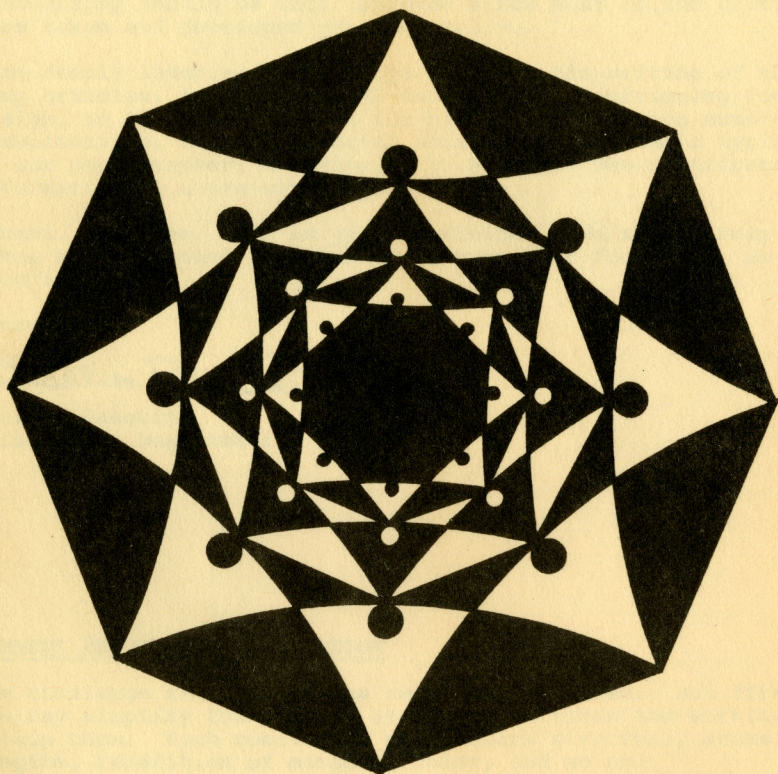
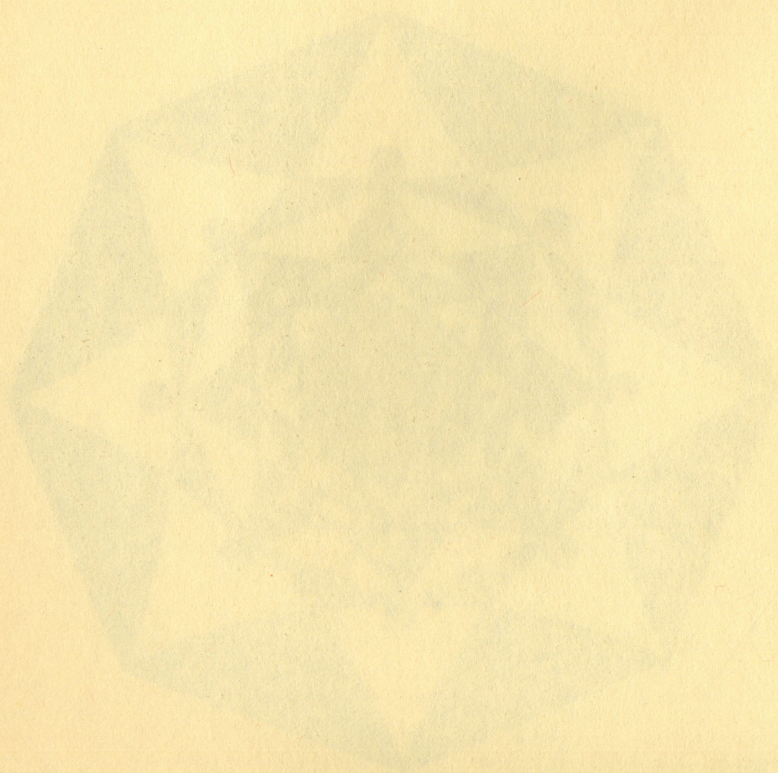


Number 2, Winter 1980



How many sequences are involved?







#### LETTER FROM THE EDITOR

Heedless of the old saying "Don't push your luck", Dr. Judd and I have forged ahead and prepared for you the second issue of what will now surely be the annual Mathematics Department newsletter.

Your response to last year's issue was most encouraging and I hope our second attempt will not disappoint you. We have arranged our presentation into several categories so you can more easily locate articles of personal interest. Also, our photography should be much improved since most of the pictures were taken and developed professionally.

I am deeply indebted to Dr. Boyd Judd for his writing of the many articles, to Dr. Sabah Al-hadad for his intriguing cover design, to Dr. Charles Hanks for his patience during numerous consultations, to our wonderful secretaries for their typing, to our photographer, and finally to everyone who contributed information to share with you.

Alumni, remember, this is your newsletter. We at Cal Poly and other alumni around the country want to hear from you. So keep in touch!

Sincerely,

*Charles Pasquini*

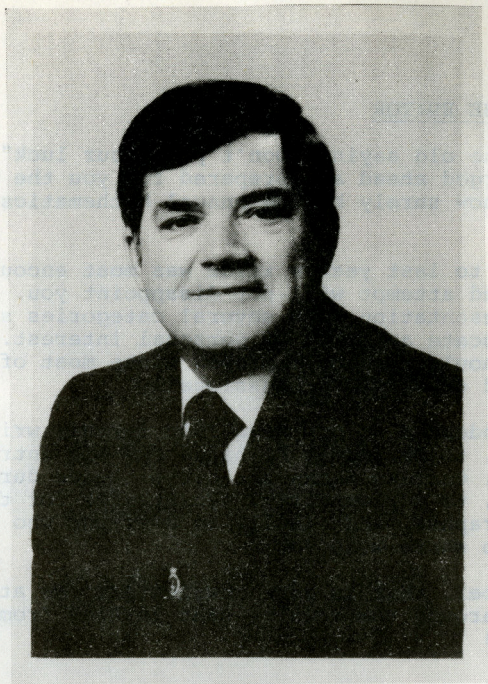
Charles Pasquini  
Mathematics Department

#### COMMENT ABOUT THE COVER DESIGN

The challenge is to count the sequences involved. But first, one may simplify the task by stating conditions and working within them. Such conditions may concern structure, areas, lengths, repetition of members, color, and so on.

Sabah Al-hadad  
Mathematics Department





Dr. Charles J. Hanks, Head  
Mathematics Department

LETTER FROM THE DEPARTMENT HEAD

Dear Alumnus:

We promised you last year that we would publish a newsletter annually, and here is our second attempt. We indicated that one of the objectives of the newsletter would be for you to provide us with feedback concerning what you are doing, as well as to what extent our Math Program has met your needs since graduation. We appreciate and thank you for your many responses. This past year a great deal of time and effort was given by the Curriculum Committee, chaired by Dr. Ed Glassco, in examining our math curriculum and making recommended changes to be incorporated in our 1981-83 catalog. Your feedback from our first newsletter was submitted to this committee for their consideration. Keep up the good work.

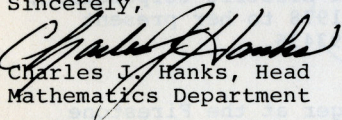


As you probably know, Cal Poly is a very popular place to attend college. In order to maintain our enrollments under fifteen thousand students, it was necessary to deny admission or redirect to other campuses approximately five thousand applicants this year. We did have a slight drop in the number of mathematics majors enrolled for fall of 1979. However, increased enrollments in engineering and agriculture resulted in our having heavy teaching loads for the mathematics faculty again this year.

With the retirement of Professor Chester Scott, George Mach and I became the two old-timers in the department. We both came to Cal Poly in the fall of 1954. Dr. Paul Lansman retired after fifteen years of teaching in June 1979, and Dr. Pat Wheatley transferred to the Computer Science Department. As a result, we hired four professors in tenure-track positions effective fall 1979.

This past year there was continued improvement in the professional growth of our faculty. There were numerous mathematics seminars and colloquia held with excellent participation. A number of outstanding mathematicians were invited to the campus to give talks. Attendance at off-campus professional meetings was at a new high despite limited funds for travel. As a result, I look forward to, and feel we are ready to meet the challenges of the 1980's.

Sincerely,

  
Charles J. Hanks, Head  
Mathematics Department



## ALUMNI NEWS

### Alumni News Briefs

Robert Acheson ('73) is currently assistant principal and math teacher at Lakeview Junior High in Santa Maria. He has an M.A. in Educational Administration from Pepperdine University and would like to move full time into administrative work. He and his wife, an elementary school teacher, have two sons. Home address: 2397 Glacier Lane, Santa Maria, CA, 93454.

Henry Biddles ('68) is working on his master's degree at the Naval Postgraduate School in Monterey. He recently completed a two-year tour as operations officer aboard the U.S.S. Duluth L.P.D-6.

