

FOCUS

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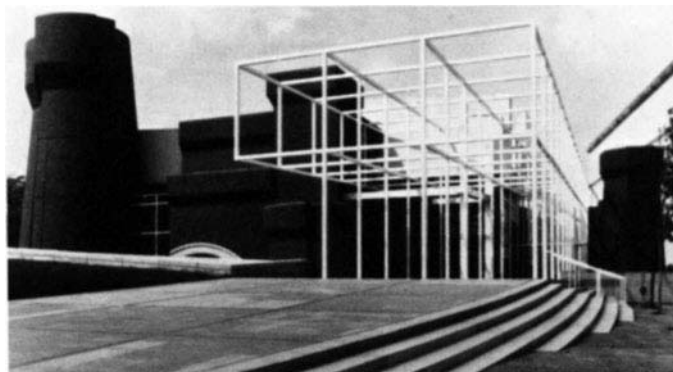
June 1990

Hello, Columbus

The Summer Meetings of the MAA and the AMS, at which the MAA will celebrate the 75th Anniversary of its founding, include an unusually rich program of events for mathematicians and their families and students. Festivities begin, and "festivities" is the only word to describe August 8, with MAA Day, a day devoted entirely to activities of the Association. MAA Day begins with a parade of the Sections, complete with Section banners, and concludes with a Mathematical Circus, a reception for students, and a banquet for all MAA members and friends. In the interim, our Program Committee has arranged six outstanding Invited Addresses.

The 75th Anniversary Meeting includes a number of events of special interest to students. At the MAA/PME Reception for Students which follows the Mathematical Circus on MAA Day, more than 200 MAA Charter Student Chapters will be recognized and awarded charter certificates. *All members of the MAA are cordially invited to this reception.* For Thursday, Arparna W. Higgins of the University of Dayton has organized an MAA Student Chapters Panel during which mathematicians from local industries will describe a variety of career opportunities available to people with a bachelor's degree in mathematics. The annual Pi Mu Epsilon banquet also will be held that evening. Ben A. Fusaro of Salisbury State University has organized an MAA Student Chapter Session on Modeling for Friday, and Ronald F. Barnes of the University of Houston-Downtown has organized MAA Student Chapter Contributed Papers for Saturday. Of course, Arthur Benjamin's lecture on "The art of mental calculation" will appeal to students of all ages.

("Hello, Columbus" continues on page two.)



The renowned Wexner Center for Visual Arts, designed by Trott and Eisenman, on Ohio State University's Columbus campus—site of the MAA's first, and now, 75th Anniversary Meeting.

Renewing US Mathematics: A Plan for the 1990s

In 1984, a committee of the National Research Council issued its report, *RENEWING US MATHEMATICS: Critical Resource for the Future* (the "David Report"), in which it reported on the health of the mathematical sciences in the United States. The current report, *A PLAN FOR THE 1990s*, issued on May 1, updates that NRC committee's earlier analysis. The following conclusions and recommendations appear in the report's "Executive Summary."

CONCLUSIONS AND RECOMMENDATIONS

1. Implement the 1984 Report's National Plan

Conclusion: Progress has been made in carrying out the 1984 Report's National Plan, but support for the mathematical sciences remains seriously out of balance with that for the other sciences and engineering. The numbers of supported senior investigators, graduate research assistants, and postdoctoral researchers are still seriously out of line with the numbers supported in other sciences of comparable size.

Recommendation 1: Fully implement the 1984 National Plan while increasing the level of annual federal funding for the mathematical sciences to \$250 million from \$133 million (in 1989 dollars) over the next three years.

("Renewing US Mathematics" continues on page two.)

ANNUAL MEETING IN COLUMBUS PROGRAM CORRECTIONS

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("Hello, Columbus" continued from front page.)

Special efforts are being made to make the Columbus meeting appealing to families. Columbus offers many attractions for children: Ohio Village, the Columbus Zoo, the Wyandotte Lake amusement park, and the Center of Science and Industry, among others. Just south of downtown Columbus is an extensive area called German Village, a part of the city settled in the 1840s and restored since the 1960s. It is a charming district filled with old brick houses and businesses on tree-lined streets, with bookstores, craft galleries, restaurants, and outdoor beer gardens. German Village is good for hours of strolling and browsing. Picnic and hiking opportunities abound in eight, large metropolitan parks which ring Columbus, and at Hocking Hills State Park, about 45 miles south of Columbus. Several pools inside the Ohio State Natatorium and large, public beaches at two reservoirs north of Columbus provide excellent swimming.

Editorial Note: We very much regret the program errors that appeared in the April 1990 issue of FOCUS. A corrected version of the MAA Day program and a description of Saturday afternoon's events (previously omitted) appear below. Also, on page 29 of that issue, we reported incorrect room and board rates for children in attendance. Their rates are the same as for adults: \$35 single and \$21 double. (The rates listed on the *Preregistration and Housing Form*, page 38 of the Summer Meetings issue, are correct.)

Wednesday, August 8, MAA Day

morning

- 8:30–9:30 Opening Ceremonies
- 9:55–10:45 Invited Address: *The Seventy-Fifth Anniversary Celebration*, G. Baley Price, University of Kansas
- 10:55–11:00 Plaque Installation Ceremony
- 11:10–noon Invited Address: *Was Newton's calculus just a dead end? Maclaurin and the Scottish connection*, Judith V. Grabiner, Pitzer College

afternoon

- 1:30–2:00 Invited Address: *Mathematics and Computation: Proliferation and fragmentation*, Wade Ellis, Jr., West Valley College
- 2:10–2:40 Invited Address: *Has progress in mathematics slowed down?* Paul R. Halmos, Santa Clara University
- 2:50–3:20 Invited Address: *The contribution of mathematics to education*, Peter J. Hilton, State University of New York, Binghamton
- 3:30–4:00 Invited Address: *The last 75 years: giants of applied mathematics*, Cathleen S. Morawetz, Courant Institute of Mathematical Sciences, New York University
- 4:15–4:30 Picture Taking: All participants at the meeting
- 4:45–5:45 Mathematical Circus
- 6:00–7:00 MAA and Pi Mu Epsilon Reception for Students
- 7:00–10:00 MAA Banquet
-

Saturday, August 11

afternoon

- 1:00–3:00 Minicourse 8 (Part B): *A mathematician's introduction to the HP-48SX scientific expandable calculator for first-time users*, John Kenelly and Don La Torre, Clemson University
- 1:00–3:00 Minicourse 10 (Part B): *CAS laboratory projects for calculus*, L. Carl Leinbach, Gettysburg College
- 1:15–2:15 Hedrick Lecture III: *Spirals from Theodorus of Cyrene to meta-chaos. Theodorus goes wild*, Philip J. Davis, Brown University
- 2:30–3:20 AMATYC-MAA Invited Address: *Crisis in mathematics education: perspective from the two-year college*, Karl J. Smith, Santa Rosa Junior College
- 3:15–5:15 Minicourse 11 (Part B): *Producing mathematics courseware with Mathematica: Calculus and Mathematica*, Don Brown, Horacio Porta, and Jerry Uhl, University of Illinois, Urbana
- 3:15–5:15 Minicourse 13 (Part B): *Spreadsheet based mathematical topics for nonmathematics majors*, V. S. Ramamurti, University of North Florida
- 3:35–4:25 Committee on the Participation of Women Special Lecture: *History of women in the MAA*, Judy Green, Marymount University
-

("Renewing US Mathematics" continued from front page.)

2. Improve the Mathematical Sciences Career Path

Conclusion: The rate at which young people enter the mathematical sciences remains inadequate to renew the field.

Recommendation II: Improve the career path in the mathematical sciences. Specifically,

- The funding called for in Recommendation I should be used to increase the numbers of senior, junior, and postdoctoral researchers, and graduate research assistants supported.
- Ten percent of the funding called for in Recommendation I should support coherent programs that directly encourage young people to enter and remain in mathematical sciences careers. Recruitment of women and minorities into the mathematical sciences is a high priority.
- Academic mathematical sciences departments should give increased recognition to faculty who act as mentors for students and junior colleagues, who contribute to education, and who interact with collaborators from other disciplines.
- Universities should do more to strengthen their mathematical sciences departments.

3. Support a Sufficient Number of Individual Investigators

Conclusion: Mathematical sciences research has been extraordinarily productive over the past five years.

Recommendation III: Increase to 2,600 the number of mathematical sciences senior investigators supported annually.

The complete report will interest everyone concerned about the health of the mathematical sciences. Contact: National Academy Press, 2101 Constitution Avenue, NW, Washington, DC 20418.

1989 Meritorious Service Awards



OKLAHOMA-ARKANSAS SECTION

Jeanne L. Agnew
Oklahoma State University
Stillwater, Oklahoma

Professor Agnew received her doctorate from Harvard University and completed her thesis under the supervision of G. D. Birkhoff. Professor Agnew's professional career is always developing. Since the middle 1970s, applied mathematics curricular materials have interested her. She wrote the materials in two NSF funded projects—"Problems from Regional Industries for Undergraduate Majors" and "The Development of an Undergraduate Educational Applied Mathematics Component with Cooperation from Regional Industries." She advised the Teaching Experiential Applied Mathematics project (TEAM) and served as Coordinator of Written Materials for the Applications in Mathematics project (AIM). Nationwide, students and teachers have enthusiastically welcomed these MAA projects.

In 1984, the Section named Professor Agnew its Twelfth N. A. Court Lecturer—the highest honor the Section bestows. She continues to contribute to the general mathematics community and, in particular, to the Oklahoma-Arkansas Section.



ALLEGHENY MOUNTAIN SECTION

Richard F. McDermot
Allegheny College
Meadville, Pennsylvania

Professor McDermot has actively participated in the Allegheny Mountain Section since receiving his doctorate from Carnegie-Mellon University and joining the faculty of Allegheny College in 1962. He served as Chair of the Section and initiated its Section Newsletter; he served as local coordinator for annual meetings; and he continues to serve as Director of the Short Course. Members of the Section value his imaginative ideas and the projects he has launched, such as the Section Newsletter and the Section minicourses and short courses. Moreover, Professor McDermot recognized the importance of forming MAA student chapters early in that program's history. He joined the MAA in 1957.

NEW JERSEY SECTION

Henry O. Pollak
AT&T Bell Laboratories and
Bell Communications Research,
retired



Dr. Pollak joined the MAA in 1956 as a founding member of the New Jersey Section. Dr. Pollak was elected member-at-large of the executive committee and, in 1959, he was elected Chairman of the New Jersey Section. From 1961 to 1964, he was Governor of the Section.

Dr. Pollak served for many years on the Committee on the Undergraduate Program in Mathematics (CUPM) and various CUPM subpanels. He represented the MAA on the US Commission on Mathematical Instruction from 1962 to 1966 and, from 1975 to 1977, he was MAA President. At national MAA meetings, Dr. Pollak has spoken to enthusiastic audiences on such topics as "Mathematical Trends in Engineering Sciences" and "Interweaving the Applications of Mathematics into the Curriculum."

Dr. Pollak received his BA from Yale (1947) and his MA (1948) and PhD (1951) from Harvard. In 1951 he joined Bell Telephone Laboratories as a research mathematician and became its Director of Mathematical Research before departing in 1983 to become an Assistant Vice-President at Bell Communications Research. He retired from this position in 1986.



MARYLAND-DISTRICT OF COLUMBIA-VIRGINIA SECTION

John M. Smith
George Mason University
Fairfax, Virginia

In 1962, Professor Smith joined the MAA and has served his Section as Secretary (1972–76), Vice-Chairman for Programs (1976–78), Newsletter Editor (1978–79), Chairman (1979–81), and Governor (1983–86). He has also served the Association as a member of the Committee on Sections (1985–present), the Chairman of the Committee on Meetings (1986–present), and as a member of the program Committee for five national meetings.

Professor Smith also belongs to the National Council of Teachers of Mathematics and its Virginia Council. He has served on a number of committees for these organizations. He received his BS from the University of Richmond and his MA and PhD from the University of Maryland.



INTERMOUNTAIN SECTION

Don H. Tucker
University of Utah
Salt Lake City, Utah

Since receiving his PhD from the University of Texas in 1958, Don Tucker has taught at the University of Utah. He joined the MAA in 1958 also. He has served mathematics and mathematics education, at all levels, with enthusiasm and dedication. He has supervised eleven PhD students, and he has devoted equal energies to undergraduate teaching and to the improvement of public school education. He has earned several teaching awards, worked with inservice programs, and consulted state mathematics programs.

Professor Tucker has led his Section since its founding. He served as Section Chairman in 1979–80 and, later, as its Governor. More recently, he has participated on the Committee for the Education of the Pre-College Gifted and the National Collegiate Honors Council.

A Message from a Chair

Dennis M. Luciano

Mathematics is the key to opportunity. No longer just the language of science, mathematics now contributes in direct and fundamental ways to business, finance, health, and defense. For students, it opens doors to careers. For citizens, it enables informed decisions. For nations, it provides knowledge to compete in a technological economy. More than ever before, Americans need to think for a living; more than ever before, they need to think mathematically.

—EVERYBODY COUNTS

Mathematics has traditionally filtered students out of programs leading to scientific and professional careers, and sometimes out of the educational system itself. From ninth grade through graduate school, the half-life of students in the mathematics pipeline is about one year. Research on learning shows most students cannot learn mathematics effectively by the typical way it is taught; that is, by listening and imitating. Do you remember the first course you taught? I do! I instructed the course as I thought all my mathematics professors whom I held in high esteem would have. To learn mathematics, students must be engaged in exploring, conjecturing, and thinking, rather than rote learning of rules and procedures. We know that learning mathematics is not a spectator sport. Much of the failure in school mathematics is due to a teaching tradition that is inappropriate to the way most students learn.

