MathFest 2006

PRIZES and AWARDS

Knoxville, Tennessee

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Program

Opening and Closing Remarks

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Mathematical Association of America

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Carl B. Allendoerfer Awards

The Carl B. Allendoerfer Awards, established in 1976, are made to authors of expository articles published in *Mathematics Magazine*. The Awards are named for Carl B. Allendoerfer, a distinguished mathematician at the University of Washington and President of the Mathematical Association of America, 1959-60.

Robb T. Koether and John K. Osoinach, Jr.

"Outwitting the Lying Oracle," *Mathematics Magazine*, vol. 78, no. 2, 2005, pp. 98-109.

A coin is flipped n times, and, each time, you first wager a certain amount and then try to predict the outcome. If you are wrong you lose your money and if you are right your money is doubled. Enter the oracle, and the game becomes much more enticing. Each time, after you announce your wager but before you make the prediction, the oracle will tell you how the coin is going to land. The twist is that the oracle may lie up to k times. What should your strategy be?

Biographical Note

Robb Koether is a Professor of mathematics and computer science at Hampden-Sydney College in Virginia, where he has taught for the past 25 years. He earned his bachelor's degree in mathematics at the University of Richmond in 1973 and his Ph.D. in algebra at the University of Oklahoma in 1978 under the direction of Bernard R. McDonald. At Hampden-Sydney College Koether enjoys the opportunity to teach in many different areas of mathematics as well as computer science. He also enjoys solving mathematical contest problems and other puzzles, one of which led to the paper "Outwitting the Lying Oracle," for which this award was given. Outside of teaching and mathematics, he enjoys many outdoor activities, including cycling, camping, and backpacking on the Appalachian Trail. He is active in a number of community organizations, including the local Boy Scout troop and his church.

Response from Robb Koether

I am greatly honored and humbled to be awarded the Allendoerfer Award . I would like to thank first my co-author John Osoinach, with whom it was a delight to work. It was largely through his enthusiasm that we pursued the ideas that developed into our paper "Outwitting the Lying Oracle." I would also like to thank Frank Farris and the anonymous reviewers who made many helpful and necessary comments on ways to improve our work. Finally I would like to thank my many graduate school professors who impressed on me, each in his own way, the importance of writing exactly what you mean to say. If winning the Allendoerfer prize is a measure of our success at communicating our enthusiasm for mathematics to others, then we are deeply gratified.

Biographical Note

John Osoinach earned his Ph.D. in 1998 at the University of Texas at Austin under the supervision of John Luecke. Immediately afterwards, he taught at Eureka College until 2000, when he married and moved to Virginia to take a position at Hampden-Sydney College. While his main area of research is in low-dimensional topology, specifically the geometry and topology of 3-manifolds, his work at small, liberal arts colleges has expanded his range of mathematical curiosity. In addition to his own research, John has supervised several undergraduates in research projects ranging from topology to the mathematics of social choice. He will begin a new position in the fall of 2006 as an Assistant Professor of mathematics at Millsaps College.

Response from John Osoinach, Jr.

I am honored and deeply humbled in receiving the Carl B. Allendoerfer Award. As an undergraduate at Vanderbilt University I was given a subscription to *Mathematics Magazine*, and I have always read the articles with keen interest. Many of the ideas in the article originated from an undergraduate contest sponsored by our department at Hampden-Sydney College. The contest was intended to spark curiosity among our majors. I am gratified and excited that this article might continue to inspire undergraduates to explore their own ideas in mathematics, so that they might too learn the joys of mathematical discovery. I would like to thank Bud Brown for his reading of the manuscript and his advice in submitting it to the *Magazine,* and Frank Farris for his numerous helpful comments. Finally, many thanks go to Robb Koether for his shared excitement and enthusiasm in writing the article.

Jeff Suzuki

"The Lost Calculus (1637–1670): Tangency and Optimization without Limits," ***Mathematics Magazine*****, vol. 78, no. 5, 2005, pp. 339–353.**

Every teacher of calculus knows that the need to understand and work with limits is what makes the definition of the derivative hard. Hence we are not surprised when historians tell us that there was much controversy with the original notions of the derivative and that it took several generations of mathematicians to get the meaning and definition of limits right. But the non-historians among us tend not to be aware of the competing definitions of the derivative that were developed in the seventeenth century. Suzuki's paper takes the reader on a pleasant ride through this little known history, and presents an "alternative universe" in which many of the problems encountered by a calculus student can be solved using an approach
that does not need limits.

In his 1637 book *La Géométrie*, Descartes gives an algebraic method for finding tangents to algebraic functions. To find a tangent to a curve at the point P, we first find the equation of a circle tangent to the curve at the point. Then the wanted tangent will be the line through P perpendicular to the radius of the circle. The problem of finding the equation of the circle is reduced to making sure that an algebraic expression has a double root. The work of Jan Hudde (1628–1704) who developed an algorithm for detecting double roots gives this method an important boost.

Using well-chosen examples, Suzuki brings the calculus of Descartes,
Hudde, Wallis, and Barrow back to life. He shows us interesting mathematics —with historical import— that can be appreciated by students and teachers of calculus.