John Clarke ('70) is now a physician specializing in Rheumatology and is located in Long Beach. After leaving Cal Poly he attended Creighton Medical School in Omaha, Nebraska, for four years, and then did his internship and residency at U.C.I.M.C. in Irvine, CA. His wife is the former Diana Hardy ('69, Social Science). They have three children, all boys, and their home address is 17035 Marina Bay Drive, Huntington Beach, CA, 92649.



**Henry Biddles (Math '68)**

Charlotte Bloecher Johnson ('73) is a technical analyst in the Missile Data Reduction Section of Federal Electric Corporation, a division of ITT. She moved in August 1978 to her present home at 1400 E. Olive Ave., Lompoc, CA, 93436.

W. Lawson Maddox ('65) is now plant manager at the Firestone Tire Company facility in Wilson, North Carolina.

Elizabeth Maggiora ('77) spent two years in the rain forest country of Ghana, West Africa. She returned recently to her California home at 4819 Sullivan Way, Santa Rosa, CA, 95405. She plans to return to teaching at the secondary level.

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A recession is a period when we have to get along without the things our grandparents never dreamed of having.

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Patricia Schanberger Redmond ('72) taught junior high school mathematics for three years and high school math for one semester in Garden Grove, CA, from 1973 to 1978. She is now "retired" in Santa Barbara with her husband and two sons. Their address is 664 South San Marcos Road, Santa Barbara, CA, 93111.

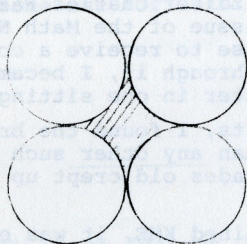
Ruth McMullen Richardson ('62) is employed as a senior systems programmer at Amdahl Corporation, Sunnyvale. She lives at 1236 Crescent Terrace, Sunnyvale, CA, 94087.

David Shipley ('74) is a captain in the weapons system unit, 48th Tactical Fighter Wing, U.S. Air Force, located at Lakenheath RAF Station, England.

Cecilia Sutherland Sundin ('76) is working as an Aide in Special Education at Whittier High School, Whittier, CA. Her husband, Steve, received his Master of Divinity degree from Talbot Seminary in La Miranda, CA, June 1979. They expect their first child early in September. Address: 12427 Pasadena St., Whittier, CA, 90601.

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BRAINTEASER #1 The diameter of each of the circles in the figure below is 2. What is the area of the shaded region?



BRAINTEASER #2 Fred weighs the same as Arnie plus his bowling ball, which weighs 16 lbs. Fred weighs twice as much as his wife, Freda. Arnie weighs 50% more than his wife, Annette. Freda is 22 lbs. lighter than Annette. How much does Arnie weigh?

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\* Answers to the brainteasers are given near the back page of the newsletter.



## Letters from Alumni

Dear Dr. Hanks:

I enjoyed the first issue of the 'Math Newsletter'. Although it has been over 7 years since I graduated from Cal Poly it is good to know that there are some familiar names on the faculty.

During the 7 years since graduation I have married, lived in Florida, Colorado, Texas, and now back in California. In January I started working for the Lockheed Center for Marine Research in Carlsbad, CA. My position is 'Biostatistician' and I am involved with environmental monitoring, impact assessment, bioassay and related projects. Little did I realize when I took my first statistics course from Ms. Curry, that I would now be working as a statistician.

Thank you for the newsletter. Please extend my greetings to the various members of the staff.

Sincerely,

Arthur L. Carpenter  
4239 Serena Ave.  
Oceanside, CA 92054

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Dr. Judd,

Congratulations to you, Editor Charles Pasquini and the staff who produced the first issue of the Math Newsletter. I was taken somewhat by surprise to receive a copy, and my interest was piqued. As I read through it, I became so engrossed that I covered the entire letter in one sitting.

Besides its obvious merits, I found the breadth of coverage to be more comprehensive than any other such paper I've encountered. Memories two decades old crept up out of long unused memory cells ...

I can't recall when I joined KME, it was either "58" or "59", but, by golly, I can remember the initiation ceremonial!

Dr. Judd, I've been employed by the Lawrence Livermore Lab for the past 13 years. My present position is Group Leader of the Operating Systems group of the Network Systems Division in the Computation Dept. My group has been responsible for the design, implementation, development and maintenance of time-sharing operating systems, in a network environment, for the CDC 6600, CDC 7600, CDC STAR-100, and CRI CRAY-1 supercomputers. In the first three cases, we provided the first usable system for those machines. Our current work is aimed at producing a distributable, extensible, location-independent operating system. It will be a capability-based system which will initially run on a single host. However, the various server processes will operate independently as if they were distributed through a network.

I am married, have three daughters, the eldest of whom will



graduate from high school this summer. My wife is a registered nurse specializing in emergency room care. She is currently attending school part time to acquire a California coronary care certification.

I encourage continuation of the newsletter and look forward to the next issue.

Very truly yours,

Pierre J. Du Bois, Jr.  
733 Canterbury Ave.  
Livermore, CA 94550

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Dear Newsletter Staff,

I appreciated receiving the "math newsletter" and would like to pass along the following puzzler which appeared in Technology Review in a feature by Alan Gottlieb. I am rephrasing it in a context more appropriate for San Luis Obispo.

Recently Charles Hanks and his wife attended a cocktail party at the Madonna Inn at which there were four other married couples. Various introductions and handshakes took place. No one shook hands with him- or herself, or with his or her spouse, and no one shook hands with the same person more than once. When Charles asked everyone how many people they had shaken hands with, to his surprise each person gave him a different answer. How many hands did his wife shake?

I hope you can find some use for this. Good luck on the next issue.

Sincerely,

Dale Durran  
(1974)

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Dear Dr. Judd,

I began working at TRW Space Systems Group in September 1977. This is where I met and eventually married Jack, also an engineer working on the same defense project. Soon after we were married, we decided to start building a home in Cerritos, which we moved into only 3 months ago. Just prior to moving in, Jack and I were both sent to Kwajalein Missile Range in the South Pacific for one month to install some defense software packages, and to brief the people there on our latest findings. This was really an experience!

'Bye for now,

Carolyn Knapp Ulmer  
19118 Chauncey  
Cerritos, CA 90701

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Dear Dr. Hanks:

In the past year I received a copy of the Cal Poly Math Newsletter. I want to applaud the department and its students for undertaking such an effort. I have enjoyed reading about various department members and their activities. I would like to indicate to you that I believe that there is one statement that is not correct in your "Letter from the Department Head". You indicate that Joyce Curry was the first person to receive the Master's Degree in mathematics. I am not sure that this is totally accurate. Joyce did receive the first MS (as I remember), but I received the first MA. In fact, I had completed all of the requirements for the MA by June, 1968, but I had to wait to receive the degree until August because that was the only time that the degrees were conferred. I wasn't even in San Luis Obispo during the Summer 1968, since I was on my way to the University of Texas-Austin to start work on a Ph.D. in Mathematics Education.

For the information of the Editor and Dr. Judd, I am currently a Full Professor of Mathematics and Mathematics Education at Cal State Bakersfield, where I work primarily with prospective elementary and secondary teachers in mathematics content and methods courses. I completed my Ph.D. in 1971 and moved directly from Austin to Bakersfield at that time.

Again, let me congratulate you on the interesting publication. Keep up the good work.

Sincerely,

Leland F. Webb, Ph.D.  
Professor of Mathematics and  
Mathematics Education  
California State College, Bakersfield

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BRAINTEASER #3 Find the following sum:

$$100^2 - 99^2 + 98^2 - 97^2 + 96^2 - 95^2 + \dots + 2^2 - 1^2$$

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At a testimonial honoring Charles W. Eliot, famed president of Harvard University, one educator remarked, "Permit me to congratulate you on the miracles you have performed at the university. Since you became president, Harvard has become a storehouse of knowledge". "That is true", said Eliot, "but I scarcely deserve the credit for that. It is simply that the freshmen bring so much knowledge in, and the seniors take so little out."



## Alumni Questionnaire

Last spring we mailed a brief questionnaire to our Mathematics alumni. Here are the results, interspersed with an occasional comment.

Total number of alumni responding : 305

Question #1: If you had it all to do over again, would you still choose Mathematics as your major in college?

Responses:	Yes	-	166	(54%)
	No	-	72	(24%)
	Not sure	-	67	(22%)

Editor's Note: Most of those who answered "No" indicated Computer Science as the major they would select. We wish now that we had also asked the year of graduation!

Question #2: Of the mathematics courses you studied at Cal Poly, which have proved to be the most useful to you?

Response: Calculus was overwhelmingly selected as the most useful course.

Question #3: Of the mathematics courses you studied at Cal Poly, which have proved to be the least useful to you?

Responses:	1st choice	-	Modern Algebra	-	33	(11%)
	2nd choice	-	Linear Algebra	-	15	( 5%)
	3rd choice	-	Modern and Linear Algebra		(tie)	

Question #4: Of the mathematics courses you did not take while at Cal Poly, can you think of any you wish you had taken?

