

FOCUS

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February 1992

Love Among the Ruins

The Education of High-Ability Mathematics Students in the USSR

Mark Saul

Lipman Bers used to tell a subtle mathematical joke in his classes. If you have a double implication to prove, one direction is frequently trivial, while the other requires significant work. So which direction do you prove first? The easy one, of course, because if there is a flood, or a fire, or some other natural catastrophe, and you lose your life, at least you will have completed a part of the proof.

The Soviet Union is in the midst of an economic, if not a natural, catastrophe. Daily life is led against a background struggle for subsistence. It is difficult to imagine that people under these conditions can lead productive, fulfilling lives. And yet both mathematical activity and mathematics education are at their most vibrant and vital in the Soviet Union today. Within a culture not too different from our own, a remarkable mathematical subculture has grown up and now thrives—a subculture from which we in America have much to learn.

A group of American high school students and teachers had a chance to participate in this subculture last summer as part of an exchange program. The program was sponsored by the National Science Foundation (NSF) in cooperation with the Institute for New Technologies in Moscow and organized by the American Regions Mathematics League. For two weeks, twenty-five American high school students of high mathematical ability and five high school teachers lived and studied with a like number of Soviet students, teachers, and mathematicians. The camp was held in Tartu, in what was then the Estonian Soviet Republic. Most of the participants came from Moscow and Leningrad, although there were some representatives of other Russian cities and of cities in the Ukraine.

The level of mathematics was high: topics included elliptic curves and commuting rational functions, p -adic numbers, words and sequences, finite automata, generating random-walk fractals, and chromatic polynomials.

But perhaps the deepest impressions were not of mathematical topics, many of which might have been studied as easily at home. It was the intellectual climate, the attitudes of American and Soviet students toward their work and toward their teachers, that was most enlightening.

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The Russian penchant for conversation, coupled with the deep interest of all the participants in mathematics, quickly led to late-night discussions on many of these points. Teachers from both countries began to compare their students' work, and patterns emerged which were agreed to intuitively by virtually all the teacher participants from either side of the ocean.

A clear example is furnished by the role of technology in the program. The Texas Instruments Corporation had donated a TI-82 graphing calculator for each participant. Most American students knew how to use the tool and could compare it dispassionately to other calculators and to computer software. The Soviet students, never having seen this sort of tool, were fascinated with it in the same way that some children cannot put down a hand-held video game. The people of Tartu soon came to accept as routine the sight of high school students walking down the streets of the town (which were mostly free of cars) engrossed in programming a hand-held calculator. American students would joke that if you want to keep a Russian student busy, you just hand him or her a calculator.

Another difference noted between Soviet and American students was in the style of their academic involvement. The Soviet teachers were amazed at the American students' discipline. The young Americans came to class promptly and completed their assignments on time—these were students chosen for their high ability and interest. The Soviet students, chosen using similar criteria, might or might not show up for class and decided for themselves when to hand in assignments. It seemed that without the leverage of important consequences for their academic careers, Soviet students' motivation was gone, while American students drew motivation from within.

(Love Among the Ruins continues on page six.)

Figure 1. Inside This Issue . . .

Remember to participate and
return your completed form
by 16 March 1992

THE MAA
ALL-MEMBER
STRATEGIC PLANNING
QUESTIONNAIRE

Association of Mathematics Teacher Educators

A new group, the Association of Mathematics Teacher Educators (AMTE), has been formed to promote the discussion of issues related to the professional development of preservice and continuing education of teachers of mathematics. A second focus of the association is to provide its members an opportunity for their own professional growth and development.

The association is initiating the following activities:

1. Special AMTE sessions at the National Council of Supervisors of Mathematics (NCSM) and the National Council of Teachers of Mathematics (NCTM) annual meetings (see program booklets for details) as well as plans for sessions at future meetings of the MAA and the American Mathematics Association of Two-Year Colleges (AMATYC).
2. Regional or state mathematics teacher education forums.
3. Newsletter, directory, and other membership services.

For additional information, contact: Judith E. Jacobs, Director of Center for Science and Mathematics Education, California State Polytechnic University, Pomona, California 91768. ■



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MAA Receives \$5.1 Million in Grants

During 1990–1991, the MAA was awarded \$5.1 million in external support for twenty-four different projects.

The largest grant in this period is \$2.4 million from IBM, including \$618,783 in cash and 135 PS/2 computers valued at \$1.8 million, for a four-year *Interactive Mathematics Text Project* (IMTP). Gerald J. Porter of the University of Pennsylvania and James E. White of the University of North Carolina at Chapel Hill and the Institute for Academic Technology are the principal investigators (PI) and were primarily responsible for designing this project and securing the funds for it. A grant of \$62,883 from the National Science Foundation (NSF) will supplement the IBM grant, providing minicourses for faculty who will use the computer laboratories and a workshop for the laboratory managers.

James R. C. Leitzel, MAA Visiting Mathematician and Professor of Mathematics at Ohio State University, is the PI for three NSF grants:

- \$52,642 for a series of workshops at MAA Section meetings to encourage faculty participation in undergraduate curricular reform;
- \$49,953 for a conference on research in collegiate mathematics education, which was held 8–10 November 1991 in Washington, DC; and
- \$16,930 for the dissemination of 4,000 copies of the MAA booklet, *Mathematical Scientists at Work*, to members of the US congress, key officials in the executive branch, and leaders of national education organizations.

The MAA has also received a number of grants from the private foundation and corporate sector. The Carnegie Corporation of New York awarded \$327,000 to the SUMMA (Strengthening Underrepresented Minority Mathematics Achievement) project to provide planning grants for intervention projects for minority students in grades 7–12. SUMMA Director William A. Hawkins, Jr., on leave from the University of the District of Columbia, is the PI for this project.

In addition, the Exxon Education Foundation has made grants to the MAA totaling \$63,000:

- \$20,000 for the Student Chapters;
- \$13,000 to fund the first three cycles of the MAA's Award for Distinguished College or University Teaching of Mathematics (ADCUTM);
- \$10,000 for the Strategic Planning Initiative; and
- \$20,000 for general support.

Finally, IBM has also made a grant of \$15,000 to support both the United States of America Mathematical Olympiad (USAMO) awards ceremonies and the Women and Mathematics (WAM) program. ■

THE MAA ALL-MEMBER STRATEGIC PLANNING QUESTIONNAIRE

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Quantum

Richard A. Askey

Last week was go-to-school week, so I went to the local high school to check the library holdings on mathematics. Among many things missing was *Quantum*, a mathematics and science journal for high school students. When *Quantum* started almost two years ago, copies were sent to every high school in the country. I assumed this would be enough exposure, and that almost all the high school libraries would subscribe. That has not happened if Madison, Wisconsin is typical. None of the four high school libraries subscribe. The librarian at the local high school said they needed reviews before they could consider subscribing. Here is most of a letter I wrote to a local newspaper when *Quantum* started, and then some further comments now that this magazine is almost two years old.

Some students learn that mathematics and science are fun, but many do not. How can we share this knowledge with those who have not learned how much fun it is to discover things? An exciting way is now available—the new magazine QUANTUM. This is based on the magazine KVANT, which, for the last twenty years, has helped tantalize students in the USSR with fascinating articles and interesting problems. KVANT's circulation is over 200,000, so this is not just a magazine for the few that will go on to get PhDs in science and mathematics.

The first issue contains profiles of both the late A. N. Kolmogorov, a great mathematician and one of the founders of KVANT, and of Sally Ride, the American physicist who has done some of her physics as an astronaut. There are physics articles on waves and on the superfluid state of helium II. There is an engineering article about bridges with suggested experiments that students can do. In mathematics, there is an article on bending paper and one on the pigeon-hole principle (you can not put $k + 1$ pigeons in k holes without having at least two in one hole) and some of the surprising consequences of this simple fact. The traditional chess column is there, and there are problems in great profusion, some which are jokes and others that challenge professional scientists and mathematicians, although they can be done with the mathematics taught in high school.

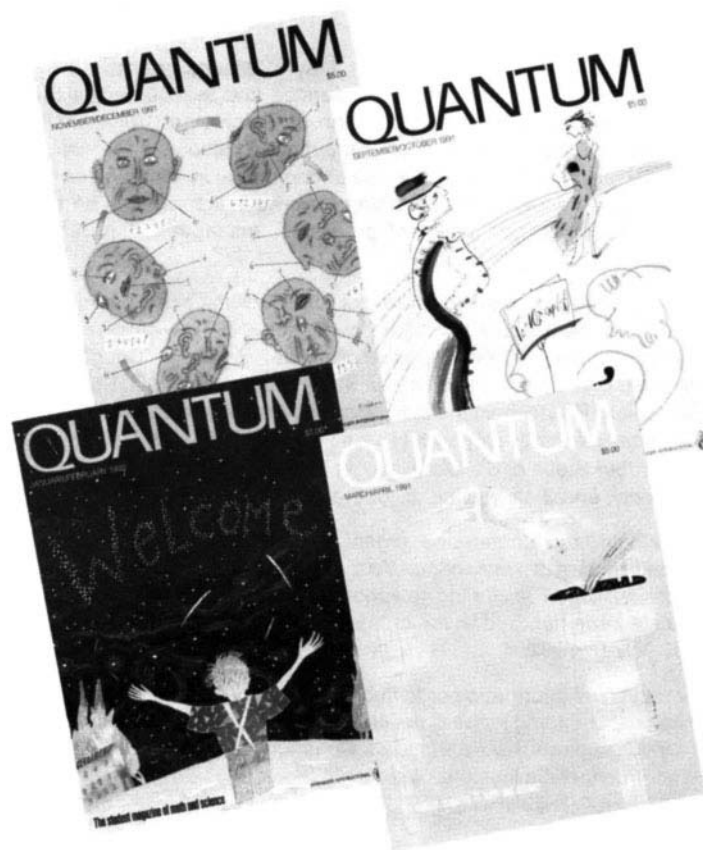
Much of the first issue comes from earlier issues of KVANT, but some of the articles were written in the USA. The American editors-in-chief are Sheldon Glashow for physics and William P. Thurston for mathematics. Glashow won a Nobel Prize in physics and Thurston won a Fields Medal, the analogue of a Nobel Prize in mathematics, so the American input should equal the high standards of the original. It does so in the January issue.

QUANTUM should be in every middle and high school library, in most public libraries, and many students will want their own copies. My only complaint about the magazine is that I have spent too much time reading it and working problems in the two days since it arrived.

Quantum has continued its high standard. There was a very interesting talk with I. M. Gelfand about his early career, the usual array of interesting mathematics and physics problems, some mathematical games by John Conway (one marred by an unfortunate typographical mistake—11221 should be 11221), a reconstruction of how Fermat may have argued to factor 100,895,598,169, and many interesting articles on physics.