Biographical Note

Jeff Suzuki, currently Associate Professor of mathematics at Brooklyn College, grew up in southern California with an inability to decide what he really wanted to do, so he ended up studying mathematics, science, and history, eventually earning his Bachelor's in mathematics (with a physics concentration) and history from California State University Fullerton. He went on to earn his M.A. and Ph.D. from Boston University with a dissertation on the history of the Lagrange-Laplace proof of the long-term stability of the solar system. He enjoys trying new things, and introducing them to his children William Y and Dorothy X Suzuki-Burke (yes, their middle names are "X" and "Y"), and his wife Jacqui, who are frequently subjected to his culinary, musical, and linguistic efforts. As a historian of mathematics he is especially interested in the eighteenth century.

Response from Jeff Suzuki

I am deeply honored to receive an Allendoerfer Award for "The Lost Calculus." Just being able to bring to life an interesting episode in the history of mathematics is a great joy, and the added excitement of being nominated for, not to mention actually winning, an Allendoerfer Award is immense. I'd like to thank Frank Farris for all his editorial work and patience, as well as Jacqui and the kids for putting up with my idiosyncratic writing and researching habits.

Trevor Evans Awards

The Trevor Evans Awards, established by the Board of Governors in 1992 and first awarded in 1996, are made to authors of expository articles that are accessible to undergraduates and are published in *Math Horizons*. The Awards are named for Trevor Evans, a distinguished mathematician, teacher, and writer at Emory University.

Ronald Barnes and Linda Becerra

"The Evolution of Mathematical Certainty," *Math Horizons*, September 2005, pp. 13-17.

In "The Evolution of Mathematical Certainty" the authors have done a marvelous job at concisely presenting the main story of the development of our understanding of the foundations of mathematics. Perhaps, more importantly, they have also shown us why mathematicians should care about these questions.

Biographical Note

Ronald Barnes received an undergraduate degree from Saint Bonaventure University and the Ph.D. from Syracuse University. He began his academic career at SUNY College Brockport and then moved on to the University of Houston-Downtown where he is currently Professor of Mathematics and Computer Science. He has been an active member of MAA and The American Statistical Association, on the national board of COMAP and editorial board of UMAP. He has written and lectured widely on mathematics, mathematics education and statistics and statistics education.

Biographical Note

Linda Becerra has a B.A. from the University of Texas at Austin and a Ph.D. from the University of Houston, where she is now an Associate Professor. She is the author of a college algebra text and several publications in mathematics and education. She has co-organized and taught teachers and students in summer camps and has mentored students in campus organizations.

Response from Ronald Barnes and Linda Becerra

We thank MAA for recognizing our paper, "The Evolution of Mathematical Certainty," with a Trevor Evans Award. The idea originated in our history of mathematics course, which begins with the earliest civilizations, but also includes more recent developments in the 19th and 20th centuries. This latter period contains much of the rigorous development of mathematics' foundations. Timelines are used to illustrate the "big picture" of the historical developments. While there are many excellent references for the development of the foundations of mathematics, we were unable to find any comprehensive references covering most of the known results.

To illustrate why these ideas are important, we introduced a number of topics such as the acceptance versus the non-acceptance of the axiom of choice (AC). We noted that several results in mathematics cannot be proven without AC, yet the Banach-Tarski paradox shows the counter-intuitive results that may occur when utilizing AC.

Stuart Boersma

"A Mathematician's Look at Foucault's Pendulum," *Math Horizons*, February 2005, pp. 19-21, 32.

In "A Mathematician's Look at Foucault's Pendulum" Stuart Boersma gives us a wonderful mathematical exposition of the motion of a pendulum on a spinning sphere. Beginning with a quote from Umberto Eco's novel *Foucault's Pendulum*, Boersma takes the reader through an intuitive discussion of the motion and then gives a thorough mathematical discussion of the pendulum. All the while he poses questions that carry the discussion beyond the pendulum to topics like curvature of surfaces.

Biographical Note

Stuart Boersma received his Bachelor of Science from the University of Puget Sound in 1988 and his Ph.D. from Oregon State University in 1994. He taught at Alfred University for six years in the cool climes of Western New York and is now Professor of mathematics at Central Washington University located in Ellensburg, WA amongst the desert sagebrush and rolling hills of the shrub-steppe. When not reading *Math Horizons*, he enjoys hiking, gardening, and woodworking.

Response from Stuart Boersma

As Department Chair, I often get notices of awards that my colleagues have received. When I received the notice from the MAA regarding this award, I had to read it several times before it dawned on me that *I* was being given this award! I am so glad that I took the time to read this particular email carefully as I have a great respect for *Math Horizons*, its editors, and its authors. I approached my article as I would approach a classroom of undergraduates: What can I say about an interesting mathematical topic that builds upon their current knowledge? Receiving this award is tantamount to receiving accolades after delivering a particularly lively lecture and, hence, is truly an honor. I thank all those who read my article and thought it good enough to "pass on" to others to read. Thank you.

Lester R. Ford Awards

The Lester R. Ford Awards, established in 1964, are made to authors of expository articles published in *The American Mathematical Monthly*. The Awards are named for Lester R. Ford, Sr., a distinguished mathematician, editor of *The American Mathematical Monthly*, 1942-46, and President of the Mathematical Association of America, 1947-48.