Responses:	1st choice	-	Computer Programming
	2nd choice	-	Computer Programming (again!)
	3rd choice	-	no clear choice

Question #5: Are you currently active in any way in mathematics, either in industry, or research, or teaching?

Responses:	Yes	-	204	(67%)
	No	-	97	(32%)
	No answer	-	4	( 1%)

Question #6: If you answered "Yes" on Question #5, in



which area(s) are you active?

Responses:	Industry	-	89	(29%)
	Research	-	36	(12%)
	Teaching	-	69	(23%)
	Other	-	10	(3%)

Question #7: Did you ever participate in student evaluation of faculty while at Cal Poly?

Responses:	Yes	-	127	(42%)
	No	-	123	(40%)
	Don't Remember	-	55	(18%)

Question #8: Do you think student evaluation of faculty is a good idea?

Responses:	Yes	-	251	(82%)
	No	-	12	(4%)
	Not Sure	-	42	(14%)

Editor's Note: Though comments on Question #8 were not directly solicited by us, several alumni volunteered such. Most of the comments supported the response that student evaluations are a good idea, that the constructive feedback makes the instructor aware of his shortcomings in meeting the students' needs, but that the evaluations should be seen only by the teacher involved.

Question #9: Have your ideas about what constitutes good and effective teaching changed at all from the days when you were a student at Cal Poly?

Responses:	Yes	-	83	(27%)
	No	-	183	(60%)
	Not Sure	-	39	(13%)

Question #10: What is your present overall opinion of the quality of teaching in the mathematics courses you took while at Cal Poly?

Responses:	Excellent	-	91	(30%)
	Good	-	150	(49%)
	Satisfactory	-	37	(12%)
	Fair	-	6	(2%)
	Poor	-	0	
	No answer	-	21	(7%)

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Every person has two educations, one which he receives from others, and one more important, which he gives himself. (Chesterton)

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MATHEMATICS DEPARTMENT

FACULTY AND STAFF



Back row, l-r: Jim Delany, Bob Bonic, Mike Colvin, Bernard Banks.  
9th row, l-r: Bernard Strickmeier, Neal Townsend, Al Bachman.  
8th row, l-r: Allen Ellefson, Myron Hood, Don Hartig, Bob Wolf, Steve Noltie.  
7th row, l-r: Charles Hanks, Don Rawlings, Kempton Huehn, Art DeKleine, George Luna, Jim McBeth.  
6th row, l-r: Tom O'Neil, Alan Holz, Euel Kennedy, Jerry Farrell, Tom Hale, Allen Miller, Gary Epstein.  
5th row, l-r: Boyd Judd, Tom Haskell, Jack Girolo, Julie Thompson, Estelle Basor, Steve Weinstein.  
4th row, l-r: Kate Rymer, John Ziebell, George Lewis, John Van Eps, Kent Morrison, Martin Lang.  
3rd row, l-r: George Mach, John Lowry, Harvey Greenwald, Chester Scott, Adelaide Harmon-Elliott.  
2nd row, l-r: Peggy Young, Margery Greenfield, Sabah Al-hadad, Nancy Reyes, Ralph Warten.  
Front row, l-r: Dina Ng, Charles Pasquini, Francesca Fairbrother, Stu Goldenberg, Ed Glassco.

Not pictured: Boyd Johnson, George Laumann, Ping-Charng Lue, Howard Steinberg, Ray Terry, Rosa Tao, Art Wirshup, Osamu Yamamoto.

On leave: Rex Hutton, Jean McDill, Paul Murphy.





Dr. George Mach (Distinguished Teacher 1965-66), Dr. Adelaide Harmon-Elliott (Distinguished Teacher 1978-79), and Dr. Ralph Warten (Distinguished Teacher 1976-77).

Dr. Harmon-Elliott

Receives Distinguished Teaching Award

The name Dr. Adelaide Harmon-Elliott brings to mind countless qualities of an outstanding teacher - boundless enthusiasm and energy, a high level of personal interaction with students both in and out of the classroom, and a dedication to high professional standards and personal integrity, to name only a few. Dr. Harmon-Elliott is one of the three faculty members at Cal Poly who have been honored as the university's "Distinguished Teachers" for the 1978-79 academic year. She was recognized for her teaching achievements during a formal presentation held on Monday, September 17, as part of the university's 1979 Fall Conference. Dr. Harmon-Elliott received an engraved plaque and a \$100 check made possible by the Armistead B. Carter Endowment Fund.



Selection of the distinguished teachers is based on recommendations of the Academic Senate Committee on Distinguished Teaching Awards. This committee acts on nominations from students, faculty, and other members of the university community and bases its recommendations on in-depth interviews and classroom visits. Incidentally, the other two distinguished teachers for 1978-79, Dane R. Jones from the Chemistry Department and Pratapsinha C. "Pat" Pendse from the Biological Sciences Department, are also from the School of Science and Mathematics.

Dr. Harmon-Elliott, who has been a member of the Mathematics faculty at Cal Poly since 1974, was one of the instructors in a series of in-service workshops for elementary teachers offered through Cal Poly's 1978-79 Mathematics Education Forum. Under Dr. Harmon-Elliott's dedicated advisorship, Kappa Mu Epsilon, the mathematics honor society at Cal Poly, has become one of the most active organizations on campus.

Dr. Harmon-Elliott is the fourth member of the Mathematics Department faculty to be named "Distinguished Teacher". Previous Math faculty recipients of the honor are Dr. Milo E. Whitson (1964-65), Dr. George R. Mach (1965-66), Dr. Kenneth G. Fuller (1966-67), and Dr. Ralph M. Warten (1976-77).

#### Faculty Notes

Dr. Myron Hood has been elected Secretary-Treasurer of the Southern California Section of the Mathematics Association of America. His office is for a three-year term which began in July, 1979.

Dr. Boyd Johnson displayed his ability as a swimmer this past May by winning third, fifth and seventh places in three different events in his age group in the National AAU Masters Swimming Championships at Mission Viejo, where over a thousand swimmers competed. During the summer he swam in four other Masters meets and was unbeaten in the 50 meter backstroke and freestyle. At one of the meets he set a regional AAU record in the 50 meter freestyle.

Dr. Euel Kennedy worked this past summer at Johnson Space Center, in Houston, Texas, with the Mission Planning and Analysis Division of NASA. The group of which he was a part consisted of several NASA personnel working in orbital mechanics, differential equations and optimization theory. In addition, there was one person from ESA (European Space Agency) and several well known professors (theoreticians) with NASA contracts who report regularly on their current research activities in the above areas. Much of the work centered on the analysis, analytical and numerical, of the nonlinear, multibody problems associated with the equations of motion of rockets and satellites. Euel's contribution consisted of two NASA publications entitled 'Lyapunov Stability and its Application to Systems of Ordinary Differential Equations' and 'Analysis of Numerical Stability and Amplification Matrices', both September, 1979.



Dr. Paul Lansman retired June 1979. He taught at Cal Poly during the period 1964-1979.

Dr. Jean Marie McDill has been invited to join a research group in categorical topology at the University of Bremen in Germany for the 1979-80 academic year. She began her sabbatical leave September 1979. She and her daughter prepared by taking German lessons and can at least engage in very short conversations, e.g. "Guten Tag. Wie geht's? Auf Wiedersehen."

Dr. Allen Miller is serving as liaison officer for the Danforth Foundation Graduate Fellowships competition for the 1979-80 academic year. The Danforth Associate Program is an activity of the Danforth Foundation designed to recognize and encourage effective teaching and to humanize teaching and learning for members of the campus community.

Dr. Keith Milliken accepted a position March 1979 in the IBM Thomas J. Watson Research Center's Experimental Systems Laboratory in Hudson Valley, about 40 miles north of New York City. The Laboratory tries to generate quantitative information about new ideas in computer science. Keith had earlier in January 1979 been invited to give a talk on "Partitioning 3-Connected Graphs into Three Connected Graphs". This talk involved a new algorithm which decomposes a 3-connected graph or network into three connected subgraphs of predetermined size. Apparently, IBM was highly impressed by Keith's presentation.

Dr. Paul Murphy is on sabbatical leave during the 1979-80 academic year at Michigan State University, where he did his graduate work. During the year, Dr. Murphy expects to renew his study of finite group theory, and to take part in seminars in that area. This will be the Murphy's second excursion to the East Coast in the last four years. In 1976-77, Dr. Murphy exchanged jobs and houses with Dr. Steve Kenton of Eastern Connecticut State College. For this current year, Dr. Murphy feels that any inclement weather will be a good inducement to study. He feels that the change in mathematical environment is well worth the change in physical environment.