The International Assessment of Mathematics and Science, sponsored by the Education Department and National Science Foundation, placed the students in the United States dead last in mathematics when compared to 11 other countries and Canadian Provinces. American educators are used to reading that Japanese and Korean students lead the mathematics academic parade while the Americans fall in the rear, somewhere between Grenada and Kokomo, the Beach Boys' fictitious island. They are usually quick to respond that our country sends a higher proportion of its students to high school and college, so the mathematical abilities of our average students should not be compared with the high achievers of the other countries. But no longer! This most recent study involved 13-year-olds. The report's authors called the American results "distressingly low and unacceptable, especially in view of the requirements of today's and tomorrow's technological environments." It is easy to criticize the curriculums and the teachers, but the problem is hardly that simple. It runs much deeper than that, and sadly enough reflects the heartbeat of our society. The International Assessment investigators asked students how they thought they were doing in mathematics. Only one-fourth of the Koreans (the group that scored the highest) were pleased with their performance, while two-thirds of the Americans were quite content. With expectations like these, it is not surprising that we are the cellar dwellers in the mathematics league. A necessary, but not sufficient, condition for success in mathematics is high goals and hard work. Do we really believe in differences in innate ability? Or do we grow and develop our abilities based on events of daily life, as Asian philosophy dictates? Well, certainly the work of Uri Treisman and Jaime Escalante subscribes to the latter.

Only in the United States do people believe that learning mathematics depends on special ability. In other countries, students, parents, and teachers all expect that through hard work most students can master mathematics. Public acceptance of low expectations contributes significantly to poor performance in mathematics. Public attitudes about mathematics are shaped by individual school experiences. Consequently, mathematics is seen not as something that people actually use, but as a painful requirement of school. Only in mathematics is poor school performance socially acceptable! Only

in America do adults (almost proudly) proclaim their ignorance of mathematics. I wish I had 2ⁿ dollars for the n persons I have been introduced to as a professor of mathematics who responded, "I never could do math." I don't know about you but I am very tired of the socially acceptable term "math anxiety." It is like a license that allows you never to do mathematics. Renewing this license closes the gate to employment not only in the sciences, but also in economics, engineering, business, and some of the arts. Please don't misunderstand me. Math anxiety is real. Yet it is a by-product of our educational systems, which means we control its destiny. Why don't we read about "English anxiety" or "history anxiety?" Let me confess that in the mid-sixties I had a severe case of "poetry anxiety." I suspect a better work ethic would have cured me! We must shift public attitudes about mathematics from indifference and hostility to recognition of the important role that mathematics plays in our lives and in society. The public perception of mathematics must shift from that of a fixed body of arbitrary rules to an exciting, active science of patterns. The public must realize that mathematics is thinking and not computing! Mathematicians must write for popular audiences. The work of John Paulos, "Innumeracy: Mathematical Illiteracy and its Consequences," was on the New York Times best-seller list for several months. Other mathematicians should follow his lead.

The deterioration of mathematics education in America is not going to be turned around overnight. One could pray for another "Sputnik Effect," and there are subtle hints that it may occur. In the fall of 1988 our plight even made PARADE MAGAZINE, a Sunday newspaper supplement that is read by millions of people. The headline was "Help Wanted: Math Majors," and, with the help of Ed Connors, the short information piece identified seven important concerns. Recent reports by the Carnegie Commission and the Holmes ("A Message from A Chair" continues on page five.)



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("A Message from a Chair" continued from previous page.)

Group recommended abolishing the undergraduate major in education as a necessary first step for reinjecting quality in public schools. These recommendations are based on two laudable objectives: to ensure that teachers are well rounded in the subjects they teach, and to attract able students to careers in teaching. Since mathematics is taught throughout the entire 13 years of school (K–12), this may mean that we can no longer expect elementary school teachers to teach all subjects and that it will be necessary to educate mathematics specialists who would be responsible for the teaching of mathematics and the sciences in the elementary school grades. These specialists would no longer teach in the present mode, but would teach in an integrated, discovery-based environment.

To remedy our problems it is obvious that mathematics teachers need to change the way they teach so that students are actively involved in discovering the beauty and utility of mathematics. Not only will we teach differently, but our audience will necessarily change. Whereas formerly 90% of the work force was white, between now and the year 2000, one in three new workers will be a member of a minority group. The successes of Jaime Escalante and Uri Treisman must be replicated throughout the nation at every level of mathematics education. The well-being of mathematics depends on an increased level of participation from minorities and from women. Gender differences in mathematics performance are predominately due to the accumulated effects of sex-role stereotypes in family, school, and society. Identification of gender differences in mathematics is hardly novel. Over the years small gains have been achieved, but in a time of crisis we must demand more. We must reduce all factors that compromise a student's potential to learn mathematics. In view of the projected shortfall of mathematically trained personnel, women and minorities must be pumped into the pipeline instead of filtered out.

Over the next fifteen years the numbers of students will increase, the demand for mathematics will increase, and the rate of retirement of mathematics teachers will increase. Consequently, there will be a very strong demand for mathematics graduates well into the next century. However, the number of students receiving degrees in mathematics declined roughly 50% from its peak in the early 1970s. The low percentage of American students in graduate programs calls attention to the obvious—that American mathematics education, especially undergraduate education, is not healthy. Of most concern to the public, mathematics departments in universities—more than any other departments—rely on graduate students to teach undergraduates. Foreign graduate students rarely make ideal teachers for American freshmen, and for that matter neither do native born graduate students. Colleges also must share the blame. When demand for mathematics increases (almost always at the freshman level), most colleges respond by hiring underqualified temporary instructors with little continuing sense of professional commitment. It is precisely at the freshman level that colleges/universities must place their most effective, accomplished teachers. Rarely is this done, since the traditional rank and tenure system rewards research, not excellent teaching. Obviously, one place to cultivate future mathematics majors is in our Calculus courses. Every student there is a potential mathematician. In the large lecture halls or the small classroom under the direction of a graduate assistant, an adjunct, or a mediocre professor, are we turning our calculus students on? Hardly, but we need to in the future, since it is obviously not happening in their prior educational experiences. Secondary schools, too, have been filling mathematics classroom positions with teachers whose qualifications are inappropriate. Of the nation's 200,000 secondary school mathematics teachers, more than 50% do not meet current professional teaching standards. It is estimated that less than 10% of the nation's elementary school teachers meet contemporary standards for their mathematics teaching responsibilities.

To replace normal retirements and resignations of high school mathematics teachers requires in excess of 7,000 new teachers a year. This is approximately half of the expected number of mathematics graduates each year. Elementary school teachers are drawn predominately from the 75% of the population who dropped mathematics after two or three courses in high school. Many of those teachers do not have fond memories of their mathematical experiences, and those feelings are often communicated to the children they teach. Undergraduate mathematics is the key for the revitalization of mathematics education. All students who prepare to teach mathematics acquire attitudes about mathematics, styles of teaching, knowledge of content, and an understanding of the power of mathematics from their undergraduate experience. With approximately 50% of school teachers leaving every seven years, it is feasible to make significant changes in the way school mathematics is taught, and consequently in the way the public perceives mathematics, simply by transforming undergraduate mathematics to reflect our new expectations. None of our problems will be remedied until we revitalize undergraduate mathematics through the reform in both curriculum and teaching style.

Dennis M. Luciano, Past-Chair of the MAA's Northeastern Section, teaches at Western New England College in Springfield, Massachusetts. His "Message" originally appeared as two, separate, but related statements in his Section newsletter.

Math Outside of Math

Solomon A. Garfunkel

In 1988–1989, the Consortium for Mathematics and Its Applications (COMAP) conducted a study, "Math Outside of Math," funded by the Exxon Education Foundation. The purpose of the study, first suggested by Gail S. Young of Columbia Teacher's College, was to answer the question—Where are the students? We all know that mathematics is becoming increasingly important for other undergraduate disciplines. We know that bachelor's degrees in engineering, biology, and several other quantitative disciplines have been increasing. Yet advanced enrollment in math courses has remained essentially flat. Where are the students of advanced mathematics? Our results make clear that an enrollment rise in advanced courses seems to be occurring, but it is not occurring in mathematics departments.

Anecdotal information and even a cursory look at college and university catalogs indicated that the content of many courses in departments (other than mathematics!) consists entirely or mainly of advanced mathematics. We found such courses not only in the expected places—departments of physics, engineering, and computer science—but also in such departments as economics, political science, biology, and management. Therefore, the fact that enrollments in advanced mathematics courses have not risen may reflect an increase in enrollment in mathematics courses taught outside of mathematics departments. We prepared our study to test this hypothesis and to provide a baseline for future studies.

The study (which specifically excluded statistics courses and any courses cross-listed with mathematics departments) determined that each year there are over 170,000 enrollments in advanced mathematics courses taught *outside* of mathematics departments. This compares with approximately 147,000 enrollments *in* mathematics departments.

("Math Outside of Math" continues on page six.)

Mathematicians Write about Writing

Ann K. Stehney

When students at high school careers fairs ask what a mathematician does all day, I say, "I write." I write now; I wrote as a faculty member; I wrote as an administrator. In fact, the only time in my adult life that I did not write regularly was during graduate school, when I was preparing for a career in which I would be writing. I go on to tell the students about other things I do, but my response is meant to warn them that writing may be important when they don't expect it.

Students, like the general public, identify mathematical writing with the specialized contents and style of research journals, but at the Center for Communications Research, a think tank sponsored by the federal government, my technical reports are more expository in nature than a journal article would be. Over the years, in addition to research papers, I have published expository articles, conference proceedings, reviews of papers and books, editor's notes for collections of articles, and essays like this one. I have also written my share of those things not intended for publication, such as referee's reports, committee reports, grant proposals, memoranda, letters of recommendation, and other correspondence.

Mathematics students will have to write in their professional lives for people who know less than they do about their work. Even those few who do research will share their new results primarily as they learned old mathematics: through lectures, books, seminars, and expository or review articles, as well as papers in research journals. Thus good exposition is needed at all levels, and students should not begin their careers thinking that they can avoid writing or can substitute symbols, equations, and technical buzz words for real sentences in English.

I suspect that clear and effective exposition does not come easily to many people. After years of experience, I still find writing a slow process of successive approximation, but I no longer try to avoid it. With instruction and practice, including a demanding year of freshman composition, I have become less anxious about writing. I have learned that by carefully reading and revising the drafts and soliciting criticism from colleagues, I can produce a piece that conveys what I mean in a fairly clear way.

Who will provide the students today with the guidance and writing practice they need? If a traditional "freshman comp" course is not required, if students lack a common experience in writing at the college level, then the task falls to the individual faculty members who assign significant written work. With this in mind, some mathematicians are participating in programs of "writing across the curriculum," an approach to undergraduate writing based on the premise that writing is important enough to all the disciplines that responsibility for it should be shared across the campus.

Mathematics faculty cite another compelling reason to include expository writing in their courses—writing can be important to learning mathematics. I find that my thoughts are developed and refined in the process of "writing up" my work. Simply rewriting notes taken in a lecture can reveal points I did not understand as well as I thought. In writing my own expository version, my knowledge of a subject is deepened and extended.

To be sure, there is no conflict between using writing to teach mathematics and using mathematics to teach writing, and I was pleased to learn that MAA members are speaking and writing about both. For the Association's 1988 Annual Meeting in Atlanta, Georgia, Andrew Sterrett of Denison University organized a session of contributed papers on "Writing as part of the mathematics curriculum,"

which drew an overwhelming response from contributors and listeners alike. Gerald M. Bryce of Hampden-Sydney College was recruited to organize a similar session on "Writing across the curriculum" for the Phoenix meeting the following year.

Sterrett is now editing a collection of articles for the MAA Notes Series, *USING WRITING TO TEACH MATHEMATICS*, as an outgrowth of these sessions. The essays that will appear in this volume, including one from which this article was adapted, range from "why" to "how-to." Faculty members who incorporated writing in their courses tell what came of their efforts, and they offer advice on such practical matters as assignments, strategies, and grading. "I wanted essays for this volume that contained ideas that are easily transported to other institutions and to other courses," Sterrett writes in the *Foreword*, "and I am confident that each of the essays selected meets that criterion." The collection, to be available in June of this year, is intended for anyone curious, for whatever reason, about the practice of writing in the mathematics curriculum.

Ann K. Stehney is on the research staff of the Center for Communications Research, Princeton, New Jersey, a division of the Institute for Defense Analysis. She was previously Professor of Mathematics at Wellesley College in Wellesley, Massachusetts.

("Math Outside of Math" continued from page five.)

While it was not our intention to make any value judgements, we decided to follow-up the survey by asking responding departments to tell us why they think these courses exist. What we found was profoundly disturbing. Respondents' comments were almost entirely critical of mathematics departments. Size of the institution or type of department did not appear to affect the nature of their remarks.

We roughly classified respondents' comments into five categories:

- Mathematics faculty does not know or appreciate applications.
- Mathematics faculty teach mathematics as an art with full abstraction, not as a tool.
- Topics span too many mathematics courses.
- Mathematical departments have not kept up with new applied mathematics.
- Mathematics courses do not give students the knowledge or the mathematical maturity for further work.

Our follow-up questionnaire to nonmathematics departments indicated that these departments believe that the substance of the survey is well known and understood on their campuses. In fact, it is clear from their responses that these departments believe that mathematics faculty are responsible for, and content with, this state of affairs.

We have sent copies of our report to all mathematics department chairs in the hopes of stimulating a national debate. We believe that both the numbers and the attitudes of nonmathematics departments are important information which require real action. We expect to prepare a follow-up article on mathematics department reaction to our findings.

Solomon A. Garfunkel is Executive Director of COMAP, Inc., located in Arlington, Massachusetts. Please see the American Mathematical Society's April 1990 issue of NOTICES for a complete report of this study.

Contributed Papers in San Francisco

Kenneth A. Ross, MAA Associate Secretary

The Joint Mathematics Meetings in San Francisco will be held January 16–19, 1991 (Wednesday–Saturday). The full announcement of the meeting will first appear in the October 1990 issues of *NOTICES* and *FOCUS*. This preliminary announcement is made to encourage members' participation and to provide lead-time for organizing the MAA sessions of contributed papers.

Contributed papers are being accepted on several topics in collegiate mathematics for presentation during contributed paper sessions at the national meeting in San Francisco, January 16–19, 1991.