If we are going to interest students in studying mathematics and science, we are going to have to do what Jaime Escalante did at Garfield High School. He, along with a few others, changed the intellectual climate to the point where it was the thing to do to take calculus. There are many ways to try to change attitudes, and the same one will not work everywhere. Getting students to see that mathematics is fun, that hard work can be very rewarding, and that others will spend hours working on problems are some of these. *Quantum* will help as one tool. There are others which are still needed. We need a high school mathematics problem journal. One has existed for decades in Hungary, and it saved at least one life. Paul Turán was taken into custody during the Second World War and put on a heavy work detail. His supervisor asked if he was related to the Turán who used to solve problems in the high school mathematics journal. Upon being told that he was that Turán, the supervisor transferred Turán to a desk job. Since food was very scarce, continued heavy work would have probably killed him, as it did many others. Solving hard problems will probably save few lives directly, but it may interest more students in mathematics and science, and change their lives. We owe it to our students to make *Quantum* widely available. I have subscribed from the start, and hope most of you will as well. Most of the articles continue to be of interest to undergraduates, so college and university libraries should also subscribe. It is published by the National Science Teachers Association (NSTA), and is available from *Quantum*, Springer-Verlag New York, Inc., PO Box 2485, Secaucus, New Jersey 07096; 1-800-SPRINGER (in New York, dial (201) 348-4033). Current subscription rates are \$28 for institutions, \$18 for individuals, and \$14 for full-time students. Six issues are published each year. ■

Richard A. Askey is Professor of Mathematics at the University of Wisconsin at Madison.





A Wellspring of Workshops A Cornucopia of Conferences

Summer Activities for the Mathematical Scientist

Eighth Annual Allegheny Mountain Section Summer Short Course

V. Frederick Rickey of Bowling Green University will conduct this year's course, centered on the history of the calculus, at Allegheny College, 22–26 June 1992.

Mornings will be devoted to lectures about the mathematicians who made the most important contributions to the calculus. They will include biographical information, details about the individuals' contributions to the calculus, and ideas about how this information can be used in the classroom. Afternoon sessions will be devoted to a visit to the Rare Book Room, reading original sources, and discussions on teaching history of mathematics courses, with a particular emphasis on how to use the history of the calculus as a motivational tool in teaching calculus. There will also be contributed papers.

Fees include \$115 for registration and \$105 for room and board. For additional information, contact: George R. Bradley, Department of Mathematics and Computer Science, Duquesne University, Pittsburgh, Pennsylvania 15282; (412) 434-5115. ■

Computing in the Calculus

This conference, scheduled 29–31 May 1992 and sponsored by the Department of Mathematical Sciences and the Center for Innovation in Undergraduate Education at Rensselaer Polytechnic Institute, will explore the use of computing in calculus and related issues. Topics will include: the use of computing in the classroom, changing what we teach, changing how we teach, effects on related disciplines, evaluation of programs, management of large classes, and future trends.

Luther S. Williams, Assistant Director for Education and Human Resources at the National Science Foundation (NSF), will deliver the keynote address. Plenary speakers include: Ronald G. Douglas of the State University of New York at Stony Brook, Joseph G. Ecker of Rensselaer Polytechnic Institute, Mary Kathleen Heid of Pennsylvania State University, Deborah Hughes Hallett of Harvard University, Lynn Arthur Steen of St. Olaf College, Thomas W. Tucker of Colgate University, and J. Jerry Uhl, Jr. of the University of Illinois.

In addition, the conference organizers seek proposals for contributed papers or workshops. Your proposal should include a title, author, affiliation (including telephone, fax, and email) and an abstract of three hundred words or less. The deadline for submissions is **30 March 1992**.

For additional information or to submit an abstract, contact: Conference on Computing in the Calculus, Anderson Center for Innovation in Undergraduate Education, 121 Communications Center, Rensselaer Polytechnic Institute, Troy, New York 12180-3590; (518) 276-4853; JWILSON@RPITSMTS. FAX: (518) 276-4852. ■

Summer Institute in Software Engineering for College Faculty

If you teach undergraduate computer science or computer engineering courses in which software engineering is a component, and if your institute is in Illinois, Indiana, Iowa, Kentucky, Michigan, Missouri, Ohio, Pennsylvania, Tennessee, West Virginia, or Wisconsin, you are invited to participate in *Bringing the Industry View of Software Engineering to the Classroom*. This summer institute will bring together twenty faculty like yourself to the campus of Indiana University-Purdue University at Indianapolis, 7–12 June 1992. The week's activities will consist of close interaction with representatives from three major industries in Indianapolis who have a wealth of experience in systems development, project management, and technical training. Four underlying themes of software engineering and a number of more specific topics will be addressed. Themes will include: client involvement, interpersonal skills, productivity and profitability, and strategic planning. Topics will include: decision making, documentation, maintenance, project management, project planning, quality assurance, team management, and verification and validation.

Many activities (panel discussions, video tapes, site visits, presentations, role-playing scenarios, CASE tool demonstrations, etc.) are planned in order to present a current industrial software engineering perspective that you can take back to your classroom.

The first session will conclude with planning for classroom activities or curriculum modules that you will have developed over the summer. A second session in Indianapolis, 8 and 9 August 1992, will be for sharing your ideas before you implement them the following academic year. A final resource book with detailed descriptions of these activities and evaluations of their success will be distributed to all participants in the summer of 1993.

The program is open to all faculty with at least three years of experience in teaching computer science or computer engineering at the undergraduate level. You must be scheduled to teach a course during 1992–1993 in which an educational unit in software engineering can be implemented.

You will be responsible for your own transportation to Indianapolis for each of the two sessions. Housing (double occupancy) at the University Place Conference Center and Hotel, meals, and materials costs are supported by the National Science Foundation (NSF). Selection of participants for the program will be made without regard to race, national origin, or gender, but preference will be given to faculty from institutions so situated as to make exposure to industry views of software engineering difficult or unlikely.

For additional information and application forms, contact: Frank H. Young, Department of Computer Science, Rose-Hulman Institute of Technology, 5500 Wabash Avenue, Terre Haute, Indiana 47803; (812) 877-8401; young@cs.Rose-Hulman.edu. The deadline for submitting applications is **15 February 1992**. ■

American Regions Mathematics League

The American Regions Mathematics League (ARML) will hold its 1992 competition on 30 May 1992 at two sites—Pennsylvania State University and the University of Iowa. The ARML competition is the largest on-site event of its kind, drawing fifteen-member teams of high school students from every region of the country. Teams are organized on a local basis. For additional information on organizing an ARML team or joining an existing team, contact: Joseph R. Wolfson, Phillips Exeter Academy, Box 1172, Exeter, New Hampshire 03833; or Barbara Rockow, Bronx High School of Science, Seventy-Five West 205 Street, Bronx, New York 10468. ■

Computer Experiments in Differential Equations

A consortium of six colleges and universities, headed by Harvey Mudd College, will host National Science Foundation (NSF) funded summer workshops for faculty during the next three summers. Each workshop will run for five days in June. The schedule is as follows:

Summer 1992	Harvey Mudd College Cornell University
Summer 1993	Rensselaer Polytechnic Institute Washington State University
Summer 1994	West Valley College St. Olaf College

The principal aim of the project is to enhance the expertise of two and four-year college and university mathematics faculty in the development and use of interactive computer experiments in differential equations within a mathematics computing laboratory environment. These experiments are intended as a supplement to standard courses and not as replacements for the traditional approach. There are many good reasons for designing experiments to be device and software independent and that is the approach to be followed in this project. Each experiment can then be performed on a variety of hardware/software platforms.

A second aim of the project is to establish a continuing organization to encourage the writing of computer experiments in ordinary differential equations and related areas of mathematics. The six sponsoring institutions are the initial members of the Consortium, both other colleges and universities are invited to join.

Workshop participants will receive a small stipend (\$200) for the five days, plus room-and-board costs. For general information about the project and the workshops, contact: Robert L. Borrelli or Courtney S. Coleman, Department of Mathematics, Harvey Mudd College, Claremont, California 91711-5990; (714) 621-8023; Borrelli@HMCVAX.BITNET or Coleman@HMCVAX.BITNET. Fax: (714) 621-8465. For specific information about the June 1992 workshop at Harvey Mudd College, contact Borrelli or Coleman; for specific information about the June 1992 workshop at Cornell University, contact: Beverly West, Department of Mathematics, Cornell University, Ithaca, New York 14853; (607) 255-2269; BWEST@MSSUN7.MSI.CORNELL.EDU. Fax: (607) 255-7149. ■

Program in Mathematics for Young Scientists (PROMYS)

Boston University's Program in Mathematics for Young Scientists (PROMYS) offers a lively mathematical environment in which talented high school students explore the creative world of mathematics. Through their intensive efforts to solve a large assortment of unusually challenging problems in number theory, the participants practice the art of mathematical discovery—numerical exploration, formulation and critique of conjectures, and techniques of proof and generalization. More experienced participants may also study abstract algebra and dynamical systems. Problem sets are accompanied by daily lectures given by research mathematicians with extensive experience in Arnold E. Ross' long-standing summer mathematics program at Ohio State University. In addition, a highly competent staff of eighteen college-aged counselors live in the dormitories and is always available to discuss mathematics with the students. Each participant belongs to a problem-solving group which meets with a professional mathematician three times per week. Special lectures by outside speakers offer a broad view of mathematics and its role in the sciences. Glenn H. Stevens directs PROMYS, which is scheduled this year from 28 June 1992 through 8 August 1992.

PROMYS is a residential program designed for sixty talented high school students entering grades 10 through 12. Admission decisions will be based on the following criteria: applicant's solutions to a set of challenging problems included with the application packet; teacher recommendations; high school transcripts; and student essays explaining their interest in the program.

The cost to participants is about \$1,250 for room and board. Books may cost an additional \$100. Financial aid is available. PROMYS is dedicated to the principle that no student will be unable to attend because of financial need.

To obtain application materials, contact: PROMYS, Department of Mathematics, Boston University, 111 Cummington Street, Boston, Massachusetts 02215; (617) 353-2560. Applications will be accepted from 1 March until 1 June 1992. ■

A Computer on Every Desk: Implications for Mathematics Courses

Ithaca College will host a five-day workshop, 2–6 June 1992, on the use of computer technology in mathematics courses beyond calculus. The workshop is intended for faculty who have some experience using CAS or other software in their teaching; it will be limited to thirty participants. In addition to sharing ideas and materials for various courses, participants will be encouraged to reflect on the long-term implications of the new technology for the structure of individual courses and for the curriculum as a whole. National Science Foundation (NSF) funding will provide for room, board, and other workshop-related expenses. Faculty who teach significant numbers of women and/or minority students are particularly encouraged to apply.

For additional information, contact: Constance McMillan Elson at the Department of Mathematics and Computer Science, Ithaca College, Ithaca, New York 14850; elson@ithaca.edu. ■

Photograph courtesy of Phoebus Phymes



(Love Among the Ruins continued from front page.)

At the same time, Soviet students possessed a strength of commitment which American students seemed to lack. Afternoons at the Institute were devoted to individual consultation: students could seek out teachers for individual work on difficult points raised during formal class or on problems assigned for individual solution. On the first day, no American students showed up for individual consultation, while most Soviet students stayed for two hours. It was then made clear to the Americans that they were expected to make appointments with their teachers—and they did, consistently and constructively.

Where American students had discipline, Soviet students had commitment. Where Americans were efficient, Soviets were intense. Sweeping generalizations about human behavior can never be applied in specific instances. It is probably not difficult to find impassioned American as well as ruthlessly efficient Russian students. Yet this contrast would like a red thread through the intellectual atmosphere of our Institute.

We began to find other, similar contrasts in the attitudes of the mathematical community as a whole towards the nurturing of young mathematical minds. American mathematics contests, for example, are highly organized, frequently administered to large numbers of students, and swiftly and efficiently evaluated. Soviet contests, we found, are often put together at the last moment—we experienced this directly during the Institute. On the other hand, Soviet contest materials frequently probe deeper into mathematical content.

