CHAUVENET PRIZE

THE Chauvenet Prize is awarded to the author of an outstanding expository article on a mathematical topic. First awarded in 1925, the Prize is named for William Chauvenet, a professor of mathematics at the United States Naval Academy. It was established through a gift in 1925 from J. L. Coolidge, then MAA President. Winners of the Chauvenet Prize are among the most distinguished of mathematical expositors.

CITATION

Travis Kowalski

South Dakota School of Mines and Technology

"The Sine of a Single Degree," *The College Mathematics Journal* **47** (2016), no. 5, 322–332, DOI:10.4169/college.math.j.47.5.322.

In a standard trigonometry course, one typically considers the sine of standard angles 30°, 45°, and 60°, but what about sine of 1°? This paper boldly asks if it is possible to find an exact value for sin 1° in terms of ratios of radicals and integers, and then takes the reader on a beautiful mathematical tour involving geometry, algebra, and complex numbers to answer that question.

Kowalski begins his tour in the realm of triangle geometry. Using some standard trigonometric identities, he deduces an exact form for sin 3°. To get closer, the author brings in tools from algebra and obtains sin 1° as a solution to a particular cubic equation. The reader is nicely brought into a discussion of the solvability of cubic equations and the structure of solutions of the depressed cubic, no discussion of which would be complete without the cube roots of unity. From here, we are taken on a brief excursion into the geometry of complex numbers before arriving at multiple exact expressions for sin 1° and ending with one that is "delightfully bizarre and strangely beautiful."

What makes this paper special is how seamlessly the author transitions from one topic to another in the hunt for sin 1°. The tour entices its reader to delve more deeply into geometry, algebra, and complex numbers, and is well designed to appeal to a wide mathematical audience.

Biographical Note

Travis Kowalski went to college to pursue art and ended up with a mathematics degree: "I didn't change my major, only my medium." He earned his undergraduate and graduate degrees from the University of California. He spent two years as a visiting professor at Colorado College, where he was known for his colorful lecture style and equally colorful collection of aloha shirts. He has been a Professor of Mathematics at the South Dakota School of Mines and Technology since 2004 and currently serves as its Interim Head of Mathematics. His mathematical interests include mathematical SOTL, applications of formal power series, and exploring the intersection of mathematics, art, and culture. He also enjoys creating napkin art, playing tabletop games with his family, and panicking at the ever-increasing size of his email inbox.

He is a recipient of the MAA's 2017 George Polya Award and the 2019 Burton W. Jones Award.

Response from Travis Kowalski

I am honored to be recognized with the Chauvenet Prize. Among its laureates are many of the authors who inspired me to see mathematics as much as an expression of artistry and humanity as an exercise in logic and rigor—Hardy, Halmos, Mazur, Krantz, Boas—and I am humbled (and in more than a little disbelief) to be considered among them. This article started as a historical romp of a talk for a departmental Pi Day celebration, an excuse for a bit of mathematical "delight and travel," as Jerome Bruner would say. I am delighted to discover that readers have enjoyed traveling with me through time and technique to admire some gorgeous mathematical gems.

I am grateful to the Mathematical Association of America for fostering this community of mathematical scholars and storytellers, and for their tireless advocacy in sharing the beauty of mathematics with everyone. I am grateful to all my teachers—Jeff Luscher, Albert Stralka, Mihai Putinar, Salah Baoendi—for instilling in me a love of doing and sharing mathematics. I am grateful to my colleagues and students at the South Dakota School of Mines for their patience in listening to this talk over and over, and their feedback in improving it each time. And I am grateful to my family—Bailey, Liliana, and Maia—for their support and love.