition to the AMS-MAA Joint Invited Addresses, the MAA is scheduling some minicourses on the weekend before the Celebration in order to allow more time for the Centennial activities. The meeting of the Board of Governors and the Business Meeting will take place during the Centennial. As a further expression of friendship, the MAA will present the AMS with a sculpture by Helaman Ferguson. The sculpture will be installed near the entrance to the Society headquarters building and a picture of it is shown on page i of this issue of FOCUS.

The Centennial Celebration provides a natural backdrop for a look to the future of mathematical research. "Mathematics into the Twentieth Century," a series of AMS Invited Addresses, constitutes the main part of the scientific program and brings together 18 of the country's stellar young mathematicians who are likely research leaders of the next 25 years. The invited speakers are Michael Aschbacher, California Institute of Technology; Luis Caffarelli, Institute for Advanced Study, Princeton; Persi Diaconis, Harvard University; Charles L. Fefferman, Princeton University; Michael H. Freedman, University of California, San Diego; Harvey M. Friedman, Ohio State University; Benedict H. Gross, Harvard University; Joseph Harris, Brown University; Roger E. Howe, Yale University; Vaughn F.R. Jones, University of California, Berkeley; Victor Kac, Massachusetts Institute of Technology; Andrew Majda, Princeton University; Charles S. Peskin, New York University-Courant Institute of Mathematical Sciences; Dennis P. Sullivan, City University of New York Graduate School and University Center; Robert E. Tarjan, AT & T Bell Laboratories, Murray Hill, NJ; William P. Thurston, Princeton University; Karen Uhlenbeck, University of Chicago; and Edward Witten, Princeton University.

On Monday morning, August 8, the opening Ceremonies will kick off the Celebration with pomp and flair by putting the Centennial into its public, international, and historical contexts. Representatives of industry and government will extend their greetings to the mathematical community together with felicitations from sister mathematical organizations from all over the world. Everett Pitcher, AMS Secretary for the past 20 years, will provide a historical perspective, and AMS President George Daniel Mostow will comment on mathematics as an intellectual discipline. Edward E. David, Jr., chairman of the committee that produced the influential David Report, will speak on where mathematicians stand as a scientific community. The day ends on a festive note, with a gala reception at the Rhode Island State House, a setting of architectural, aesthetic, and historical appeal. Chamber music, hors d'oeuvres, and a special AMS birthday cake will enliven this elegant soirée.

Other special events include three mathematical exhibits at Brown University. The John D. Rockefeller Library will present an exhibit of archives and historical material pertaining to the Society. Rare mathematical books and manuscripts will be on display at the John Hay Library. The David Winton Bell Gallery at Brown's List Art Center will present the Royal Vale Heath Collection of mathematical puzzles, which Heath called "mathemagic."

The AMS headquarters will be open to visits by conference participants during the entire week of the Celebration. These visits will enable the membership to better understand the magnitude and sophistication of the AMS enterprise and to meet the dedicated staff that makes it all happen. For a convivial finale, the Celebration ends with a traditional Rhode Island clambake in a lovely outdoor setting.

Other Celebration activities throughout the year are briefly described on page xvii of the October 1987 issue of FOCUS. For a detailed calendar of events, write: JPB-100 Years, 818 Connecticut Avenue, N.W., Washington, D.C. 20006.

EXCERPTS FROM AN ARTICLE IN THE AMS NOTICES WRITTEN BY ALLYN JACKSON.

Calendar (continued from back page)

July 1988

6–8. **Workshop on the Role of Mathematicians in Education Reform**, University of Illinois at Chicago, Chicago, Illinois. This workshop will consider "Facilitating the involvement of mathematicians and mathematics educators in pre-college educational improvement projects." Presenters include: Tom Berger of the University of Minnesota; Franklin Demana of Ohio State University; Harvey Keynes of the University of Minnesota; Katherine Pedersen of Southern Illinois University; Uri Treisman of the University of California at Berkeley; and Philip Wagreich of the University of Illinois at Chicago. For more information, contact Kay Poyner Brown, Department of Mathematics, MC 249, University of Illinois at Chicago, Box 4348, Chicago, Illinois 60680; (312)996–2438.

6–9. **Allegheny Mountain Section Short Course: "Applications of Graphs and Relations,"** Allegheny College, Meadville, Pennsylvania. Fred S. Roberts of Rutgers University will present eight lectures on such topics as applications of graph coloring, T-colorings of graphs, applications of Eulerian chains and paths, competition graphs and their applications, relational systems and the theory of measurement, meaningless statements, representation and uniqueness theorems, and possible merging functions. For more information, contact: Richard McDermot, Allegheny College, Meadville, Pennsylvania 16335 or Dave Well, Penn State University, New Kensington, Pennsylvania 15068.