For instance, a recent (1991) Leningrad local Olympiad was administered, in the first round, to ten thousand students (in a city of five million). Almost sixty percent of the mathematics faculty of Leningrad University participated in writing and correcting Olympiad materials (which are virtually all long-answer questions requiring either proofs or answers with justification). In New York, a city of eight million, a similar contest (of Soviet origin) was recently offered. Only 120 students took part, and an appeal to the local chapter of the Mathematical Association of America for help in grading yielded only two responses.

Russian mathematicians seem to develop a passion for their subject quite early, retain it for their entire professional career, and are anxious to impart it to a new generation. These cultural elements, particularly the last, are much less developed in American mathematics education.

What characteristics of the surrounding culture produced this remarkable blend of intensity and evangelism? Why is it missing in American mathematical life? Many Soviet mathematicians trace its origins to a strategy for intellectual survival in a totalitarian environment. In such surroundings, mathematics is a relatively safe intellectual activity. The humanities (history, art, literature, even music) offer as many opportunities for censorship as for expression. Even biology, where the theories of Lysenko could not be questioned, had its dangers in the USSR.

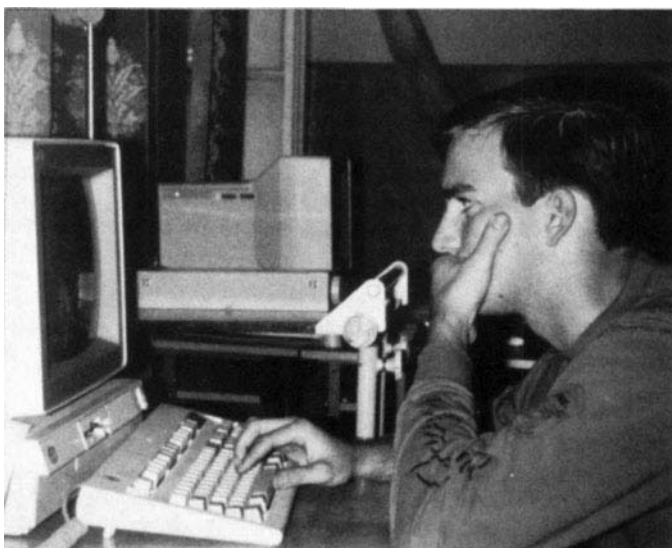
The physical sciences were less susceptible to these political influences. Chemistry and physics were areas in which a young person could find mentors, could see a future career, and could pursue intellectual interests more freely. Trouble with the authorities could come, but not usually as a direct result of the espousal of a particular view or the pursuit of a particular line of investigation. Mathematics was safer still, being further removed from direct applications. Also, the mathematician's relative freedom from dependence on laboratory equipment deprived authorities of an important means of leverage to conformity.

(Love Among the Ruins continues on opposite page.)

Photograph courtesy of Shana Ellenberg



Photograph courtesy of Shana Ellenberg



(Love Among the Ruins continued from opposite page.)

There are even instances in which doing mathematics began to take on the air of a subversive activity. Russian history and culture are full of such quirks. It has often been noted how literature, even before the 1917 revolution, has been intensely political: it was seen as an outlet for otherwise limited expression of political views. Without being directly political, the study of mathematics, particularly the relationships among students and teachers, began to resemble a club for those who refused to join in a totalitarian life of the mind. This attitude surfaced, for instance, one night when Soviet students organized a musicale for the Americans, consisting of hymns to Lenin, sung in a mock-heroic style from "Young Pioneer" songbooks which were once considered sacred. Although this might have happened in any gathering of youth, the music seemed to resonate with special vibrancy among the young mathematicians gathered to listen.

The enjoyment of mathematics as "forbidden fruit" also fostered another remarkable tendency in Soviet education: the intimacy which develops between teacher and student. Americans find Soviet classrooms, like most European classrooms, rather formal. And yet we found teachers whose relationship with their students was more that of elder brother than parent.

The Russian language contains within it numerous markers of the relationship between two people engaged in conversation. Russians adopted the "polite" versus "familiar" use of singular and plural second person pronouns from the French (*tu* versus *vous*). Besides this relatively familiar phenomenon, Russian names come in a variety of forms, ranging from the coldly formal name-and-patronymic to numerous diminutive forms. Each form conveys a slightly different relationship between the speakers. This flexibility, which often confuses readers of classic Russian literature, allows for an accurate measure of the relationship between two people.

The normal form of address from a student to a teacher is by name and patronymic ("Ivan Sergeevitch"), and corresponds roughly to our use of the titles "Mr." or "Ms." We found many instances, however, of students calling their teachers by a diminutive first name ("Grisha" for Gregory; "Yura" for George), which would have no direct translation. It's not quite as strained as calling a teacher by his or her first name, and yet shows more familiarity between teacher and student. Coupled with the directly experienced evidence of such relationships, it is easy to see how the study of mathematics might develop into a youthful passion which we observe in the United States only with respect to sports.

Teachers tell of mathematics "battles"—competitions involving ritualized debates between teams—lasting far into the night, and ending only with the close of the Metro system or a panicked call from a parent. They talk about summer camps in which participants endured the most primitive circumstances in order to be together and study mathematics. They tell of weekend outings and hikes with students and teachers participating as equals—students of mathematics, not football.

Some of our informants trace this tradition to a similar tradition within the Moscow State University. Americans can more easily imagine this atmosphere on the college level, especially for graduate students, where a thesis advisor can become a mentor in a variety of ways. Others reached back further, to the times after the first Russian revolution (1905) when Moscow University was closed, and whole departments went into exile. This led to the establishment of "universities without walls," both in Moscow and among émigrés in Paris, in which it was natural for students and teachers, both exiles and both often in poverty, to develop close personal relationships.

A similar event occurred in biology teaching for different reasons. When Lysenko was deposed in 1964, the teaching of biology essentially stopped in the Soviet Union for a year, as teachers and professors "retooled" to learn genetic theory and modern molecular biology. This experience, too, brought teachers and students closer together in a struggle to integrate new ideas into their thinking.

Mathematics education also benefitted from other actions of the totalitarian regime. Gifted young people, whose careers were blocked for political reasons, found new careers in education. Major mathematicians (I. M. Yaglom comes to mind) were sometimes "demoted" to secondary schools, where they made important contributions to the literature for students of high ability. Antisemitism, which still plagues Soviet life, caused numerous young Jewish mathematicians to enter educational careers.

All these effects of the totalitarian system contributed to the intensity of Soviet mathematical life. Even the lack of discipline on the part of the students, which was our first clue that something was different here, can be seen as a lack of acceptance of the legitimacy of authority extended from political authority to classroom authority.

So what have we to learn from this experience? That we must be more authoritarian in our approach to education? That political life should exercise more control over the process? Certainly not. But perhaps we can borrow some of what we have seen in the USSR. Perhaps a cloning of these genes, which were bred for survival in a harsh totalitarian climate, could lend strength to our stock.

For example, we can involve the entire mathematical profession in the process of education. This is beginning to happen: it is more acceptable now to pay attention to undergraduate and secondary education, even if one works in a purely research environment. But we are far from the sixty percent participation of a major university in a secondary school competition.

We can learn from the Soviet experience, and we should probably learn fast. The transition to a market economy and a democratic political life will certainly transform the mathematical culture as well. While we must welcome these changes, we must also appreciate the difficulties they bring. Already the rise in costs of paper has led to a tripling of the subscription price for *Kvant*, the superb Soviet journal for students of mathematics and physics. This increase in price has brought with it a plunge in readership, as measured by paid subscriptions. The journal *Matematika V Shkole*, for teachers of mathematics, can't get paper: rumor has it that their publishers find it more profitable to use their allotment of paper for detective novels.

We don't know whether the extraordinary mathematical culture that has arisen in the Soviet Union will survive the free market. But if we want American mathematics to retain its strength, if we want to be first in the world in mathematics education by the year 2000, if we want to stop importing more PhD students in mathematics than we currently produce, we should learn from the Soviet success in this field. The Soviets may be needing our help this winter. It is important for us to know that we need theirs too. ■

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FOCUS EDITORIAL

Pick up any newspaper and, as likely as not, you will find an article or a letter decrying the current state of mathematics education in the USA. Read a little further and the writer will inform you that everything would be much better if only the American school system became more like the British one. In the eyes of many Americans, Britain still rules the free world when it comes to public television and education.

Well, there may still be some good television programs coming out of the United Kingdom—though nothing like as much as is popularly supposed these days—but sit down with a British parent and you will hear much the same catalogue of education woes as you do in the USA: demoralized and underpaid teachers; rapid staff turnover; unprepared teachers; badly trained teachers; dull, repetitive lessons; teaching to the test; unmotivated and disruptive students; and all the rest of it.

I know all of this because, until four years ago, I was a British parent. Now I am a parent in the United States: same parents, same children, different country. But same problems, same complaints, same worries.

No, don't look to Britain for a shining example. If you want a successful system on which to model the future of American education, you will have to look elsewhere. But where?

Japan, did I hear you say? Yes, I know that Japan figures as often as Britain in the American headline writer's educational paradise. It crops up regularly in British newspapers as well. After all, all that success in consumer electronics and business must indicate a smoothly working educational system, mustn't it? And all those marvellous mathematics performance scores we keep reading about must mean something!

Well, what do the Japanese newspapers have to say about their own educational system? On a visit to Japan to attend a conference last November, my eye was caught by an article in the English language *Japan Times* (18 November 1991). Written by special correspondent Takamitsu Sawa, Professor of Economics at Kyoto University and Director of the Economic Research Institute there, it looked strangely familiar.

"Elementary and secondary education place stress only on the percentages, the odds of success in passing the tests for admission to a higher-division school and then to college," complains the writer. Then he gets down to specifics:

"Mathematics is taught as a repetitive exercise, just as the study of English and the Japanese language. History is merely the memorization of names, places, and dates. In physics and chemistry, students are taught to learn set formulas by rote instead of being encouraged to do original thinking and experimentation."

Sound familiar? You haven't heard anything yet. With Japanese newspaper writers decrying the Japanese educational system, who do parents in Tokyo or Kyoto regard as holding the educational torch? Two sentences later, Mr. Sawa tells us: "The Japanese method of uniform education is better suited to production of quality goods at low cost, compared to, say the individual-oriented education in the United States."

For Mr. Sawa, the individuality of American society, and the educational system that goes with that approach to life, are the important features, not the test scores. American students may not grow up to be "efficient" producers in the Japanese sense, but the system does generate a lot of free-thinking individuals and some great innovators. And there you have it. While Americans, or some of the more vocal at least, look enviously at the mathematics test scores of Japanese children and the business success of their parents, the Japanese look eastwards, just as enviously, towards Uncle Sam.

So what does all this tell us about the current state of American education? Very little, actually. Many of the problems we read about are real and intolerable. But the solution will not be found trying to emulate the British, the Japanese, or anyone else for that matter. And a preoccupation with high-school mathematics test scores would be disastrous. A diet of dull, repetitive teaching and dull, repetitive testing might eventually produce "increased standards," but does the country really need increased standards in dull, repetitive tests that measure nothing other than an ability to take dull, repetitive tests?