Ibtesam Bajunaid, Joel M. Cohen, Flavia Colonna, and David Singman

"Function Series, Catalan Numbers, and Random Walks on Trees," ***The American Mathematical Monthly*** **, vol. 112, no. 9, November 2005, pp. 765-785.**

Sparked by the strange behavior of the series

$$\frac{1}{1+t}\sum_{n=0}^{\infty} C_n \left[\frac{t}{(1+t)^2}\right]^n,$$

which converges on $[0,\infty)$ to a function that's constant on [0, 1] but nonconstant elsewhere, the authors' investigations touch on the Catalan numbers (the C_n in the series above), a basic calculus style function, functional equations, random walks on trees and on the nonnegative integers, and properties of series convergence. All of these apparently disparate elements, and others, are explained, and drawn cleverly together, often through links to probabilistic questions about random walks.

The exposition is brisk but friendly, with numerous generalizations, pointers, and asides, and surprises for experts and beginners alike. (A link from generalized Catalan numbers to ballotcounting surprised one reader, for example.) Finding unexpected connections is among the delights of studying mathematics, the authors assert, and their paper proves their point.

Biographical Notes

Ibtesam Bajunaid is an Assistant Professor of mathematics at King Saud University in Saudi Arabia. She received her Ph.D. from King Saud University in 1999 under the direction of Victor Anandam. She was the first to be granted a Ph.D. in mathematics from King Saud University. Her primary mathematical interest is potential theory, and she is currently collaborating with Dr. Anandam on polypotentials on trees.

Joel M. Cohen has been Professor of mathematics at the University of Maryland since 1978. He received his Ph.D. in mathematics from MIT in 1966 and also taught at the University of Chicago and the University of Pennsylvania. His early work in algebraic topology and low-dimensional complexes led to an interest in combinatorial group theory. The study of free groups led naturally to trees. The trees then led him astray to functional analysis, harmonic analysis, integral geometry, and potential theory. In his spare time he is active in politics, and served as national chair of the liberal political group, Americans for Democratic Action, from 2001 until 2005.

Flavia Colonna is Professor of mathematics at George Mason University. Before her tenure there, she was a junior faculty member at the University of Bari, Italy. She received a Ph.D. in mathematics from the University of Maryland in 1985. Her research interests include complex and harmonic analysis, potential theory, integral geometry, and image processing. She has been involved in various outreach programs for girls in sixth through eighth grades and serves as a judge in the MathCounts National Competition.

David Singman is Professor of mathematics at George Mason University. He received a Ph.D. degree in mathematics from McGill University in 1980. His research interests include potential theory in classical, axiomatic, and discrete settings.

Response from Bajunaid, Cohen, Colonna and Singman

We began our article by saying, "The delight of finding unexpected connections is one of the rewards of studying mathematics." To have had so much fun writing an article, and then be further rewarded for it is yet another delight! We want to say how honored we feel. It is really amazing to us to have a paper that joins a list that includes work by R.H. Bing and Peter Lax, influential papers such as Mark Kac's, "Can one hear the shape of a drum?" articles by giants like John Milnor and Norman Levinson, Paul Halmos and Jean Dieudonné, Ron Graham and Donald Knuth, to list but a few of the great mathematicians who have been honored by winning the Lester R. Ford Award.

We appreciate the enormous amount of help that we got from the editor and referees. They had wonderful ideas for mathematics that could be related and incorporated into the article. They gave us suggestions on style, as well as solid encouragement on the directions we had chosen. Bruce Palka was incredible at helping us find better ways to express our ideas. We can't imagine how many red pencils he must have used up, but every markup of his led to a much better version.

Our deep thanks to them and to the selection committee.

Viktor Blåsjö

"The Evolution of the Isoperimetric Problem," ***The American Mathematical Monthly,*** **vol. 112, no. 6, June–July 2005, pp. 526-566.**

Beginning with Virgil's *Aeneid* and the legend of Dido and concluding with the Minkowski inequality, Blåsjö offers a *tour de force* survey of the history of the isoperimetric problem. He presents sixteen proofs of the isoperimetric theorem and closely related matters, starting with the polygonal demonstration of Zenodorus and the geometric arguments of Jakob Steiner, and including proofs using the calculus of variations (naturally), dissections, projections, Fourier series, power series, convexity, vector analysis, integral geometry, and parallel curves. Blåsjö pays special attention to the question of the existence of a curve having maximal area for a given perimeter, as several proofs (particularly Steiner's) appear to assume tacitly that there is a solution.

The profusely illustrated discussion is literate, inviting, amusing, and insightful. The compelling yet elementary arguments make this article accessible to all, and reading it is a delight.

Biographical Note

Viktor Blåsjö graduated from Stockholm University in 2005 and then spent a semester at the Technical University of Berlin. Besides mathematics he also studied classical music and art history. For the 2006-07 academic year he will be teaching at Marlboro College as a Mathematics Fellow.

Response from Viktor Blåsjö

I wrote this article in youthful rebellion against what I perceived as shameful neglect of our mathematical heritage, bordering on doctrinal contempt for classical mathematics. The kind response my article received may have softened me a little. I was especially happy to see the article published in the

"Evolution of" section of the *Monthly*, whose editors, Abe Shenitzer and John Stillwell, have been role models for my vision of mathematical scholarship. This award and the kind words I received from readers give me hope that efforts to understand the masters of the past are not futile.

