Book Reviews

Garfield, the Pythagorean theorem, and the fight for universal education

by Suzanne Klebe

The Mathematical Universe
by William Dunham
John Wiley and Sons, New York, 1994
314 pages, hardbound, $22.95

William Dunham's latest book contains an intriguing story about U.S. President James A. Garfield—the same Garfield who was assassinated in 1881 by networks controlled by the British monarchy (see "British Monarchy Takes Aim at Another President," *EIR Feature,* Dec. 2, 1994). Garfield, as Dunham elaborates, developed a unique proof of the Pythagorean Theorem. This, obviously, was back in the days when U.S. political leaders still admired a Classical education. How far we are now from the oratory of an Abraham Lincoln, or from the inspired crusade for Classical education in free, public schools by a Thaddeus Stevens. And how unusual for a U.S. President and congressman to be involved in geometrical constructions! But perhaps this story further fills in the picture of why such a political leadership was considered a threat to the British aristocracy who had just seen their support for the Confederacy go up in flames.

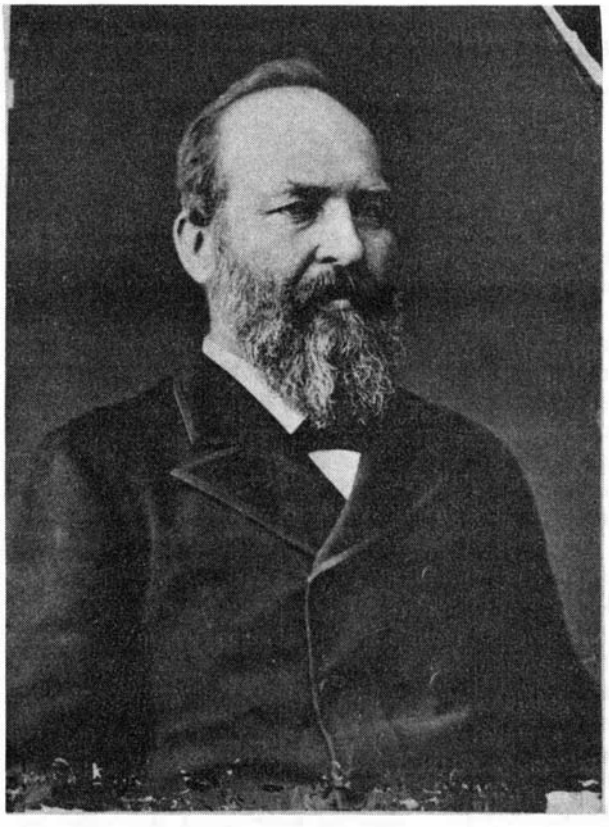
Dunham's book, which is arranged to present different discoveries and personalities in the history of mathematics "from A to Z," includes under the letter "H," the chapter "Hypotenuse," in which he discusses three different proofs of the Pythagorean Theorem. These include the "Chinese Proof" embodied in the *hsuan-thu* diagram of a square tilted in another square, dated from somewhere between 1000 B.C. and 1 A.D.; the proof by John Wallis in the 17th century based on the proportionality of similar triangles; and finally, the proof developed by U.S. Rep. James Garfield in 1876, based on the construction of a trapezoid containing a right triangle (see illustration from Dunham's book).

Dunham details—and provides extremely useful source material for readers to follow their own investigations further—the mathematical interests of U.S. chief executives from Presidents Washington to Grant:

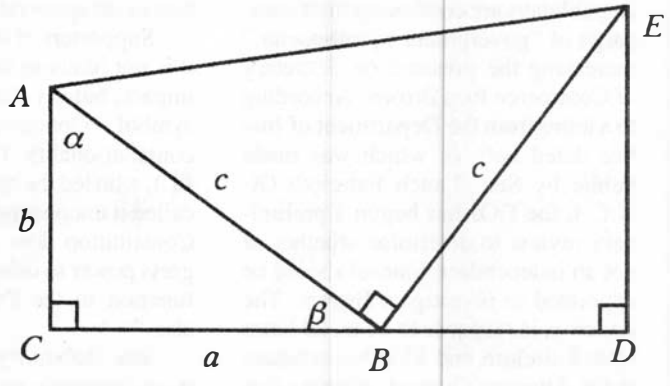
"U.S. Presidents, whatever abilities they exhibit in other spheres, are seldom known for their mathematical powers. . . . Historically, however, some chief executives have possessed mathematical talent. One was George Washington, an accomplished surveyor, who endorsed mathematics with the following words: 'The investigation of mathematical truths accustoms the mind to method and correctness in reasoning, and is an employment peculiarly worthy of rational beings. . . . From the high ground of mathematical and philosophical demonstration, we are insensibly led to far nobler speculations and sublime meditations.' "

