Berkeley
Mathematics
Newsletter

A newsletter for the alumni, faculty, staff and students of the Department of Mathematics at the University of California at Berkeley

Riemann's 'Nondifferentiable' Function

BY DONALD SARASON

The accompanying pictures are from the article [1] of J. J. Duistermaat of the University of Utrecht, currently visiting Berkeley. Figure 1.1 depicts the graph of the function

$$f(x) = \sum_{n=1}^{\infty} (n^2\pi)^{-1} \sin(n^2\pi x) \qquad (x \in R),$$

which, according to K. Weierstrass, was proposed by G. F. B. Riemann as a nondifferentiable function. (At least one commentator [5], however, questions whether Riemann actually believed the

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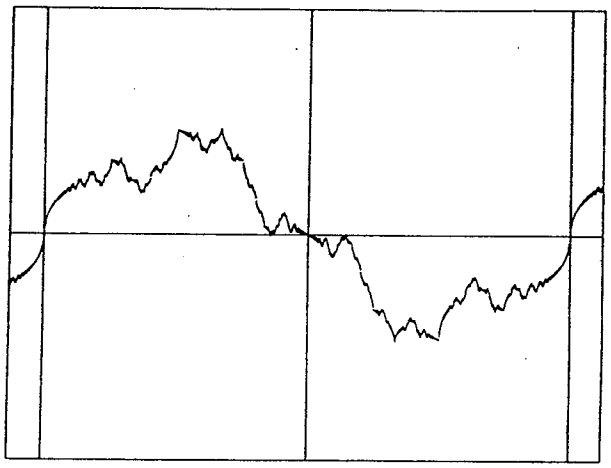

FIGURE 1.1. $y = \sum_{n=1}^{\infty} \frac{1}{n^2\pi} \sin(n^2\pi x); -0.127 < x < 2.127; |y| < 0.845.$

Message from the Chair

BY JACK WAGONER

Greetings and welcome to the Fall 1994 edition of our departmental newsletter.

THE BUDGET

One of the primary concerns of the last few years at Berkeley has been the budget problem stemming from a decrease in funds from the State. For 94-95, the Department received another 1% permanent budget cut of $64,000, which was absorbed through reductions in our visiting teaching program. If state revenues received are lower than anticipated in the state budget, the University may face mid-year cuts. However, word from the College is that it is unlikely that further cuts will be allocated to individual departments this year. Further permanent budget cuts next year may require reductions in our teaching assistant program, which we have done our utmost to protect up to this point.

RETIRING FACULTY

One of the measures taken by the University to help solve its budget problems has been the program of three VERIP early retirements starting in July 1991. When our last newsletter was written, it was expected that a sizable number of mathematics faculty would take VERIP III. But we didn't know how many would actually do so. In the end, there were 10: Professors John Addison, Shoshichi Kobayashi, Ralph MacKenzie, Sherman Lehman, Andrew Ogg, Beresford Parlett, Stephen Smale, Robert Solovay, John Stallings, and Joseph Wolf.

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Highlights

What's inside this issue:

(Riemann *continued from page 1)*

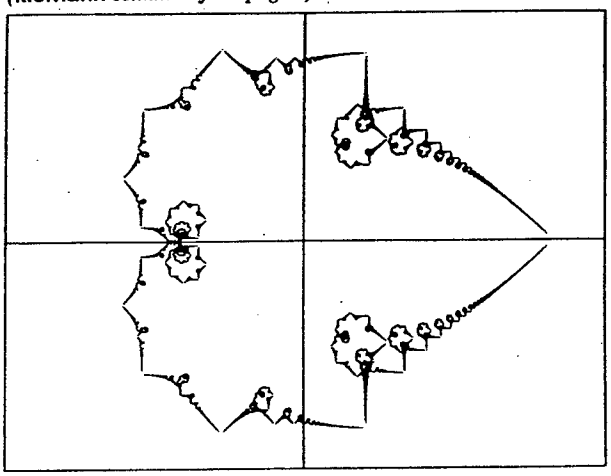


FIGURE 1.3. $x = g(t), y = f(t); |x| < 0.637; |y| < 0.477$

function to be *nowhere* differentiable.) Figure 1.3 depicts the range in the complex plane of the function $i\phi$, where $\phi = f - ig$, and g is defined by replacing sine by cosine in the series for f:

$$g(x) = \sum_{n=1}^{\infty} (n^2\pi)^{-1} \cos(n^2\pi x).$$

The first rigorous confirmation of Riemann's suggestion was published by G. H. Hardy [4] in 1916; he proved that f is nondifferentiable at all irrational values of x and at certain rational ones. There matters stood until 1970, when J. Gerver [2] confounded expectations by proving that f is in fact differentiable, with derivative $-\frac{1}{2}$, at rational values of x whose numerator and denominator are both odd. In a subsequent paper [3] Gerver settled the other cases left open by Hardy, proving that the preceding points are the only ones where f is differentiable.