- **PROFESSIONAL DEVELOPMENT FOR TEACHERS OF MATHEMATICS**—*John A. Dossey, Illinois State University, and Elizabeth J. Teles, Montgomery College. Wednesday and/or Thursday.* This session, sponsored by the Committee on Faculty Development (John Dossey, Chair), invites papers that describe departmental, system, state, regional, or sectional programs aimed at promoting continued faculty growth in mathematics or its teaching. Special consideration will be given to programs easily transported from one setting to another. Discussion topics can include, but are not limited to, the following: special faculty study programs, focused colloquia series, reading/study groups, teaching improvement programs, and the development and use of technological aids.
- **STATISTICS AND PROBABILITY**—*Sheldon P. Gordon, Suffolk Community College and Florence S. Gordon, New York Institute of Technology. Friday and/or Saturday.* Contributed papers on any issue relating to statistics and probability courses in the mathematics curriculum are welcome. For instance, (1) What are some innovative approaches to teaching these courses, such as the use of computers and other technology, simulations, exploratory data analysis, or student "research" projects? (2) What does statistical literacy mean for liberal arts, science, mathematics, business, or social science students? (3) What statistical ideas are being introduced into the secondary curriculum, and what are the implications for the undergraduate curriculum?
- **ALTERNATIVES TO THE LECTURE METHOD**—*James R. C. Leitzel, Ohio State University. Friday and/or Saturday.* This session, sponsored by the Committee on the Mathematical Education of Teachers (COMET), will be devoted to classroom practices which provide alternatives to a strictly lecture approach. Papers are solicited which address strategies and techniques for classroom practice across a variety of topics in the undergraduate curriculum. Presentations which represent large and small class size and upper division as well as lower division courses are desired.
- **HUMANISTIC MATHEMATICS**—*Alvin M. White, Harvey Mudd College and the Humanistic Math Network; Marilyn J. Frankenstein, University of Massachusetts, Boston; and Joan Countryman, Germantown Friends High School. Wednesday and/or Thursday.* Contributions are invited that describe teaching, using, or creating mathematics as a humanistic discipline. Papers should describe the experience, and its effect, if any, on the point of view. Philosophical and/or historical papers that contribute to mathematics as a humanistic discipline are also welcome.
- **LESSER-KNOWN GEOMETRICAL GEMS**—*Don Chakerian, University of California-Davis; Richard E. Pfeifer, San Jose State; and Jane R. Sangwine-Yager, Saint Mary's College. Wednesday*

and/or Thursday. Contributed papers are invited which illustrate interesting but not widely known results which may be used by the teacher to enliven an upper division geometry course. These may include both new insights and forgotten classics in geometry that deserve wider appreciation.

- **USING HISTORY IN THE TEACHING OF MATHEMATICS**—*David E. Zitarelli, Temple University. Friday and/or Saturday.* The history of mathematics is used in various ways to enrich and to teach mathematics. Papers in this session should address such uses in courses ranging from liberal arts courses for non-science majors to required courses for mathematics majors. Of particular interest are descriptions of history of mathematics courses, including graduate level courses and those designed for education majors.

Presentations are normally limited to ten minutes, although selected contributors may be given up to twenty minutes. Individuals wishing to submit papers for any of these sessions should send the following information to the MAA Washington office (1529 Eighteenth Street, NW, Washington, DC 20036) by **September 25**: (1) one page stating the author's name and address, intended session, and a one-paragraph abstract (for distribution at the meeting); and (2) a one-page outline of the presentation.

Rooms where sessions of contributed papers will be held are equipped with overhead projector and screen. Blackboards are not normally available. Persons having other equipment needs should contact the Associate Secretary (Kenneth Ross, Department of Mathematics, University of Oregon, Eugene, OR 97403) as soon as possible, but in any case prior to **November 16**. Upon request, the following will be made available: one additional projector, 35mm slide projector, 16mm film projector, or VCR/VHS with one color monitor.

David A. Hoffman Accepts 1989 Chauvenet Prize



David A. Hoffman

At the 1990 Annual Meetings in Louisville, Kentucky, David A. Hoffman of the University of Massachusetts at Amherst accepted the 1989 Chauvenet Prize for his essay, "The Computer-Aided Discovery of New Embedded Minimal Surfaces."

This award winning article first appeared in *THE MATHEMATICAL INTELLIGENCER* 9, No. 3 (1987), 8–19.

Hoffman's exposition describes the recent and multifaceted progress in the theory of minimal surfaces. After presenting some history, interesting and relevant to his subject, he briefly details the mathematics of minimal surfaces.

As recently as 1984, the only known, complete, minimal surfaces of finite total curvature in 3-space were the plane and the catenoid. Then Celsoe Costa, in his 1982 IMPA (Rio de Janeiro) thesis, found equations for a new surface in \mathbf{R}^3 . This new surface would join the plane and catenoid as a third example—if it had no self-intersections. Hoffman and William H. Meeks, III successfully demonstrated this and thus, proved that Costa's example was, indeed, an embedding.

MAA SEEKS ASSOCIATE DIRECTOR

Associate Director for Programs The Mathematical Association of America (MAA) is seeking a highly qualified individual to fill the position of Associate Director for Programs (ADP) starting in June 1990 or possibly at a later date. The ADP works in the Washington, DC headquarters of the MAA and oversees mathematical activities of the Association, including the publications program and various MAA projects.

The Executive Director, the Associate Director for Finance and Administration, and the ADP are the central planning and administrative staff team for the Association. They bear the responsibility for day-to-day management of Association business, long-range planning, and outreach to other organizations. They work in close cooperation with the officers of the Association, journal editors, committee chairs, and project directors.

Candidates must have a PhD in the mathematical sciences or equivalent stature, substantial teaching experience in collegiate mathematics, demonstrated ability to work productively with colleagues and committees, and skill in writing and oral presentation. Experience in program management, fund raising, editorial work, and publications production and promotion are not required, but are highly desirable.

Salary is negotiable, depending on the qualifications and experience of the candidate. Please see bottom of this column for application information.

MAA SEEKS PROJECT DIRECTOR FOR SUMMA: Strengthening Underrepresented Minority Mathematics Achievement

Project Director for SUMMA The MAA expects to launch a long-term, comprehensive, national program for minorities and mathematics in June 1990 and is seeking a highly qualified project director. This individual, who will work in the MAA Mathematical Center in Washington, DC, will play a critical role in determining the direction and success of the program. Qualifications for the position include:

- PhD in mathematics or mathematics education or equivalent stature;
- Track record for improving access of minorities to careers in mathematics, science, and engineering;
- Knowledge and appreciation of the problems that different minority groups have in entering and succeeding in mathematically related fields;
- Excellent organizational and communication skills;
- Experience in fund raising.

Salary is negotiable depending on the qualifications and experience of the candidate and on budgetary constraints. Please see bottom of this column for application information.

The MAA is an Equal Opportunity Employer and encourages applications from minorities and women.

Candidates for either position should send a resumé and letter of application to: Dr. Marcia P. Sward, Executive Director, The Mathematical Association of America, 1529 Eighteenth Street, NW, Washington, DC 20036.

NSF Grant Awarded for MAA Calculators in the Classroom Project

The National Science Foundation has awarded the MAA a four-year continuation grant for \$1.2 million to produce nine units of instructional materials that will enable secondary and middle school teachers to effectively incorporate calculators into their mathematics classes. Texas Instruments, Inc. will contribute \$310,000. The "Teaching Mathematics with Calculators" project is a joint effort of the MAA and the National Council of Teachers of Mathematics. It will be directed by John Kenelly of Clemson University and the College Board. John Harvey of the University of Wisconsin at Madison will serve as co-director. The materials will be produced in the Mesquite, Texas Public Schools and a second Texas school district that is currently being selected. The project's advisory board includes: Gary Bitter of Arizona State University; John A. Dossey of Illinois State University; Shirley Frye of Scottsdale Schools; John Jobe of Oklahoma State University; David Pagni of California State University at Fullerton; Cathy Seeley of Texas Education Agency; Dorothy Strong of Chicago Public Schools; Bert K. Waits of Ohio State University; Steve Willoughby of the University of Arizona. Texas Instruments will be represented by Jennifer Hansard and Gay Riley; and James Wilson of the University of Georgia is project evaluator. In an earlier, \$25,000 grant from Texas Instruments to the MAA, essentially the same advisory board produced the middle school motivational video, "Math: You Can Count on It!"

The nine sets of materials will cover elementary and advanced techniques with graphing calculators, matrices combined with discrete mathematics, elementary and programmable scientific calculators, refinements, new topics enabled through exact arithmetic fraction calculators, consumer economics with time value of money calculators, and improved arithmetic instruction with four function calculators. The materials will include integrated video and print sections for individual teacher study and development, as well as instructional items for classroom use. As the packages are produced, they will be distributed without charge to school district representatives at the 1991, '92, and '93 annual meetings of the National Council of Supervisors of Mathematics.

CRUX MATHEMATICORUM

The Canadian Mathematical Society (CMS) publishes CRUX MATHEMATICORUM, a problem-solving journal that is unique among subscription publications. CRUX (founded in 1975) has an international reputation and is regarded as the prime source in the world for problem-solving questions. Mathematics educators at the high school and university levels and talented students benefit from the wide range of challenging problems and solutions. CRUX is published 10 times per year (a total of 320 pages) and the current subscription rate is only \$35.00 (Canadian), which includes postage and handling. Members of the Canadian Mathematical Society are eligible for a 50% discount in the subscription rate. For further information, contact:

Managing Editor
Canadian Mathematical Society
Crux Mathematicorum
577 King Edward
Ottawa, Ontario
K1N 6N5 CANADA



MAA

Minority Participation • Membership • Student Chapters • Applications in Mathematics • Consultants • Visiting Lecturers • Faculty Development • Section Committees • Undergraduate Program in Mathematics • Prizes and Awards • Publications • Meritawards • Women and Mathematics • Committee on Faculty

ANNUAL REPORT 1989

President's Message



Lida K. Barrett

How does one report on a busy year—two national meetings, the work of more than 80 committees, activities related to 45 sectional meetings, and interaction among the MAA and the American Mathematical Society (AMS),

the Society for Industrial and Applied Mathematics (SIAM), the National Council of Teachers of Mathematics (NCTM), the Board on Mathematics Sciences (BOMS), the Mathematical Sciences Education Board (MSEB), the Committee on the Mathematical Sciences in the Year 2000 (MS2000), and the 14 other organizations of the Conference Board of Mathematical Sciences (CBMS)? Our organization is a keystone in a complex national mathematical enterprise. I therefore select three highlights for this report.

First, the standing Committee on Minority Participation in Mathematics has been established. It has issued a policy statement and helped in drawing up a proposal for a project. Funding for this ongoing proposal, *SUMMA: Strengthening Underrepresented Minority Mathematics Achievement*, has been sought and we are pleased that the initial funding has been received. A search for the director of the project is underway. The project will be housed in our MAA Mathematical Center in the newly refurbished Pólya Building at 1527 Eighteenth Street, NW. The demographics of the 1990s, the year 2000, and beyond show the importance of minority participation in mathematics for all of us. The Association has taken a lead in addressing this issue. What we, as mathematics educators, are learning from minority educational activities is helping all of us who teach mathematics to be better teachers and will improve mathematical education for all students.

Second, the MAA, in August 1989, welcomed Marcia P. Sward as its new Executive Director, and, in the fall, Rhoda Dechter Goldstein as its new Associate Director for Finance and Administration. The transition in leadership has gone smoothly. Marcia brought with her not only her past experience as Associate Director of MAA, but also, from her experience at the Mathematical Sciences Education Board, a superb linkage with the national mathematics community and the activity taking place outside the MAA. This linkage is supported by our decision to stay in Washington, to refurbish our building, and to utilize additional space for mathematics activities—*(“President’s Message” continues on page ten.)*

From the Executive Director's Desk . . .



Marcia P. Sward

Since assuming the position of MAA Executive Director in September 1989, I have come to know and love this organization more than ever before, and to appreciate ever more deeply the unique contributions to collegiate

mathematics it has made during the past 75 years and the new challenges it faces as we approach the 21st century.

Executive directors are privileged people—we get to be involved in virtually every aspect of the organization. We see first-hand the dedication of hundreds of volunteer committee members. We get to engage in extended discussions about future directions of the organization, and to consider these in the broader context of the needs of the nation, with its changing demographic profile, troubled schools, and the increasing need for a mathematically-skilled work force. From this perspective, I believe the greatest challenge we in the mathematics community face in the coming years is to change ourselves and our organizations by:

- expanding our collective sense of responsibility for the success of all students;
- enlarging our repertoire of effective ways to teach and learn;
- reaching out more warmly to young mathematics students, welcoming them into our scholarly community, and helping them to see in it a future for themselves;
- extending our understanding of the roles of mathematics in areas of critical national and international concern, such as the environment;
- finding ways to reach across the boundaries of research and education, school and college, pure and applied, to create a greater mathematical community devoted to common goals and interacting on the basis of deep, mutual respect;
- developing a deeper understanding of how our organizations can simultaneously serve the needs of an increasingly diverse professional community, and interact with and influence school mathematics, higher education, government, business and industry, and the public.

(“From the Executive Director” continues on page ten.)

("From the Executive Director" continued from page nine.)

We came a long way in the last decade, but we still have a long way to go.

The Annual Report is filled with interesting accounts of what the MAA is doing to meet these challenges. Thus, in this Executive Director's report, I will focus on the practical things that support our work—buildings, staff, membership, the budget, and fund raising—all of which are critical elements in the life and health of the MAA.

MATHEMATICS CENTER: SERVING THE COMMUNITY'S EXPANDING NEEDS
During 1989, renovations in our Washington, DC Mathematical Center were undertaken, including replacement of leaky windows and roofs, installation of central air conditioning, painting inside and out, and other essentials. Renovations were completed in October, and our three-building complex is in much improved condition, and is looking very handsome as well.

The Center houses 23 staff members who provide a range of services for the organization—membership and subscriptions services, publications (editorial and sales), financial management, front desk and mailroom, development, and program management. There

was a large turn-over of staff during 1989, with 12 new staff members coming on board during the year. We have a very capable and enthusiastic staff, fully dedicated to their work for the MAA. During 1990, we expect the MAA staff to expand to 27 or 28 as new projects are launched.