Professor Chester H. Scott retired December 31, 1978. He taught at Cal Poly without interruption from September 1952 to his retirement. Taking advantage of a new "early retirement" plan for teachers in the CSUC system, Prof. Scott will be back to teach one quarter each year over the next several years. He plans to write textbooks and do some traveling when he's not teaching.



Dr. Neal R. Townsend attended the Hawaii-Western Region Mathematics Conference in Honolulu August 8-10. He addressed one section meeting of the conference on the topic, "Some Historical Applications of Geometry".

Dr. Patrick Wheatley transferred to the Computer Science Department September 1979. Pat writes "Although I am still very much interested in mathematics, I have wanted to become much more involved with computers. I expect that I shall pursue my mathematical interests in numerical analysis. Moreover, I hope to be involved in teaching programming languages as well as working in areas more related to computer science than to mathematics.

"This move to the computer science department is an opportunity for me to change careers and, I hope, to be of greater service to the students and to Cal Poly. I have many friends and colleagues in the Mathematics Department so that I am delighted my move is a very short one geographically."

#### Promotions

Promoted to associate professor Spring 1979: Arthur DeKleine, Adelaide Harmon-Elliott, Alan Holz, Eucl Kennedy, and Raymond Terry.

Promoted to full professor: Gary Epstein, Gerald Farrell, George Lewis, and Bernard Strickmeier.

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Sixty years ago I knew everything. Now I know nothing. Education is a progressive discovery of one's own ignorance. (Will Durant)

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Nature gave man two ends - one to sit on and one to think with. Ever since then man's success or failure has been dependent on the one he used most. (George R. Kirkpatrick)

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BRAINTEASER #4: What is the perimeter of a regular octagon inscribed in a circle of radius 2?

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BRAINTEASER #5 Find the number of digits in the number  $2^{12} \times 5^8$ .

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### New Faculty

#### Michael R. Colvin

Received his B.S., M.S., and Ph.D. degrees from the University of Houston. How's that for perseverance? His dissertation is titled "Smith Groups for Fredholm Manifolds". Dr. Colvin was a teaching assistant at the University of Houston and an instructor at Louisiana State University.

#### Donald Hartig

Received his B.S. from Rensselaer Polytechnic Institute, his M.S. from the University of Wisconsin, Milwaukee, and his Ph.D. from the University of California at Santa Barbara. Don's professional interests lie in the areas of Functional Analysis and Topology; his dissertation involves characterizing the functor  $C(X)$ . Don has taught at Ohio University and the U.S. Naval Academy. His wife, Ana, is from Barcelona, Spain, and presently teaches part-time in Cal Poly's foreign language department. Their daughter, Eulalia, is in the second grade at Pacheco School. Don and Ana both enjoy tennis and hiking.

#### Ping-Charng Lue

Received his B.S. from National Taiwan University and his M.A. and Ph.D. from SUNY at Stony Brook. Dr. Lue was also a teaching assistant at these universities. His dissertation is titled "The Asymptotic Expansion for the Trace of the Heat Kernel on a Generalized Surface of Revolution". Dr. Lue is married; he enjoys swimming and playing the game GO.

#### Don Rawlings

Received his Ph.D. in June, 1979. His dissertation, titled "Permutation and Multipermutation Statistics", was completed in Strasbourg, France. Don had a teaching assistantship at U.C. San Diego for 4 years. Interests include classical guitar, tennis, and bicycling.

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**BRAINTEASER #6** A circle has an 8-inch chord. The diameter perpendicular to this chord is divided by the chord into two segments, the shorter of which is 1 inch long. How long is the diameter of the circle?

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### Obituary - Volmar Folsom

Services were held in San Luis Obispo on Monday, January 28, 1980, for Volmar A. Folsom, an emeritus member of the Mathematics Department faculty who passed away on January 25 at the age of 68. Prior to his retirement in 1975, Mr. Folsom had been on the mathematics faculty since 1946. He was founder of the Poly Royal high school mathematics contest which, as you all know, has brought students from throughout California to our campus each April since 1953.

Memorial contributions can be forwarded to the Mathematics Department and will be placed in the Mathematics Department discretionary fund.

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### Letters from Emeriti Math Faculty

Dear Boyd,

Thank you for the invitation to send a brief resume of my activities since retirement for the NEWSLETTER. Congratulations on the first issue, I found it very interesting. Please give my regards to those in the Department who knew me and my best wishes to the others who have joined one of the best departments at Cal Poly!

As many of you know, music (between which and mathematics there is a great affinity) has been one of my consuming avocations. It was because of this that I was asked in 1970 to come to Oregon to play viola in the Peter Britt Music Festival held in Jacksonville each August. Jacksonville is a National Historic Site filled with beautiful restored residences and buildings of the 1850's.

Each summer I came to enjoy making music "under the stars" on a beautiful hillside, and in 1975 met a lovely lady from the Festival Board whose interest in music was evident from the first meeting on the Festival grounds. Each of us having lost our spouses, it soon became evident that "something was going to happen". We were married up here, spent my final year at Cal Poly living in San Luis Obispo, and retired to Oregon beginning in 1978. Here, the change from winter to spring is almost like an explosion! The fruit trees in the valley are all in bloom, the early flowers make a colorful scene, and the view from our house over the southern Oregon landscape is terrific.

Almost immediately upon my arrival I began playing with the Rogue Valley Symphony (four programs and 12 concerts each season). In the summer I played with the Siskiyou Chamber Orchestra for five concerts in beautiful Lithia Park at Ashland, home of the famous Shakespearean Festival. I am now



an associate board member of the Britt Festival and am once again playing in that orchestra. As time permits, quartet playing brings additional satisfaction. Just recently we performed a quartet for a chamber music program at the College in Ashland. In addition there are the usual extra engagements such as two performances of the Messiah, two of the Mozart Requiem, and a recent performance of La Boheme with the traveling group from the San Francisco Opera.

My wife, Pat, is very active in the Rogue Valley Art Association and the Medford Arts Commission. We both enjoy participation in those activities - sales, gallery showings, etc. The arts are alive and flourishing in southern Oregon!

Finally, but not insignificantly, we have a 15 year old daughter, musically inclined, who keeps us busy with advice, concerns, transportation and all the other aspects of teenage life. She and her flute will be going to Europe this year on a music tour. Of course there are always the "chores" to complete on our almost two acres of property; so there is plenty to do!

Regards,

Dave Cook, 3583 Ross Lane, Medford, OR 97501

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Dear Boyd:

The following is a brief description of my activities since retirement in June of 1977:

In addition to the regular day by day activities such as golf, reading, housepainting and yardwork, my wife and I have done a considerable amount of traveling. In June of 1977 we traveled extensively through England, Ireland and Wales. Early in the next year we visited Guatemala including the Maya ruins. During the summer we traveled by bus through Northern and Eastern Europe and then through the Soviet Union and back to London. We are planning to continue our traveling by going to Germany and possibly the Scandinavian countries this fall.

Oswald Falkenstern

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Dear Boyd:

Vi and I are enjoying retirement in S.L.O. We occasionally fly back to the eastern cities to visit or drive to Nevada to put some probability theory to test.

We have won six bowling trophies.

Looking after our apartments takes much of my time. As usual, we have excellent renters. You see, we only rent to Poly students and staff.

Vol Folsom

Editor's Note: We are all saddened by the news of Mr. Folsom's death on January 25, 1980.



Dear Boyd,

Your letter of 3/23/79 gives neither a deadline date nor an indication of the length of article desired. I sincerely hope this will be in time and not too long. If it is the latter, cut all after "strive earnestly". Maybe it would be best to do that anyway. I can't imagine that anyone would be interested in my paean of self praise. After all, it is not so remarkable that a guy who taught logic nine years at Poly should be able to construct a logical argument.

A genius is a person who possesses a talent in some field and who, by assiduous work and purposeful practice, has developed that talent to a high degree.

Since my retirement from Poly I have been leading a life of slothful ease. I rapidly discovered a strong latent talent for loafing. Since July 1973 I have spent most of the time developing it; by now, thru unrelenting effort I have achieved such expertise in the field that I can modestly claim to merit the title of genius.

Golf, the retired man's lifeline, is a game I love and actively pursue. My improvement, while not spectacular, has been steady. From a modest average of 88 in 1973 I have gradually improved until I can confidently predict a score between 100 and 105 whenever I take out my clubs. Please don't congratulate me, anyone can do it. But you must strive earnestly.

The one thing, pertaining to my teaching, that I have done is in the field of logic. Before coming to Poly I served in the United States Coast Guard for 34 years. In 1974 it was possible for a retired officer to sign up for a "Survivor Benefit Plan" to provide for his widow. While expensive the plan was considerably better than commercial insurance. A close Service friend of mine told several people he was going to enroll in SBP and failed to continue his principal insurance policy. However, by the end of the enrollment period (3/20/74) he had not signed up. A short time later (7/7/74) he died of a brain tumor leaving his widow and two children nearly destitute. In August 1978 the widow got around to telling me about it. Meanwhile, the Twelfth Coast Guard District had twice appealed to Headquarters to grant her the benefit of SBP and her attorney had addressed an appeal to the Board for Correction of Military Records. All had been rejected. I took the material available, recast it in the light of logical principles and presented it to the Commandant of the Coast Guard. He, in turn, forwarded my letter to the Board for the Correction of Military Records and in about two months she was enrolled in SBP with back pay to the time of her husband's death.