America's educational problems can only be solved in an American way, not by emulating other countries. At its best, American education is already the equal of anything you will find anywhere in the world. And if you want confirmation of that, read the article by Mark Saul, beginning on the front page of this month's FOCUS. President of the American Regions Mathematics League, based in New York City, Saul presents some observations he made last summer, when he accompanied a group of American high school students on an exchange visit to the Soviet Union. Though the Soviet Union may have ceased to exist as a political entity in the interim, Soviet students, parents, and teachers have not, and the comparisons Saul makes will still be valid. To my mind, the lesson for America is not to be found so much in the positive things Saul says about the Soviet students as in what he has to say about the American students. ■

Keith Devlin

The above are the opinions of the FOCUS editor. They do not necessarily represent the official view of the MAA.

Included Inside This Issue . . .

THE ALL-MEMBER STRATEGIC PLANNING QUESTIONNAIRE

COMMUNICATING AMONG COMMUNITIES

**A Report of a Conference on
Research in Collegiate Mathematical Education**

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COMMUNICATING AMONG COMMUNITIES

Introduction

The Mathematical Association of America (MAA), with support from the National Science Foundation, hosted an invitational conference on Research in Collegiate Mathematical Education in Washington, DC, November 8-10, 1991. Twenty-eight invited participants, representing the mathematics and mathematics education communities, candidly discussed issues relating to the growing interest among faculty and others concerning research in the teaching and learning of mathematics at the undergraduate level. The conference participants focused on four aspects of research in collegiate mathematics education:

- Communicating to college and university faculty the growing body of research in undergraduate mathematics education;
- Improving student learning by stimulating change in collegiate teaching based on the findings of this research;
- Encouraging high standards of quality research in undergraduate mathematics education;
- Supporting the increasing number of collegiate faculty who undertake research in undergraduate mathematics education.

It is no surprise that the views of those attending the conference varied considerably on these matters. There was general agreement on the urgency of seeking improvement in the teaching and learning of mathematics at the undergraduate level. A distinction was made between general activity in support of improving undergraduate mathematics education and the role of research in the teaching and learning of mathematics at the undergraduate level. There was some disagreement as to the role played by mathematics education research. Some felt that basic research in undergraduate mathematics education is an essential and continuing part of the process of change. Still others were skeptical that such research would have any effect at all, and cited the limited amount of persuasive evidence produced in a field which is perceived by many mathematicians to be jargon-laden. Another group argued that such basic research is critically important but independent of attempts to improve undergraduate education. There was also a group who believed that there are some mathematicians in the teaching force who would not be motivated to change their habits regardless of how compelling the research results may be.

Those favoring more emphasis on research argued that basic research in the learning and teaching of mathematics is an essential component of any endeavor that seeks to improve undergraduate mathematics. They cited as examples the many profound conceptual questions about students' understanding of function and the wide range of questions generated by the impact of technology for students' learning and doing of mathematics. They further argued that the growing number of individuals engaged in investigating these questions at the collegiate level requires scholarly support structures to ensure the vitality of their field.

Those opposed to placing more emphasis on research argued that it is more critical to address current teaching practices and seek improvement. Furthermore, while many mathematicians are becoming more interested in improving the teaching of undergraduates, they do not have the inclination to learn the specialized vocabulary or understanding of techniques required to read or participate actively in research issues at the collegiate level. What would be beneficial, in their view, would be more access to survey or

review articles, written in a more expository style, that convey the results of current research at the collegiate level.

Conference Statements and Recommendations

Many mathematicians tend to think of research in mathematics education as being concerned primarily with the improvement of teaching or the evaluation of some particular curricular innovation. For many attending the conference, the vast array of research topics being pursued by those working in pre-college and collegiate mathematics education was somewhat surprising. A sampling from that list includes: students' understanding of the limit as a process and not a number; stages of development in understanding the concept of function; issues centering around problem solving; issues addressing proof, logic, and reasoning; how students' learning styles may affect the context in which problems are posed; students' use of visualization in "doing" mathematics; translational difficulties as students' move among graphical, symbolic, or numeric representations of ideas. The well-established professional community doing research in school mathematics education has much to offer those investigating similar issues at the collegiate level. This is particularly so since many colleges and universities teach school-level mathematics in their entry level courses and are confronting the need for more careful attention to these courses. Efforts to make connections between those pursuing education research at the pre-college and collegiate level are already underway.

There appeared to be agreement that a journal on research in collegiate mathematics education would be an important means of strengthening professional standards, of encouraging quality research, and of providing support for individuals doing this type of scholarly activity. However, to be effective in providing the scholarly support needed for workers in the field, that journal would need to achieve sufficient stature to command the respect of the broad mathematical community -- including both mathematicians and those doing research in mathematics education. Given the number of existing journals accepting papers in mathematics education research and the critical need for building awareness among the mathematical community as to the contribution that research can make to improve teaching and learning in mathematics at the undergraduate level, there was clear feeling among the participants that launching such a journal at this time would not be the most appropriate first step. To deal with the present need for sharing the fruits of research in undergraduate mathematics education in as broad a way as possible, the following recommendations received consensus support.

RECOMMENDATION 1. *The Mathematical Association of America (MAA) and the American Mathematical Society (AMS), in cooperation with the National Council of Teachers of Mathematics (NCTM), should plan a series of annual volumes presenting exemplary research papers in collegiate mathematics education. These volumes would serve as precursors to the establishment of a journal.*

Conference participants believed that the reception of these annual volumes by the community would be a measure of interest and of the need for further steps. To achieve maximum effectiveness of this recommendation additional strategies will be needed to create awareness among the broader mathematical community of the issues being addressed by those working in this field of research. A full array of suggestions and strategies were noted by the conference participants. Many of these extend current means of communicating information at sectional, regional, and national meetings; more extensive use of mini-courses and contributed paper sessions; developing appropriate panel presentations; attempting to get topics on research in undergraduate mathematics on the agenda of Departmental Chairs meetings; encouraging the program committee for national meetings to invite speakers to address the research topics; encourage the professional societies to seek ways to develop summer faculty institutes for teaching and learning

mathematics. The final suggestion was for the societies to pursue vigorously the creation of a national network of centers for the teaching and learning of mathematics.

RECOMMENDATION 2. *Editors of MAA and AMS periodicals are encouraged to solicit substantial review or survey articles to appear simultaneously with publication of the annual volumes to stimulate interest among mathematicians in issues addressed in these research volumes.*

Most of the editors present supported the recommendation. The only concern expressed related to appropriateness for the mission of specific journals. In fact, some encouraged the submission of quality survey articles, written for an audience predominately consisting of mathematicians, for publication in their journals on an ongoing basis.

Many participants noted that electronic linkages for sharing results among workers in the field are being established independently and through informal networks. It was strongly suggested that the MAA and AMS should investigate and develop as rapidly as possible appropriate mechanisms for more formal electronic exchange of information among individuals engaged in research on undergraduate mathematics education, and between members of this community of researchers and those who teach college and university mathematics. In particular, part of this investigation might include exploration of the possibility of establishing an electronic journal on undergraduate mathematics education. In the spirit of trying to enhance communication across the communities, the participants put forth two specific recommendations:

RECOMMENDATION 3. *Editors of journals and periodicals that are read by college and university mathematicians should provide regular information on research in undergraduate mathematics education through such means as brief "telegraphic" reviews of research papers and special survey articles or issue papers dealing with the application of educational research to the improvement of student learning.*

RECOMMENDATION 4. *The MAA and AMS, in cooperation with the NCTM, should plan special conferences or sessions at sectional, regional, or national meetings dealing with aspects of research in collegiate mathematics education. These activities should be designed to expand the interface between educational researchers and mathematicians.*

This recommendation further expands the current means of communicating information at sectional, regional, and national meetings of the professional associations. Other special meetings might be designed that would promote scholarly exchange among those actively engaged in research in collegiate mathematics education, for the purpose of setting a research agenda, or for the purpose of attracting newcomers to undertake investigation of issues important to the field.

There was considerable optimism about the perception that most mathematics departments are now more concerned about the teaching and learning of mathematics by their students, and that individual faculty frequently are discussing issues related to curriculum and teaching. There was concern, however, that some universities have addressed the issue by appointing special adjunct faculty to deal with instructional concerns of both students and faculty. This arrangement can lead to further isolation of the full-time faculty from activities in teaching and learning at the undergraduate level. Overall, there is much more faculty interest

in looking for ways to improve student learning. Professional mathematics societies need to encourage this interest by identifying and publicizing in mainstream mathematics journals effective methods for stimulating and institutionalizing improved mathematics instruction. When appropriate, ties with the results of research findings in undergraduate mathematics education should be directly indicated.

To spur the continued development of department-based activity regarding issues of curriculum and teaching, professional societies should identify lists of prominent individuals who would be prepared to speak on issues of research in undergraduate mathematics education. Once compiled, this list should be sent to departments as suggestions for colloquium speakers and to program planning committees for sectional, regional, and national meetings. Before distribution, this list of speakers would be reviewed by the MAA Council on Education and the AMS Committee on Education. The appropriate committee at NCTM would also be consulted.

Data from the CBMS Survey, *Statistical Abstract of Undergraduate Programs in the Mathematical Sciences and Computer Science 1990-1991*, were cited to document the tremendous increase in the use of part-time faculty, particularly at two-year colleges. The Survey notes that there are far more part-time faculty than full-time faculty currently teaching at two-year colleges. Attempts to influence the teaching and learning of mathematics at these institutions must directly address this large instructional force. Conference participants expressed great concern about this becoming a serious barrier to creative change.

RECOMMENDATION 5. *The MAA and AMS, in conjunction with the American Mathematical Association of Two-Year Colleges (AMATYC), should undertake a study of the effects of the increasing reliance on part-time faculty for mathematics instruction, especially to determine in what ways part-time faculty may differ from full-time faculty in their approaches to teaching.*

A serious and frequently surfacing concern among conference participants was the need for research in collegiate mathematics education to become an "accepted" field of scholarly inquiry in mathematics departments. The field is relatively new and participation by creative, energetic individuals will be needed to enhance its vitality. There are some indications that as departments become more concerned about undergraduate education, they begin to broaden their definitions of scholarly activity. But this is by no means universal! In fact, several participants held the belief that mathematical research, and only that, should be the fundamental criterion for initial promotion and tenure in mathematics departments. Of course this must be carefully interpreted, for there are departments where individuals are specifically hired because of the contributions that they make in the field of mathematics education research and should be evaluated on that basis. However, given the growing number of individuals who are making significant contributions in the field of collegiate mathematics education, the issue cannot be ignored.

In addition, there are growing numbers of college and university faculty who are involved in highly creative curriculum projects or software development. These new directions for faculty, often recognized as valuable by the department (but sometimes not rewarded), require enormous amounts of time. If the definition of scholarship is broadened to include these types of activities, then there is still an issue of how contributions in the area can be adequately assessed. One clear suggestion was that the faculty need to write and publish results of their work. But even that task can be complex and suffers from differences in approach. There are those who pursue research using the methodologies inherent in the field of mathematics education and there are others who deal with innovative practice in the teaching and learning of mathematics where the resulting articles are more anecdotal in style. In fact, broad discussion of the evaluation of alternative forms of mathematical scholarship is needed by the community. Fortunately, the Joint Policy

Board for Mathematics (JPBM) has recently established the Committee on Professional Values, Recognition, and Rewards. The conference directs the next recommendation to this committee.