Edward B. Burger

"A Tail of Two Palindromes," *The American Mathematical Monthly,* **vol. 112, no. 4, April 2005, pp. 311-321.**

Two real numbers α and β are called *equivalent* if there exist integers *A, B, C,* and *D* such that *AD - BC* = ±1 and

$$\alpha = \frac{A + B\beta}{C + D\beta}.$$

This witty and entertaining paper considers the question of when $p + q\sqrt{d}$ is equivalent to its algebraic conjugate $p - q\sqrt{d}$; here *p* and *q* are rational numbers and *d* is a positive integer such that $\sqrt{d}$ is irrational.

The remarkable answer to this question depends upon the continued fraction expansion of $p + q\sqrt{d}$. As has been known for more than two centuries, the continued fraction expansion of this number is eventually periodic. In other words, the entries in the continued fraction expansion of $p + q\sqrt{d}$ eventually become repetitions of a finite sequence of integers.

The author cleverly shows that $p + q\sqrt{d}$ is equivalent to $p - q\sqrt{d}$ if and only if the periodic part of the continued fraction expansion of $p + q\sqrt{d}$ is composed of two palindromes (recall that a palindrome is a finite sequence that reads the same backwards as forwards). For example, the continued fraction expansion of $\frac{1}{4} + \sqrt{5}$ eventually has entries that are repetitions of the finite sequence 2, 17, 2, 3, 1, 70, 1, 3. This finite sequence is composed of the two finite sequences 2, 17, 2 and 3, 1, 70, 1, 3, each of which is a palindrome. Thus $\frac{1}{4} + \sqrt{5}$ is equivalent to $\frac{1}{4} - \sqrt{5}$ (which is far from obvious solely from the definition of equivalent numbers).

Biographical Note

Edward Burger pursued his undergraduate studies at Connecticut College and earned his Ph.D. at The University of Texas at Austin. In 1991, after a Postdoctoral Fellowship at the University of Waterloo, he arrived at Williams College. During sabbatical leaves he has held the Stanislaw Ulam Visiting Professorship of Mathematics at the University of Colorado.

Burger's research interests are in Diophantine analysis and he is the author of over fifty articles, books, CD-ROM texts, and DVD courses. His latest book, *Extending the Frontiers of Mathematics: Inquiries into proof and argumentation*, was published last month. He has given several AMS and MAA invited addresses and serves as an Associate Editor of the *American Mathematical Monthly*.

Burger was awarded the 2001 MAA Deborah and Franklin Tepper Haimo Award for Distinguished Teaching of Mathematics, the 2001 Robert W. Hamilton Book Award, and was named the 2001-2003 Pólya Lecturer. In 2004 he received the Chauvenet Prize and in 2006 *Reader's Digest* named him in their annual list of "100 Best of America" as "Best Math Teacher."

Response from Edward B. Burger

I wish to thank the Mathematical Association of America for this award. I believe that the vitality of mathematics depends not only on our efforts to move the frontiers of mathematics forward, but also on our efforts to share those advances so as to inspire further explorations. Our lectures and our writings, at all levels, are wonderful opportunities to entice our audiences to search for new mathematical vistas. My hope for the article "A Tail of Two Palindromes" was to offer some new number theoretic results in a novel and ideally entertaining manner. Therefore to have my efforts recognized by the Mathematical Association of America through this honor is especially meaningful. Finally, I wish to express my sincerest gratitude to Professor Bruce Palka for his willingness to accept my article for publication, his outstanding editorial talents, and his many years of guidance, encouragement, and friendship.

Karl Dilcher and Kenneth B. Stolarsky

"A Pascal-Type Triangle Characterizing Twin Primes,"
***The American Mathematical Monthly*, vol. 112, no. 8, October 2005, pp. 673-681.**

This elegant article proves that there are still surprises to be had in examining binomial coefficients. The familiar characterization of prime numbers in terms of the divisibility properties of the rows of Pascal's triangle is extended to a similar characterization of prime pairs with a similar divisibility criteria for rows of a modified Pascal- like triangle.

Let

$$\alpha(k,s) := \binom{k+s}{2s+1}\frac{(2k-1)(2k+1)}{2s+3}$$

where $k \geq 1$, and $0 \leq s \leq k - 1$. These numbers form a triangle of integers, where k corresponds to the row number. The main result is that the entries in the kth row are divisible by $2k - 1$ with exactly one exception, and divisible by $2k+1$ with exactly one exception, if and only if, both $2k-1$ and $2k+1$ are prime. Compare this to the familiar result that the entries of the kth row of Pascal's triangle, without the initial and final 1's, are all divisible by k if and only if k is prime.

The techniques are simple and attractive and connect with various familiar objects that should be in the hope chest of any young mathematician: Chebyshev and orthogonal polynomials and generating function techniques.

Biographical Note

Karl Dilcher received his undergraduate education at the Technische Universit at Clausthal in Germany. He then did his graduate studies at Queen's University in Kingston, Ontario, and finished his Ph.D. there in 1983 under the supervision of Paulo Ribenboim. He is currently a Professor at Dalhousie University in Halifax, Nova Scotia, Canada, where he first arrived in 1984 as a Postdoctoral Fellow. His research interests include classical analysis, special functions and sequences, and elementary and computational number theory.