In his article, and in a September Mathematics Department Colloquium, Professor Duistermaat explained how one can base a study of Riemann's function on the classical theta function, defined in the upper half-plane by

$$\theta(z) = \sum_{n=-\infty}^{\infty} \exp(in^2\pi z).$$

The function θ lacks boundary values on the real axis, and the series defining it does not converge in the standard sense when z is real. However, formally one has $\phi' = \frac{1}{2}(\theta - 1)$, an equality that becomes literally true if one extends ϕ in the natural way to the upper half-plane.

The function θ is periodic with period 2, and it obeys the functional equation

$$\theta\left(\frac{-1}{z}\right) = e^{-\pi i/4} z^{1/2} \theta(z),$$

which goes back to C. F. Gauss, A. Cauchy, and S. Poisson. Starting from these two transformation laws, Professor Duistermaat is able to deduce the differentiability properties of Hardy and Gerver, as well as the selfsimilarity features of f and ϕ that one can detect in Figures 1.1 and 1.3 and, at a magnified scale, in Figure 4.2.

As many of you know, Joseph Gerver was a graduate student at Berkeley, receiving his Ph.D. in 1976. His startling discovery of points of differentiability of Riemann's function was made before his arrival here, when he was an undergraduate at Columbia. What follows is a slightly abridged version of a recent communication from Gerver. (Gerver's notation is slightly different from Duistermaat's; in his definition of Riemann's function, the factor π does not appear.)

"I first heard about the problem my sophomore year, in Lang's Calculus III class. He mentioned

(continued on page 10)

Researcher Makes Waves

BY ALBERTO GRUNBAUM

Professor Johannes (Hans) Duistermaat is widely known for his fundamental contributions to the study of wave phenomena, Fourier integral operators, Lie theory, differential equations and mechanics. He has visited Berkeley on several occasions; this time his stay is for six months as a research associate.

He recently completed a term as Chair of the Mathematics Department at the University of Utrecht, where he received his Ph.D. in 1968 and is currently a professor.

He has common research interests with Professors Weinstein, Marsden, and Grunbaum, among others. The title of his talk from a recent lunch seminar sponsored by the Center for Pure and Applied Mathematics, "Rolling rigid bodies", is equally reflected in his intense, perhaps dramatic style of wind surfing, one of his interests outside of mathematics. His other interests include chess and tennis. Ω

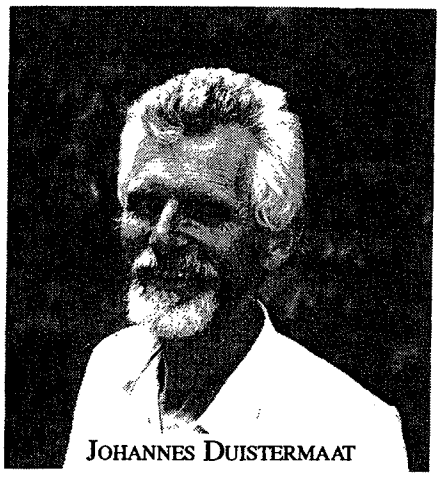


Photo by George Bergman

JOHANNES DUISTERMAAT

Students Reward Instructor

BY RONDI PHILLIPS

Sam Gebre-Egziabher had his first experience with the Professional Development Program (PDP) when, as an undergraduate at Cal State Northridge in Los Angeles, he applied to participate in the 1990 Summer Math Institute at UC Berkeley. Later, when he was a Mathematics Graduate Student Instructor at Berkeley, Lana Fukasawa of PDP remembered him and invited him to teach one of their sections in Math 1A. It proved to be a rewarding and inspiring job.

Mathematics more than "Plug in Formulas"

Gebre-Egziabher likes the format for teaching these PDP sections. Twenty students meet with him for five hours a week. They go over homework problems the first half hour of class; then the remainder of the time they solve math problems together. These problems are more challenging than the homework and are more than "plug in formula" type problems. The students find out how much thought and trial-and-error goes into mathematics. Most like it. Others find out how difficult and "challenging" mathematics really can be.

Photo by Steve Hillion

SAM GEBRE-EGZIABHER

The challenge and problem-solving with groups was so inspirational and different from high school math that one student decided she would declare mathematics as one of her majors. Gebre-Egziabher says, "It's fun to see how they tackle the problems and begin to develop their understanding of mathematics. More student involvement makes teaching easier." He added that not only does he get a chance to know his students better, to see their problems and what help they need, but he has lots of resource help at PDP for his and the students' use. There is a computer lab and software, books, and problem-solving workbooks available in PDP's library.

"It's fun to see how they tackle the problems"

Spring 94 semester, Gebre-Egziabher taught Math 1B. Some of his students were those he had taught in Math 1A. The students appreciated his hard work, enthusiasm and inspiration so much that they presented him with a plaque at the end of the year to honor him. Ω

PDP Intensives Need GSI's

BY RONDI PHILLIPS

For the past six years the Department of Mathematics and the PROFESSIONAL DEVELOPMENT PROGRAM (PDP) have been organizing and offering intensive sections in the Math 1 series and Math 32 aimed at minority and women students. The goal is to get under-represented students to consider mathematics as a major and help them succeed in "gateway" courses on campus (such as Math 32, 1A, or 1B).