RECOMMENDATION 6. *The JPBM Committee on Professional Values, Recognition and Rewards should seek to identify and disseminate effective evaluation and reward mechanisms that promote high standards in professional activities in mathematics education. In particular, the committee's agenda should address the needs of those faculty whose professional work is devoted to research in mathematics education, as well as those whose work centers on curriculum development or educational practice.*

It will not be simple to implement these recommendations and suggestions. The final recommendation made by the conference is an effort to put in place a framework for monitoring progress on this report.

RECOMMENDATION 7. *The MAA Ad-Hoc Committee on Research in Undergraduate Mathematics Education should take the necessary steps to request that it become a permanent, joint committee of MAA and AMS. When such a joint committee is established, NCTM and AMATYC should be asked to appoint liaison representatives to this committee. The charge to this new permanent committee should include the monitoring of progress on all the recommendations contained in this report.*

Those participating in the conference did not agree at every juncture, but they did reach consensus that to achieve any objectives at all will require the visible and active leadership of both the MAA and the AMS.

Conference Organization

There was little question that the conference participants knew they were attending a "working conference." The first general session convened after dinner Friday evening, November 8. In all, there were six general sessions and two structured writing sessions. The general sessions were focussed on the four aspects of the conference noted in the introduction and two sessions were devoted to responding to the work of the writing groups. At each of the two writing sessions, three groups dedicated themselves to developing sets of strategies for addressing the concerns raised in the general discussions. The three writing groups were each asked to discuss and make recommendations regarding a pre-determined set of questions. On the basis of individual interest, the conference participants self-selected the writing group in which they would participate. What emerged was consensus on a variety of statements and recommendations. Many of these address the urgent need to communicate across the mathematics and mathematics education communities. The efforts to strengthen and enhance this communication is a full community task -- not one that can be done alone by individuals or by any particular professional association.

To the hard working participants of the conference we express our profound thanks. Sincere appreciation is extended to the National Science Foundation without whose support the conference would not have taken place. We also acknowledge the additional support for various conference activities provided by the American Mathematical Society.

The Conference on Research in Collegiate Mathematical Education was hosted by The Mathematical Association of America and held in Washington, DC, November 8-10, 1991. The project was supported, in part, by the National Science Foundation. Opinions expressed in this report are those of the authors and not necessarily those of the Foundation.

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From The Mathematical Association of America

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Marta Sved

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192 pp., Paperbound, 1991
 ISBN 0-88385-500-3
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 Catalog Number JOG

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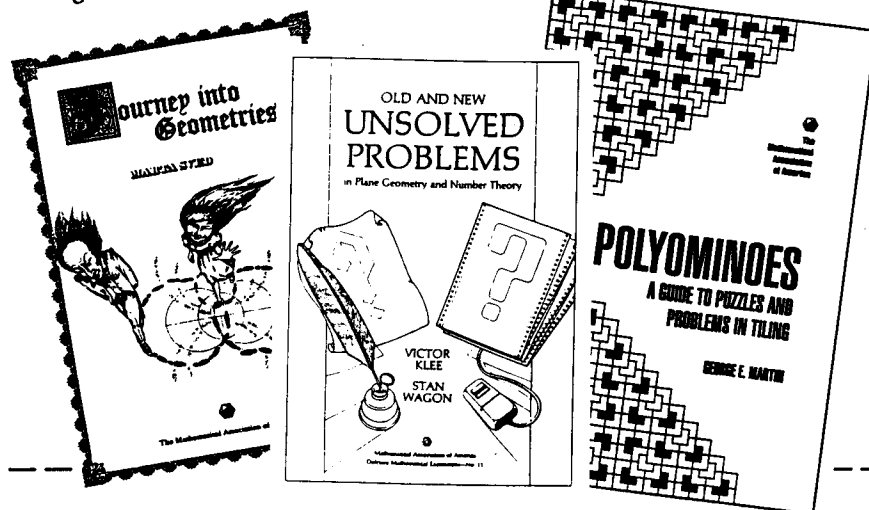
George Martin

George Martin has done a truly marvelous job of presenting the material in this book in an attractive and clear way.

POLYOMINOES will delight not only students and teachers of mathematics at all levels, but will be appreciated by anyone who likes a good geometric challenge. There are no prerequisites. If you like jigsaw puzzles or if you hate jigsaw puzzles but have ever wondered about the pattern of some floor tiling, there is much here to interest you.

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Dr. Thomas Koshy, Chairman
Department of Mathematics

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Dept. of Math & Stat
Dearborn, Michigan 48128-1491

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Fall 1992

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MPO Box 905
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Applications are invited for two tenure-track assistant professor positions—one in mathematics and one in statistics, to begin September 1992. PhD preferred (ABD may be considered). We also anticipate some temporary one-year positions in mathematics and mathematics education. Minimum requirement is a master's degree. Teaching load may include off-campus teaching assignments. Send cover letter (indicating clearly which position is being applied for), resumé, transcripts, and three letters of reference to: Affirmative Action Office, Department of Mathematics and Statistics Searches, Winona State University, PO Box 5838, Winona, MN 55987-5838. All positions are open until filled. Screening of tenure-track applications will begin **March 10, 1992**. AA/EEO. Women, minorities, and disabled individuals are encouraged to apply.

UNIVERSITY OF MICHIGAN ANN ARBOR

Expects to hire director of mathematics laboratory, which supports students in courses through the second year of calculus. The position will be at the lecturer or assistant professor level. In addition to the math lab duties, the director participates in the coordination of entry-level courses and teaches. Candidates should have a strong record in teaching and an interest in current developments in undergraduate courses including the incorporation of computers and calculators into the curriculum. Some administrative experience as well as experience training or supervising instructors is desirable. PhD in mathematics preferred. First review of applications: 1-15-92. Contact: Professor D. J. Lewis, Chairman, Department of Mathematics, University of Michigan, Ann Arbor, Michigan 48109-1003; math_chair@ub.cc.umich.edu. Nondiscriminatory Affirmation Action Employer. Starting date: 15 August 1992.

CALIFORNIA STATE UNIVERSITY SAN MARCOS Numerical Analyst

California State University, San Marcos, located thirty miles north of San Diego, is the newest campus in the California State University system. CSUSM seeks a PhD mathematician in numerical analysis for a tenure-track assistant professor position to begin in August 1992. CSUSM seeks an individual with strong academic and professional preparation and with an interest in the development of the mathematical sciences at a new institution. Experience with machine computation is preferred. An application consists of a statement of interest in teaching, research, and service, a complete resumé, and at least three reference letters which should comment on the applicants credentials in teaching, research, and service. Copies of scholarly work may be included. Opening pending authorization. Applicants should be US citizens or individuals lawfully authorized to work in the US. Applications should be sent to: Mathematics Search Committee, California State University, San Marcos, 820 West Los Vallecitos Blvd., San Marcos, CA 92096-1477. Review of candidates will begin February 15, 1992, and continue until the position is filled. Women and minorities are strongly encouraged to apply. CSUSM is an Affirmative Action, Equal Opportunity Institution.

UNIVERSITY OF SOUTH CAROLINA Department of Mathematics

The Department of Mathematics invites applications for expected tenure-track faculty positions for fall 1992, at all ranks. Applications in all areas of mathematics will be considered. Research is supported by excellent inhouse library and computing facilities. The PhD degree or its equivalent is required. Appointments will be consistent with the department's commitment to excellence in research and in teaching at the undergraduate and graduate levels. A detailed resumé, containing a summary of research accomplishments and goals, and four letters or recommendation should be sent to:

Dr. George F. McNulty, Chairman
Department of Mathematics
University of South Carolina
Columbia, SC 29208

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

MATHEMATICS

Rockford College, a liberal arts college of 1,500 students 90 miles NW of Chicago, invites applications for a tenure-track position in mathematics. Responsibilities include teaching approx. 12 hrs/wk/semester (4 preparations), student advising, and committee work. Qualified applicants should have a PhD and excellent teaching recommendations; ability to teach courses in computer science is desirable. Rank and salary commensurate with qualifications. Send resumé and 3 letter of teaching recommendations to: Dr. John Schumaker, Chair, Mathematics Department, ROCKFORD COLLEGE, 5050 E. State Street, Rockford, IL 61108-2393.

COMPUTER SCIENCE

Rockford College, a liberal arts college of 1,500 students 90 miles NW of Chicago, invites applications for a tenure-track position in computer science. Responsibilities include teaching approx. 12 hrs/wk/semester (4 preparations), student advising, and committee work. Qualified applicants must have at least a master's in computer science (or MIS) and excellent teaching recommendations; ability to teach both upper division CS and MIS is desirable. Rank and salary commensurate with qualifications. Send resumé and 3 letters of teaching recommendations to: Dr. Gerald Caton, Chair, ROCKFORD COLLEGE, 5050 E. State Street, Rockford, IL 61108-2393.

MATHEMATICS

Chair—earned doctorate with significant teaching experience in undergraduate mathematics, good oral and written communication skills, and leadership qualities. Commitment to teaching excellence and responsiveness to student and faculty needs essential. Duties include teaching, advising students, and maintaining communication among administration, chair and faculty. Salary range, \$23,000—\$35,000, dependent upon qualifications and experience. Effective August 17, 1992; review of applications will begin February 17 and continue until position is filled. Send letter of application, resumé, copies of transcripts, and three letters of recommendation to: Personnel Director, West Virginia Institute of Technology, Montgomery, WV 25136.

SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY

The Mathematics and Computer Science Department invites applications for an anticipated tenure-track position in statistics. Applicants must have a PhD in statistics or a PhD in mathematics with teaching experience in graduate and undergraduate statistics.

Duties include teaching statistics courses and some mathematics courses at the graduate and undergraduate levels, advising students, guiding them in projects, and participating in scholarly activity and departmental and college committees. The normal teaching load is three courses per semester.

Applicants should submit a letter of application, resumé (with curriculum vitae), official transcripts, and three letters of recommendation to: Search Committee, Department of Mathematics and Computer Science, South Dakota School of Mines & Technology, 501 E. St. Joseph, Rapid City, SD 57701.

Preference will be given to individuals with an established record of excellence in teaching and research and to those applications received by February 15, 1992. All applicants will be considered until the position is filled.

OLD DOMINION UNIVERSITY

Senior Faculty Position

The Department of Computer Science and the Department of Mathematics and Statistics have an opening for a joint appointment in a senior position. We are seeking a research faculty member to enhance our existing strong program in high performance computing. The successful applicant must have a proven research and grant record in some combination of applied mathematics and high performance computing.

The Computer Science Department has a high performance computing lab, which includes DAP and N-Cube machines, an innovative minor in high performance computing at the undergraduate level, and a highly successful graduate research group working in parallel computation and parallel architecture. The Department of Mathematics and Statistics has very active research groups in continuum mechanics, mathematical biology, and numerical analysis-approximation theory. Research projects to develop computational models and algorithms for parallel computers involve faculty from both departments. In addition, there are joint research efforts using computational and asymptotic methods in the areas of fluid dynamics and combustion.

These research groups are complemented by a strong network research group which concentrates on developing gigabit networks to support the distribution of remote supercomputing services to local clients.