11–15. **Rocky Mountain Section Short Course: "Mathematical Modeling,"** Fort Lewis College, Durango, Colorado. Frank R. Giordano and Maurice D. Weir will present this short course with a focus on pedagogy and content for undergraduate courses in mathematical modeling. For more information, contact Gary Grefsrud, Fort Lewis College, Durango, Colorado 81301; (303) 247–7336.

August 1988

1–6. **1988 AMATYC Summer Institute**, Ricks College, Division of Continuing Education, Rexburg, Idaho. Courses include: Math Application vs. Classroom Experiments and Teaching Strategies. \$25.00 deposit by 31 May 1988 will ensure a reservation. For more information, contact Larry Saunders or Steven Terry, Ricks College, Rexburg, Idaho 83440; Saunders: (208) 356–1466 (work) or (208) 356–3816 (home); Terry: (208) 356–1406 (work) or (208) 356–3091 (home).

1–20. **Oxford Course on the History of British Mathematics.** "On the Shoulders of Giants: A History of British Mathematics" will again be offered at Oxford University. See FOCUS, Volume 7, Number 1, January-February, 1987 or write to the instructor: Professor Paul Wolfson, Department of Mathematical Sciences, West Chester University, West Chester, Pennsylvania 19383 for details.

5–8. **Second Boston Workshop for Mathematics Faculty**, Wellesley College, Massachusetts. Goal: to strengthen undergraduate teaching, including new efforts in calculus and linear algebra. For more information, contact: Gilbert Strang, Room 2–240, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139.

15–26. **T_eX Users Group's Annual Conference**, McGill University, Montreal, Canada. The general theme of the meeting will be "Using T_eX in Production Environments." Program inquiries should be directed to: Dean Guenther, Washington State University, Pullman, Washington 99164–1220; (509) 335–0411. Requests for additional information about the conference, courses, and registration should be directed to: T_eX Users Group, P.O. Box 9506, Providence, Rhode Island 02940; (401) 272–9500, ext. 232.

October 1988

19–21. **Conference on Iterative Methods for Large Linear Systems**, The University of Texas at Austin, Austin, Texas. This conference will be dedicated to providing an overview of the state of the art in the use of iterative methods for solving sparse linear systems with an eye to contributions of the past, present, and future. The emphasis will be placed upon identifying current and future research directions in the mainstream of modern computing. For more information, contact: Center for Numerical Analysis, RLM Building 13.150, University of Texas at Austin, Austin, Texas 78713–8510; (512) 471–1242; Arpanet: kincaid @ sally.utexas.edu.

Calendar

National MAA Meetings

72nd Annual Meeting, Phoenix, Arizona, January 11–14, 1989.
(Board of Governors, January 10, 1989).

Sectional MAA Meetings

- Allegheny Mountain**, Bethany College, Bethany, West Virginia, April 22–23, 1988.
- Florida**, University of Florida, Gainesville, Florida, March 1989.
- Illinois**, Bradley University, Peoria, Illinois, April 29–30, 1988.
- Indiana**, Butler University, Indianapolis, Indiana, April 16, 1988.
- Intermountain**, Utah State University, Logan, Utah, April 15–16, 1988.
- Iowa**, Grinnell College, Grinnell, Iowa, April 15–16, 1988.
- Kansas**, Fort Hays State University, Hays, Kansas, April 15–16, 1988.
- Kentucky**, Georgetown College, Georgetown, Kentucky, April 15–16, 1988.
- Louisiana-Mississippi**, Mississippi State University, Mississippi State, Mississippi, February 24–25, 1989. Held at Biloxi, Mississippi.
- Maryland-DC-Virginia**, Mount Saint Mary's College, Emmitsburg, Maryland, April 23, 1988.
- Metro. New York**, Concord Resort Hotel, Kiamesha Lake, New York, April 22–24, 1988.
- Michigan**, Eastern Michigan University, Ypsilanti, Michigan, May 6–7, 1988.
- Nebraska**, Kearney State College, Kearney, Nebraska, April 15–16, 1988.
- New Jersey**, Ocean County College, Toms River, New Jersey, April 23, 1988.
- North Central**, College of St. Thomas, St. Paul, Minnesota, April 29–30, 1988. Concordia College, Moorhead, Minnesota, October, 1988.
- Northeastern**, St. Michael's College, Winooski, Vermont, June 10–11, 1988.
- Ohio**, Kent State University, Canton, Ohio, April 29–30, 1988.
- Wittenberg University**, Springfield, Ohio, Fall, 1988. Ohio State University, Columbus, Ohio, Spring, 1989.
- Oklahoma-Arkansas**, Hendrix College, Conway, Arkansas, Spring, 1988.
- Pacific Northwest**, University of British Columbia, Vancouver, British Columbia, June 16–18, 1988.
- Rocky Mountain**, Hosts: Metropolitan State College and the University of Colorado at Denver, Denver, April 29–30, 1988.
- Seaway**, Brock University, St. Catharines, Ontario, April 29–30, 1988.
- Syracuse University**, Syracuse, New York, Fall, 1988.
- Southeastern**, Furman University, Greenville, South Carolina, April 15–16, 1988.
- Southwestern**, Northern Arizona University, Flagstaff, Arizona, April 22–23, 1988.
- Southern California**, Claremont McKenna College, Claremont, California, November 12–13, 1988.
- Texas**, Trinity University, San Antonio, Texas, April 14–16, 1988.
- Wisconsin**, University of Wisconsin at La Crosse, Wisconsin, April 22–23, 1988.