These smaller group sections meet for longer times per week to allow better opportunities for sharing, teacher with students and students with each other. The graduate student instructor (GSI) only teaches one of these longer sections, rather than the normal two-section load and receives 60% time rather than the usual 50%.

The teaching style, Cooperative Learning Model, was developed at PDP and has been a successful adjunct during the last five years to mathematics courses, as well as in Chemistry. Plans are being developed now to add these sections to Biology and Physics. This style encourages students to work in groups and utilize each other as resources. The GSI becomes more familiar with her/his students thereby enabling more individualized help for them.

Graduate student instructors are encouraged to consider teaching in PDP. For more information contact:

Lana Fukasawa
642-7659
lanarae@uclink

Ω

Announcements

It is with regret we announce the death of PROFESSOR ALFRED FOSTER on December 24, 1994 at age 90. He died of complications from his surgery last spring. His ashes were scattered over the ocean Thursday, January 5, by his express wish.

PROFESSOR RAPHAEL ROBINSON, who suffered a stroke on December 10, 1994, has moved to Sheffield Convalescent Hospital at 1133 Van Ness (between 22nd & 23rd Streets) in San Francisco. Those who know him well may wish to pay him a brief visit; he is unable to talk but responds to yes / no questions by nodding.

Visitors Welcomed

BY HARUKO BRUCE

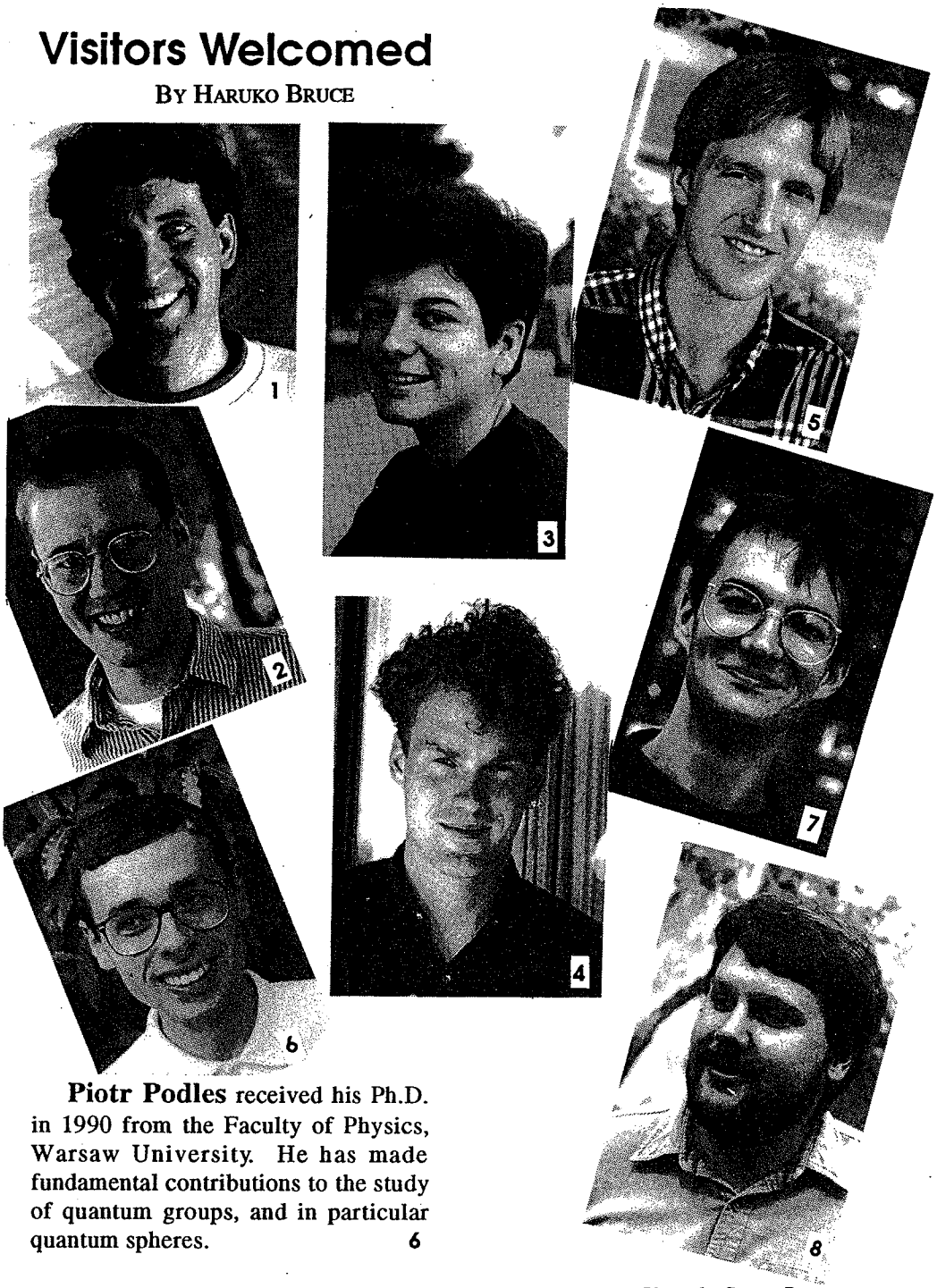
David Auckly received his Ph. D. from the University of Michigan in 1991. He studied under Peter Scott, and has subsequently been an instructor at the University of Texas. His research mostly concerns gauge theory and 3-dimentional topology, and is so well regarded that he won an NSF postdoc last year. 1