Both departments have established programs at the bachelor's, master's, and PhD level. Standard equipment for faculty and student offices includes a Sun workstation connected via ethernet and FDDI to other computing resources and Internet. Special equipment needs can be supported. Salary competitive. PhD in applied mathematics, computer science, or computational science preferred. To apply, send curriculum vitae, copies of research papers, and the names of three referees.

Applications close February 15, 1992, but late applications will be considered until the position is filled. Send all inquiries to:

Chair
High Performance Computing Search Committee
c/o Dean of College of Sciences
Old Dominion University
Norfolk, VA 23529-0162
hpcsearch@cs.odu.edu

Old Dominion University is an Affirmative Action, Equal Opportunity Employer and requires compliance with the Immigration Reform and Control Act of 1986.

FRANKLIN & MARSHALL COLLEGE

Dept. of Mathematics
Lancaster, PA 17604-3003

Position in undergraduate mathematics department starting fall 1992, renewable for a total of three years. PhD expected by Sept. 1992. Teaching: three courses per semester; change to five courses per academic year in progress. Send resumé, undergraduate and graduate transcripts, and three letters of recommendation, one or more of which addresses teaching ability, to: A. D. Feldman, Chair. Applications will be considered starting March 1, 1992, and will be accepted until position is filled. Franklin and Marshall College is committed to cultural pluralism and strongly encourages applications from minorities and women. EOE/AA.

DEPARTMENT HEAD FOR MATHEMATICS, PHYSICS, AND HYDROLOGY

Tarleton State University (Texas) invites applications for Department Head for Mathematics, Physics, and Hydrology, beginning August 1, 1992. This is a tenure-track associate professor-professor opening. PhD in mathematics, physics, or hydrology required. The department head administers the department and teaches in own discipline. Successful teaching experience on the college level required; teaching experience in public schools and/or community college is desirable. Must have strong administrative skills, especially the ability to work with people in a harmonious manner. Salary and rank commensurate with credentials.

Review of applicants will begin immediately and continue until position is filled. Send letter of application along with curriculum vitae and three letters of recommendation to:

Dr. Lamar Johanson, Dean
College of Arts and Sciences
Tarleton State University
Box T-9
Stephenville, Texas 76402

Minorities and women are encouraged to apply.

AA/EEO.

MARYVILLE COLLEGE

Maryville, Tennessee 37801

Junior-level, tenure-track position in mathematics, beginning September 1992. PhD in mathematics preferred. ABD considered. Duties include teaching undergraduate mathematics courses, advising majors, and supervising senior research. Expertise in applied mathematics preferred, all areas considered. Maryville College is a Presbyterian-related, undergraduate college with a strong liberal arts tradition. Classes are small and excellence in teaching is emphasized. Send resumé, graduate transcript, and three letters of reference (at least one of which should address teaching experience and potential) to: *Dr. William Dent*, Chair, Department of Mathematics and Computer Science, Maryville College, Maryville, TN 37801. Applications completed by **February 29, 1992** will be given first consideration. EOE.

ST. MARY'S UNIVERSITY

San Antonio, Texas

The Department of Mathematics invites applications for a tenure-track position at the assistant or associate professor level beginning in the fall semester of 1992. Requirements include a doctorate in mathematics or mathematics education and a strong commitment to both teaching at the undergraduate level and to continued scholarly activity. In addition the candidate should have an interest and, preferably, experience in interaction with local school districts and in using technology in the teaching of mathematics.

Send a letter of application including a statement of professional goals, resumé, and three letters of reference to:

Dr. S. Eugene Sims, Chair
Department of Mathematics
St. Mary's University
San Antonio, TX 78228-8560

The closing date for applications is **February 24, 1992**. St. Mary's University is an Equal Opportunity Employer.

MATHEMATICS

Utica College of Syracuse University. Assistant professor of mathematics, fall semester 1992, tenure-track. Teach undergraduate courses in mathematics, 12 hour load. Doctorate in mathematics or mathematics education required. Candidate should have demonstrated potential for excellence in teaching and will be expected to carry on research in his/her field. Please send vitae, a statement of teaching philosophy, and three references to: Professor Mariarosa Allodi, Department of Mathematics, Utica College of Syracuse University, 1600 Burrstone Road, Utica, NY 13502. Application deadline is **February 15, 1992**. Utica College is an Equal Opportunity, Affirmative Action Employer which specifically invites women and minority candidates to apply.

NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY

Tenure-Track Positions
Assistant Professor of Mathematics

New Mexico Institute of Mining and Technology has two tenure-track assistant professor of mathematics openings, effective August 20, 1992. Both positions require English language skills. Experience in teaching, computing, and industry are desired. Duties include developing a research program and interdisciplinary consulting. One position involves teaching graduates and undergraduate courses in probability, statistics, and stochastic processes. Requires a PhD in statistics or a related field. The other position involves teaching undergraduate courses in applied mathematics (DEs, vectors, PDEs) and either statistics or operations research. Teaching graduate courses in either applied mathematics or OR, requires a PhD in mathematics, statistics, or related field. Deadline for applying is **February 28, 1992**. Send resumé and three letters of reference to: New Mexico Institute of Mining and Technology, Human Resources, Wells Hall (Statistics, Box C-122 or Applied Math Box C-121), Socorro, New Mexico 87801. AA/EEO.

NEBRASKA WESLEYAN UNIVERSITY

Mathematics-Computer Science
5000 Saint Paul Avenue
Lincoln, NE 68504-2796

Applications are invited for a tenure-track position in mathematics to begin in the fall of 1992. Candidates must have a PhD, excellent teaching credentials, and a strong commitment to innovative undergraduate teaching using technology. Academic hardware facilities include a UNIX-based computer from SunOS, Sun workstations, and Hewlett Packard (IBM compatible) and Apple Macintosh microcomputer labs. Salary and rank are open. Normal teaching load is 12 hours per semester. Nebraska Wesleyan University is a private, undergraduate institution with an excellent reputation in the sciences for preparing students for graduate and professional schools. NWU is classified as a Liberal Arts I institution by the Carnegie Foundation for the Advancement of Teaching, a category given to "highly selective" institutions. To apply, please send letter of application, vita, and copy of transcripts, and direct three letters of reference to: Dr. Carol Freeman, Chair, Department of Mathematics and Computer Science at the above address. Application materials are to be postmarked by **February 28, 1992**. We are an Equal Opportunity Employer. Women and minorities are encouraged to apply.

YORK COLLEGE

Department of Mathematics
and Computer Science

Applications are invited for two tenure-track positions at the assistant or associate professor level, starting fall 1992. PhD in mathematics, computer science, or a closely related field required. Ability and interest in teaching excellence, scholarly research, and commitment to professional growth in developmental mathematics, mathematics, or computer science are expected. Areas of interest include: classical applied math, computational math, data structure & algorithms, database, computer graphics, networking, and computer-based instructions: design, implementation, & management of delivery systems. Salary ranges from \$28,630 to \$47,601, based on qualifications and experience. The application deadline is **February 21, 1992**. Candidates should send a letter of application, curriculum vitae, and name, address, and phone no. of three references directly to:

Personnel Director
York College, CUNY
Jamaica, NY 11451

RESEARCH-TEACHING FELLOW

Office for Mathematics and Science Education
and Department of Mathematics,
Statistics, and Computer Science
University of Illinois at Chicago

Full-time fellow in mathematics and mathematics education. Responsibilities include teaching one mathematics or mathematics education course per semester and working on the Teaching Integrated Mathematics and Sciences (TIMS) Project, a major NSF-funded curriculum development project. One-year renewable appointment. Qualifications: master's degree in mathematics or mathematics education. Doctoral degree preferred. Strong mathematics background and precollege teaching experience preferred. **Review of applications will begin February 1, 1992 and will continue until the position is filled.** Please send curriculum vitae and three letters of reference to: Dr. Philip Wagreich, Codirector, Office for Mathematics and Science Education (m/c 250), UIC Box 4348, Chicago, IL 60680. AA/EEO.

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

Subject to final confirmation, we expect to have two one-year visiting positions at the assistant professor level, commencing September 1, 1992. One position to teach courses in real and complex analysis, the other to teach computer science. Colby is a highly selective, private, four-year liberal arts college located in mid-Maine. Faculty teach five courses in the year. Maximum class size is 28. We look for excellent teachers who can also contribute to the very active research activity of the department. PhD required. Send letter of application, and arrange for three letters of recommendation to be sent to: **Professor Keith Devlin**, Chair, Department of Mathematics and Computer Science, Colby College, Waterville, ME 04901. Applications received by **February 20, 1992** will receive full consideration. Thereafter, we shall accept applications until the positions are filled. Colby is an AA/EO Employer and strongly encourages applications from women and minorities.

CENTRAL CONNECTICUT STATE UNIVERSITY

MATHEMATICAL SCIENCES: Assistant-Associate Professor—fall 1992. Pending funding of position. Tenure-track. To teach courses leading to the BA or MA degree in mathematics in addition to math courses required of majors in other departments; advise undergraduate or graduate students and maintain an active level of scholarship in the discipline. PhD in mathematics required. Solid background in geometry and analysis; previous teaching experience on the college level preferred.

MATHEMATICAL SCIENCES: Assistant Professor—fall 1992. Pending funding of position. Tenure-track. To teach courses leading to the BA or MA degree in mathematics in addition to math courses required of majors in other departments; advise undergraduate and graduate students and maintain an active level of scholarship in the discipline. PhD in mathematics or completion of course work toward a PhD degree if the dissertation is within one year of completion required. Previous teaching experience on the college level preferred.

Send letter of application and resumé with names, addresses, and telephone numbers of three references to: Penelope Coe, Chair, Search Committee, Department of Mathematical Sciences, CENTRAL CONNECTICUT STATE UNIVERSITY, New Britain, CT 06050-4010. Review of candidates will begin on February 10, 1992. CCSU is an AA/EO employer. Women, minorities, the handicapped, and veterans are encouraged to apply.

DEPARTMENT OF MATHEMATICS COLLEGE OF NATURAL SCIENCE AND MATHEMATICS

Notice of Vacancy Tenure-Track Position Beginning September 1992

Position: Assistant professor of mathematics in a department which places a high priority upon teaching excellence and expects faculty to be professionally active.

Responsibilities:

1. To teach 12 semester hours of undergraduate and graduate courses per semester. No more than three different course preparations per semester will be required.
2. To advise students and to serve on faculty committees.
3. To participate in other academic and professional activities of the department, university, and the discipline.
4. To participate in continuing scholarly activity.

Qualifications:

1. Doctorate (or degree nearing completion) required.
2. Teaching experience preferred.

Review of applications will begin on January 15, 1992 and continue until position is filled.

Applications must include a transcript, resumé or curriculum vitae, the names, current addresses, and telephone numbers of five referees, one of whom must be your current employer/supervisor. Please send to: Search Committee B, Department of Mathematics, Indiana University of Pennsylvania, Indiana, PA 15705; (412) 357-2608.

IUP is an Affirmative Action-Equal Opportunity Employer.

DEPARTMENT OF MATHEMATICS College of Natural Science and Mathematics Indiana University of Pennsylvania

INDIANA UNIVERSITY OF PENNSYLVANIA invites applications for one tenure-track and one anticipated tenure-track position in elementary and/or secondary mathematics education at the assistant or associate professor level, to begin in the fall of 1992.