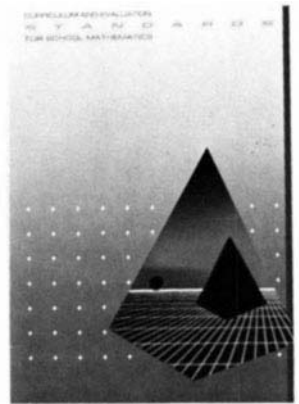
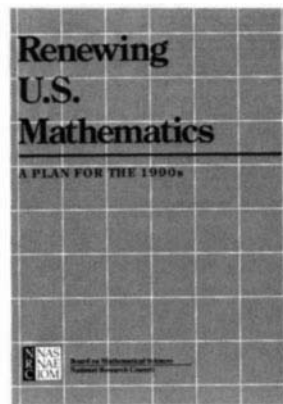
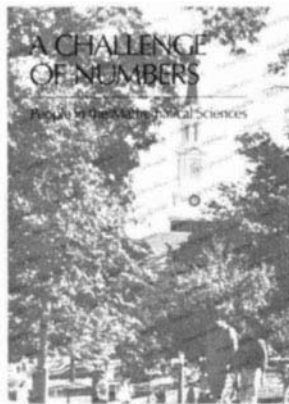
Our Center also contains other mathematical activities. Since 1982, the Conference Board of the Mathematical Sciences (CBMS) has been housed in a small, fifth-floor office. With the completion of the renovation, CBMS moved into two attractive offices, one to be used by presidents or other officers of the CBMS member societies when they are in Washington, DC on society business.

Our Mathematical Center is also the home for the Office of Governmental and Public Affairs (OGPA) for the Joint Policy Board for Mathematics (JPBM), which has three employees, including Al Willcox, MAA Executive Director for 21 years. It has been a special pleasure for me to work near, and with Al during this interim period before his retirement in June 1990.

MEMBERSHIP PASSES MILESTONE During 1989, our membership passed the 30,000 mark, up from 27,500 at the beginning of the

EVERYBODY COUNTS

A Report to the Nation
on the
Future of Mathematics Education



("President's Message" continued from page nine.)

a decision which has proven to be an extremely wise one. We are pleased that the Conference Board of Mathematical Sciences has enlarged its office, that the Office of Governmental and Public Affairs for the Joint Policy Board of Mathematics has returned to Eighteenth Street, and that the Minority project will also occupy space in our building next door, space formally occupied by our tenants, a group of lawyers.

Third, as the largest of the college-and-university-level mathematics professional organizations, and, with our location in Washington, we hold an important place on the educational ladder linking the activities of the National Council of Teachers of Mathematics with those of the American Mathematical Society and the Society for Industrial and Applied Mathematics. There have also been many significant activities outside of the MAA this past year—activities to which our MAA members and the organization itself have made major contributions. These activities include publication of: **EVERYBODY COUNTS: A REPORT TO THE NATION ON THE FUTURE OF MATHEMATICS EDUCATION**, issued jointly by the Mathematical Sciences Education Board, the Board on Mathematical Sciences and the Committee on Mathematical Sciences in the Year 2000; **A CHALLENGE OF NUMBERS: PEOPLE IN THE MATHEMATICAL SCIENCES**, issued by MS2000; **RENEWING US MATHEMATICS: A PLAN FOR THE 1990s** (often referred to as the "David II Report"), issued by the Board on Mathematical Sciences; and **PROFESSIONAL STANDARDS FOR TEACHING**

MATHEMATICS, issued by the National Council of Teachers of Mathematics. We must understand these reports and influence the future direction of mathematics education in the 1990s.

I am pleased to note that I am the second female president of the Mathematical Association of America. I want to pay tribute here to Dorothy L. Bernstein, the first female president. It is good to be the second woman in a role. It is tiring to always be the gender pioneer. As our Committee on the Participation of Women in the MAA has pointed out in their skits and in other ways, much of the cultural pressure on women is unintentional but it does wear us down. It gives me special pleasure to have Deborah Tepper Haimo following me as the next President of the MAA. A time will come when gender issues are not a factor in participation in science and mathematics, but it has not yet arrived. The Committee on the Participation of Women in the MAA, led by Patricia Clark Kenschaft, is helping us move in that direction. I personally owe them a vote of thanks for making my role more comfortable and for helping all of us, as members of the MAA, be cognizant of how to make our organization more inclusive. Additionally, we owe the Committee on Minority Participation in Mathematics a vote of thanks for enhancing our sense of our diversity and making all of us better able to play our roles effectively as members of the MAA and of the national mathematics community. Hopefully, as an organization we can, through our student chapters, a new activity with growing numbers, introduce the next mathematical generation to a profession in which they will all feel warmly accepted.

("From the Executive Director" continued from page ten.)
 year. This continued pattern of healthy growth in membership started in 1982. Especially gratifying is the growth of student and high school teacher membership. We now boast over 6,000 student members, many of whom are members of our new Student Chapters, and nearly 2,800 high school mathematics teachers.

1989 BUDGET: BETTER THAN PREDICTED As Donald L. Kreider indicates in his Treasurer's report, we came through 1989 with flying colors, considering the numerous fiscal uncertainties we faced. A deficit, yes, but well below what was predicted. With a more stable year coming up, 1990 should end up solidly in the black.

GIFTS AND GRANTS HELP BUILD A STRONG MAA A \$25,000 memorial gift was received from Mrs. Charles W. Trigg, and news came of a major bequest from the estate of Stella Pólya, the wife of mathematician George Pólya. (As of May 1990 these gifts, along with others received in 1990, have brought us more than half-way to our goal of paying off the building renovation costs of \$600,000.)

Contributions to the Greater MAA Fund totaled over \$52,000, and the voluntary dues check-off produced another \$74,000. These

funds have, over past years, played an important part in providing the flexibility needed by the MAA leadership to initiate new projects and support on-going projects.

During 1989, we received 15 new grants totaling \$412,000 and supported 14 projects with another \$393,000 in funds from grants awarded in prior years. These grants are listed on page 20 of this Annual Report. The generous support of our federal agency and private foundation sponsors is deeply appreciated and helps significantly to expand the programs and impact of the MAA.

CONCLUSION I would like to place these practical matters in the context of the broader mission with which I began this column.

The MAA is in an enviable position today—financially solid, with a distinguished, 75-year history of accomplishment, dedicated and capable leaders, handsome offices in the nation's capital, a growing membership, good relationships with other mathematical and scientific societies, and escalating public support for its central mission. I am confident that we will build successfully on this strong base, and will play a significant role in shaping the future of mathematics education in the United States and in the world.

Minority Participation in Mathematics

In September of 1989, the MAA Board of Governors unanimously approved the following Association policy statement on minority participation in mathematics:

The MAA affirms that strong moral, societal, and economic justifications exist for a comprehensive national program with the following goals:

1. *Increase the representation of minorities in the fields of mathematics, science, and engineering.*
2. *Improve the mathematics education of minorities.*

The MAA is committed to using its human and financial resources to provide leadership to such a program, which we recognize will require a substantial long-term effort and collaboration with other organizations. In particular, the MAA encourages college and university professors to address these two goals through their research, teaching, and community activities.

The Association's new Committee on Minority Participation, co-chaired by Manuel P. Berriozábal of the University of Texas at San Antonio and William A. Hawkins, Jr. of the University of the District of Columbia, proposed this statement to the Board of Governors. This committee, established on the recommendation of the Task Force on Minorities, has developed plans for a comprehensive, national program for minorities in mathematics. This program, titled *SUMMA: Strengthening Underrepresented Minority Mathematics Achievement*, encompasses five component programs:

- Intervention Programs for Middle and Secondary School Students
- Mainstreaming Programs for College/University Students
- School and College Mentorship Program
- Development Assistance Program for Minority Mathematicians
- Program to Attract Minorities into Mathematics Teaching

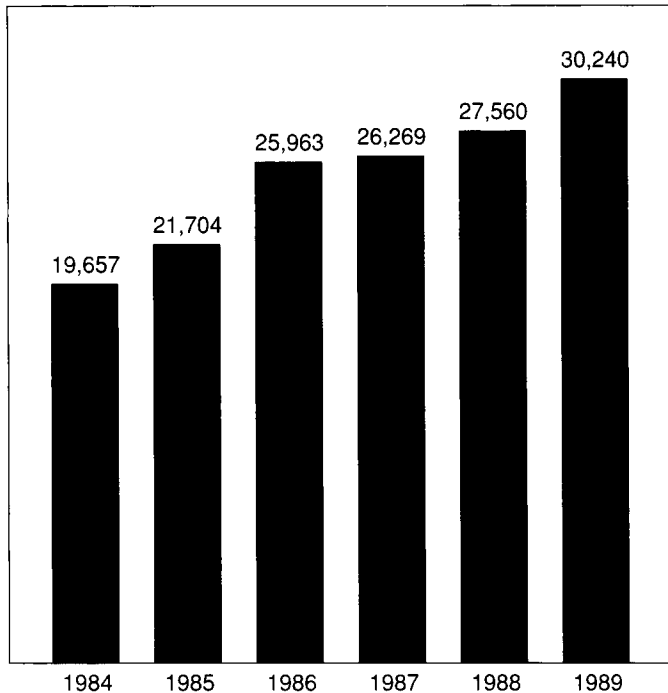
Funding for SUMMA's initial planning phase has been received from the Exxon Education Foundation (\$50,000) and the Carnegie Corporation of New York (\$25,000). The MAA has also committed its own funds (\$15,000) to this work. Major grants are being sought from several public and private foundations to support SUMMA activities over the next three years. A search is underway for a qualified individual to serve as the Project Director in the MAA's Washington, DC Mathematical Center.

SUMMA was publicly announced at the May 1990 convocation, *Making Mathematics Work for Minorities*, sponsored by the Mathematical Sciences Education Board (MSEB) of the National Research Council. The MAA will become a member of the new *Alliance to Improve Mathematics for Minorities* (AIMM) being organized by the MSEB. Among the 33 initial members are the Children's Television Network, the National Governors Association, the California State University System, the National Action Council for Minorities in Engineering, the National PTA, the United Indians of All Tribes Foundation, the US Department of Energy, and the US Department of Housing and Urban Development.



SUMMA seeks to translate localized, minority program successes, such as Uri Treisman's Professional Development Program at the University of California at Berkeley, depicted above during a workshop session, into effective, nationwide programs.

MAA Membership at Year-End: 1984–1989



Membership Surpasses 30,000

In 1989 MAA membership grew by nearly 10%, reaching a record of 30,240. Since 1983, the MAA has grown more than 50%. Much of this growth is attributable to direct mail campaigns guided first by former Executive Director, Alfred B. Willcox, and now by his successor, Marcia P. Sward. Marketing General, a direct-mail marketing consultant firm, implemented these campaigns.

Year-End Membership Demographics

	1988	1989
Students	4,326	6,202
High School Teachers	2,635	2,760
College and University Faculty	13,259	13,477
Industry and Government	3,552	4,090
Retired or Unemployed	2,087	2,239
Other	1,701	1,472
TOTAL MEMBERSHIP	27,560	30,240

This total includes 442 Life Members. In addition, Institutional Members, including high schools, junior and community colleges, four-year colleges and universities, and 15 special Corporate Members, increased from 566 to 593—nearly a 5% gain.

Reciprocal agreements with the Canadian Mathematical Society (CMS) encourage joint activities and membership. CMS members not residing in the US are eligible for a 15% discount on MAA dues. MAA members not residing in Canada are eligible for a 15% discount on CMS dues.

In addition, the MAA now offers a free, one-year membership to students who present papers at Section meetings, as well as to each new holder of a doctoral degree in mathematics or mathematics education from a US or Canadian institution.

Student Chapters

The MAA Student Chapters program, inaugurated in 1988, continues to grow by leaps and bounds. Approximately 2,000 members now belong to more than 200 chapters. Furthermore, in 1989, the Exxon Education Foundation contributed \$20,000 for initial development of various Student Chapter activities. Portions of that grant supported four pilot projects at section meetings that hold promise for implementation at national meetings. In 1989, the following sections and principal investigators received grants:

OKLAHOMA-ARKANSAS

Robert C. Eslinger of Hendrix College, Conway, Arkansas

OHIO

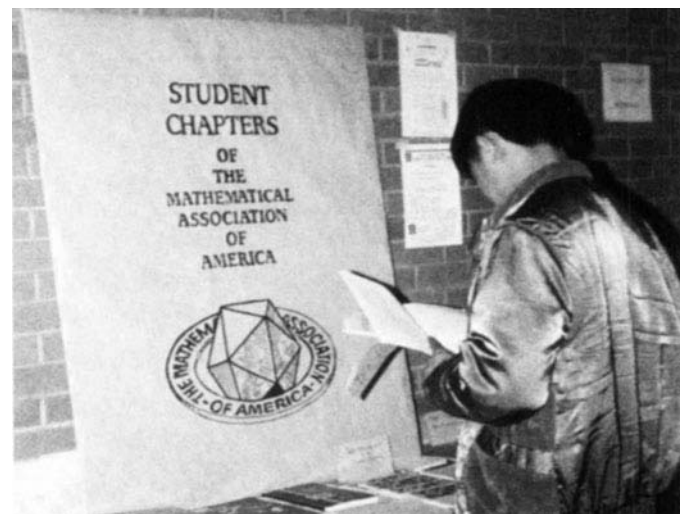
Milton C. Cox of Miami University, Oxford, Ohio and Alan C. Stickney of Wittenberg University, Springfield, Ohio

MARYLAND-DISTRICT OF COLUMBIA-VIRGINIA and ALLEGHENY MOUNTAIN
Ben A. Fusaro of Salisbury State University, Salisbury, Maryland

NORTHEASTERN

Karen J. Schroeder of Bentley College, Milton, Massachusetts

This year the committee (Chair: Howard Anton of Drexel University and Anton Textbooks) devoted its energies to developing communications among student chapters and creating resource materials for chapter and section activities. Development of a student chapter newsletter and the implementation of student activities at national meetings represent the committee's most immediate goals.



A Student Chapter member examines MAA literature during an Eastern Pennsylvania-Delaware Section Meeting.

Applications in Mathematics

Applications in Mathematics (AIM), an NSF funded project under the direction of Jeanne L. Agnew and John M. Jobe of Oklahoma State University, produced seven modules of curricular materials in applied mathematics for high school students. Each module includes a video cassette, student and teacher resource books, and computer software.

During their final year of funding, the AIM producers concentrated on distribution activities. Presentations were made at regional NCTM and MAA section meetings, as well as at national meetings. To complete the project, the MAA intends to make the modules available, free of charge, to MAA Student Chapters and other organizations on a first-come-first-served basis.