Charles Conley received his Ph. D. in 1991 from UCLA. Before coming to Berkeley, he held a position as a C.L. E. Moore Instructor at MIT. His research concerns representations of Lie groups and applications to physics. 2

Galia Dafni received her Ph. D. from Princeton this year. She is a mathematical analyst, with strong research interests in harmonic analysis and several complex variables. Her thesis concerned the interplay between two types of hardy spaces which are defined for regions in n-dimensional complex space. She is a Morrey Assistant Professor. 3

Joel Hamkins received his Ph. D. this year from UC Berkeley. He studies logic and set theory, with a particular emphasis on the interaction of large cardinals and forcing. In his dissertation he proved the relative consistency of there being a strong, supercompact or I1 cardinal whose measurability is fragile. Because he proved it by forcing, this result supports the meta-mathematical view that much larger cardinals do not have irregular implications down low. 4

Richard Kenyon received his Ph. D. from Princeton University in 1990. He is currently on leave from the Centre National de Recherche Scientifique in France. He is primarily a geometer, with extensive research interests in self-similar and aperiodic tiling of the plane, fractal geometry, and quasiconformal mappings. 5



Photos by George Bergman

Piotr Podles received his Ph.D. in 1990 from the Faculty of Physics, Warsaw University. He has made fundamental contributions to the study of quantum groups, and in particular quantum spheres. 6

Justin Roberts received his Ph. D. from Cambridge University this year. He is a topologist, primarily interested in the so-called "quantum" invariants for low dimensional manifolds, originating in heuristic work of Witten. He has, in particular, provided a very elegant interpretation of the Turaev-Viro invariant, in terms of skein theory and handlebody decompositions. He is a Morrey Assistant Professor. 7

Ted Stanford received his Ph. D. in 1993 from Columbia University. He works on Vassiliev invariants of knots, and their generalizations to other knot-like objects such as braids, links, tangles, etc. He also works on the relationship of Vassiliev invariants to other areas of low-dimensional topology. Ted is also a recipient of the prestigious NSF Fellowship award. 8

MUSA on the Move

By Luke Clossey

The Mathematics Undergraduate Student Association (MUSA) is a group of students who are eager to make Berkeley an exciting place to study mathematics at the undergraduate level.

MUSA offers a variety of services and sponsors a number of events throughout the academic year. We provide free drop-in tutoring and maintain extensive exam files for many undergraduate classes. We also keep brochures on math graduate programs, and we help distribute actuarial information. This fall we are sponsoring a pair of lecture series designed to acquaint undergraduates with a wide range of mathematical topics.

Additionally, MUSA has initiated a Usenet newsgroup, ucb.math.undergrads. This serves as a "virtual bulletin board" on which people can post announcements, questions, and comments. One way to access this newsgroup is by entering "trn ucb.math.undergrads" at a unix prompt.

Another means of communication available to Mathematic majors are message boxes, found in 938 Evans. Important surveys such as when seniors would like commencement ceremonies are distributed there.

MUSA's traditional spring activities include a book sale, Career Day, and a T-shirt designing contest and sale. In addition, we administer the Department's Teacher of the Year award and hold elections for next year's MUSA officers. This year Luke Clossey was voted in as President and Nancy Lai as Vice-President. Last year's incumbent, Graham Randall, was chosen for this year's Treasurer.

MUSA is currently looking for professors to lecture on topics of interest to undergraduate students. We are also eager to get in touch with alumni who are interested in describing their experiences in the job world at our Career Day in the spring. If you can help, or if you would like more information about any of our services, please contact us in 1064 Evans or at musa@math. Ω

MGSA Looks Out for Grad Students

The Mathematics Graduate Student Association is a student-run organization whose purpose is to promote and organize activities that will bring together its members, and allow them to discuss mutual concerns as well as to meet other members of the mathematics department. It also seeks to represent graduate mathematicians by relaying their concerns in the appropriate direction.

Any Berkeley mathematics (or logic) graduate student is automatically a member, and may vote in elections for officers at the end of the Spring semester.

The MGSA officers for this academic year are Concha Gomez (President), Steven Hillion (Vice-President), and Greg Perry (Treasurer). They can be found in 1049 Evans, and encourage drop-in visitors during weekly office hours posted on the door.