Biographical Note

Kenneth B. Stolarsky received his undergraduate education at Caltech, and obtained a Ph.D. from the University of Wisconsin (Madison) in 1968 under the supervision of Marvin I. Knopp. He did one year of postdoctoral work at the Institute for Advanced Study (Princeton) and has been (aside from sabbaticals at the University of Colorado/Boulder and Yale University/New Haven) at the University of Illinois/Urbana-Champaign since then, where he is presently Professor of mathematics. His research interests include number theory, extremal problems of geometry, and classical analysis.

Response from Dilcher and Stolarsky

Years ago Dick Askey told one of us that new discoveries awaited to be made about objects as simple as rational functions in few variables. Thus, with this most welcome recognition, we are delighted to have the chance to put in the spotlight an appealing new property of a rational function of two variables. Our twenty-year collaboration on problems of polynomial type began after Paulo Ribenboim introduced us to each other. Thanks, Paulo!

William Dunham

"Touring the Calculus Gallery," ***The American Mathematical Monthly*****, vol. 112, no. 1, January 2005, pp. 1-19.**

The eponymous (albeit imaginary) museum of calculus history features exhibits honoring Newton, Leibniz, l'Hospital, Euler, Berkeley, and Cauchy. An adjoining "modern wing" has exhibits on Baire and Lebesgue. Attempting to sample so many mathematical treasures in a short time is difficult, but our author, like a discriminating tour guide, provides an expertly tasteful selection.
He offers useful commentary on how the exhibits relate to each other and to other historical figures, including the Bernoullis, Darboux, Riemann, Volterra, and others.

As in every great museum, some of the exhibits here are familiar, but there are also surprises. Some version of the Marquis de l'Hospital's rule, for example, is familiar to every calculus novice, but few would guess that the Marquis stated it without mentioning limits, and that the first published example was so arcane: to find the value of

$$\frac{\sqrt{2a3x - x4} - a\sqrt[3]{aax}}{a - \sqrt[4]{ax3}}$$

"when $x = a$." Every visitor, no matter how expert, will leave instructed, entertained, and amazed at the power and refinement of the art of calculus.

Biographical Note

William Dunham is the Koehler Professor of mathematics at Muhlenberg College. Born long ago in the Truman administration, he received his B.S. from the University of Pittsburgh (1969) and his M.S. (1970) and Ph.D. (1974) from The Ohio State University. His dissertation, written under Norman Levine, was in general topology, but Bill's interests subsequently turned to the history of mathematics.

Five times between 1988 and 1996 he directed National Endowment for the Humanities seminars on the history of mathematics at Ohio State, and he has authored four books – *Journey Through Genius: The Great Theorems of Mathematics* (Wiley, 1990), *The Mathematical Universe* (Wiley, 1994), *Euler: The Master of Us All* (MAA, 1999), and *The Calculus Gallery: Masterpieces from Newton to Lebesgue* (Princeton, 2005). He previously received the MAA's George Pólya Award (1992) and Trevor Evans Award (1997), and *The Mathematical Universe* was recognized by the Association of American Publishers as the Best Mathematics Book of 1994.

Response from William Dunham

I am thrilled to be the recipient of the Lester Ford Award for my imagined tour of the Calculus Gallery. Truth to tell, I often found myself picturing the place as real, with its exquisite halls displaying masterpieces as wonderful as any that hang in the Louvre.

First off, I thank my wife and Muhlenberg colleague Penny Dunham, who has played a key role in *everything* I've done for nearly four decades. I also thank the MAA's Don Albers and Jerry Alexanderson, who have been so supportive of my expository efforts over the years, and Princeton's Vickie Kearn, who edited the book upon which this article was based. Most of all, I want to recognize Bruce Palka, *Monthly* editor, who, from the beginning, encouraged me to take this gallery tour.

George Pólya Awards

The George Pólya Awards, established in 1976, are made to authors of expository articles published in the *College Mathematics Journal*. The Awards are named for George Pólya, a distinguished mathematician, well-known author, and professor at Stanford University.

Ezra Brown

"*Phoebe Floats!*" *College Mathematics Journal*, vol. 36, no. 2, March 2005, pp. 114-122.

Every mathematics instructor dreams of that special classroom moment when the stars align in just the right way: motivated students, an interesting question, and a trail of mathematical connections to unravel. Bud Brown shares such a moment, but the real delight for us is that we become participants rather than mere observers. Perhaps we are being imprecise when we say it is the stars that align, since we begin with a thought experiment involving one of the planet Saturn's most unusual moons, Phoebe. Bud and his students take us along as they follow connections from Archimedes' Law of Floating Bodies and Eudoxus' Method of Exhaustion through Cardano-Tartaglia and cubic polynomials all the way to Newton's method, computer algebra systems, and chaos. Can we discern Archimedes' thought process? What are the connections to solving polynomial equations and dynamical systems? How does this all relate to your calculator? Where will the trail lead next? Brown takes us on a whirlwind trip to Saturn's moon and ancient Greece; it's a journey which takes us a long way in both space and time, but it is a most enjoyable trip.