Very best,

Bill Hogan, 162 Serrano Heights, San Luis Obispo, CA 93401



Dear Boyd:

Thank you for your kind invitation of March 23rd to supply you with news items concerning myself for inclusion in the Mathematics Department Alumni Newsletter. Since I taught service courses taken by non-math majors, I doubt if many of the readers of your newsletter would recognize my name or be interested in what I have been doing since retiring.

Since retiring I have not done anything in the math area worthy of note. The only non-math item of possible interest that I can think of would be the 9,000 mile trip we took last fall in a motor home from San Luis Obispo, up the Alaska Highway, through British Columbia and the Yukon, to Fairbanks. We returned by ferry-steamer from Skagway to Prince Rupert, driving home from there. It was a memorable trip with vivid fall colors and lots of wildlife. We returned with a rack of caribou antlers, moose and caribou meat, frozen berries which we picked, and a broken windshield as reminders of our trip.

Sincerely,

George H. McMeen, 18 Hathway Ave., San Luis Obispo, CA 93401

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Dear Boyd:

Thank you for the invitation to write a brief description of my activities since retiring. As you know I retired from teaching so my description will bear out the fact I "retired from teaching".

Since retiring Oct. 1, 1974 my activities have been taking trailer trips, some golf, doing some of the unfinished tasks around our home and rug making. We toured the perimeter of the United States and the Maritime Provinces from Jan. 1, 1975 to mid-Sept. as our most extensive sojourn. Serving as president of the newly formed Cal Poly Retired Faculty/Staff Club has been very enjoyable over the past two years and my main tie to the University and Alumni Association.

I trust this will suffice and not be too long. I see former students on nearly every trip whether in California, Florida or Nova Scotia. Time-filling is never a problem so I can recommend this promotion to all when you have served your apprenticeship. Mine lasted 47 years.

Sincerely,

Milo E. Whitson, 1938 Wilding Ln., San Luis Obispo, CA 93401

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Experience - that's what you've got when you're too old to be hired.

---



Boyd - Please edit the following as much as you like!

Traveling:

- 1) A 21 day trip to Europe the summer of 1974.
- 2) Spring of 1975, one month in Hawaii.
- 3) Christmas in PA, 1976, with Helen's relatives.
- 4) February and March 1978, PA, around Lancaster with Helen's relatives.
- 5) Summer 1977, trip by motor home to Canada - Banff, Saskatoon, Edmonton, Jasper, Vancouver, Seattle, and home.
- 6) Every Fall by motor home to N. Calif. and southern Oregon for fishing.
- 7) Fall 1978, 36 day trip to S. Pacific and Orient.
- 8) Three weeks on Colorado River, March-April 1979.

Other:

Golfing once or more per week, fishing likewise. Helping son build a house. These things have filled in the rest of my time.

Best regards,

John Woodworth, 624 Mission, San Luis Obispo, CA 93401

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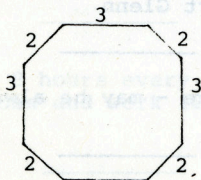
BRAINTEASER #7 If the numbers 1,2,3,4,5 are divided in any manner into two sets, show that one of the sets must contain two numbers and also the difference of those two numbers.

\_\_\_\_\_  
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"What made you go into teaching?" one first-grade teacher asked another after a particularly hectic day. "Oh, I had three good reasons for choosing a career in teaching", was the reply, "June, July, and August."

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BRAINTEASER #8 Find the area of an octagon if it is known that each side is either 2 inches or 3 inches long, with the 2 and 3 alternating, as shown.



\_\_\_\_\_  
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18



HAPPENINGS IN THE DEPARTMENT



Graduation 1979

L-R: Dr. Charles Hanks, Dean William Langworthy,  
David Haussler, Assoc. Dean Philip Bailey.

Recent Graduates

Mathematics Graduates - Spring 1979

Master of Science Degree

Greenfield, Margery L.  
Haussler, David  
McBeth, James Michael  
Seaman, Robert Glenn

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A toast to the Graduate - may he always remain in a  
class by himself!

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And here's to the Girl Graduate - may she become even  
more beautiful by degrees!



## Bachelor of Science Degree

Abbott, John Wallace\*\*  
Dalfol, Doreen Lynn\*\*  
Dawson, Craig William  
Garrett, Marshall Ray\*  
Hansen, Laura Jane\*  
Johnson, Patricia Ann  
Jones, Jeffrey Paul\*\*  
Kiger, Michael Eugene  
Meinhardt, Karl Richard\*\*  
Ortiz, Maria Gabriella  
Parker, John William  
Pierce, Gary Dean\*\*  
Shane, William Edward\*\*  
Straser, Margaret Ellen\*  
Suits, Robert David\*\*  
Tomasini, Karen Marie

\* With Honors

\*\*With Highest Honors

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## Outstanding Student Award

David Haussler, a mathematics graduate student from Atascadero, was the winner of this past year's award as the Outstanding Student in Mathematics. Dave is presently at the University of Colorado working on a Ph.D. degree. A plaque with names of all winners to date of this award is now in one of the showcases outside the Mathematics Department office. The plaque was financed by donations from Mathematics faculty, with Dr. Hanks, Department Head, agreeing to contribute a share equal to the total collected from all the other members of the faculty.

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The Canadian professor and humorist Stephen Leacock once met an American student during the summer break. When Leacock asked him about the courses he planned to take that fall, the student replied, "Turkish, music and architecture." "Do you expect to be choir-master in a Turkish cathedral?" asked Leacock. "No", said the student, "those courses come at 9, 10, and 11 o'clock."

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Work faithfully for 8 hours every day and someday you may get to be the boss and work 12 hours every day.  
(Robert Frost)





#### Honors Luncheon

L-R: Dr. Tom O'Neil, Ken Valente, Jay Devore (CSC), Peggy Young, Dr. Charles Hanks, John Abbott, Jeffrey Jones.

#### Honors Luncheon

The annual honors luncheon, at which the academically outstanding graduating seniors in the School of Science and Mathematics are recognized, was held on Thursday, May 24, 1979. Mathematics majors honored at this event were John Abbott, Doreen Dalfol, Jeffrey Jones, Robert Suits, and Kenneth Valente.

#### Outstanding Graduating Senior

The School of Science and Mathematics Student Council selected Nanette Harter, mathematics major, to be honored for Outstanding Service to the School of Science and Mathematics.

If people really liked to work, we'd still be plowing the land with sticks and transporting goods on our backs. (William Feather)



### Change in Senior Seminar

Many alumni may not yet have heard of the recent changes in our Senior Project/Senior Seminar sequence, Math 461/2/3. Beginning with the 1977-9 catalog, Senior Seminar, Math 463, was replaced with Math 459, Undergraduate Seminar--now a prerequisite for Senior Project, Math 461.

You will recall that, in Math 463, each student made a presentation of his Senior Project, as well as presentation of mathematical topics of interest not typically a part of any course.

In Math 459, students explore a variety of applications of mathematics and mathematical modeling in ways that courses in mathematics typically cannot explore. It is felt that this exposure is of benefit as a foretaste of kinds of mathematical activity the student will experience when he becomes employed. Further, mathematical vistas will be opened, and widened, better enabling our students to enter the Senior Project experience.

It may be that some of you will be able to share interesting instances of mathematics put to work to handle problems arising in your job experiences. We are sure that augmentation to "case histories" of mathematical modeling will be most welcome to instructors of Math 459. Dr. Thomas O'Neil has been the pilot for this course as it has been "getting off the ground", although, in future quarters, other instructors will have occasion to put their hands to the controls.

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### Mathematics Education Forum Update

The Mathematics Department has received a \$10,000 grant from the National Science Foundation to continue its Mathematics Education Forum for the California Central Coast. This program provides in-service training for elementary and secondary mathematics teachers in San Luis Obispo County and Northern Santa Barbara County. Under the directorship of Dr. Alan Holz, the forum is now in its third year.

A primary activity of the math education forum is the presentation of seminars for secondary teachers. This year, Dr. Stephen Weinstein is conducting a seminar on the "History of Mathematics" during winter quarter. A seminar on the "Application of Mini-Computers to Mathematics Instruction" will be taught in the spring quarter by Dr. Rex Hutton.