Other Meetings

April 1988

28. **"The Impact of Mathematics: Nonlinear Mathematics, Chaos and Fractals in Science."** The Board on Mathematical Sciences and the National Research Council will sponsor a symposium at the National Academy of Sciences, 2102 Constitution Avenue, N.W., Washington, D.C. 20418.

28–29. **11th Annual Idaho State University Spring Conference in Mathematics: "Applied and Computational Linear Algebra,"** Idaho State University, Pocatello, Idaho.

May 1988

26–28. **Third Lehigh University Geometry and Topology Conference**, Bethlehem, Pennsylvania. For more information, contact: D. Davis or D. Johnson, Department of Mathematics, Lehigh University, Bethlehem, Pennsylvania 18015; (215) 758–3730.

June 1988

6–10. **Maryland-DC-Virginia Section Workshop: "Fractals and the Microcomputer,"** Salisbury State College, Salisbury, Maryland W.D. Withers of the United States Naval Academy will conduct this workshop. Topics include: Basic fractals; refinements of iterated function systems; fractal measures; fractal interpolation; Julia sets and the Mandelbrot set; and fractals in the classroom. For more information, contact Dr. B.A. Fusaro, Salisbury State College, Salisbury, Maryland 21801; (301) 543–6471.

13–17. **Maryland-DC-Virginia Section Workshop: "Program Design and Data Abstraction,"** Salisbury State College, Salisbury, Maryland. W.J. Collins of Radford University will conduct this workshop. Topics include: Algorithm Design; Data Types and Data Abstraction; "Stack" Data Type; and Data Abstraction and Discrete Mathematics. For more information, contact: Dr. B.A. Fusaro, Salisbury State College, Salisbury, Maryland 21801; (301) 543–6471.

13–17. **Northeast Section Short Course:** Frank Giordano of the U.S. Military Academy, West Point and Maurice Weir of the Naval Postgraduate School, Monterey will lecture on "Teaching of Mathematical Modeling in Undergraduate Mathematics" at the University of Maine, Orono, Maine. For more information, contact: Clayton Dodge, University of Maine, Orono, Maine 04469; (207) 581–3908.

13–17. **Eastern Pennsylvania and Delaware Section Workshop: "Applied Math via Classroom Experiments,"** Messiah College, Grantham, Pennsylvania. Herbert R. Bailey of the Rose-Hulman Institute of Technology will conduct this workshop. Topics include appropriate experiments and analysis of the resulting models for several physical science problems—linear motion, projectile motion, rotational motion, collisions, fluid flow, heat flow, and Calculus of Variations type problems. For more information, contact Professor Marvin Brubaker, Messiah College, Grantham, Pennsylvania 17027; (717) 766–2511.

20–24. **Eastern Pennsylvania and Delaware Section Workshop: "History of the Calculus."** See Calculus Watch on page.

20–24. **Conference on Matrix Spectral Inequalities**, The Johns Hopkins University, Baltimore, Maryland. The principal lecturer, Robert C. Thompson, will give 10 lectures on inequalities for eigenvalues, singular values, and invariant factors with applications to control theory and functional analysis. Apply now, but not later than April 8, 1988 to ensure consideration for on-campus housing and financial support. For more information, contact: Roger Horn, Department of Mathematical Sciences, The John Hopkins University, Baltimore, Maryland 21218; MSC HRAH (at JHUVMs).

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