Biographical Note

Ezra (Bud) Brown grew up in New Orleans and has degrees from Rice University and Louisiana State University. He has been at Virginia Tech since 1969, with time out for sabbatical visits to Washington, DC (where he has spent his summers since 1993) and Munich. In 2005, he was appointed Alumni Distinguished Professor of Mathematics. His research interests include number theory, graph theory and combinatorics. He has received a teaching award and three writing awards from the MAA.

He enjoys working with students who are engaged in research. Over the years, he has put together twenty-one nomination dossiers which led to college and university recognition of his colleagues' superior teaching, advising and outreach. He enjoys singing (everything from grand opera to rock'n'roll), playing jazz piano, and mathematical puzzles; with his wife Jo's help, he has become a fairly tolerable gardener. He occasionally bakes biscuits for his students.

Response from Ezra Brown

Sometimes, a simple integration application for a calculus class just gets out of hand. For me, one such problem was Archimedes' Floating Ball of Cork: given its density, to what depth does the ball sink below the surface of the fluid? Each time I presented the problem, something else got added, invariably because of student questions. After my granddaughter Phoebe Rose was born, the ball of cork became Phoebe, a moon of Saturn that is lighter than water.

I love mathematical connections, and this problem is chock-full of them, so I wrote this story with the hopes that its readers might likewise enjoy those connections and discover their own new wrinkles in old problems. For this reason, it is a great joy to be honored with the Pólya Award, and it is a privilege to be mentioned in the same sentence with George Pólya.

James Sandefur

"A Geometric Series from Tennis," ***The College Mathematics Journal*****, vol. 36, no. 3, May 2005, pp. 224-226.**

Tennis anyone? Whether you play tennis or not, you will want to play with this problem. What are your chances of winning a game if you know your chances of winning any given point? For those of you who know love-love about tennis, Jim Sandefur begins with a review of the rules: The first person to win four points wins, but you must win by two. Thus, theoretically, a game can go on forever; the Guinness Book of World Records reports that, practically, the longest recorded game was 80 points.

Although the rules of tennis require that a number of cases be considered, Sandefur --- in clear, convincing and precise prose---reduces the probability of winning a game to a geometric series. This is a natural problem, one that will attract our students. The problem is not too simple, but not too complicated. This is a classroom capsule that one can immediately use in any situation where elementary counting arguments are discussed.

After solving the initial problem, Sandefur does what all good problem solvers do: Carpe exemplum! Squeeze the problem a bit more and see if you can get more out of it. When the solution is plotted (the probability of winning the game is a function of the probability, p, of winning a point), the graph is clearly central-symmetric with an inflection. But the function is complicated enough so that these properties are not at all clear. Sandefur provides clever, and not quite standard, arguments that the curve has these properties. This lovely paper ends with some mathematically supported practical advice: If your chances of winning a point are 50-50, then a 1% increase in your probability of winning each point yields a 2.5% probability of winning the game: so average players have the most to win by improving a bit.

Biographical Note

After receiving his Ph.D. from Tulane University in 1974, **James Sandefur** went to Georgetown University, where he is currently Professor of mathematics. As a result of his research interests in differential equations, he has been devoted to sharing, through his teaching and writing, the joys of interesting and illuminating applications of mathematics. This has resulted in numerous articles, as well as the texts *Discrete Dynamical Systems*, *Discrete Dynamical Modeling*, and *Elementary Mathematical Modeling*. He was one of the writers for the NCTM's *Principles and Standards for School Mathematics*, and is a co-author, with Rosalie Dance, of NSF-funded developmental mathematics modules, available at http://www.georgetown.edu/projects/handsonmath/. His collaboration with Professor Dance also resulted in an NSF-funded Teacher Leadership Institute. His current interests, begun through teaching Georgetown's introduction to proof course, is to better understand how students learn to problem solve and construct proofs.

Response from James Sandefur

While I am thrilled to win a George Pólya Award, it is particularly special in that I have been developing an introduction to proof course based on the ideas in George Pólya's classic *How to Solve It*. I also feel honored to know that I have made a positive contribution in increasing students' perceptions that mathematics is interesting, understandable, and important.

I gratefully thank the referee who encouraged me to go beyond the analysis in my original submission to *CMJ*. To do this required that I draw upon techniques I had not used in years. It also helped me understand why I have begun losing consistently to one of my favorite opponents; he has recently improved his game a little, which by the analysis in this article, has resulted in a much larger gain in the percentage of games he has won.

Annie & John Selden Prize for Research in Undergraduate Mathematics Education

In January 2005, the MAA Board of Governors established the Annie and John Selden Prize for Research in Undergraduate Mathematics Education honoring a researcher who has established a significant record of published research in undergraduate mathematics education and who has been in the field at most ten years.

Chris Rasmussen

Chris Rasmussen, Associate Professor of Mathematics and Statistics at San Diego State University, received his Ph.D. in Mathematics Education from the University of Maryland in 1997. He has 12 refereed journal publications with 2 more under review, 5 book chapters, 3 other publications, and 14 refereed conference proceedings, in addition to many presentations. He has received an Early Career Grant and other research grants from the National Science Foundation, an Outstanding Faculty Scholar Award from Purdue University Calumet, and an Excellence in Teaching Award for Graduate Assistants from the Department of Mathematics at the University of Maryland.

