Mathematicians Awarded for 2024 Expository Mathematical Writing in MAA Publications

WASHINGTON DC - MAY 23, 2024

We are excited to announce the 2024 award recipients for the Chauvenet Prize, the Euler Book Prize, the Daniel Solow Author's Award, the George Pólya Awards, the Paul R. Halmos-Lester R. Ford Awards, the Trevor Evans Award, and the Carl B. Allendoerfer Awards.

Chauvenet Prize

Jeffrey Witmer, Oberlin College

Simpson's Paradox, Visual Displays, and Casual Diagrams." The American Mathematical Monthly 128(7): 598-610.

"Simpson's Paradox" refers to the phenomenon that inequality can hold for several groups of data but reverse itself when the groups are combined into a single data set. Witmer's article not only nicely illustrates the phenomenon but also shows the reader a useful technique for avoiding it, namely the use of causal diagrams. These diagrams give a methodical way to clarify the hypothesized causal link that is being tested, and therefore determine which is the most appropriate way to look at the data. The paper ends with a plethora of examples for the

reader to consider, from sports statistics to SAT scores to the Titanic, providing something for everyone.

Euler Book Prize

Sarah Hart, Gresham Professor of Geometry, at Gresham College, London

Once Upon a Prime: The Wondrous Connections Between Mathematics and Literature. New York: Macmillan, 2023

Once Upon a Prime is a lively, well-researched excursion through the overlapping worlds of mathematics and literature. Drawing from diverse literary and mathematical traditions and cultures, Hart compellingly and wittily reveals mathematics's role in literature. This book will help every reader see both mathematics and literature in a new light, expanding the joy of reading literature and learning mathematics.

"I'm delighted that my book's exploration of the beautiful links between mathematics and literature has resonated so strongly with readers."

Daniel Solow Author's Award

Joel David Hamkins, O'Hara Professor of Logic at the University of Notre Dame

Proof and the Art of Mathematics. Cambridge University Press, 2022.

Organized around mathematically rich topics rather than methods of proof," it allows "students to learn to write proofs [by engaging] with material that is itself intrinsically interesting. The emphasis is on writing clearly and well, and on communicating intuition." Instructors who used this book noted that their "students had not realized that math had so many different faces" and were amazed that it involved so many different ways of thinking. Proof and the Art of Mathematics offers readers "a look behind the curtain at the workings of the mind" of a mathematician.

"What a joy it has been to share the beauty of mathematics with aspiring mathematicians and help them learn the art of proofwriting!"

George Pólya Awards

Damiano Fulghesu, James A. Sellers, Courtney K. Taylor

"Infinite Families of Infinite Series With Integer Sums" *The College Mathematics Journal* 54, no. 1 (2023).

In the article, “Infinite Families of Infinite Series With Integer Sums” by Damiano Fulghesu, James A. Sellers & Courtney K. Taylor, the authors have created a splendid deep dive into a topic that many of our students, even at the calculus level, find curious: infinite series that actually converge! Moreover, the series that the authors develop with the reader converges to an integer, making the series especially curious for students and faculty alike. The authors develop families of convergent infinite series using different approaches, providing the reader with the power to find a non-trivial infinite series converging to exactly the positive integer they wish! The article is written in a friendly and enthusiastic manner that an introductory-level mathematics student and an experienced faculty member can enjoy, separately or even together.

“We hope our work motivates students and faculty to further explore convergent series.”

William Dunham

“Bryn Mawr College Matriculation Exams from a Century Ago.” *The College Mathematics Journal* 54, no. 2 (2023): 83–89.

In this well-written article, Professor Dunham demonstrates the range of mathematical skills that would-be students of that time should have, from non-trivial arithmetic through intermediate-level algebra and a demanding knowledge of geometry. He notes that applications of the quadratic formula appeared often and that relating graphing to equations was non-existent.

“Many thanks to the MAA for the 2024 Pólya Award. I never had more fun writing an article. With the assistance of Bryn Mawr librarians Eric Pumroy, Marianne Hansen, and Allison Mills, I found myself in the college archives, thumbing through yellowed matriculation exams from days of yore. These were the in-house admissions tests of the time. And they were horrifying. Candidates seeking admission to Bryn Mawr might be asked to inscribe a square in a semicircle with a compass and straightedge (try it!) or to prove Heron’s formula for the

triangular area (have a lot of paper handy). They might have to establish intricate trig identities or solve strange problems from solid geometry. And, once the math was done, they'd still have to translate Latin poetry, write intelligently about the essays of John Ruskin, and identify major battles from the Punic Wars. In short, applicants had to be extremely well-educated just to get into Bryn Mawr. Knowing that I would have stood no chance of passing a matriculation exam, I came away mightily impressed by these bright young women of long ago."

Paul R. Halmos-Lester R. Ford Awards

Dan Kalman and Robert Mena

"A Tale of Two by Two Matrices." *The American Mathematical Monthly* 130, no. 4 (2023): 315–324.

The authors show how to use a set of matrices introduced in 1949 by Kjell Kolden, along with associated directed graphs and sequences, to provide efficient approaches to numerous results, ranging from standard ones commonly encountered by undergraduates to a well-ordering of the positive rationals. The matrices in question encode continued fraction expansions and enjoy multiple properties, including a unique factorization property. The infusion of bits of humor and history throughout makes reading this interesting article an enjoyable journey.