Committee on Consultants



The MAA Committee on Consultants has completed its preliminary work on production of its brochure, PROGRAM OF CONSULTANTS. Currently, 77 consultants represent each of the 48 contiguous states. Their areas of expertise include mathematics, statistics, emerging doctoral programs, two-year and four-year college programs, and university programs. Furthermore, the program also features individuals with expertise in other timely topics of mathematical interest such as funding and calculators and computers in the classroom.

The Committee hopes that every mathematics department in the United States will examine its brochure and decide if they would like some consultants to visit their campuses and, if so, for what purpose. During 1990, the Committee will revise its booklet as additional consultants become available, and as currently active consultants evaluate both their program experiences and audience responses to their visits.

Committee on Visiting Lecturers



In 1989, 22 lecturers delivered 58 lectures through the MAA's Program of Visiting Lecturers. The 1990 VISITING LECTURER BOOKLET, recently distributed to all mathematics department chairs, provides the names, addresses, lecture topics, and brief biographies of the program's 105 speakers, including 47 new participants. Under a recently adopted plan, lecturers agree to remain in the program for four years, after which they must wait two years before being invited to participate again. The committee

instituted this policy to ensure the availability of fresh topics each year.

Visiting lecturers are prepared to give formal lectures as well as confer with students on opportunities for graduate study and employment. They will cooperate with participating departments in all ways possible to further the aims of their mathematics programs.

Committee on Faculty Development

The Committee on Faculty Development (Chair: John A. Dossey of Illinois State University) seeks to formulate recommendations and submit proposals to the Association to support faculty development, such as minicourses, workshops, and summer institutes. Such activities would be appropriate not only at the national level, but also at the sectional level, perhaps as an adjunct to a sectional meeting. Currently, four activities occupy the Committee:

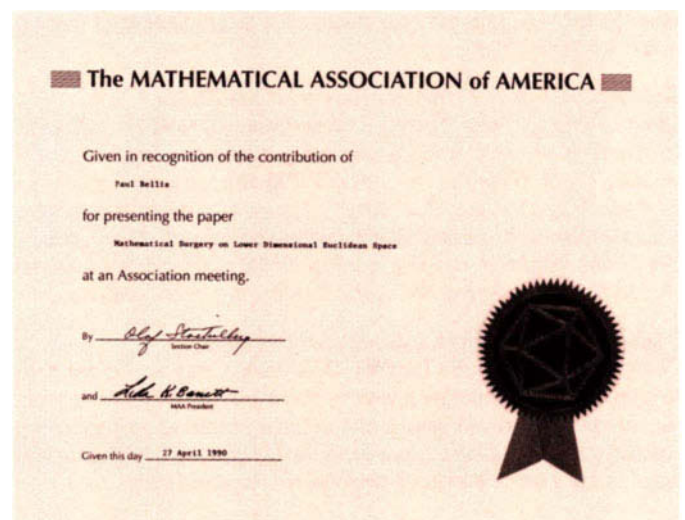
- First, development of a position statement for the Association on the role of faculty development in higher education;
- Second, sponsorship of a contributed papers session at the San Francisco Annual Meeting on the topic of faculty development issues and programs;
- Parallel with such sponsorship, publication of an MAA Notes volume on programs for faculty development at the local and state/provincial levels;
- Finally, realization of a proposal to reproduce annual and summer meetings minicourses on a regional basis in conjunction with section meetings or as summer sessions.

Committee on Sections

The MAA's 29 Sections remain healthy, growing, and constantly innovating. In 1989, more MAA members—approximately 4,500—attended a Section meeting than attended the two national meetings combined. Furthermore, during these Section meetings, members sampled from more than 125 invited addresses, 700 contributed paper sessions, 250 student paper sessions, and 20 workshops and short courses. If you enrich these activities, then, with the renewal of old friendships, the establishment of new friendships, and the conviviality of numerous social events, you will realize, as many members will heartily testify, a memorable Section meeting.

The Sections, however, not content with their present participation levels, seek to increase meeting attendance. They recognize that total MAA membership continues to grow, especially in the areas of two-year college faculty, secondary school teachers, and students. Consequently, the Sections have established many new activities and programs for these groups. Twelve of the twenty-nine Sections now sponsor joint meetings with two-year faculty groups. They have responded to the rapidly growing numbers of Student Chapters with programs designed to attract these members. Furthermore, through numerous efforts, the Sections strive to increase participation by groups currently underrepresented in the MAA.

The MAA's collection of Sections, each providing programs and services adapted to the needs and desires of their members, remains unique among professional organizations. The Sections pledge not only to continue their activities, but also to expand them whenever and wherever possible.



In 1989, students delivered a myriad of contributed papers during Section Meetings. In recognition of their contributions, the MAA awards these participants a *Contributed Paper Certificate*, reproduced above.

1989 Report of the Committee on the Undergraduate Program in Mathematics

Undergraduate mathematics is the wellspring of mathematics, both for education and research. College is where teachers are educated and where students choose careers. The undergraduate years provide primary opportunities to develop enthusiasm for research and to reveal mathematical applications' broad power.

The agenda of CUPM, the Committee on the *Undergraduate Program in Mathematics*, must, therefore, encompass a broad agenda. Some CUPM work is carried out by Subcommittees of CUPM; much related work is carried out by other committees and coordinated through CUPM at its two annual meetings. These related areas involve mathematics both before and after the undergraduate years (precollege and graduate), new approaches to teaching, and pipeline considerations.

CUPM Subcommittees

SUBCOMMITTEE ON SERVICE COURSES

1988 Chair: Donald W. Bushaw, Washington State University; *1989 Chair:* Barbara A. Jur, University of Tennessee at Chattanooga. *Charge:* To promote dialogue with client disciplines in order to recommend the mathematical content of courses designed especially for students majoring in other subjects (e.g., engineering, biology, chemistry). Following discussions about the role of statistics in engineering curricula, this Subcommittee is now studying mathematics service courses for businesses.

SUBCOMMITTEE ON CALCULUS REFORM AND THE FIRST TWO YEARS

Chair: Thomas W. Tucker, Colgate University. *Charge:* To examine emerging practice concerning the several courses that serve to introduce college mathematics (especially calculus, discrete mathematics, statistics, linear algebra, and differential equations) and make recommendations concerning the content, sequencing, and relationships among these beginning courses. In 1989 The CRAFTY Subcommittee received a small NSF grant to prepare a timely report on current calculus projects: this report, which should appear in mid-1990, offers detailed descriptions of selected projects and brief abstracts on a large number of current calculus reform efforts.

SUBCOMMITTEE ON THE UNDERGRADUATE MAJOR (SUM)

Chair: Bettye Anne Case, Florida State University. *Charge:* To examine present practice regarding the undergraduate mathematics major in light of the 1981 CUPM RECOMMENDATIONS FOR A GENERAL MATHEMATICAL SCIENCES PROGRAM and make recommendations which will lead to a revision of that document. The Subcommittee has begun to develop curriculum recommendations based on information gathered at several forums and open meetings.

SUBCOMMITTEE ON SYMBOLIC COMPUTER SYSTEMS

Chair: Zaven A. Karian, Denison University. *Charge:* To promote widespread experimentation with symbolic computer systems in order to stimulate development of curricular materials and teaching practices appropriate to a world in which common mathematical practice will routinely employ the power of such systems.

This Subcommittee has received a grant from the Sloan Foundation to fund their work, which has included poster sessions and speakers at national meetings. The Subcommittee is currently preparing two publications—a set of annotated problems that make use of CAS systems and a volume of papers addressing curricular matters.

SUBCOMMITTEE ON UNDERGRADUATE RESEARCH

Chair: Lester J. Senechal, Mount Holyoke College. *Charge:* To stimulate interest in research experience for undergraduates and to articulate an appropriate role for undergraduate research in the experience of mathematics majors. This Subcommittee was just appointed in 1989, and is planning several events for the January 1991 meeting to highlight the role of undergraduate research in mathematics. They are also finishing an MAA Notes volume consisting primarily of reports from many current programs.

SUBCOMMITTEE ON QUANTITATIVE LITERACY

Chair: Linda R. Sons, Northern Illinois University. *Charge:* To examine and make recommendations concerning all aspects of undergraduate mathematics or quantitative literacy requirements (including courses as well as tests) that may be established for all students who receive a bachelor's degree. This is the newest Subcommittee of CUPM, and is just beginning to work on its very broad and important agenda.

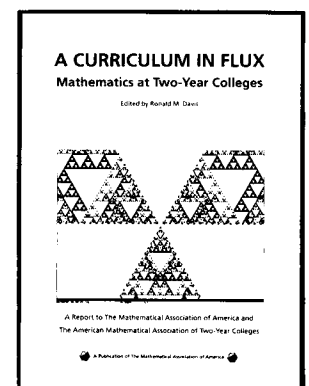
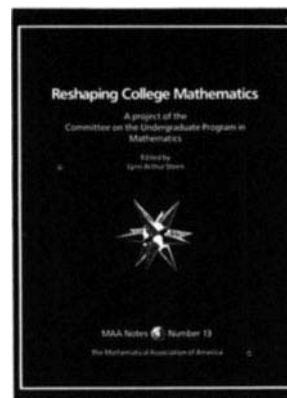
SUBCOMMITTEE ON THE BASIC LIBRARY LIST

Chair: Lynn A. Steen, St. Olaf College. *Charge:* To prepare a revision of the MAA BASIC LIBRARY LIST. The Subcommittee received a grant from NSF and from the Exxon Education Foundation to support a major review process to screen approximately 20,000 books that have been published since the earlier edition of this important reference work appeared. The new volume, which should appear in spring 1991, will combine both the two-year and the four-year lists, separately coded.

Other 1989 CUPM Activities

Two reports were issued by CUPM in 1989. From CUPM itself came *RESHAPING COLLEGE MATHEMATICS*, an MAA Notes volume containing reprints of all CUPM reports for the last 10–12 years, each with a new preface by the original committee chair. The major part of this compendium is a reprint of the 1981 CUPM report, *RECOMMENDATIONS FOR A GENERAL MATHEMATICAL SCIENCES PROGRAM*, which had gone out of print.

From the CUPM-CTUM-AMATYC Subcommittee on the Curriculum in Two-Year Colleges (chaired by Ronald M. Davis of DeKalb College) came *A CURRICULUM IN FLUX: MATHEMATICS AT TWO-YEAR COLLEGES*, a report to the MAA and AMATYC on issues such as baccalaureate transfer programs, statistics, remediation, occupational career programs, and computing.



(*"1989 CUPM Report" continued from page sixteen.*)

A joint MAA-AAC Task Force on Study in Depth, chaired by Lynn A. Steen, prepared the mathematics part of a study of the "depth" component of liberal education being conducted by the Association of American Colleges (AAC).

The report of this Task Force, called CHALLENGES FOR COLLEGE MATHEMATICS: AN AGENDA FOR THE NEXT DECADE, will be published in late 1990.

CUPM and COMET are represented on a special joint NCTM-MSEB-MAA committee to coordinate curricular implications of new professional standards for preparation of mathematics teachers. John A. Dossey—a member of the Board of Governors—represents CUPM in this enterprise.

Finally, CUPM prepares a regular column for UME TRENDS, the new newsletter on undergraduate mathematics education sponsored by the Joint Policy Board for Mathematics (JPBM). Each issue features a report of one of the CUPM Subcommittees.

Plans for 1990

A new committee on Assessment of Undergraduate Mathematics will be established (Chair: Bernard L. Madison of the University of Arkansas) to examine issues concerning college-level mathematics assessment both of undergraduate majors and of introductory skills. The committee will focus on relating emerging practice to curricular objectives and to sound assessment principles.

Upon CUPM's recommendation, the MAA and the American Statistical Association have formed a Committee on Statistics (Chair: George Cobb of Mount Holyoke College) to make recommendations concerning statistics teaching in mathematics departments.

CUPM will pursue curricular recommendations that emerge from the National Research Council's forthcoming report from the MS 2000 Steering Committee concerning undergraduate mathematics. The Committee also hopes to influence the emerging curriculum projects that the National Science Foundation will support as its undergraduate programs' scope grows beyond calculus.

American Mathematics Competitions and Mathematical Olympiads: 1989

In 1989, the American Mathematics Competitions realized another remarkable year—394,214 students from 6,411 secondary schools and 262,650 students from 3,927 middle schools participated in these challenging examinations. In addition, 1,244 students competed in the American Invitational Mathematics Examination.

In March 1989, the Committee on the American Mathematics Competitions (CAMC) coordinated the American High School Mathematics Examination (AHSME) and the American Invitational Mathematics Examination (AIME) in secondary schools throughout the US and Canada. Top performers on these two examinations continued to the next tier in the competition sequence—the Eighteenth United States Mathematical Olympiad (USAMO). In 1989, 148 students from 127 schools competed in this rigorous examination designed to challenge both mathematical knowledge and ingenuity. From these 148, eight remarkably talented US students emerged as Olympiad medal winners: Jordan S. Ellenberg of Potomac, Maryland; Andrew H. Kresch of Havertown, Pennsylvania; Jonathan T. Higa of Honolulu, Hawaii; Richard S. Rusczyk of Decatur, Alabama; Jeffrey M. Vanderkam of Raleigh, North Carolina; David B. Carlton of Oberlin, Ohio; Samuel K. Vandervelde of Amherst, Virginia; and Demetrio D. Muñoz of Alexandria, Virginia.

These eight winners and sixteen other students who performed with distinction on the Olympiad examination subsequently embarked on an intensive, four-week mathematical training session at the US Military Academy at West Point. Such training sessions condition these students, as both *individuals* and as members of a *team*, for the demands of the International Mathematical Olympiad (IMO).

Following such rigorous preparation, 6 of the 24 trainees traveled to Braunschweig, West Germany—site of the 30th IMO: David B. Carlton of Oberlin, Ohio; Jordan S. Ellenberg of Potomac, Maryland, Andrew H. Kresch of Havertown, Pennsylvania, Samuel Kutin of Old Westbury, New York; Jeffrey M. Vanderkam of Raleigh, North Carolina; and Samuel K. Vandervelde of Amherst, Virginia. Ellenberg accepted a Gold medal for his perfect score of 42. Kresch (37), Kutin (37), Vanderkam (35), and Vandervelde (32) earned Silver Medals; and Carlton (24) received a Bronze Medal.