Comments from colleagues highlight Dr. Rasmussen's qualifications: "His research interests are varied and cutting edge; his published work and conference body of research is extensive and stands as an example of what a truly dedicated undergraduate mathematics educator can do." They spoke also of his mentoring work with beginning mathematics educators and of his work on the SIGMAA on RUME. They pointed to Dr. Rasmussen's work in undergraduate calculus and differential equations, and said that by "extending theoretical perspectives from mathematics education researchers who focus primarily at the elementary and secondary level, his research has helped to extend both of these areas." Finally, the nomination stated that
Dr. Rasmussen's work on the teaching and learning of differential equations not only informs the teaching of that subject but also "shows mathematicians who may have doubts about mathematics education research that mathematics education can also address 'significant' mathematics."

Dr. Rasmussen's scholarship is theoretically important, and he has made influential, intellectually powerful contributions to the field.

Biographical Note

Chris Rasmussen is an Associate Professor of Mathematics Education at San Diego State University. Rasmussen's undergraduate training was in engineering, followed by a master's degree in mathematics and a doctorate in mathematics education. In 1998 he received the prestigious Early Career Award from the National Science Foundation. Rasmussen's work over the past years has focused on the learning and teaching of undergraduate mathematics, using differential equations as a prototype to investigate how approaches that have been successful at promoting student learning in earlier grade levels can be adapted to the university setting. His work has included analyses of student thinking about central ideas in dynamical systems, theoretical elaborations of the instructional design theory of Realistic Mathematics Education, empirical investigations of the role and function of argumentation, symbol use, and tool use in mathematics learning and effective means by which teachers can support student learning. Rasmussen has written student material for a first course in differential equations and is co-editor of a forthcoming book focusing on connecting research and practice in undergraduate mathematics education. Rasmussen is currently serving as Coordinator for the SIGMAA on Research in Undergraduate Mathematics Education (SIGMAA-RUME).

Response from Chris Rasmussen

I am deeply honored to receive this award and I want to especially thank Annie and John Selden for their support of research in undergraduate mathematics education. The creation of this award is just one example of their tireless efforts aimed at promoting and enriching the discipline, including the SIGMAA on Research in Undergraduate Mathematics Education. I was quite surprised to receive this award, given the many people doing such good work. Collectively, we are beginning to make a difference. Indeed, my own work has in no way been a sole, individual effort. I have been incredibly fortunate to work with exceptional colleagues who have pushed my thinking and enlarged my vision of what is possible in undergraduate mathematics education. To these individuals I am truly grateful. I have also had the good fortune to collaborate with several mathematicians who have helped me better understand the challenges and possibilities for change. I also want to thank the many undergraduate students who showed me new ways that powerful mathematical ideas can be built from the ground up when offered opportunities to engage in genuine mathematical activity.

Henry L. Alder Award for Distinguished Teaching by a Beginning College or University Mathematics Faculty Member

The award was established in January 2003 to honor beginning college or university faculty whose teaching has been extraordinarily successful and whose effectiveness in teaching undergraduate mathematics is shown to have influence beyond their own classrooms. An awardee must have taught full time in a mathematical science in the United States or Canada for at least two, but not more than seven, years since receiving the Ph.D. Henry Alder was MAA President in 1977 and 1978 and served as MAA Secretary from 1960 to 1974.

Garikai (Kai) Campbell

Garikai (Kai) Campbell of Swarthmore College has demonstrated outstanding teaching through a lecture-discussion based style, often dedicating parts of a class period to students working on problems in groups and then making presentations to the class. His intense interaction with students outside class encourages them to develop their talent and to perform at high levels. He has been an instructor in four programs for encouraging underrepresented groups in mathematics and serves as a role model at Swarthmore. He was on the advisory board for the NCTM *Figure This* family problem-solving initiative and the NACME *Math is Power* ad campaign. He has carried out summer research projects with four students--one resulting in a paper in the *Rocky Mountain Journal of Mathematics*. He is known at Swarthmore for his effective use of technology in his teaching. This past year, he required seniors doing senior projects with him to do a poster session and an online presentation of the project. For these and many other evidences of effective and inspiring teaching, Garikai is awarded a 2006 Alder Award.

Biographical Note

Garikai Campbell received his Ph.D. from Rutgers University and his B.A. from Swarthmore College, where he is currently an Associate Professor. Garikai has worked with initiatives such as the Enhancing Diversity in Graduate Education (EDGE) program and the National Action Council for Minorities in Engineering (NACME) Vanguard scholarship program in efforts to increase the representation of underrepresented groups among the nation's mathematicians and engineers; conducted and published research, alone and with students, (mostly) on elliptic curves; and has served several times as a reviewer for some of NSF's Division of Undergraduate Education grants. When not doing mathematics, Garikai enjoys spending time with his wife, helping coach his three boys' soccer teams and reading about new technologies.