"We are deeply honored and grateful that our paper has been selected to receive the Halmos-Ford Award. We thank the MAA for providing publications and award programs that enrich our profession."

Eli Hicks, R. Andrew Hicks, Ron Perline, and Sarah G. Rody

Frobenius Integrability, Automotive Blind Spots, Non-reversing Mirrors, and Panoramic Mirrors." *The American Mathematical Monthly* 130, no. 1 (January 2023): 1–16.

In this engaging article, the authors take readers through a series of inverse problems in geometric optics. Using the language of multivariable calculus and linear algebra, the authors give an accessible discussion of planar distributions, the Frobenius Theorem, and how such

mathematical tools can be used for physically relevant problems such as automotive blind spots and mirrors of all types. The article features lively diagrams, elucidating photographs, and historical and technological context.

We're thrilled to be honored by the MAA with a Halmos-Ford award for our paper “Frobenius Integrability, Automotive Blind Spots, Non-reversing Mirrors, and Panoramic Mirrors". Thanks for that MAA!

Rafael López

What Is the Shape of a Cupola? The American Mathematical Monthly, 130:3, 222-238.

This beautiful article considers the problem of determining the shape of a (suitably idealized) hanging surface or, equivalently, the shape of a cupola or dome that will stand under its own weight. The author analyzes the simplest case and treats readers to interesting connections to the work of architects, in particular Antonio Gaudí. The author closes with a new design for a roof whose rotational axis of symmetry is horizontal rather than vertical.

“Our article about the mathematical shape of a cupola found not only the expected surfaces of revolution around a vertical axis but also more exotic surfaces of revolution about a horizontal axis.”

Judith B. Bruckner, Brian S. Thomson and Andrew M. Bruckner

Can One Visualize a Continuous Nowhere Differentiable Function? The American Mathematical Monthly, 130:3, 214-221.

Although a continuous nowhere differentiable function (aka a “monster”) is a classic example in introductory analysis texts, it is not very easy to visualize. The authors offer a geometric approach that avoids the computational and visual complications of using infinite sums of functions for constructing monsters. This lively paper gives readers a chance to reevaluate their visual concept of a continuous nowhere differentiable function.

Trevor Evans Award

Megan Martin, Cornelia A. Van Cott, and Qiyu Zhang

“The Beauty of Halving It All.” *Math Horizons* 31, no. 2 (2024): 14–17.

In the article “The Beauty of Halving it All,” the authors divide a triangle into equal areas with a straight line and then consider the family of all lines with this property. Explaining the ensuing images and observations involves envelopes, combinatorics, and differential equations. Extensions to regular polygons provide even more possible investigations. The article is beautifully illustrated and is a wonderful example of mathematical discovery.

“It is an honor to win this award. Thank you to MAA and to my inspiring collaborators. The best part about winning this award is that I’m receiving it together with two of my wonderful students.”

Carl B. Allendoerfer Awards

Alissa S. Crans and Glen T. Whitney

“Integral Tiling Pentagons,” *Mathematics Magazine*, 96:2, 130-140,
DOI: 10.1080/0025570X.2023.2176101.

For nearly a hundred years, mathematicians - professionals and amateurs alike - have been on a quest to find all convex pentagons that tile the plane. In their paper, the authors give a lively recounting of the quest, acknowledging the sometimes decades-long gaps between advances; they concisely summarize the status of the problem (namely, that 15 families of convex pentagon tilers were discovered between 1918 - 2015; and, in 2017, mathematician Michael Rao announced that he had computationally verified that the list of 15 families is complete); and as per the title of their paper, they completely solve the integral tiling pentagons problem, providing “exact criteria to determine whether a given 5-tuple of natural numbers can occur as the side lengths of a pentagon within each of the 15 families.”

“We hope this recognition familiarizes more people with the inspiring story of how a diverse group contributed to solving a tantalizing tiling problem over many decades.”

John Chase and Matthew Wright

"Bacterial Growth: Not So Simple." *Mathematics Magazine* 96, no. 4 (2023): 433–441.

In bacterial growth models we often use average time to division to get a simple exponential function for the number of bacteria at a given time. However, as the authors of this article demonstrate, the growth of the bacteria population depends in interesting and surprising ways on the overall distribution of the time to division, rather than just the average. In fact, for the natural distributions the authors examine, the usual model significantly underestimates the bacterial population's growth over time. This paper's elucidating mix of theory and simulation shows readers the surprising depths of an apparently simple problem.

"I am honored to receive the Carl B. Allendoerfer Award, together with my coauthor Matthew Wright. Our paper was inspired by conversations with one of my high school math teacher colleagues, Will Rose, who questioned the underlying premises of bacterial growth. I did work in stochastic processes in my graduate program, and I thought this would be a perfect time to put that knowledge to use. When Matthew and I first uncovered the results in our paper, we found them surprising and delightful. Using bacterial growth as a first example of exponential growth is so commonplace it seemed unlikely that there would be anything new to say. We are pleased that others found the paper surprising and delightful as well. Our results are not groundbreaking and are likely well-known by those who have a deep knowledge of stochastic processes, but we were glad for the opportunity this paper gave us to popularize these results. We hope that this expository treatment of the topic will open conversations among educators and students in both undergraduate and secondary settings. I hope that any recognition the award brings will broaden the reach of our paper and highlight the delightful mathematics, not just the authors.

More information on the award and how to submit a nomination.

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