In 1989, 291 students from 50 countries participated in the IMO. The American team, with a combined score of 207 out of a possible 252, placed fifth in the 30th IMO. China (237), Romania (223), the USSR (217), and East Germany (216) claimed first through fourth place respectively. Furthermore, in a competition dominated by Eastern Bloc countries, our team captured the highest place among participating western countries; indeed, only three western countries ranked within the fifteen most successful teams—the USA, West Germany (187), and France (156). In addition, for the ninth consecutive year, every US team member earned at least a bronze medal—an IMO record. No other nation has achieved a comparable history of impressive and consistent performance.

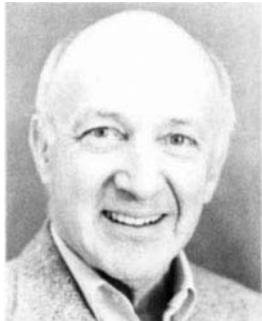
Eight national associations sponsor the Olympiad activities—the American Mathematical Association of Two-Year Colleges, the American Mathematical Society, the American Statistical Association, the Casualty Actuarial Society, the Mathematical Association of America, Mu Alpha Theta, the National Council of Teachers of Mathematics, and the Society of Actuaries. The MAA administers the Olympiad program and its awards ceremonies. Both public and private agencies provide financial support; these generous and much appreciated groups include the Army Research Office, Hewlett-Packard, International Business Machines, Inc., the Matilda R. Wilson Fund, and the Office of Naval Research.



US team winners sport their medals following their admirable performance at the 1989 IMO in West Germany. Left to right: Carlton, Vanderkam, Vandervelde, Kresch, Kutin, and Ellenberg.

MAA Prizes and Awards

In January 1990, at the annual meetings in Louisville, several mathematicians received recognition for their various contributions to the discipline. Leon A. Henkin, Professor of Mathematics at the University of California at Berkeley, accepted the first Yueh-Gin Gung and Dr. Charles Y. Hu Award for Distinguished Service to Mathematics

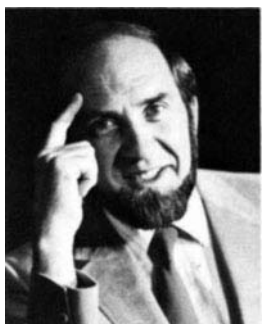


Leon A. Henkin

for "his leadership in so many different areas of mathematics education and his initiatives to increase opportunities for minorities and women to succeed in mathematics." In 1964, Henkin and Jerzy Neyman initiated a program at Berkeley to increase the number of minority students entering college from San Francisco Bay Area high schools; in 1969, he headed a statewide, University of California program that continues to send graduate students in mathematics to teach advanced mathematical topics in elementary classrooms. He played a central role in the development of the Bay Area Mathematics Project, one of the early, collaborative projects linking students, teachers, parents, administrators, and community leaders to improve the teaching of mathematics. In the April 1990 issue of FOCUS, Donald J. Albers, Chair of the MAA Committee on Publications, interviewed this distinguished mathematician about his career—past, present, and future.

In 1989 the MAA also honored several authors for excellence in expository writing in both books and journals. For a more detailed discussion of these winners and their noteworthy exposition, please see page 7 of the October 1989 issue of FOCUS. Each winner received a check, a certificate, and the recognition and esteem of their colleagues. Through interviews with these authors, a common impetus for writing emerged: to communicate not only the substance of their discoveries, but also their wonder at the beauty of mathematics implicit in their work.

David A. Hoffman, Professor of Mathematics at the University of Massachusetts at Amherst, accepted the Chauvenet Prize for his article, "The Computer-Aided Discovery of New Imbedded Minimal Surfaces," which appeared in *The Mathematical Intelligencer* 9, No. 3 (1987). The Committee on the Chauvenet Prize described Hoffman's paper as "a many-faceted exposition of progress in the Theory of Minimal Surfaces." For a more detailed description of Hoffman's award winning essay, see page 7 of this issue of FOCUS.



Thomas M. Thompson

In August 1989, at the 68th summer meeting, the Beckenbach Book Prize Committee presented its first award to Thomas M. Thompson of Walla Walla College, College Place, Washington for his volume, *FROM ERROR-CORRECTING CODES THROUGH SPHERE PACKINGS TO SIMPLE GROUPS*. The committee praised Thompson's book as "a beautiful work that follows the path of a series of related mathematical developments spanning a period of twenty-five years . . . He presents not only a historical account based in large measure on contacts with those who were directly involved, but he also provides a lucid, interesting account of the mathematics itself that is intended to be comprehensible to an upper division student."

Each year the MAA journal awards committees honor outstanding articles in each of the Association's periodicals—the Lester R.

Ford Award for papers in *THE AMERICAN MATHEMATICAL MONTHLY*, the Carl B. Allendoerfer Award for papers in *MATHEMATICS MAGAZINE*, the George Pólya Award for papers in *THE COLLEGE MATHEMATICS JOURNAL*, and the Merten M. Hasse Prize for an exceptional expository paper in any Association journal, written by an author less than 40 years of age at the time of publication.

THE LESTER R. FORD AWARD Gert Almkvist of the University of Lund, Lund, Sweden, and Bruce C. Berndt of the University of Illinois, jointly, for "Gauss, Landen, Ramanujan, the Arithmetic-Geometric Mean, Ellipses, pi, and the Ladies Diary," Vol. 95, No. 7 (1988), 585–608, and to Richard K. Guy of the University of Calgary, Alberta, Canada, for "The Strong Law of Small Numbers," Vol. 95, No. 8 (1988), 697–712.

THE CARL B. ALLENDOERFER AWARD W. B. Raymond Lickorish of Cambridge University and Kenneth C. Millett of the University of California at Santa Barbara, jointly, for "The New Polynomial Invariants of Knots and Links," Vol. 61, No. 1 (1988), 3–23; and to Judith V. Grabiner of Pitzer College for "The Centrality of Mathematics in the History of Western Thought," Vol. 61, No. 4 (1988), 220–230.

THE GEORGE PÓLYA AWARD Beverly L. Brechner of the University of Florida and John C. Mayer of the University of Alabama, jointly, for "Antoine's Necklace—or How to Keep a Necklace from Falling Apart," Vol. 19, No. 4 (1988), 306–320; and to Edward R. Rozema of the University of Tennessee for "Why Should We Pivot in Gaussian Elimination?," Vol. 19, No. 1 (1988), 63–72.

THE MERTEN M. HASSE PRIZE Irl C. Bivens of Davidson College for "What a Tangent Line Is When It Isn't a Limit." Biven's article, also a 1987 George Pólya Award winner, appeared in *THE COLLEGE MATHEMATICS JOURNAL*, Vol. 17, No. 2 (1986), 133–143.

Finally, also at the Louisville meeting in January 1990, five members received the MAA's Meritorious Service Award. Recipients included: *Intermountain*—Don H. Tucker of the University of Utah; *New Jersey*—Henry O. Pollak, retired, of Bell Telephone Laboratories; *Maryland-District of Columbia-Virginia*—John M. Smith of George Mason University; *Allegheny Mountain*—Richard McDermot of Allegheny College; and *Oklahoma-Arkansas*—Jeanne L. Agnew of Oklahoma State University. For additional information on these winners, see page 3 of this issue of FOCUS.

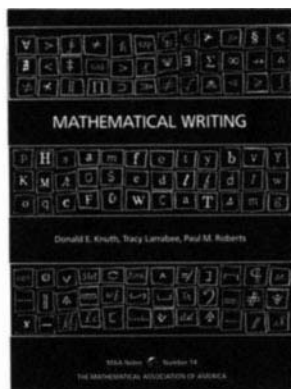
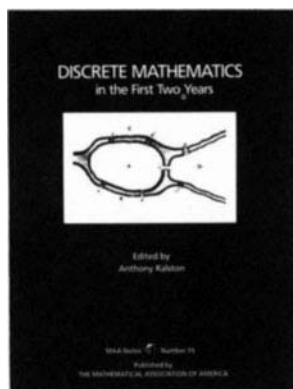
New Committees

The MAA's rapid growth during the past decade, coupled with its reliance upon an effective committee structure, prompted President Barrett to ask President-elect Haimo to chair an ad hoc Committee on Committee Structure. This committee is considering structures which would enhance communication among committees with similar interests and would also make it easier for the leadership of the Association to keep informed of committee work. On pages 14 and 15 of this issue of FOCUS, Lynn A. Steen discusses three new CUPM Subcommittees. Other initiatives taken by President Barrett include the appointment of a Committee on Minority Participation in Mathematics (Co-Chairs: Manuel P. Berriozábal of the University of Texas at San Antonio and William A. Hawkins, Jr. of the University of the District of Columbia), and an ad hoc Committee on a National Center for the Teaching of Undergraduate Mathematics (Chair: Robert Bumcrot of Hofstra University). The ad hoc Pólya Lecturer Committee (Chair: Alan C. Tucker of the State University of New York at Stony Brook) and the Committee on Sessions of Contributed Papers (Chair: Duane D. Blumberg of the University of Southwestern Louisiana) were constituted to contribute to the communication of mathematics among our members.

1989 MAA Publications

In 1989, MAA Publications delivered to its membership seven new volumes, two additional titles from related organizations, and a spectacular catalogue featuring a shimmering, four-color fudgeflake fractal. Clearly, our publications, both new and familiar, pleased our readership for sales exceeded \$400,000 that year.

MAA Studies in Mathematics, whose authors and editors rank among the leaders in their disciplines, published a revised and updated STUDIES IN GLOBAL DIFFERENTIAL GEOMETRY. Over twenty years have elapsed since S. S. Chern, its editor, compiled the volumes' essays. Since then, the field has grown broader and more sophisticated, both in mathematics and physics; contributors' revisions and additional essays reflect this growth.



MAA Notes, designed to disseminate information rapidly and inexpensively, published four new volumes in 1989. Lynn A. Steen discusses two Notes titles—RESHAPING COLLEGE MATHEMATICS and A CURRICULUM IN FLUX: MATHEMATICS AT TWO-YEAR COLLEGES—in his CUPM report on pages 14 and 15 of this issue of FOCUS. Three other Notes titles joined these selections: Donald Knuth's MATHEMATICAL WRITING, an overwhelmingly popular choice during the Louisville meetings; Anthony Ralston's DISCRETE MATHEMATICS IN THE FIRST TWO YEARS, a consideration of the curriculum changes computers, computer science, and algorithmics have inspired; and John W. Kenelly's THE USE OF CALCULATORS IN THE STANDARDIZED TESTING OF MATHEMATICS, cited in the Committee on Testing's report on page 18 of this issue of FOCUS.

MAA Spectrum, the Association's most recent and delightfully eclectic series, published yet another Martin Gardner jewel in 1989—MATHEMATICAL MAGIC SHOW. Harvey Mellar in the *Times Literary Supplement* rhapsodizes on Gardner's distinctive, mathematical appeal: "MATHEMATICAL MAGIC SHOW begins with a chapter on nothing, and finishes with a chapter on everything. In between we visit most of the prime sites of recreational mathematics—game theory, factorials . . . playing cards, finger arithmetic, Möbius bands, polyominoes, perfect numbers, the knight's tour, trees, and dice.

In 1990, MAA publications promises several new volumes in each of its series. If you attend the 75th Anniversary Meeting in Columbus, Ohio, browse through the Association's book exhibit—titles just published for the meeting await your inspection! Look for Andrew Sterrett's USING WRITING TO TEACH MATHEMATICS; Thomas W. Tucker's CRAFTY'S CALCULUS SCENARIOS; and a preview of Stephen Cunningham's and Walter S. Zimmermann's VISUALIZATION IN MATHEMATICS in the Notes series; Robin Wilson's revision of Oystein Ore's GRAPHS AND THEIR USES in the New Mathematical Library Series; another, long awaited MATHEMATICAL MORSELS from Ross A. Honsberger; and our most recent Carus Monograph—COMPLEX ANALYSIS: THE GEOMETRIC VIEWPOINT from Steven G. Krantz.

Minicourses

The 1989 Annual Meeting in Phoenix, Arizona offered fifteen continuing education minicourses and nine discussion groups within one workshop. Approximately 630 mathematicians enrolled in these classes. Moreover, during the 68th Summer Meeting in Boulder, Colorado, over 370 mathematicians sampled from the MAA's 9 minicourse offerings.

Each year, the number, variety, and popularity of these minicourses increase substantially. For example, in 1982—only eight years ago—the January Meeting featured two minicourses over a Thursday and Friday evening. The expansion of topic selections since then represents a 750% gain! Now, meeting participants dash to three-part courses conducted throughout the conference week. Clearly, the mathematical community profits from our minicourses' many avenues of professional development—enrichment of the depth and scope of individual mathematical interests; introduction to and advanced instruction in new technologies and in their many uses inside the classroom; discussions, grounded in experience, on the implementation of programs designed to address specific student and faculty needs; innovative teaching strategies; and timely and occasionally controversial issues in mathematics and mathematics education.

During 1989, the following minicourses and their greatly valued instructors exemplified the Association's commitment to enhancing the mathematical lives of our members.