He continues: "Abraham Lincoln was also a strong advocate of mathematics. As a young adult studying law, Abe recognized the need to sharpen his reasoning skills, to learn what it meant to prove a point by means of a sound logical argument. As he later recalled in an autobiographical sketch: 'I said, "Lincoln, you can never make a lawyer if you do not understand what demonstrate means"; and I left my situation in Springfield, went home to my father's house, and stayed there till I could give any proposition in the six books of Euclid at sight. I then found out what "demonstrate" means, and went back to my law studies.' "

James Garfield was trained at Western Reserve Academy and Hiram College in Ohio, graduating from Williams College in Massachusetts in 1856. He planned to return to Hiram to teach mathematics, but, in the heat of the debate over slavery and the threat of war, he was elected to the Ohio Senate in 1859. "Radical in his politics and fiercely patriotic, he left academe to join the Union Army when war erupted in 1861," writes Dunham. "Interestingly the math teacher turned out to be a fine soldier. Garfield quickly rose in the ranks until he was appointed chief of staff for Union Gen. John Rosecrans. In 1863, Garfield shifted from the U.S. Army to the U.S. House of Representatives, where he spent the next 17 years as a Radical Republican intent upon reforming, if not punishing the South. . . . In 1880 James A. Garfield earned the Republican nomination for the presidency and narrowly defeated another Civil War hero, the Democrat Winfield Scott Han-



President James Garfield



As a congressman, Garfield considered it a worthwhile form of "amusement" to get together with his colleagues from both sides of the aisle and solve problems in geometry. Shown here, a diagram from his proof of the Pythagorean theorem.

cock, in that fall's election. At his inauguration in March of 1881, our mathematical President promised to improve the educational opportunities of all Americans, because, 'It is the high privilege and sacred duty of those now living to educate their successors and fit them, by intelligence and virtue, for the inheritance which awaits them.'*

"But promise was about all that came from the Garfield administration, for on July 2, 1881, having served less than four months, he was shot by a disgruntled office seeker while boarding a train in Washington. . . . He lingered until mid-September before death overtook him. . . . Politically, his was a life with its greatest dreams left unfulfilled. But he left a mark upon mathematics."

'Some mathematical amusements'

Garfield's demonstration of the Pythagorean principle was presented in 1876 while a member of the House of Representatives, as he himself explained, while " 'in some mathematical amusements and discussions with other M.C.' [members of Congress], and [was] published in the *New England Journal of Education*, a periodical devoted to 'education, science, and literature.' "

Garfield's construction itself proceeds by dropping two parallel lines from the legs of a right triangle, and then connecting those lines with a base line in such a way that the right triangle is now embedded in a trapezoid—and the trapezoid itself is cut into three right triangles. The demonstration then compares the area of the trapezoid with the areas of the three right triangles and concludes that the sum of the squares of the legs of the right triangle is equal to the square of the hypotenuse of the right triangle.

Dunham remarks, "Garfield's is really a very clever proof," and shows later that the demonstration is a mirror image of the *hsuan-thu* diagram of the "Chinese proof." The author then concludes: "Here again we see the benefits of looking at the trapezoid's area from two different viewpoints. As the author of the *New England Journal* article wryly observed, 'we think it something on which the members of both houses can unite without distinction of party.' "

* In 1866, Representative Garfield had Pennsylvania State Sen. Thaddeus Stevens's famous 1835 speech in support of public schools read into the *Congressional Record*. Stevens had made his speech to defend the 1834 law establishing public schools against a large-scale petitioning campaign for its repeal. Stevens biographer Thomas Woodley wrote of Stevens: "His zeal to extend educational opportunities to the masses, early showed itself and continued with uniform intensity throughout life. It was a necessary corollary to his ambition for human equality in the matter of liberties, rights, and punishments. To him, education was the best means afforded to humankind to obtain equal opportunity in life, and he never veered from his staunch conviction that public schools were a fundamental requisite for the maintenance of our form of government. . . . He kept up his propaganda, however, and at public gatherings where toasts were offered, his would be "Education—May the film be removed from the eyes of Pennsylvania and she learn to dread ignorance more than taxation" (from *Thaddeus Stevens*, by Thomas Frederick Woodley, Harrisburg, Pa.: The Telegraph Press, 1934).