Response from Garikai (Kai) Campbell

I would like to thank the MAA for this distinguished award. I am deeply honored. I have been surrounded by so many fantastic teachers—starting with all my colleagues at Swarthmore who let me pick their brains and encourage me to try the things I dream up--that winning this award feels very much like a shared experience. Thanks also to all those who have helped and mentored me from the several programs I've participated in, with an extra special thanks going to Carl Pomerance, Rhonda Hughes and Edray Goins. And of course, thanks to all my students who consistently give me the greatest reward of letting me share in some of their "aha" moments, breakthroughs and accomplishments. But most importantly, I would like to thank both my wife and my first teachers, my parents, whose high expectations and constant nourishment form the backbone of me as a teacher and as a man.

Christopher N. Swanson

Christopher N. Swanson of Ashland University motivates students to perform at their best by being a role model for them. His enthusiasm for the study of mathematics, his willingness to work hard, and his obvious caring for all his students are readily recognized and appreciated by students. While meticulously preparing for all classes, his teaching style is versatile and student-centered. He has created new courses, and he has introduced the Ashland University students to the Putnam Competition and to Pi Mu Epsilon. Despite a four-course teaching load each semester, he has directed four Honors theses (two of which received awards), and he has had the theses writers present their work at conferences, including MathFest. He was invited to give both a plenary and after-dinner talk at the Spring 2005 meeting of the Ohio Section of the MAA, and is now serving as co-chair of Ohio NExT. He has given enrichment lectures for students at other universities and presented a training workshop for high school teachers in Ohio. For these, and other demonstrations of outstanding teaching, Christopher Swanson is awarded a 2006 Alder Award.

Biographical Note

Christopher N. Swanson is an Associate Professor of mathematics who just completed his seventh year of teaching at Ashland University in Ashland, Ohio. He received his B.S. from Denison University in 1994 and his Ph.D. from the University of Michigan (GO BLUE!) in 1999 under the direction of Thomas F. Storer. His research interests are combinatorics and probability. Chris is a national Project NExT Fellow (Brown dot) and is Program Co-chair of Ohio NExT. He is a member of the Ohio Section of the MAA's Committee on Student Members and has delivered nine presentations during meetings of the Ohio Section of the MAA. In his spare time, Chris enjoys watching movies with his wife, playing disc golf with his children, and annoying Ohio State Buckeye fans by flying his University of Michigan car flags while blaring "Hail to the Victors" with his car windows down.

Response from Christopher Swanson

I am very appreciative to the MAA for selecting me for this award, and for sponsoring programs such as Project NExT and the PREP Workshops. I would not nearly be as effective as an instructor had it not been for these programs. I thank my colleagues at Ashland University for taking a chance by hiring a new Ph.D. with little teaching experience and for creating a supportive and enjoyable work environment. I thank my professors from Denison University for modeling effective teaching, my thesis advisor Tom Storer for invigorating my love of mathematics, my parents for always encouraging me to excel, my wife Linda for her understanding during late night review sessions and for the various ways she supports my career and family, and my children for reminding me every day to take time out from work to play.

Lesley Ward

Lesley Ward has shown herself to be both an effective and enormously popular teacher at Harvey Mudd College. Student and faculty evaluations are consistently high and uniformly enthusiastic. She is termed an "outstanding lecturer" by faculty at other institutions. She is credited with making the senior thesis requirement at HMC into a cohesive program, and she has advised five seniors for their thesis work and co-authored four research papers with undergraduates. One of her students was cited as having the best student paper in the *Pi Mu Epsilon Journal* one year, and another was awarded an Honorable Mention in the Association for Women in Mathematics Schafer Prize competition. She has mentored many women students in mathematics, and she served as an adviser to the Society for Women Engineers. Her former chair credits her with innovative work in the redesign of the core mathematics curriculum at HMC. Her offering of a new course on wavelets led to an invitation for her to teach a three-week course for undergraduates for the 2003 IAS/Park City Mathematics Institute in Park City, Utah. She co-taught a course for the summer 2004 IAS/Princeton Program for Women in Mathematics, at the Institute for Advanced Study. For these and numerous other indications of excellent teaching, Lesley Ward is granted a 2006 Alder Award.

Biographical Note

Lesley Ward grew up in Australia. She earned her B.Sc. degree in pure mathematics from The Australian National University, and her M.Sc., M.Phil., and Ph.D. degrees in mathematics from Yale University. She was an Evans Instructor of Mathematics at Rice University, and spent a semester at MSRI as a Postdoctoral Fellow. She is an Associate Professor at Harvey Mudd College. She serves on the Long Term Planning Committee of the AWM. Her research is in complex analysis, harmonic analysis, and Internet search algorithms. She enjoys involving undergraduate students in research and helping them learn ways to communicate mathematics, through senior thesis projects and the HMC Mathematics Clinic program. She and her husband have a four-year-old son, Alexander.

Response from Lesley Ward

It is a great honor to receive the MAA's Alder Award. I am deeply grateful to the many people who have mentored me and given me opportunities to develop my teaching. Among them are Michael Moody, John Polking, Francis Su, Art Benjamin, Lisette de Pillis, Lisa Sullivan, Bob Borrelli, and the organizers of the Park City Mathematical Institute and the IAS/Princeton Program for Women in Mathematics. I thank my students for all they have taught me, and my wonderful colleagues for creating the constructive, flexible, and supportive environment of the Department of Mathematics at Harvey Mudd College. I thank my husband Jorge Aarao for his continuous loving support.