Responsibilities:

1. Teach undergraduate and graduate courses in elementary and/or secondary mathematics education and advise students. Teach 12 semester credit hours including courses in mathematics content, mathematics pedagogy, and supervision of field experiences.
2. Continued scholarly growth.
3. Participate in university, college, and department committees.

Required Qualifications:

1. PhD/EdD by September 1992 (or degree near completion) in an area related to mathematics education with graduate course work in mathematics education.
2. Evidence of effective teaching experience in mathematics at the elementary and/or secondary level.
3. Academic preparation and evidence of ability to teach basic college mathematics.
4. Evidence of successful research or research promise in mathematics education.

Preferred Qualifications:

1. Experience with inservice presentations and/or curriculum consultation.
2. Active participation in recognized professional organizations.

Salary: Commensurate with experience. Excellent fringe benefits.

Review of applications will begin on January 15, 1992 and will continue until position is filled. Applications must include a transcript, resumé or curriculum vitae, the names, current addresses, and telephone numbers of five referees, one of whom must be your current employer/supervisor. Please send to: Search Committee A, Mathematics Department, Indiana University of Pennsylvania, Indiana, PA 15705; (412) 357-2608.

IUP is an Affirmative Action, Equal Opportunity Employer.

PEPPERDINE UNIVERSITY Visiting Positions in Mathematics

Seaver College, the undergraduate liberal arts college of Pepperdine University, seeks applicants for two one-year visiting appointments in mathematics for 1992-93. PhD required. Both positions require a commitment to excellence in undergraduate teaching at all levels. In the first position, expertise in probability and statistics is required; for the second position, a background in artificial intelligence is desirable. Both positions may be renewable for an additional year. Pepperdine is an independent, Christian university under the control of a self-perpetuating Board of Regents and is related to the Churches of Christ. Forward curriculum vitae, transcripts, and three letters of recommendation, each of which comments on the candidate's teaching to: Dr. Ben Hutchinson, Natural Science Division, Pepperdine University, Malibu, CA 90263. An Equal Opportunity Employer.

UNIVERSITY OF NEBRASKA AT KEARNEY

Mathematics: Tenure-track position at assistant-associate rank, beginning 8-20-92, to teach undergrad/grad mathematics. PhD in mathematics with emphasis in the classical applications of math to the physical and applied sciences. Potential for research expected. Send resumé and 3 references to: Dr. Randall Heckman, Search Committee Chair, Department of Mathematics & Statistics, Univ. of NE at Kearney, Kearney, NE 68849-5360. EEO/AA.

UNIVERSITY OF NEBRASKA AT KEARNEY

Statistics: Tenure-track position at assistant-associate rank, beginning 8-20-92, to teach undergrad/grad statistics and math. PhD, quality teaching, strong promise for research, and applied background. Prefer actuarial expertise with a potential to direct the statistics and actuarial programs. Send resumé and 3 references to: Dr. Randall Heckman, Search Committee Chair, Dept. of Mathematics & Statistics, Univ. of NE at Kearney, Kearney, NE 68849-5360. EEO/AA.

URSINUS COLLEGE

Department of Mathematics
and Computer Science
Collegeville, PA 19426

Anticipated one-year position, fall 1992. Rank commensurate with qualifications. PhD desired. Three courses per semester teaching load, full range of courses in the mathematical sciences. Standard fringe benefits. Independent coed liberal arts college with about 1,100 students, founded in 1869. Campus of 140 acres about 30 miles from Philadelphia. Send application and 3 letters of recommendation to: Nancy Hagelgans, Chairperson. Excellent teaching references essential. EEO/AA.

TRINITY COLLEGE

The Department of Mathematics at Trinity College invites applications for a one-year position, at the rank of assistant professor, for the academic year '92-'93. The teaching load is five courses per year ('3/2'). Requirements for the position: PhD in mathematics, strong evidence of teaching excellence at the undergraduate level, and an interest in curriculum development.

Applicants should send *only* a cv, a statement of teaching interests, three letters of reference (at least one of which addresses teaching), and one self-addressed, stamped envelope to:

Search Committee Chair
Dept. of Mathematics
Trinity College
Hartford, CT 06106

This position will remain open until March 1, after which it may be filled at any time.

The department also invites applications for anticipated adjunct positions to be filled in '92-'94 as the need arises. Applications must be made separately to David Mauro at the above address, and should include a cv, a statement of teaching interests, one letter of reference which addresses teaching, and one self-addressed, stamped envelope.

Trinity College is an Equal Opportunity, Affirmative Action Employer. Women and members of minority groups are especially encouraged to apply.

CHAIR**Department of Mathematical Sciences**

The College of Arts and Sciences at Appalachian State University invites applications for the position of Chair of the Department of Mathematical Sciences. The position will be available beginning July 1, 1992. The successful candidate will have both administrative and teaching responsibilities and will assume leadership for a department of more than 35 members. Salary is competitive and commensurate with qualifications.

Qualifications include:

- an earned doctorate in a field appropriate to the department;
- professional development appropriate to associate professor or professor;
- evidence of academic administrative ability and effectiveness;
- a commitment to teaching, scholarship, and service that is consistent with the mission of the university and department;
- demonstrated teaching effectiveness at the college level;
- the ability to work effectively with colleagues from other disciplines; and
- strong interpersonal skills.

Appalachian State University, a member of the University of North Carolina System, is a comprehensive university situated in the heart of the Blue Ridge Mountains. With an enrollment of over 11,000 students, Appalachian offers baccalaureate degrees in 130 disciplines and over 70 graduate programs. The primary mission of the university is undergraduate instruction with scholarship and service complementing the instructional mission. Appalachian seeks to attract superior students and faculty through high quality programs and a challenging academic environment.

Undergraduate degree programs in the Department of Mathematical Sciences include pure and applied mathematics, mathematics education, computer science, and statistics. Master's degrees are offered in pure and applied mathematics and in mathematics education. A master's degree in computer science is in the development stage.

Applications for the position should include: a letter of application; a current resumé; and the names, addresses, and telephone numbers of three of more references. Completed applications must be received no later than 5:00 pm, on Friday, February 28, 1992. Women and minorities are encouraged to apply. Applications should be sent to:

Dr. Theresa Early, Chair
Mathematical Sciences Chair Search Committee
c/o Dean's Office, College of Arts and Sciences
201 I. G. Greer
Appalachian State University
Boone, NC 28608

Appalachian State University is an Equal Opportunity Employer.

FOCUS Advertisements reach more than 32,000 mathematicians in business, industry, government, and academia.

MATHEMATICS AND COMPUTER SCIENCE FACULTY**Rhode Island College**

Tenure-line and three-year term appointments available. To teach a variety of graduate and undergraduate courses. Doctorate required for tenure-line appointment. All degree requirements for the doctorate must be completed by September 1, 1992. Master's degree required for term appointment; doctorate preferred. Preference will be given to applicants with college teaching experience and scholarly research and academic accomplishment, and to those with expertise in mathematics education, geometry, computer science, statistics, applied math, or the integration of technology in the college math classroom. Positions subject to availability of funds. Salary competitive; excellent benefits. **APPLICATIONS MUST BE RECEIVED BY MARCH 18, 1992.** Send letter of application, resumé, transcripts, and three letters of reference to: Office of Personnel Services, Rhode Island College, Providence, Rhode Island 02908—Attention: Mathematics-Computer Science Search.

An Affirmative Action, Equal Opportunity Employer.

INSTRUCTOR AND LECTURER POSITIONS**Department of Mathematics
University of Arizona
Tucson, Arizona 85721**

The Department of Mathematics at the University of Arizona offers nontenure-track teaching appointments to qualified individuals who are dedicated to a quality undergraduate program. We are looking for individuals who are willing to work alongside tenure-track faculty to improve the learning environment and who would like to be a part of a dynamic department engaged in the improvement of the curriculum and the effective use of technology in teaching. The primary responsibility is teaching the following courses: college algebra, precalculus, finite math, and calculus. These positions offer an excellent opportunity for individuals to work with other caring teachers to contribute to, and be part of, an innovative learning environment. Full- and half-time adjunct faculty enjoy all the benefits and privileges available to other university employees.

There are two types of positions:

(A) *One-year adjunct instructor positions.* Adjunct instructors may be reappointed if performance is satisfactory and the department continues to need the service. Except under extraordinary circumstances, no one will be appointed for more than a total of six years.

(B) *Multiyear lecturer positions.* Subject to university policy, lectureships may be renewed for three year terms if performance is satisfactory and the department continues to need the service.

We encourage early application. Deadline date will be **February 15, 1992** or whenever positions are filled. Women and minority applicants are especially welcome. Correspondence regarding job descriptions, qualifications, and application procedures should be sent to:

Alan C. Newell, Head
Department of Mathematics
Entry-Level Teaching Positions
University of Arizona
Tucson, Arizona 85721, USA

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

MONTCLAIR STATE COLLEGE**Department of Mathematics
and Computer Science**

The Department of Mathematics and Computer Science invites applications for three positions. There are two tenure-track, assistant professor positions and one nontenure, one-year appointment in mathematics at the instructor rank. The job descriptions are listed below. Candidates are expected to participate in curriculum development and pursue grants. Scholarly and professional activities are also expected. Teaching load is 12 credits per semester. Applicants must have a commitment to quality teaching.

Applied Mathematics V-23

Expertise in operations research, mathematical modeling, discrete and continuous applied mathematics. Experience in teaching undergraduate and graduate courses in operations research, mathematical modeling, discrete and continuous applied mathematics and have experience in using the computer to solve practical problems in those areas. PhD in applied mathematics or mathematics required. Tenure-track position.

Math Ed and**College Remedial Developmental Math V-24**

Teach undergraduate mathematics and graduate mathematics education courses. Expertise in junior and senior high school mathematics curriculum and current software required; supervisory experience preferred. Doctorate in mathematics education or mathematics. Tenure-track position.

Mathematics-Computer Science V-32

Applicants will teach a general range of undergraduate mathematics and computer science courses including liberal arts students. MAMS or PhD in mathematics plus teaching experience. One-year, nontenure-track position.

Submit resúmes with appropriate V number and names, addresses, and phone numbers of three references to: Dr. Kenneth C. Wolff, V#, Box C316, Montclair State College, Upper Montclair, NJ 07043. Screening begins **February 3, 1992** and continues until positions are filled. Starting date is September 1, 1992. Montclair State College is an Equal Opportunity, Affirmative Action Employer.

APPALACHIAN STATE UNIVERSITY**Department of Mathematical Sciences
Boone, NC**

MATHEMATICAL SCIENCES: The Department of Mathematical Sciences at Appalachian State University, in the University of North Carolina system, with approximately 11,500 students, invites applications for one or possibly two tenure-track positions in the mathematical sciences, beginning August 1992. Applicants will be considered in all areas of mathematical sciences. PhD in mathematics or statistics or an EdD in mathematics education required. Applications in the areas of statistics and mathematics education are encouraged. Appointments are expected to be at the assistant professor level. A commitment to teaching is essential. Research is encouraged and supported. Salary is commensurate with qualifications. Send a letter of application, resumé, graduate transcripts, and have three current letters of recommendation.

Dr. H. W. Paul, Search Committee M, Department of Mathematical Sciences, Appalachian State University, Boone, North Carolina 28608. Completed applications must be received by **March 1, 1992**. Appalachian State University is an Equal Opportunity Employer.