Activities of the MGSA include the organization of social events (such as the Halloween party and the Spring picnic), orientation receptions for various student groups, and commencement ceremonies in the Fall and Spring.

The MGSA also maintains folders with qualifying exam questions, a student directory, and a handbook of graduate student services in the department. All students are encouraged to make full use of the resources which the MGSA provides, and to suggest ways in which it can pool the talents and information which exist in the department's student body.

The officers are also constantly looking for volunteers to help them with various projects during the course of the school year. Feel free to send e-mail to the officers at mgsa@math. Ω

Graduate Student Awarded Sloan

Jeremy Avigad from UC Berkeley's Department of Mathematics is one of the recipients this year of the Alfred P. Sloan 1994 Doctoral Dissertation Fellowship. Nominations are solicited each year by the Sloan Foundation from the Chairs of leading graduate departments of economics and mathematics. The Sloan Dissertation Program, established in 1984 to assist doctoral candidates complete their research and dissertation, allows Fellows to concentrate on finishing their doctoral work. The award covers full tuition plus a stipend of $14,000.

Jeremy, born in New York City in 1968, was an undergraduate at Harvard where he took courses in computer science as well as mathematics. He came to Berkeley knowing that he was looking for a mathematical basis for understanding computation. With somewhat of a revelation, he discovered in his first year here, that logic offered such a basis. He has been hooked on logic ever since. Jeremy studies Logic under Jack Silver.

Classical mathematical reasoning is highly non-constructive, making implicit references to a weird Platonic realm where mathematical objects live. Jeremy's field, Proof Theory, looks for constructive justifications of such reasoning and tries to find the computational algorithms that are "hidden" in classical proofs. His research in particular has focused on theories of "ordinary" mathematical strength, that is, theories which are just strong enough to capture the day-to-day practice of the average working mathematician. Ω

MSRI Workshop Breaks Spell

BY JANE GILMAN AND WILLIAM THURSTON

Photo by Nancy Shaw

MSRI HYPERBOLIC GEOMETRY WORKSHOP PARTICIPANTS, SUMMER 1994

UC Berkeley graduate students Ken Bromberg, Greg Anderson, Mahan Mitra, Aaron Abrams (standing, l-r), Jeff Brock, David Gay, Nancy Cunningham, Karen Edwards, Daniel Allcock (sitting, l-r) and Wayne Whitney (missing) were among a group of 50 from around the country who participated in a two-week Workshop on Hyperbolic Geometry at the Mathematical Sciences Research Institute (MSRI) this summer.

The workshop was taught by Professors David Epstein (University of Warwick), Jane Gilman (Rutgers-Newark), and William Thurston (MSRI), who used such items as paper, scissors and gluesticks, in addition to traditional lectures as a way to draw people in and to break the spell of the symbolic representations of mathematics.

The goals of the workshop were to convey a glimpse of some beautiful mathematics, to really engage students in thinking, learning, communicating, and colaborating, and to stimulate students to rethink culturally ingrained patterns of teaching.

The workshop was a novel experience for most of the participants, and many people commented on the tremendous energy and the creative atmosphere. Ω

Library Welcomes New Manager

The Astronomy/ Mathematics/ Statistics Library underwent another important change during the summer. A new Managing Librarian has been appointed to head the library for the eighteen months remaining in Ralph Moon's appointment as Assistant University Librarian.

Catherine Candee, a recent graduate of UC Berkeley's School of Library and Information Studies, is at home in the Math Library. As a graduate student, Catherine completed her internships and a field study in other Berkeley science libraries, and conducted her independent research projects at the Astronomy/Mathematics/Statistics Library.

Catherine's recent experience includes four years at the Northern California Regional Audio Visual Library of Kaiser Permanente, and ten years as the Circulation Manager for the Institute for Social and Economic Studies.

Already working closely with faculty and staff in the Mathematics, Astronomy, and Statistics Departments, Catherine is committed to maintaining the excellent service and superior collection for which the library is known. An amateur astronomer in her private life, she lives in North Berkeley, with her husband and three children. Ω

Photo by George Bergman

CATHERINE CANDEE

What are UCB Math Alumni Doing Now?

Casey Fitzsimons (AB, 1968), after obtaining her degree in math at UCB, continued her studies in art and law. She received a master's degree in Fine Arts at San Jose State University and a law degree from Hastings. After practicing law a couple of years, Casey taught art, published a book on drawing, and now edits high school math books for Addison Wesley Publishing Co. She says she uses her art to assist math and physics authors give their material visual appeal. Additionally, Casey does free-lance visual art development and text-editing for math and science authors. If you need an editor / artist for your publication, you can reach Casey at (415) 364-3265.

Matthew Franklin (MA, 1985) obtained a Ph.D. in computer science from Columbia University in 1993. He is currently a Technical Staff Member for AT&T Bell Labs Research. His special interests are cryptography and distributed computing.

Sander Greenland (AB, 1972; MA, 1973) received a Ph.D. in Epidemiology from the University of California at Los Angeles in 1978 and is now a professor at the School of Public Health at UCLA.