Ada for mathematicians, *H. Joseph Straight of the State University of New York at Fredonia* ■ Applications of discrete mathematics, *Fred S. Roberts of Rutgers University* ■ Applications of the HP28S supercalculator for more experienced users (at both the annual and the summer meetings), *Thomas W. Tucker of Colgate University* ■ Chaotic dynamical systems, *Robert L. Devaney of Boston University* ■ Combinatorics via functional equations, *Donald R. Snow of Brigham Young University* ■ Computer based discrete mathematics, *Nancy Hood Baxter of Dickinson College and Ed Dubinsky of Purdue University* ■ Computer graphics in elementary statistics, *Florence S. Gordon of New York Institute of Technology and Sheldon P. Gordon of Suffolk County Community College* ■ Group theory through art, *Thomas H. Brylawski of the University of North Carolina at Chapel Hill* ■ Faculty-managed programs that produce minority mathematics majors, *Uri Treisman of the University of California at Berkeley and Ray C. Shiflett of California State Polytechnic University* ■ HP28S short course for nearly inexperienced users, *Jerold C. Mathews of Iowa State University* ■ Learning math through discrete dynamical systems, *James T. Sandefur of Georgetown University* ■ Modeling with the Poisson process, *Linn I. Sennot of Illinois State University* ■ muMATH workshop, *Wade Ellis, Jr. of West Valley College* ■ Seminar on women in mathematics, *Miriam P. Cooney of Saint Mary's College* ■ Starting, funding, and sustaining mathematics laboratories, *Stavros N. Busenberg of Harvey Mudd College* ■ Surreal numbers, *Leon Harkleroad of Bellarmine College* ■ Teaching Assistants and Part-Time Instructors: Responses to the Challenge (workshop featuring nine discussion groups), *Bettye Anne Case of Florida State University* ■ Teaching mathematical modeling, *Frank R. Giordano of the United States Military Academy at West Point and Maurice D. Weir of the Naval Postgraduate School* ■ Use of personal computers in an introductory linear algebra course, *Homer F. Bechtel of the University of New Hampshire* ■ Using computer graphing to enhance the teaching and learning of calculus, *Franklin D. Demana and Bert K. Waits, both of Ohio State University* ■ Using history in teaching calculus, *V. Frederick Rickey of Bowling Green State University* ■ Writing in mathematics courses, *George D. Gopen and David S. Smith, both of Duke University*.

Women and Mathematics

The Women and Mathematics (WAM) program encourages female students, primarily in grades 6 through 12, to explore mathematics and scientific topics and to develop their talents in these areas. The program provides contact with role models, career and academic counseling, workshops, corporate tours, and mentors, as well as student, parent, teacher association, and classroom presentations. WAM members are all women pursuing careers that require an extensive, foundational knowledge of mathematics. In 1990 the WAM program will celebrate its 15th anniversary.

Active regions in the Women and Mathematics program include: Baltimore/Washington, Boston, Chicago, Greater Philadelphia, Hawaii, Kansas City, Michigan, Montana, New York/New Jersey, North Carolina, Northern California, Puget Sound, Southern California, Texas, and Utah. In past years, regions in Central Ohio, Connecticut, and Oregon have participated in the program. WAM currently seeks coordinators for these areas as well as for Southern California. A region in Florida also implemented the WAM program, but that state's success with an aggressive career and academic advising program minimized its demand for WAM activities. WAM is always interested in serving new regions where coordinators and funding can be established.

In 1989 WAM contacted over 25,250 students and 2,200 teachers, counselors, parents, and other adults through more than 400 presentations. Currently, 2 national directors, 19 regional coordinators, and 450 role models administer and implement the program.

WAM funding in 1989 totaled over \$40,000. One-third was in-kind contributions from WAM participants and coordinators, and contributions of time and other support from their employers. International Business Machines, Inc., Northern Telecom, the George I. Alden Trust, John Hancock, and the MAA donated monetary grants. Hewlett-Packard contributed thirty 22S calculators to be distributed as awards throughout the regions.

WAM regions, working alone and with other women's groups, organize and participate in such career conferences as Sonya Kovalevskaya Day and Expanding Your Horizons. Indeed, the Expanding Your Horizons Conference in California, for example, now engages workshop leaders who were first encouraged to enter their field by a WAM speaker or by exposure to an earlier conference.

If you would like to participate in, or contribute to, the Women and Mathematics Program, or wish to receive further information, please contact: Alice J. Kelly, National Director, Women and Mathematics Program, Department of Mathematics, Santa Clara University, Santa Clara, California 95053.

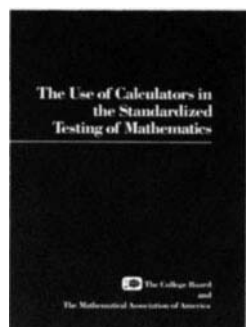


Virginia E. Knight, (center) Chair, Mathematical Sciences Department, Meredith College, received funding from Northern Telecom to implement the WAM program in North Carolina.

Committee on Testing Activities

In November 1989, the name of the Committee on Placement Examinations (COPE) was changed to the *Committee on Testing* (COT). In the past few years, COT has begun to deal broadly with the issues of mathematics assessment and evaluation; the new name reflects this expanded mission. In addition, this name should make it easier for those seeking advice and assistance from the MAA on testing to identify the appropriate committee.

A primary, continuing concern of COT is the MAA Placement Testing (PT) Program. In 1990, 419 postsecondary institutions subscribed to the PT Program. Approximately 21% of the subscribing institutions were two-year colleges; 44% were four-year colleges; 18% awarded both bachelor's and master's degrees; and 16% were doctoral institutions. The present PT Program test packet contains six college-level placement tests that range from a test of arithmetic and skills to one of calculus readiness and two prognostic tests that subscribers use to test rising high school juniors so as to describe the possible initial college mathematics placement of those students. During mid-1990, a newly developed *Arithmetic and Skills Test* will be included in the test packet.



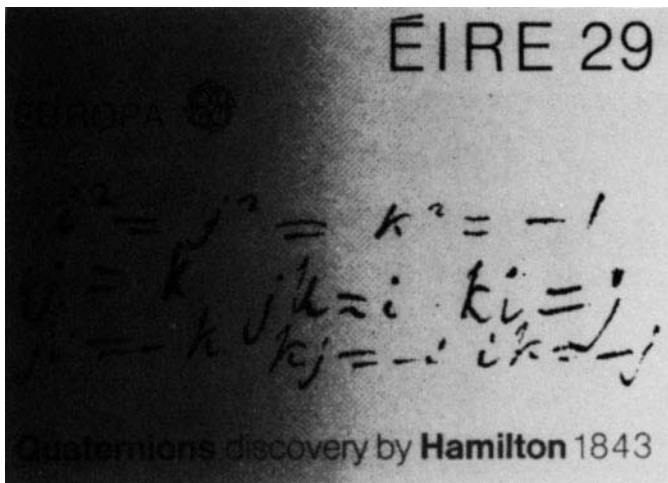
Since 1986, COT has been developing calculator-based (CB) analogs for all of the tests in the PT Program test packet. Development of four of these tests has been completed. Two of them, the *CB Arithmetic and Skills Test* and the *CB Calculus Readiness Test*, will be placed in the PT Program packet by mid-1990. Currently, two calculator-based prognostic tests are being developed; one of these tests will require the use of a graphics calculator and will be the first nationally published mathematics test of its kind. Furthermore, in 1989, the MAA, in association with the College Board published its twelfth NOTES volume: THE USE OF CALCULATORS IN THE STANDARDIZED TESTING OF MATHEMATICS. John W. Kenelly of Clemson University and COT liaison to the Executive and Finance Committee edited this essay collection; John G. Harvey of the University of Wisconsin at Madison and COT Chair composed the preface and concluding essay.

In April 1990, an exciting new project was initiated. The *Teaching Mathematics with Calculators* Project is a joint project of the MAA and the National Council of Teachers of Mathematics (NCTM). Directed by John W. Kenelly and co-directed by John G. Harvey, the intent of this project is to develop nine sets of instructional materials that will help middle and high school teachers to use calculators effectively in their classrooms and, as a result, to help them implement the NCTM STANDARDS. This project is discussed in greater detail on page 8 of this issue of FOCUS.

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COMPUTER-GENERATED PLACEMENT TESTS This three-year COT project was initially funded by the Fund for the Improvement of Postsecondary Education (FIPSE) in 1988. The computer system that generates the individual test items and the tests is nearing completion. During the next 18 months, research on the tests and items generated by this system will be conducted. This project will produce improved, parallel test forms for the PT Program.

OUTREACH COT members continue to be active in outreach activities. We support the MAA Prognostic Testing Network and regularly offer workshops and minicourses at mathematics meetings and conferences, including the January Joint Meetings and the annual meetings of the American Association for Two-Year Colleges (AMATYC). At the January 1990 Joint Meetings, COT sponsored or co-sponsored four sessions on testing and placement.



The MAA staff collaborates on many Association endeavors including production and distribution of its three journals. The December 1989 issue of *MATHEMATICS MAGAZINE*, an example of such collaboration, featured this commemorative stamp on its cover.

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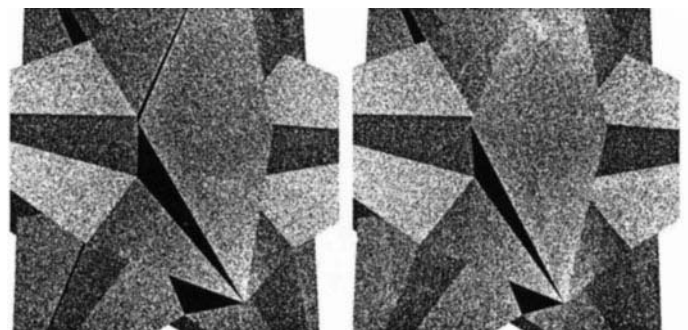
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Consolidated MAA Balance Sheet

	12-31 1988	12-31 1989
ASSETS		
Current Assets		
Cash	\$ 157,619	\$ 776,415
Liquid Assets	369,848	468,152
Accounts Receivable	639,965	219,337
Publications Inventory	188,831	178,944
Prepaid Expense	162,528	130,450
Total Current Assets	\$1,518,791	\$1,773,298
Non-Current Assets		
Investments (at cost)	\$ 868,162	\$ 810,671
Furniture and Equipment	405,412	478,105
Building (at cost)	816,456	816,456
Building Improvements (at cost)	135,473	684,618
Accumulated Depreciation	(467,825)	(543,481)
Deferred Development Costs	49,286	57,448
Total Non-Current Assets	\$1,806,964	\$2,303,817
TOTAL ASSETS	\$3,325,755	\$4,077,115
LIABILITIES AND FUND BALANCES		
Current Liabilities		
Accounts Payable	\$ 190,170	\$ 29,948
Accrued Royalties	31,409	29,632
Other Accrued Liabilities	106,129	257,869
Prepaid Dues and Subscriptions	1,427,634	1,689,493
Total Current Liabilities	\$1,755,342	\$2,006,942
Long-Term Liabilities		
Mortgage Payable	\$ 289,085	\$ 801,963
Unexpended Grant Receipts	102,258	145,520
Total Long-Term Liabilities	\$ 391,343	\$ 947,483
TOTAL LIABILITIES	\$2,146,685	\$2,954,425
Fund Balances		
Unrestricted Fund Balances	\$ 471,456	\$ 440,949
Restricted Fund Balances	308,387	265,960
Endowment	399,227	415,781
Total Fund Balances	\$1,179,070	\$1,122,690
TOTAL LIABILITIES AND FUND BALANCES	\$3,325,755	\$4,077,115

1989 Financial Report



Donald L. Kreider
MAA Treasurer

In 1989, the MAA experienced a deficit of approximately \$56,000 in its total budget of around 3.5 million dollars. In the general fund, which is the MAA's operating fund, the deficit was \$75,000. A deficit of \$92,000 in operations had been budgeted for 1989, it being a year in which there was no dues increase. The savings came from some careful financial management during the latter part of the year.

The year 1989 was one of extraordinary transition for the MAA. Al Willcox stepped down as Executive Director after 21 years of excellent leadership. Since September he has been serving as Director of the Office of Governmental and Public Affairs for the Joint Policy Board for Mathematics and has been working part-time for the MAA to assist with the transition. He is completing both of these assignments this summer and is planning a year-long sailing trip through the Caribbean with his wife, Shirley.

Marcia P. Sward became the new Executive Director of the MAA in September; Rhoda Dechter Goldstein, the Associate Director for Finance and Administration, joined her. Taking over an operation as complex as the MAA was not a simple task, and doing so in the middle of the season for preparing year-end reports and budgets for the new year was an added challenge. Things have gone remarkably smoothly during this period, and we are grateful for both Marcia's and Rhoda's patience, good humor, and steadfast professionalism as the MAA has moved ahead into the Sward years. (*"1989 Treasurer's Report" continues on next page.*)

1989 Revenues and Expenditures

REVENUES

Dues	\$1,459,000
Subscriptions	345,000
Book Sales and Advertising	493,000
Interest, Dividends, and Capital Gains	112,000
Contributions	107,000
Grants and Direct Cost Reimbursements	307,000
Contest Fees and Sales	554,000
Space Rental	22,000
Miscellaneous	150,000

TOTAL REVENUES \$3,549,000

EXPENDITURES

Membership Department	\$ 241,000
Journals and FOCUS	1,245,000
Books	581,000
Sections, Meetings, and Joint Programs	292,000
Development	48,000
Grant Supported Programs	332,000
Mathematical Competitions	571,000
Building Operations	123,000
Miscellaneous Programs	173,000

TOTAL EXPENDITURES \$3,606,000

("1989 Financial Report" continued from previous page.)

The year 1989 saw the completion of the renovations undertaken to restore the MAA headquarters building to first-class condition. The main structural elements of the building have been restored—external brickwork, roof, windows, and air conditioning systems. The building next door, at 1527 Eighteenth Street, has been fully renovated inside as well as outside and is now becoming the mathematical center in Washington that we had hoped. The building will house the Office of the Director of Governmental and Public Affairs for the Joint Policy Board for Mathematics. It will continue to house the office of the Conference Board for the Mathematical Sciences. It will have office space for SUMMA (Strengthening Underrepresented Minority Mathematics Achievement), the MAA's new project to make mathematics work for minorities. And the newly refurbished Pólya Building will provide a Washington presence for many mathematical organizations and their officers. The first two floors are being rented to help cover the cost of operating the building.

The MAA is in a strong position to provide leadership in the national effort to improve the quality of mathematics education. Marcia Sward can be expected to bring to the MAA the same, vigorous stewardship that she exercised during the past five years as Executive Director of the Mathematical Sciences Education Board. That board, under her direction, was instrumental in focusing national attention on the problems of mathematics education, and the MAA is uniquely placed on center stage in that effort. Certainly the years ahead will require a great deal of work on the part of everyone connected with the MAA, and it would be impossible to cite individually the many people on whom the organization depends. Last year I made special mention of the work of the MAA President and the many MAA committees. This year it would be fair to make special mention of our staff within the Washington office of the MAA. They endured the renovations taking place around them during the past year and never flagged in their work as the change in administration was effected. So much of what the MAA does depends on their work, and they merit special thanks for helping to bring us through the past year and making it possible to move ahead.