Two nationally known math educators will also be presenting lectures which are open to all teachers and other interested members of the public at no charge. The first lecture, held on February 14, is titled "Helping Students Read Mathematics". The speaker is Dr. Robert B. Kane, Head of the Department of



Education, Director of Teacher Education, and Professor of Education and Mathematics at Purdue University. Dr. Kane will identify reading skills which enable a student to read mathematics textbooks with comprehension and will discuss teaching strategies which help students develop these skills. The second talk in this year's series of lectures will be presented by Dr. Peter Hilton on May 5. Dr. Hilton, a faculty member of Case Western Reserve University, will speak on "The Causes and Cures of the Failure of Mathematics Education".

Finally, a major project of the math education forum this year will be the formation of a Leaders Group for teachers and administrators with particular interests in mathematics education issues. The group of educators from San Luis Obispo County schools will explore future directions in math education on the California Central Coast.

For further information on the activities and operations of the forum, you may write to

Dr. Alan W. Holz, Director  
NSF Mathematics Education Forum  
Mathematics Department  
California Polytechnic State Univ.  
San Luis Obispo, CA 93407

or phone (805) 546-2632.

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Department Colloquia  
February through November 1979

<u>Date</u>	<u>Speaker</u>	<u>Topic</u>
Feb 22	Pamela Halari (U.S.C.)	"An Application of Algebraic Systems Theory to Feedback Control"
Feb 27	Nancy Jacqmin (Stanford)	"General Techniques for Solving Integer Linear Programs"
Mar 1	Shirley A. Hill (Univ. of Missouri and President NCTM)	"Some Critical Issues Concerning High School Preparation for College Math" and "The Teacher and Basics in Math" (two talks)
Mar 6	Gregory B. Passty (U.S.C.)	"Asymptotic Behavior of Systems Generated by Accretive Operators"
Mar 9	Donald G. Hartig (U.S. Naval Academy)	" $C(X)$ , Something for Everyone"
Mar 13	Edward F. Schmeichel (U.S.C.)	"Hamiltonian Cycles in Planar Graphs"
Mar 15	Paulette Saab (U. of Illinois)	"Integral Representation by Boundary Vector Measures, and Applications"



<u>Date</u>	<u>Speaker</u>	<u>Topic</u>
Mar 29	Sheila Tobias (Formerly Assoc. Provost at Wesleyan)	"Math Anxiety - Research and Applications"
May 8	Robert B. Davis (Illinois)	"Recent Research in the Teaching and Learning of Mathematics That Should be of Interest to Professional Mathematicians"
May 9	Maynard Thompson (Indiana)	"Models for Information Diffusion" or "How Many People Never Heard a Rumor?"
May 18	F. Burton Jones (U.C. Riverside)	"On a Generalization of the N-ARC Theorem"
May 22	Dina Ng (Cal Poly)	"A Result on Convergence of Nonsingular Real Symmetric Matrix Pairs"
May 31	Ross L. Finney (Illinois)	"Professional Applications of Undergraduate Mathematics"
Oct 5	Michael Colvin (Cal Poly)	"Equivariant Infinite-Dimensional Topology"
Oct 23	Steven Krantz (U.C.L.A.)	"Continuously Varying Peaking Functions"
Oct 25	Don Rawlings (Cal Poly)	"Generalized Worpitzky Identities"
Nov 19	Eldon Vought (Chico State)	"Countable Connected Hausdorff Spaces"
Nov 26	Errett Bishop (U.C. San Diego)	"Some Remarks on the Philosophy of Mathematics"

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### 39th Annual Putnam Competition

Fifteen Cal Poly students participated in the 39th Annual William Lowell Putnam Mathematical Competition on December 2, 1978. A total of 2019 students from 339 colleges and universities in Canada and the United States competed this year. There were teams (3 members) from 246 schools. Cal Poly's team didn't place in the top 150 teams that were ranked. This year's participants were Donald Gibson, Charlie Cross, Ken Choy, Tom Spears, Jeff Jones, Chris Curzon, Valerie Grosshans, Dale Brown, Jon Ervin, Doug Grabinsky (Math), Richard Kopel (CSC), Jack Auchincloss, Mike Helms (ME), Robert Martin (Phys), and Bill Shane (ME and Math).



### 1979 Poly Royal Math Contest

The 1979 Poly Royal Mathematics Contest winners were as follows:

#### Team Winners

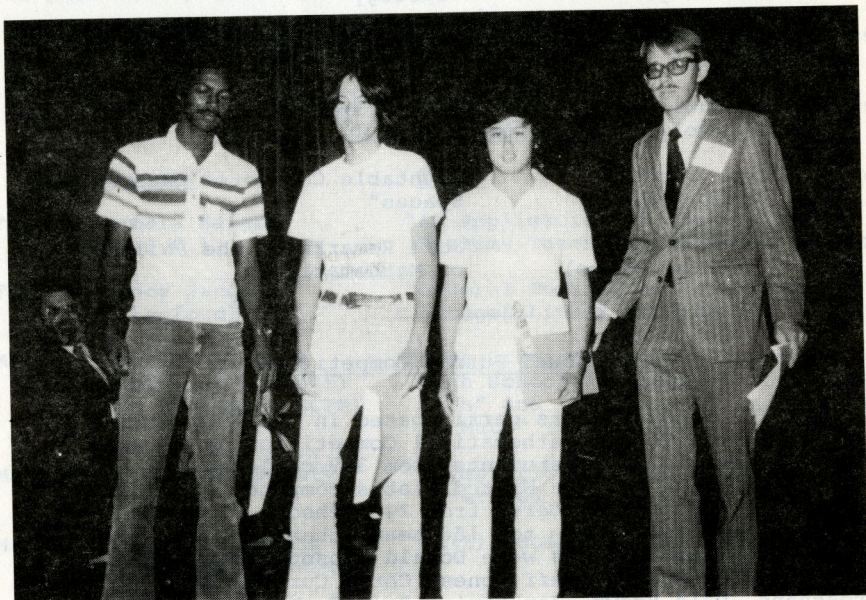
1st place	Helix High School (La Mesa)
2nd place	Rolling Hills High School
3rd place	Salinas High School

#### Individual Winners

Written Contest (seniors)	Ron Unz, North Hollywood H.S.
Chalk Talk Contest (juniors)	Robert Van Buskirk, Del Mar H.S. (San Jose)

Total number of participants:

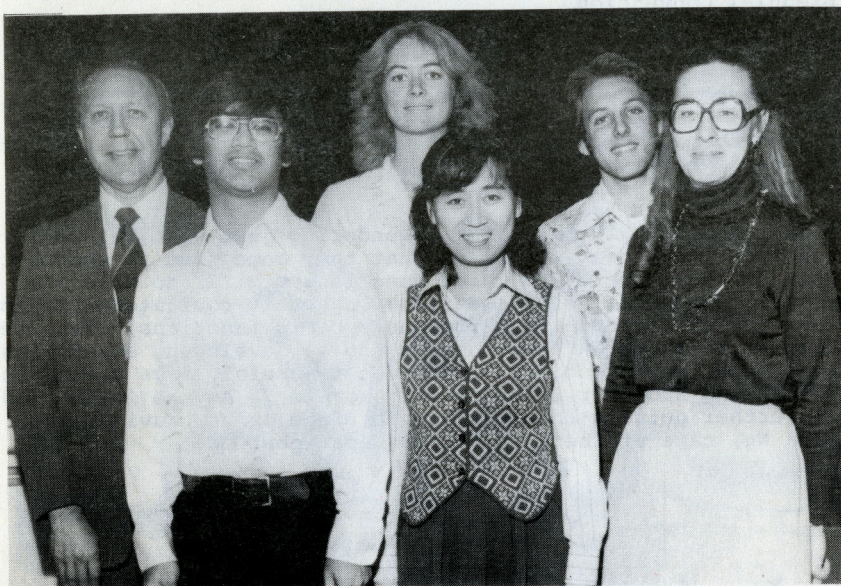
Written Contest	221	(from 80 high schools)
Chalk Talk Contest	47	



1st place team from Helix High School  
with Dr. Martin Lang, Contest Director



## Kappa Mu Epsilon Highlights



L-R: Dr. George Mach, Faculty Advisor and National Secretary  
Roberto Fontillas, 1st Vice-President  
Nancy Tennyson, 2nd Vice-President  
Dr. Dina Ng, Faculty Advisor  
Dan Moczarny, President  
Dr. Adelaide Harmon-Elliott, Faculty Advisor

### Career Conference

KME hosted speakers from TRW, The Travelers, Hewlett-Packard, Raytheon and ITT Corporations and the U.S. Air Force at its third annual career conference held February 1, 1979. The purpose of these yearly events is to provide our mathematics majors with some insight into the various kinds of careers available to them, with specific details of the duties involved in each career.

### Junior High Math Contest

For the past three years KME members, assisted by Mathematics Department faculty, have organized and supervised a mathematics contest open only to students of junior high school age within San Luis Obispo County. This year's contest was held on March 31. Top school honors went to Arroyo Grande High School for



the 9th grade level and to Judkins Intermediate School for the 7th and 8th grade levels.