Hugh M. Griffith (AB, 1989) is currently working on pursuing an MS degree in Mathematics at CAL State University-Los Angeles. He teaches math to high school students and says of them, "The kids in our California public schools (contrary to public opinion) are eager to learn and better themselves!" Hugh also keeps busy playing competitive racquetball, initiated by his experience with CAL's Racquetball Team at UCB. [Editor's note: Thanks, Hugh, for your enthusiasm and vote of confidence in the youth of today!]

Chuck Mason (AB, 1977) is currently employed by the Department of Economics and Finance at the University of Wyoming in Laramie.

Sister Monica C. Masso, CSC (AB, 1984) professed final vows in the Congregation of the Sisters of the Holy Cross in summer, 1993. Currently, she is working on her doctoral degree at Notre Dame in Scripture, particularly, the Hebrew Bible, for which she prepared by obtaining a master's in Systematic Theology from Notre Dame in 1992.

Mike Matsumoto (AB, 1974) is currently on a one year assignment in Tokyo, Japan working as liaison between engineering in Tokyo and the Mountain View, CA headquarters for Adobe Systems. Adobe is a major manufacturer of PostScript printers.

Michael May (Ph.D. 1988) is currently working as an assistant professor of mathematics at St. Louis University in St. Louis, MO. In June, 1993 he was ordained a Catholic priest. Michael also has a Masters of Divinity from Weston School of Theology.

William I. McLaughlin (Ph.D. 1968), manager of advanced astrophysics missions at Jet Propulsion Laboratory in Pasadena, CA recently, and to his surprise, resolved the 2500-year-old set of Zeno's paradoxes, using Edward Nelson's version of nonstandard analysis. His technical paper can be found in the September 1992 issue of SYNTHESE; a more "popular" version is scheduled for the November 1994 issue of SCIENTIFIC AMERICAN.

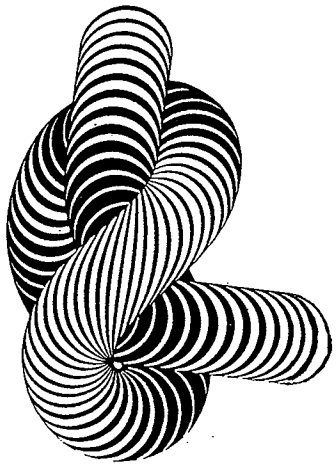
Richard W. Montgomery (Ph.D. 1986) received a Fulbright fellowship for five months at the Isaac Newton Institute of Mathematical Sciences in Cambridge, England. He works as an associate professor at U.C. Santa Cruz.

David Pearce (AB, 1976) is currently a member of the faculty at UCSF in the Department of Medicine's Program in Biomedical Sciences.

K. Brooks Reid (AB, 1964; Ph.D. 1968 Univ. of Illinois) is occupied with a second career as one of twelve founding faculty of California State University at San Marcos in 1989-90. Classes started in Fall 1990 and the University now has six mathematicians and a new M.S. Program. Professor Reid currently works in combinatorics/graph theory and holds an O.N.R. research grant. He has published about 50 papers. At Louisiana State University from 1968-89, Professor Reid moved through the ranks from Assistant to full Professor, and Chair from 1987 until early retirement in 1989.

Howard G. Tucker (AB, 1948; MA, 1949; Ph.D. 1955) is currently a professor at the University of California at Irvine, having refused early retirement with VERIP. Professor Tucker says he is "very much involved in research in Probability and mathematical statistics, teaching (number theory and experimental design) and collegial statistical consulting."

Stephen Wong (MA, 1973) works as a computer scientist/math programmer at Lawrence Livermore National Laboratory.



Two Math Dept Staff Launch Restaurants

By Deborah Craig

It's said that *everyone*, sooner or later, wants to open a restaurant, despite the known high failure rate that scares off most of those dreamers. Recently, two staff members of the Department of Mathematics overcame the fear of failure to follow their dreams.

Deborah Craig, a secretary in the Faculty Services Unit, and her husband, Gary, are new owners of **Rocky's New York Pizza** on Solano Avenue. Their partner and chef, and the restaurant's namesake, is Rocky Grunner, a New York native with many years of experience as owner/operator of Bay Area pizzerias.

Sui Jen, payroll and personnel assistant in the Personnel and Finance Unit, is co-owner and manager with Marlin Wong of **Viet Nam Village** in the mini-mall on Durant Avenue. (In the "It's a small world" category of coincidences, this is where Rocky Grunner got his start in the 70's, with the former Carolina Pizza.)

The Craigs teamed up with long-time friend Rocky to open their small restaurant in April – at the top of Solano Avenue at the corner of The Alameda on the premises of the former Cafe Glenda. Their specialty is Rocky's authentic New York thin-crust pizza, sold by the slice or in whole pies, to eat in or take out. Many of their regular customers are transplanted natives of the Big Apple who miss their regular neighborhood take-out pizza joint, and who praise Rocky's pizza as "the real thing".