GRANTS AND AWARDS In 1989, grants totaling \$412,005 supported MAA endeavors. These generous supporters include Texas Instruments, Inc. (\$23,600) for continuation of a Calculator-Based Testing Program; the Alfred P. Sloan Foundation (\$115,000) for Symbolic Computation Systems in Undergraduate Mathematics. The National Science Foundation (NSF) supported Rapid Dissemination of New Calculus Projects (\$41,540) and A Basic Library Collection (\$60,000). Exxon also contributed to this Basic Library Collection (\$30,000) as well as to general MAA support (\$15,000). Several organizations contributed to the 1989 Mathematical Olympiads: the Matilda R. Wilson Foundation (\$20,000); the Office of Naval Research (\$18,005); the Army Research Office (\$16,950); IBM (\$10,000); and Hewlett-Packard (\$1,410). IBM also contributed to the Women and Mathematics Program (\$12,500), as did Northern Telecom, Inc. (\$8,000); the George I. Alden Trust (\$4,000); and John Hancock (\$1,000).

The MAA received and expended \$392,500 from grants in 1989. The following projects, including the current portion of new grants listed above and continuing grants awarded in prior years, received support: Applications in Mathematics (\$92,300 from NSF); Rapid Dissemination of New Calculus Projects (\$14,700 also from NSF); the American Mathematics Project (\$71,700 from NSF, \$14,600 from the Ford Foundation, and \$7,300 from the Carnegie Corporation); the Prognostic Testing Network (\$9,600 from NSF); Development of Software for Computer Based Placement Tests (\$26,100 from the Department of Education (DOEd)); Training of Teaching Assistants in Mathematics (\$26,900 also from the DOEd); a Calculator Based Testing Program (\$9,200 from Texas Instruments, Inc.); Develop Standards for Teachers (\$34,900 from Exxon); Mathematical Olympiad and Awards Ceremony (\$60,900 from the Academy of Applied Science); and the Women and Mathematics Program (\$22,800 from the many sources mentioned above).

More Than Half-Way To the Goal!

Through the generosity of members and friends of the MAA, the campaign for the MAA Mathematical Center Fund has already raised over \$350,000 toward its \$600,000 goal. The Center, a superb example of Italian Renaissance Revival architecture, rests in the historic, Dupont Circle district of downtown Washington, DC and houses the offices of the MAA, the Conference Board of the Mathematical Sciences, and the Office of Governmental and Public Affairs of the Joint Policy Board for Mathematics.

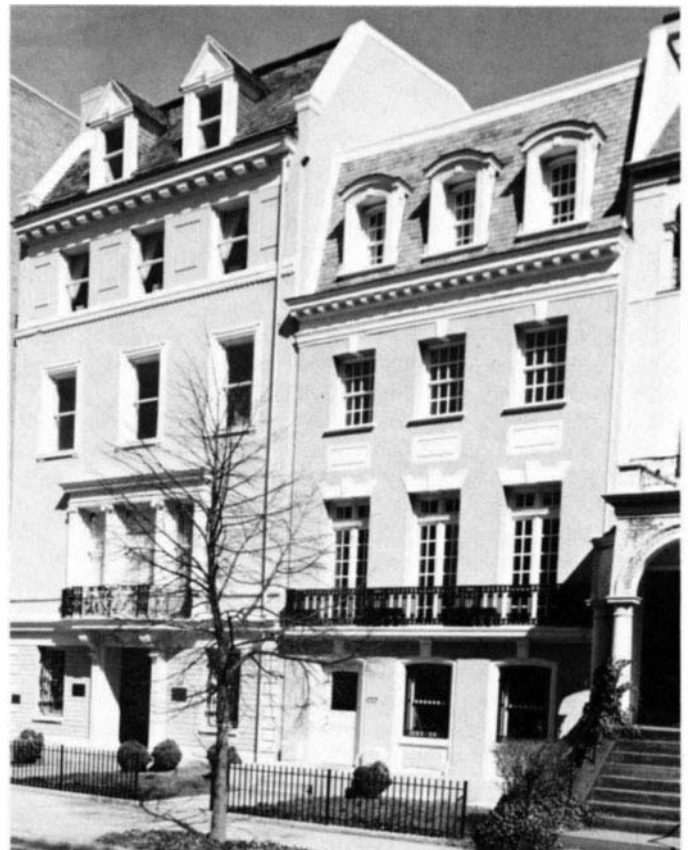
Early in 1989, the MAA launched a three-year campaign to pay for the Center's much needed renovation. The estate of George Pólya bequeathed \$175,000 to the Association—the largest, single gift contributed to the Fund. At its January 1990 meeting in Louisville, the MAA Board of Governors voted unanimously to name the building at 1527 Eighteenth Street, NW in Pólya's honor.

The Fund has also received two \$25,000 grants: one from Mrs. Charles W. Trigg, for a room to be named in memory of her husband, Professor Charles W. Trigg; and one from Professor Marie T. McKellar, for a room to be named after her parents, Viola D. and Bernard J. Hank. In addition, the MAA has also received promise of two \$10,000 gifts.

Many members have chosen to pledge \$3,000 over the three year campaign period. The MAA intends to inscribe the names of donors who give \$300 or more on a brass plaque to be hung permanently in the Center. Furthermore, in August, during the 75th Anniversary Meeting at Ohio State University, the MAA will sponsor a gala Donor Recognition Breakfast for all donors who contribute to the Fund by 1 July 1990.

Send your contribution to the Mathematical Center Fund today!

For more information, call MAA Executive Director, Dr. Marcia P. Sward at (202) 387-5200.



The MAA Mathematical Center in Washington, DC.

The Greater MAA Fund 1989 Honor Roll of Donors

In 1989, 1,056 donors contributed \$52,002 to the Greater MAA Fund. In addition, as of mid-May, 1990—five months into its three-year campaign—the MAA Mathematical Center Fund received over \$325,000 from 131 donors.

PLANNED GIVING A special seminar on Planned Giving is scheduled for the January 1991 Annual Meeting of the Association in San Francisco, California.

The Officers of the Association express their gratitude to the membership for its support of the Greater MAA Fund. The names of all 1989 donors, except of those wishing to remain anonymous, are listed below:

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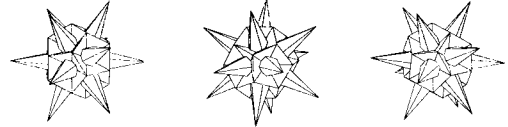
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The Mathematical Programming Society (MPS) invites nominations for the A. W. Tucker Prize for an outstanding paper authored by a student. The award will be presented at the International Symposium on Mathematical Programming in Amsterdam, The Netherlands (5–9 August 1991). All students, graduate and undergraduate, are eligible. Nominations of students who have not yet received the first university degree are especially welcome. In advance of the Symposium an award committee will screen the nominations and select at most three finalists. The finalists will be invited, but not required, to give oral presentations at a special session of the Symposium. The award committee will select the winner and present the award prior to the conclusion of the Symposium. The members of the committee for the 1991 A. W. Tucker Prize are: Richard W. Cottle, Stanford University; Thomas M. Lieblich, Swiss Federal Institute of Technology, Lausanne; Richard A. Tapia, Rice University; and Alan C. Tucker, State University of New York at Stony Brook.

ELIGIBILITY

The paper may concern any aspect of mathematical programming; it may be original research, an exposition or survey, a report on computer routines and computing experiments, or a presentation of a new and interesting application. The paper must be solely authored, and completed after January 1988. The paper and the work on which it is based should have been undertaken in conjunction with a degree program.

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Richard W. Cottle
Department of Operations Research
Stanford University
Stanford, California 94305-4022

by a faculty member at the institution where the nominee was studying for a degree when the paper was completed. Letters of nomination must be accompanied by four copies each of: the student's paper; a separate summary of the paper's contributions, written by the nominee, and no more than two pages in length; and a brief biographical sketch of the nominee.

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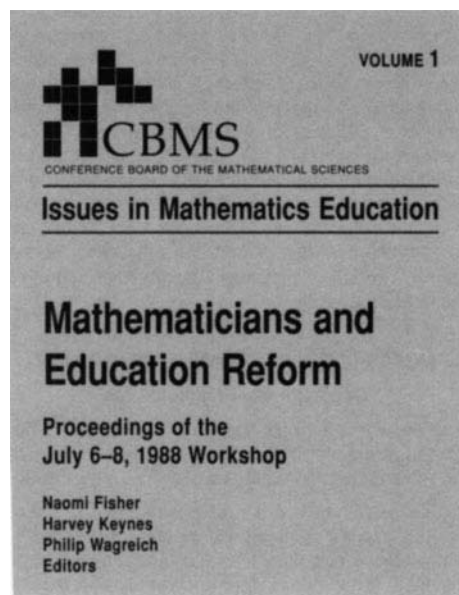
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National MAA Meetings

- August 8–11, 1990** 66th Summer Meeting, Columbus, OH (Board of Governors, August 7, 1990)
January 16–19, 1991 74th Annual Meeting, San Francisco, CA (Board of Governors, January 15, 1991)
-

Sectional MAA Meetings

- Eastern Pennsylvania and Delaware** University of Delaware, Newark, November 10, 1990
Florida Eckerd College, St. Petersburg, March 1–2, 1991
Illinois Eastern Illinois University, Charleston, April 26–27, 1991
Louisiana-Mississippi University of Mississippi, Biloxi, March 1–2, 1991
Maryland–District of Columbia–Virginia Towson State University, Towson, MD, November 16–17, 1990; Virginia Commonwealth University, Richmond, Spring 1991
Michigan Calvin College, Grand Rapids, 1991
Nebraska Nebraska Wesleyan University, Lincoln, April 26–27, 1991
Northeastern Roger Williams College, Bristol, RI, June 8–9, 1990; Framingham State College, Framingham, MA, November 16–17, 1990
Northern California California State University at Hayward, February or March 1991
Ohio Marietta College, Marietta, October 19–20, 1990
Oklahoma-Arkansas Cameron University, Lawton, Oklahoma, March 29–30, 1991
Pacific Northwest Portland State University, Portland, OR, June 14–16, 1990
Rocky Mountain University of Northern Colorado, Greeley, CO, Spring 1991
Seaway State University of New York at Oswego, November 2–3, 1990; State University of New York at Oneonta, Spring 1991
Southern California University of California at Irvine, November 10, 1990
Southeastern University of South Alabama, Mobile, April 5–6, 1991
Wisconsin University of Wisconsin, Oshkosh, April 26–27, 1991
-

Other Meetings

- June 11–14** Fifth SIAM Conference on Discrete Mathematics, Hyatt Regency Hotel, Atlanta, GA. Organizer: Peter Winkler of Emory University and Bellcore. For information, contact: SIAM Conference Coordinator, 3600 University City Science Center, Philadelphia, PA 19104-2688; (215) 382-9800.
June 11–15 NSF supported workshop on "Computational Number Theory." Lecturer: Carl Pomerance, University of Georgia. For information, contact: R. M. Najjar, College of Letters and Sciences, University of Wisconsin at Whitewater, Whitewater, WI 53190; (414) 472-1620
June 13–16 The Mathematical Sciences Institute (MSI) at Cornell University workshop on "Function Estimation and Statistical Applications," addressing modern statistical methods that do not rely

on parametric assumptions. Organizers: David Ruppert, Cornell University; and J. S. Marron, University of North Carolina at Chapel Hill. For information on the scientific program, contact: David Ruppert, School of Operations Research and Industrial Engineering, Cornell University, 343A Upson Hall, Ithaca, NY 14853; (607) 255-9136; david@orie.cornell.edu.

June 18–22 NSF sponsored Computer Algebra System Workshop at Mississippi State University. For information, contact: Jimmy Solomon, Mississippi State University, PO Drawer, MS 39762.

June 25–29 Allegheny Mountain Section Short Course, "Theory and Applications of Symbolic Computation." (See April 1990 FOCUS, page 10, for details.) For information, contact: Dave Wells, Penn State University, New Kensington, PA 15068; (412) 339-6049.

June 25–29 Northeastern Section Short Course, "Outline for Teaching Differential Equations with Modeling and a Computer Algebra System." (See April 1990 FOCUS, page 10, for details.) For information, contact: Clayton W. Dodge, University of Maine, Orono, ME 04469; (207) 581-3908.

July 9–13 Eastern Pennsylvania and Delaware Section Short Course, "A Laboratory Approach to Calculus Using *Derive*." (See April 1990 FOCUS, page 10, for details.) For information, contact: Marvin L. Brubaker, Messiah College, Box 1051, Grantham, PA 17027; (717) 766-2511.

July 15–20 SIAM Annual Meeting. Organizer: Andrzej Manitius of George Mason University. Includes one-day short course on "Chaotic Dynamics, an Emerging Science." For information, contact SIAM at address above (June 11–14).

July 15–20 NSF sponsored Computer Algebra Systems Workshop at Colby College. For information, contact: Don Small, Colby College, Waterville, ME 04901.

July 16–20 Eastern Pennsylvania and Delaware Short Course, "Teaching Numerically with MATLAB." (See April 1990 FOCUS, page 10, for details.) For information, contact: Marvin L. Brubaker, Messiah College, Box 1051, Grantham, PA 17027; (717) 766-2511.

July 16–27 Regional Institute in Dynamical Systems at Boston University. Introductory lectures for graduate students and college faculty on the basic ideas of dynamics. Speakers: P. Blanchard, R. L. Devaney, D. Fried, and G. R. Hall. For information, contact: Dynamics Institute, Mathematics Department, Boston University, Boston, MA 02215.

July 16–August 3 "Enriching Discrete Mathematics Courses with Recent Developments" at the University of Wyoming. William F. Lucas of Claremont Graduate School will lecture throughout the conference. Carl W. Lee of the University of Kansas will lecture for at least two weeks. Discussions and work sessions included. Funds for living costs and a small stipend available. For information, contact: A. D. Porter, Mathematics Department, PO Box 3036 University Station, University of Wyoming, Laramie, Wyoming 82071-3036.

July 22–27 NSF sponsored Computer Algebra Systems Workshop at St. Olaf College, Northfield, Minnesota. For information, contact: Don Small, Colby College, Waterville, ME 04901.

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