### Biennial Convention

Cal Poly sent five delegates to this past year's KME Biennial Convention held in Pittsburg, Kansas, April 26-28. They were: Mary Danbom, Jane Hansen, Diane Dahlgren, Dan Moczarny and Karl Meinhardt. Providing transportation for the group with his brand new motor home was Dr. George Mach, chapter advisor and national secretary. Diane Dahlgren presented a paper entitled "The Diamond Functions" at the convention.

**Editor's Note:** In case you're wondering just what "diamond" functions are, Diane tells us that they come from an abstract form of trigonometry in which functions similar to sine and cosine, for instance, are defined on a unit equilateral diamond centered at the origin. From these basic functions, identities similar to those in trigonometry can be developed, along with some other new functions. The idea is useful, says Diane, as a teaching aide for learning trigonometry. Anyone interested in further details should write to Diane or her advisor, Dr. Dina Ng, care of the Mathematics Department.

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**BRAINTEASER #9** Given positive integers  $a$  and  $b$  such that  $a$  divides  $b^2$ ,  $b^2$  divides  $a^3$ ,  $a^3$  divides  $b^4$ ,  $b^4$  divides  $a^5$ , ..., etc., prove that  $a$  must equal  $b$ .

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After much debate, two college seniors decided to flip a coin to decide what to do that night. One said, "If it turns up heads, we'll catch a movie; if tails, we'll give Nancy and Sue a call; and if it stands on edge, we'll study."

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A perfectionist is a person who takes great pains - and gives them to other people.



## Math Club News



L-R: Jon Morin, Secretary; Estelle Basor, Bob Wolf, Faculty Advisors; Carolyn Dernbach, Treasurer; Greg Beserra, Vice-President; Ken Willeford, President.

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New officers for 1979-80 are:

President: Ken Willeford; from Simi Valley, a sophomore math major, applied option (likes sports).

Vice-President: Greg Beserra, also from Simi Valley, a sophomore math major, applied option.

Treasurer: Carolyn Dernbach, from Costa Mesa, a junior math major, applied option (likes sailing and sports).

Secretary and Membership Chairman: Jon Morin (also a past president), from Campbell, a senior math major, teaching option. Jon likes sailing and teaches swimming in Morro Bay (we seem to have a club full of swimmers, sailors and sportsmen!)



### Chess Club

Dr. George Lewis, Mathematics Department, is the advisor of the Cal Poly Chess Club, which is housed within the Math-Home Economics Building on campus.

George tells us that Cal Poly's Chess Team participated for the very first time in the Pan American Intercollegiate Championships, held December 26 through December 30, 1978, in Chicago. Our team placed 51st out of 85 competing teams.

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A student who had spent most of his quarter partying approached his professor. "Do you think", he asked anxiously, "that if I 'bone up' for the next two weeks, I can pass the exam?" "Sir", the professor replied, "You make me think of a thermometer in a cold room. You can make it register higher by holding your hand over it, but you won't be warming the room."

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**BRAINTEASER #10** A runner runs once around a circular track, without stopping anytime in between his start and finish. His speed at the starting and finishing point is zero. Show that there must exist two diametrically opposite points at which his speed is the same.

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## FEATURE ARTICLES

### I. Those Puzzling Paradoxes of Logic

by

Bob Wolf

One type of puzzle that can usually be counted on to fascinate almost everybody is the paradox - an apparently reasonable situation or sequence of steps that leads to an impossible or contradictory result. And probably no subject has produced as many interesting paradoxes as logic (though probability theory and physics are not far behind).

In spite of their great variety, virtually all paradoxes in logic (and set theory) are based on a single idea: the idea of self-reference. That is, a logic paradox involves a statement or concept which is (directly or indirectly) defined or described in terms of itself, in a contradictory way. Suppose you looked up the word "artichoke" in your dictionary, and the definition said "an artichoke-like vegetable". This would not be a paradox, but it would be a useless definition, because it is "circular" or self-referential. But now suppose the definition said "anything other than an artichoke". This would be a paradox, though it's a pretty silly one.

The simplest of all logic paradoxes is also one of the oldest. It's called the Liar's Paradox and dates back to the 6th century B.C. (in a slightly different form called Epimenides' Paradox). It consists of the single statement, "This statement is false", or even simpler, "I am lying". If this statement were true, it would have to be false; but if it were false, it would have to be true! Thus we have a contradictory situation, a paradox. Note that the self-reference or circular definition is very obvious here. Still, even this very simple paradox is not all that easy to explain away!

Here is a slight embellishment of the Liar's Paradox: a card, one side of which says "The statement on the other side of this card is true", while the other side says "The statement on the other side of this card is false". As before, any attempt to label these statements as true or false leads to a contradiction. The main way this differs from the Liar's Paradox is that now the "loop" of self-reference has two steps instead of one. (By the way, would it still be a paradox if each side said the other side was false?)

Once self-reference is understood, the possibilities for paradoxes are endless. Here is the most famous paradox of set theory: let A be the set of all sets which are not elements of themselves (in symbols,  $A = \{B/B \notin B\}$ ). Is  $A \in A$ ? If it is, it's not, but if it's not, it is. This trivial-sounding paradox,



discovered by Georg Cantor (the founder of set theory) and Bertrand Russell in 1900, revolutionized not only set theory but the entire foundations of mathematics! (This paradox has also been popularized in a form called the Barber's Paradox).

Finally, here is a subtle paradox involving both logic and set theory, called Berry's Paradox: certain English phrases of fewer than 30 syllables obviously define or describe a particular natural number. Examples would be "ninety-seven", "the three-millionth prime number", "the number of cubic inches in a cubic yard", etc. Now there are only a finite number of such phrases, and thus there are only a finite number of natural numbers which can be defined by such phrases. So there are numbers which can't be defined in this way, and of course that means there's a smallest such number. Now consider the phrase "the smallest natural number which can't be described by any English phrase of fewer than thirty syllables." By our discussion, this phrase should describe a certain number. But since this phrase has only 28 syllables, the number it apparently describes can't possibly be described by it! See if you can demystify this intriguing paradox for yourself.

Space limitations prevent me from telling you about my favorite paradox, the Prisoner's Paradox. But an excellent discussion of this deep paradox is given in The Unexpected Hanging and Other Mathematical Diversions, by Martin Gardner (Simon & Schuster, 1968). Some other references on logic paradoxes are Introduction to Mathematical Logic, by Elliott Mendelson (Van Nostrand, 1964); Introduction to Metamathematics, by Stephen Kleene (Van Nostrand, 1952); The Paradox Box, by Scientific American (W.H. Freeman, 1975); and Gödel, Escher, Bach - An Eternal Golden Braid, by Douglas Hofstadter (Basic Books, 1979).

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## II. Math Anxiety

Cal Poly was privileged this past year to have an expert on math anxiety and math avoidance, Dr. Sheila Tobias, formerly Associate Provost at Wesleyan University, give a presentation on this subject at one of our departmental colloquia, sponsored by the Mathematics Education Forum under the direction of Dr. Alan W. Holz of Cal Poly.

The subject of math anxiety has become so well recognized that even the newspaper columnist Sylvia Porter has written a piece on it, appearing in the San Luis Obispo Telegram-Tribune of December 14, 1979. Porter quotes Dr. Stanley Kogelman, a math therapist, as saying that the problem crosses all brackets of income, education, sex and occupation. People with math anxiety include lawyers, judges, writers and photographers, with about two-thirds of his (Kogelman's) clients being female. Professor Kogelman compares overcoming math anxiety to performing in competitive sports - intense practice is the key.



Two suggestions he gives to those afflicted are: trust your intuition more when it comes to math and forget the notion that there is only one way to solve a problem.

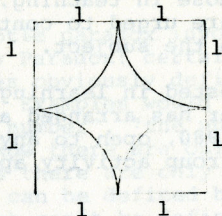
Any alumni, especially those in teaching, who may wish to learn more about this subject are urged to contact Dr. Holz. He has a 52 item bibliography on the subject.

Alumni may also be interested in learning that Cal Poly's Learning Assistance Center has arranged a Math Anxiety Group offering winter quarter 1980, open to any students who feel they may benefit from a group activity approach to this problem.



# ANSWERS TO THE BRAINTEASERS

- 1) Form a square by joining the centers of the circles thus:



Then we note that the desired area is equal to the area of the square less the total area of four quarter-circles. But the four quarter-circles have an area equal to that of one circle of radius 1, hence an area of  $\pi(1)^2$ , or  $\pi$ . Since the area of the square is  $2 \times 2$ , or 4, the area of the shaded region in the original picture must be  $4 - \pi$ , or about 0.86.