Unusual for a pizzeria, Rocky's also sells hamburgers and grilled sandwiches, including "Veggieburgers". Rocky says, "The burgers sell almost as well as the pizza". (Copy Editor's note: Rocky's serves just about the best Calzone anywhere, and they deliver!)

Photo by Gary Craig

Gary & Deb Craig and Rocky Grunner at Rocky's

Photo by Gary Craig

Marlin Wong and Sui Jen at Viet Nam Village

Many years of experience working in her parents' restaurants convinced Sui Jen to try her hand at ownership. When an opportunity presented itself at the Durant Avenue location, she decided to make the leap. She has been working seven days a week since June to keep it prospering, in addition to her duties in the Math Department and pursuing an MBA at Cal State Hayward.

The Viet Nam Village serves the popular native beef-noodle soup known as Pho. She says, "It's one of our best sellers". Other specialties include an assortment of noodle dishes and barbecued meats, curry dishes and great sour soups. (Another Copy Editor's note: At the top of the soup list is The Village's special yellow noodle soup!)

Both Deborah and Sui say business is good but could be better. With more than 300 restaurants in Berkeley, competition is fierce for customers – especially for those loyal patrons whose return business can be counted upon to pay the overhead. Both women say that once folks try their restaurant's fare, they usually return. The problem is getting more people to try the first time.

What are the mathematical probabilities of these enterprising women succeeding against the odds? Figure the answer while enjoying a slice of pizza at Deb's place or a bowl of pho at Sui's. Then, tell your friends. Ω

Manager Acknowledges Staff

BY CAROLYN KATZ

Reynolds promoted to Supervisor

Our summer was very busy, a time of transition. Following the spring departure of Doris Smith, Stephanie Reynolds (formerly Math's Undergraduate Assistant) was promoted to the Supervisor's position in Student Services. Stephanie was successful in expanding counseling and other student services in her former position and I know that she will continue to enhance student services in her new role.

Hong joins Math Dept

Christina Hong joined Math in August to fill the Undergraduate Assistant's position. Christina has been a valued employee of the School of Education, having worked in both the undergraduate and graduate student services offices. She brings a special student's perspective, as she received her B.A. degree in Political Sciences in 1990. Christina has settled into her new position quickly; already she has made significant contributions to the Department by expanding the informational flyers distributed to undergraduate students regarding various academic and departmental issues. She plans to work closely with MUSA to develop an undergraduate newsletter as another means of communicating information to our students.

Lopez accepted in School of Education

It is with mixed feelings that I announce the departure of Julianna Lopez, who has served as Projects Coordinator for the past one and a half years. Julianna enabled us to implement a number of projects which helped us improve communications and departmental operations, including researching and implementing a new system for teaching evaluations. I valued her perpetual enthusiasm, energy, and creativity; and her willingness to volunteer for any job. We will miss her. However, I was delighted when I learned of her acceptance in the Ph.D. program in Language and Literacy in the School of Education. Her dream of making an impact in the field of education is coming to fruition. Her new position working to help develop Education's Cal Corps Program will bring her closer to achieving her educational goals. So it was with best wishes for her success that we bade her farewell at the end of September.

I offer a warm welcome to our new Mathematics students. Please drop by or send me e-mail if you have any concerns. Through our collaborative efforts, we will continue to make progress toward achieving administrative improvements. We are grateful to the students who have so generously given their time and energy toward this goal.

JULIANNA LOPEZ

STEPHANIE REYNOLDS

CHRISTINA HONG

Photos by George Bergman

(Riemann *continued from page 2)*

it in a lecture in December 1967, after reading about it a few years earlier in a memorial article on Hadamard that Kahane had written. Lang was under the impression that nothing was known about the function, and I proved within a few days that it has an infinite derivative at 0. So Lang wrote to Kahane, who told him that Hardy had proved in 1916 that the function is not differentiable at $\frac{(2a+1)\pi}{4b+2}$, $\frac{2a\pi}{2b+1}$, and π times any irrational. Then, in February 1968, while in bed with the flu, I started thinking about the point $x = \pi$, and within a few weeks convinced myself that the function has a derivative of $-\frac{1}{2}$ there, although it took me the rest of the spring semester to write up the proof. It turned out to be fairly straightforward to extend this result to $\frac{(2a+1)\pi}{2b+1}$. About a year later, I showed that the remaining points which Hardy had not covered were non-differentiable. In my thesis I shortened the proof somewhat and also came up with some results on

$$F(x) = \sum_{n=1}^{\infty} \alpha(n)^{-1} \exp(i\alpha(n)x)$$

for $\alpha(n)$ other than n^2, the principal result being that there exist $\alpha(n)$ with growth arbitrarily close to, but less than, exponential, for which $F(x)$ is differentiable on a dense set of x. (Hardy had proved that $F(x)$ is nowhere differentiable if $\alpha(n) = c^n$ with $c > 1$.)