SIMPSON COLLEGE INDIANOLA, IOWA

**Assistant Professor
Instructor of Mathematics**

Applications are invited for a full-time, tenure-track position at the assistant professor-instructor level, beginning in late August 1992. A PhD or ABD in the mathematical sciences is required; the PhD is required for eventual tenure. Preference will be given to candidates having an emphasis in applied mathematics, excellent communication skills, and successful teaching experience. A strong commitment to quality undergraduate education in a liberal arts environment is essential. Send letter of application, vita, and three letters of recommendation to: Dr. William C. Dunning, Chair, Mathematics Department, Simpson College, 701 North C Street, Indianola, Iowa 50125. **Applications will be accepted until the position is filled; review process will begin February 10.** Simpson is an Equal Opportunity, Affirmative Action Employer. Women and minorities are encouraged to apply.

ASSISTANT PROFESSOR OF MATHEMATICS

University of Northern Iowa

We have a tenure-track position for an assistant professor to aid in teaching our general education courses and to support our majors and graduate students. Applicants should have a doctorate in mathematics and be committed to quality education and scholarship at a comprehensive university.

Appointment is for the academic year beginning in August 1992. Salary is highly competitive; fringe benefits are excellent. Application screening begins **February 14, 1992**. For more information, contact: Joel Haack, Mathematics and Computer Science, University of Northern Iowa, Cedar Falls, IA 50614; (319) 273-2631; Haack@ISCSVAX.UNI.EDU.

An Affirmative Action, Equal Opportunity Educator and Employer.

BAYLOR UNIVERSITY

Mathematics—Tenure-Track Positions

Two tenure-track positions open fall 1992. The positions are at the assistant professor (possibly associate) level. Excellence in teaching is required. We hope to fill one position with a person strong in research in analysis who will contribute to our graduate program, presently MS with a PhD under consideration. All areas considered for the other position. PhD required.

Baylor University is a private university with 12,000 students. We are committed to excellence in both the undergraduate and graduate programs. Baylor is an Equal Opportunity, Affirmative Action Employer and is under the patronage and general direction of the Baptist General Convention of Texas. Minorities and women are encouraged to apply.

Provide a resumé, transcript, and three letters of reference to: Howard L. Rolf, PO Box 97328, Waco, TX 76798-7328.

THE COLLEGE OF WOOSTER

One-year, visiting leave replacement position in mathematics, beginning August 1992. To teach elementary and advanced mathematics courses and direct student independent study projects. MS in mathematics, PhD in mathematics preferred. The College of Wooster is an independent, liberal arts college with a commitment to excellence in undergraduate education. Send vita, transcripts, and three letters of recommendation to: Professor Donald Beane, Dept. of Mathematical Sciences, The College of Wooster, Wooster, OH 44691. Review of applications may begin as early as **January 20, 1992**, and continue until the position is filled. We wish to insure that the search identifies qualified candidates who are women or members of minorities. Affirmative Action, Equal Opportunity Employer.

MERCYHURST COLLEGE

**Mathematics
Computer Systems Department**

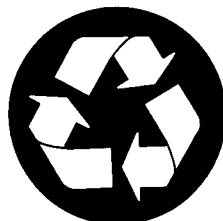
The department invites applications for a position as instructor or assistant professor beginning September 1992. Duties include teaching mathematics courses at all undergraduate levels. Previous teaching experience is desirable. A master's degree in mathematics is required, additional graduate hours is preferred; an appropriate PhD is required for tenure-track.

Salary commensurate with qualifications. Applicants should submit a letter of interest, a resumé, and at least three letters of reference. Application review begins **March 1, 1992** and continues until the position is filled. Send application materials to: Professor Diane Williams, Chairman, Department of Mathematics and Computer Systems, Mercyhurst College, Erie, PA 16546.

MATHEMATICS DEPARTMENT UNIVERSITY OF NORTH DAKOTA

**PO Box 8162 University Station
Grand Forks, ND 58202**

Applications are invited for 2 or more tenure-track positions at the assistant professor level starting August 16, 1992. Consideration will be given to all areas of mathematics, as well as statistics and math education. Applicant must possess a strong commitment to teaching and research and have completed PhD requirements by starting date. Teaching loads are three courses/semester. Must be eligible to work in US. Salary and fringes competitive. Send current resumé, copy of transcripts, and three letters of reference to: Selection Committee. Review of applications begins **February 3, 1992** and continues until positions are filled. UND is an AA/EEOE.



The MAA now prints FOCUS on recycled paper.

MATHEMATICS EDUCATION

The Department of Mathematics & Computer Science at West Chester University invites applications for a tenure-track assistant professor in mathematics education, beginning September 1992, to teach pre- and inservice content and methods courses as well as other mathematics service courses. Doctorate with a master's in mathematics (candidate at dissertation level considered); demonstrated teaching excellence, and strong interest in education at pre-college level required. Demonstrated ability in education research and grant proposal writing in mathematics education preferred. Please send vita, transcripts, and three letters of reference postmarked by **March 1, 1992** to: Prof. Ralph Verno, Dept. of Mathematics-Computer Science, West Chester University, West Chester, PA 19383.

AA-EOE. Women and minorities are encouraged to apply.

THE VIRGINIA MILITARY INSTITUTE

Mathematics-Computer Science

A tenure-track position beginning August 1992. Applicant must have a strong interest in teaching.

Applicant must have a PhD in mathematics or computer science. Applicants with a PhD in mathematics must have a demonstrated ability to integrate computers into math courses.

VMI is state-supported with 1,300 undergraduates in engineering, liberal arts, and science. It is located in an attractive college town with three colleges within a six mile radius. Faculty wear uniforms but have no other military duties.

Initial review of credentials will begin **February 1, 1992** and will continue as necessary. Send resumé, three letters of recommendation, and a graduate transcript to: George Piegari, Department of Mathematics and Computer Science, Virginia Military Institute, Lexington, VA 24450.

AA/EEO.

EDINBORO UNIVERSITY OF PENNSYLVANIA

**#140-0353 Tenure-Track
Instructor Assistant Professor**

Beginning August 1992 to teach upper and lower division mathematics courses, assisting with curriculum development. Requires doctorate in mathematics or mathematics education with strong background in graduate mathematics, plus three years teaching experience or equivalent. Salary range \$24,603-\$40,076. Submit letter of application, detailed resumé, names, addresses, and telephone numbers of three references, and copies of all college transcripts to: Dr. Jerry B. Covert, Dean of Science, Management & Technologies, EDINBORO UNIVERSITY OF PENNSYLVANIA, Department FOC, Edinboro, PA 16444. Only applications received by **March 15, 1992** will be assured of consideration. AA/EEOE.

Calendar

National MAA Meetings

17–23 August 1992 Seventh International Congress on Mathematical Education (ICME-7), Université Laval, Québec, Canada. For additional information, see "Other Meetings" on this page. Immediately before ICME-7 opens, the MAA Board of Governors will meet in Québec, on Saturday, 15 August 1992.

13–16 January 1993 Seventy-Sixth Annual Meeting, San Antonio, Texas (Board of Governors, 12 January 1993)

15–19 August 1993 Sixty-Eighth Summer Meeting, Vancouver, British Columbia (Board of Governors, 14 August 1993)

12–15 January 1994 Seventy-Seventh Annual Meeting, Cincinnati, Ohio (Board of Governors, 11 January 1994)

25–28 January 1995 Seventy-Eighth Annual Meeting, Denver, Colorado (Board of Governors, 24 January 1995)

10–13 January 1996 Seventy-Ninth Annual Meeting, Orlando, Florida (Board of Governors, 9 January 1996)

Sectional MAA Meetings

Allegheny Mountain Slippery Rock University, Slippery Rock, Pennsylvania: 10 and 11 April 1992

Eastern Pennsylvania and Delaware Messiah College, Grantham, Pennsylvania: 11 April 1992

Florida University of North Florida, Jacksonville, Florida: 6 and 7 March 1992

Illinois North Central College, Naperville, Illinois: 24 and 25 April 1992

Indiana University of Indianapolis, Indianapolis, Indiana: 11 April 1992

Intermountain Weber State University, Ogden, Utah: 10 and 11 April 1992

Iowa Graceland College, Lamoni, Iowa: 24 and 25 April 1992

Kansas Hesston College, Hesston, Kansas: 20 and 21 March 1992

Kentucky Bellarmine College, Louisville, Kentucky: 27 and 28 March 1992

Louisiana and Mississippi Louisiana State University, Baton Rouge, Louisiana: 6 and 7 March 1992

Maryland-District of Columbia-Virginia University of Virginia, Charlottesville, Virginia: 24 and 25 April 1992

Metropolitan New York Webb Institute of Naval Architecture, Glen Cove, New York: 3 May 1992

Michigan Saginaw Valley State University, University Center, Michigan: 8 and 9 May 1992

Missouri Northwest Missouri State University, Maryville, Missouri: 10 and 11 April 1992

Nebraska Hastings College, Hastings, Nebraska: 10 and 11 April 1992

New Jersey The Center for Discrete Mathematics and Theoretical Computer Science (DIMACS), Rutgers University, New Brunswick, New Jersey: 28 March 1992

Northeastern Merrimack College, North Andover, Massachusetts: 5 and 6 June 1992; Trinity College, Hartford, Connecticut: 20 and 21 November 1992

Northern California University of the Pacific, Stockton, California: 29 February 1992

Ohio University of Dayton, Dayton, Ohio: 27 and 28 March 1992

Oklahoma and Arkansas Henderson State University, Arkadelphia, Arkansas: 3 and 4 April 1992

Pacific Northwest University of Montana, Missoula, Montana: 18–20 June 1992

Rocky Mountain Colorado College, Colorado Springs, Colorado: 10 and 11 April 1992

Seaway Queen's University, Kingston, Ontario, Canada: 1 and 2 May 1992; Cornell University, Ithaca, New York: 6 and 7 November 1992

Southeastern Kennesaw College, Marietta, Georgia: 10 and 11 April 1992

Southwestern University of Arizona, Tucson, Arizona: Spring 1992

Texas University of Houston-Downtown, Houston, Texas: 9–11 April 1992

Wisconsin University of Wisconsin at Whitewater, Whitewater, Wisconsin: 24 and 25 April 1992

Other Meetings

29–31 March 1992 *Fifteenth Annual Symposium on Developmental Education*, The Nevele Country Club, Ellenville, New York. Sponsor: the New York College Learning Skills Association. For additional information, contact: Barbara Risser, Department of English, Onondaga Community College, Route 173, Syracuse, New York 13215; (315) 469-7741, ext. 2424.

3–5 April 1992 *1992 Annual Conference of the New York State Mathematics Association of Two-Year Colleges (NYSMATYC)*, The Nevele Hotel, Ellenville, New York. For additional information, contact: Richard Rupprecht, Jamestown Community College, 525 Falconer Street, Jamestown, New York 14701.

17–23 August 1992 *Seventh International Congress on Mathematical Education (ICME-7)*, Université Laval, Québec City, Québec, Canada. For additional information, contact: Congrès ICME-7 Congress, Université Laval, Québec, QC, Canada G1K 7P4; (418) 656-7592; ICME-7@VM1.ULAVAL.CA. FAX: (418) 656-8000. Telex: (021) 051-31621 UNILAVAL UBC. Deadline for applications for accommodations: **1 July 1992**. For additional information, see pages ten and eleven of the September 1991 issue of FOCUS.

FOCUS

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