- 2) Let  $F$  = Fred's weight,  $f$  = Freda's weight,  $A$  = Arnie's weight, and  $a$  = Annette's weight. From the statements given in the problem, we have

$$F = A + 16$$

$$F = 2f$$

$$A = a + 50\%a = a + .50a = 1.50a = \frac{3}{2}a$$

$$f = a - 22$$

$$\text{Thus: } A + 16 = 2f = 2(a - 22) = 2\left(\frac{2}{3}A - 22\right) = \frac{4}{3}A - 44$$

$$3A + 48 = 4A - 132 \quad A = 180 \text{ lbs.}$$

So Arnie weighs 180 lbs.

- 3) Let  $S$  = the desired sum

$$\text{Then } S = 100^2 - 99^2 + 98^2 - 97^2 + \dots + 2^2 - 1^2$$

$$= (100-99)(100+99) + (98-97)(98+97) + \dots + (2-1)(2+1)$$

$$= 100 + 99 + 98 + 97 + \dots + 2 + 1$$

$$= \frac{(100 + 99 + 98 + 97 + \dots + 2 + 1) + (1 + 2 + \dots + 97 + 98 + 99 + 100)}{2}$$

$$= \frac{(100+1) + (99+2) + (98+3) + (97+4) + \dots + (2+99) + (1+100)}{2}$$

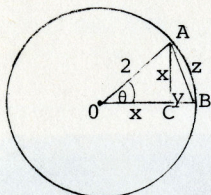
$$= \frac{101 + 101 + 101 + 101 + \dots + 101 + 101}{2}$$

$$= \frac{100(101)}{2} = 50(101) = 5050$$

Editor's Note: Math alumni should recognize that we added some unnecessary steps in the above solution. This was done to assist some of our non-Math-major readers.



4)



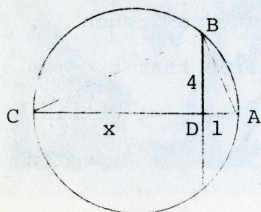
Let  $z$  represent one side of the octagon then  $p = \text{perimeter} = 8z$   
 we also note that the angle  $\theta$   
 (see diagram)  $= \frac{360^\circ}{8} = 45^\circ$ .

Hence, using the Pythagorean Theorem on  $\triangle AOC$ , we obtain  
 $x^2 + x^2 = 2^2$ ,  $2x^2 = 4$ ,  $x^2 = 2$ ,  $x = \sqrt{2}$ . Now we have  
 $x + y = 2$ , thus  $y = 2 - x = 2 - \sqrt{2}$ . Again, using the  
 Pythagorean Theorem on  $\triangle ABC$ , we have  $z^2 = x^2 + y^2 =$   
 $(\sqrt{2})^2 + (2 - \sqrt{2})^2 = 2 + 4 - 4\sqrt{2} + 2 = 8 - 4\sqrt{2}$ . Therefore,  
 $p = 8z = 8\sqrt{8 - 4\sqrt{2}} = 16\sqrt{2 - \sqrt{2}}$ , which is about 12.25.

$$5) \quad 2^{12} \times 5^8 = (2^4 \times 5^8) (5^8) = 2^4 [(2^8) (5^8)] = 2^4 \times 10^8 \\ = 16 \times 10^8 = 1,600,000,000$$

Thus, the number of digits is 10.

6)



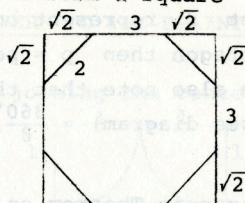
The trick is to observe that triangles  
 $ABD$  and  $BDC$  are similar triangles. This  
 means that  $1:4 = 4:x$   $\frac{1}{4} = \frac{4}{x}$   
 $x = 16$ .

Hence the diameter is  $16+1$ , or 17 inches long.

- 7) One way to attack this problem is to make an attempt to put the five given numbers into two sets in such a way that no one set contains two numbers and their difference and then hope to arrive at a contradiction. Now 1 and 2 cannot be in the same set. Neither can 2 and 4 be in the same set. So we see that if we put the 2 into set A, we must put the 1 and the 4 into set B. But now we see that the 3 cannot be placed into set B. So 3 would have to go into set A with the 2. Now, what about the number 5? It can't go into set A, since  $5-3 = 2$ . Also, the 5 can't be put into set B, because  $5-4 = 1$ . So we have our contradiction. Thus, we are forced to accept the fact that one of the sets must contain two numbers together with their difference.



- 8) As in problem 1, we form a square



Thus, the area of the octagon = the area of the square less the total area of the four triangles in the corners.

$$\therefore \text{Area} = (3 + 2\sqrt{2})^2 - 4\left[\frac{(\sqrt{2})^2}{2}\right] = 9 + 12\sqrt{2} + 8 - 4 \\ = 13 + 12\sqrt{2}, \text{ or about } 29.97 \text{ sq. in.}$$

- 9) This one is a bit tough - so hang on. What we can do is factor both  $a$  and  $b$  into prime factors.

Thus let  $a = p_1^{\alpha_1} p_2^{\alpha_2} \dots p_n^{\alpha_n}$  and  $b = p_1^{\beta_1} p_2^{\beta_2} \dots p_n^{\beta_n}$

(Of course, some of the  $\alpha_i$  or  $\beta_i$  may be zero.) Now we know that  $a|b^2$ , so there exists at least one  $i$  such

that  $p_i^{\alpha_i} | b^2$ . So  $p_i^{\alpha_i} | p_i^{2\beta_i}$ , which implies that  $\alpha_i \leq 2\beta_i$ .

Similarly, using the given fact that  $b^2|a^3$ , we obtain  $p_i^{2\beta_i} | p_i^{3\alpha_i}$ , from which we conclude  $2\beta_i \leq 3\alpha_i$ . Repeating the argument in this manner, we have

$$(2n-1)\alpha_i \leq 2n\beta_i$$

$$\text{and } 2n\beta_i \leq (2n+1)\alpha_i \text{ for all } n.$$

Note that if  $\alpha_i = 0$  then we must also have  $\beta_i = 0$ .

Otherwise,  $\frac{2n-1}{2n} \leq \frac{\beta_i}{\alpha_i} \leq \frac{2n+1}{2n}$  for all  $n$ , from which

we conclude  $\frac{\beta_i}{\alpha_i} = 1$ , or  $\alpha_i = \beta_i$ . Thus, going back to

the factored form, we have  $a = b$ .

- 10) Let  $v(x)$  be the runner's speed at point  $x$  from the starting point and let  $2a$  represent the circumference of the track. Let  $f(x) = v(x+a) - v(x)$ . Thus,  $f(x)$  represents the difference in speeds at diametrically opposite points. Now we note that  $f(0) = v(a) > 0$  and  $f(a) = v(2a) - v(a) = 0 - v(a) = -v(a) < 0$ . Since  $f(0)$  and  $f(a)$  have opposite signs, there must exist a point  $x_0$  between 0 and  $a$  at which  $f(x_0) = 0$ . But then  $v(x_0+a) - v(x_0) = 0$ , or  $v(x_0+a) = v(x_0)$ .



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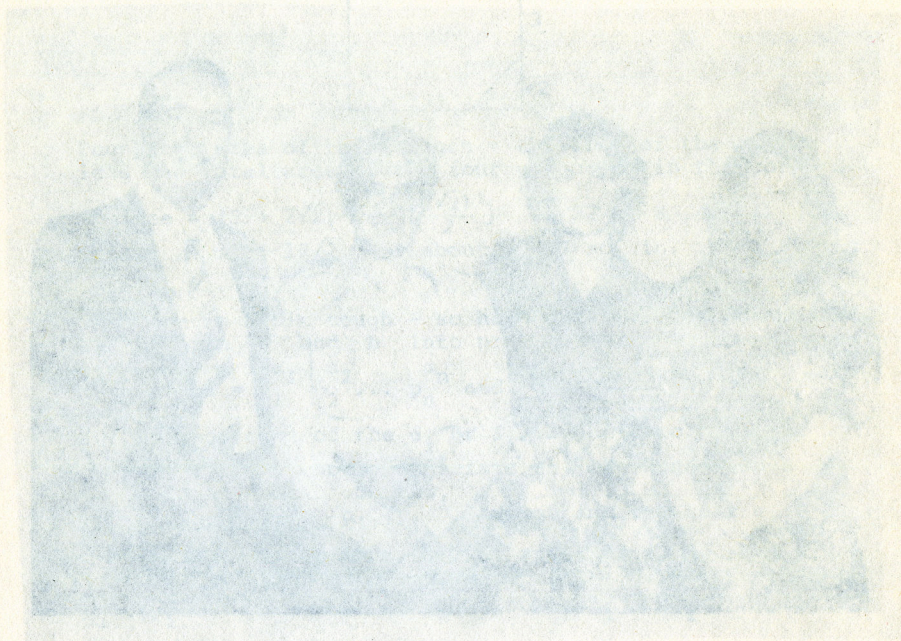
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