"By the way, after avoiding thinking about this problem for twenty years, I have recently returned to it. In particular, inspired by the 1979 paper of Heath-Brown and Patterson on Kummer sums (the cubic version of the Gauss sums that were pivotal to my work on the Riemann function) I have been working on

$$F(x) = \sum_{n=1}^{\infty} n^{-b} \exp(in^3x).$$

I can prove that $F(x)$ is differentiable almost nowhere if $b < \frac{1+\sqrt{10}}{2}$. The best previous result (Luther) is that $F(x)$ is nowhere differentiable if $b \leq 2$. I will be giving a ten-minute talk on this result at the AMS meeting in January."

Gerver is now a professor at Rutgers University, Camden.

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3. J. Gerver, "More on the differentiability of the Riemann function." *Amer. J. Math.* 93 (1971), 33-41.
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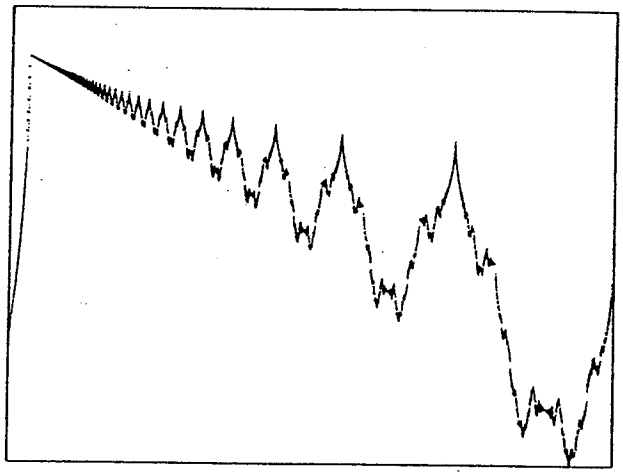

FIGURE 4.2. $y = f(x)$ near $x = ½$; $0.498 < x < 0.563$; $0.349 < y < 0.398$ Ω

Alumni News & Update Form *(please type or print, using a separate sheet if necessary)*

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What items in this issue were of particular interest to you?

What other types of articles or information would you like included in future issues?

Other Comments:

Thank you for taking the time to help us plan for our next issue. Please return this form to:

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Editor's Letter

RONDI PHILLIPS

Your responses are appreciated very much. I get my best ideas from reading about what you want to read. Please keep our "dialogue" open with updates on what you are doing. I always like to include photos in the newsletter, so please send pictures.

Several people have asked about making donations to the newsletter, which, of course, are welcomed. The intent of the newsletter is to keep in touch with our alumni and math community. As for donations, feel free to contact either Carolyn Katz, manager of the department, or Jack Wagoner, Chair, who know what projects need funding. They can be contacted through the News and Update Form on this page, or by calling them at **(510) 642-4129 or 642-0692.**

Corrections from last issue:

- The page numbering for Spring 1994 issue should have read as follows: page 8, 10,11, 9, 12. We are sorry for the inconvenience this may have caused you when reading the article.

- Professor John Addison was also elected into the Golden Key National Honor Society at the same time as Professor Paul Chernoff, March 15, 1994.

(Chair *continued from page 1*)

I thank each of these faculty for many years of dedicated service to mathematics and to this university. A number of the them, along with other recent emeriti, are still quite active in research, seminars, etc. We deeply appreciate their continued participation in the life of the department.

REBUILDING

The UC Berkeley campus has lost about 29% of its faculty to the three VERIP programs. The regular ladder faculty in our department numbered 67 in July 1991, and since then we have lost 23 faculty, or 34%, to early retirement. In addition, there have been two deaths and two separations. With recent additions to our ranks we currently have 50 regular faculty, a total decrease of about 25% from July 1991. The long range campus plans call for building back up to a faculty size at Berkeley of about 1420, which is 10% less than just before July 1991. Just how this overall cut will be distributed among individual departments is a topic of ongoing review and debate at several levels. Our departmental goal is to rebuild to at least 60 faculty. The coming years will be ones of exciting opportunity. We will continue to review the department's academic and administrative programs and identify areas which can be strengthened and improved.

LATEST ON FERMAT

On a final note, here is an update on Fermat's Last Theorem. Many of you no doubt remember that in Summer 1993 Professor Andrew Wiles of Princeton University announced the solution of Fermat's Last Theorem. Namely, that $x^n + y^n = z^n$ has no positive integer solutions for $n > 2$. Much excitement and fanfare followed the world over. But as Fall 1993 unfolded, it turned out that there was a gap in the proof. However, FLT has come to life again just recently. Wiles and one of his former students, Professor Richard Taylor of Cambridge University, have announced that the gap has been corrected. They have circulated a joint paper in which rings of Hecke operators are apparently used to repair the portion of Wiles' original manuscript which contained the gap. At the present time there is a feeling of guarded optimism as the new manuscript is being reviewed by other mathematicians to independently verify that the new proof is correct.

Remember to stay in touch and to let us know any suggestions you might have about improving our communication with you. Ω

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