A **43-YEAR** ODYSSEY CONCLUDES WITH **PUBLICATION**

IN the ancient world, geometry was a practical subject with many uses. It was the Greek philosophers who went beyond practical problems, observing interrelationships among the statements they made about points, lines, planes, triangles, rectangles and circles. Euclid of Alexandria (active c. 300—265 B.C.E.) identified certain statements about these which seemed to him to be "self-evident truths," and in his "Elements" he undertook to show how every statement in geometry is a logical consequence of these. Thus, the mathematical discipline of geometry was born, and Euclid's work has come to be regarded as one of the great triumphs of the human intellect.

One reason Euclidean geometry has long been considered an essential part of a literate person's education is that it teaches the student how to reason—how to draw non-obvious conclusions from a collection of statements that are accepted as true. The study of geometry does not involve political, religious or other emotionally charged issues that might distract the student from studying the reasoning process itself, and it is accessible because one can draw pictures to illustrate it.

Several attempts have been made to modernize and update Euclid's geometry; one of the most influential was that of David Hilbert in his 1899 paper "Grundlagen der Geometrie" (Foundations of Geometry). The most recent update to Euclid's work is a 527-page book, "Euclidean Geometry and its Subgeometries," authored by four Andrews University mathematicians and recently published by the Swiss technical publisher Birkhäuser/Springer (available also at Amazon).

Shandelle Henson, current chair of the Department of Mathematics, states, "The Department of Mathematics at Andrews University has a long and distinguished history of excellence in research and student mentoring, and our current departmental culture and success can be traced back directly to the leadership of Ed Specht and Harold Jones. Don Rhoads, associate professor emeritus and former chair, along with Keith Calkins, have continued in that long tradition. Ed Specht and Harold Jones were wonderful scholars and teachers. I am incredibly pleased to see their efforts continue to flower in this masterful Birkhäuser volume."

Edward Specht, the principal author, was chair of the Andrews University Department of Mathematics from 1947 to 1972. He had a special love for Euclidean geometry and began in the early 1970s to work seriously on a set of class notes for teaching it. Specht was assisted in this enterprise by Harold Jones, who served some 40 years on the Andrews faculty (and was the father of Meredith Jones Gray, currently professor of English).

Specht and Jones decided to approach geometry in a way that is genuinely modern, using the widely taught concepts of sets and mappings. They decided to make their axioms independent, meaning that no axiom, as it is added, can be derived from any combination of those previously invoked. They did so even though building a theory from independent axioms always entails extra work to get to key theorems. Specht's and Jones' approach is close to that of Hilbert, but, unlike Hilbert, they use reflection mappings to access the ideas of isometry and congruence which play such a prominent role in geometry.

Keith Calkins taught gifted high school students in the RESA Math and Science Center until 2011 and is now on the faculty of Ferris State University. Because of his computer expertise, as well as his familiarity with geometry, he was "drafted" to keyboard Specht's handwritten notes into LaTeX, the typesetting language used by mathematicians. Keith, in fact, had taken a course at Andrews in the 1980s that used an early version of these notes as a text. "I enjoyed it immensely and produced a list of errors for it," he says. The stack of original notes, now in the Andrews University Archives, measures 3½ inches in thickness.
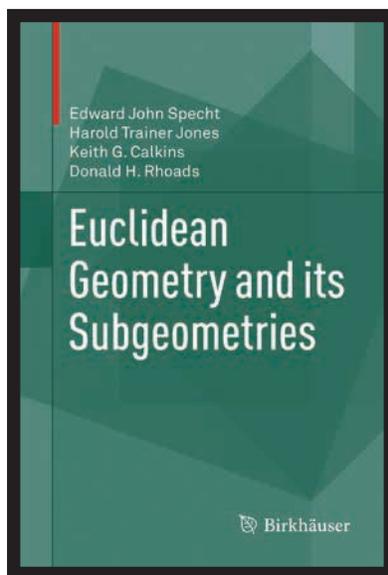
> THE BOOK 'EUCLIDEAN GEOMETRY AND ITS SUBGEOMETRIES' IS **PURE MATHEMATICS** AT ITS BEST

Euclidean Geometry and its Subgeometries

Edward John Specht
Harold Trainer Jones
Keith G. Calkins
Donald H. Rhoads

Birkhäuser

FINISHING A BOOK WRITTEN BY ANOTHER MATHEMATICIAN IS UNBELIEVABLY DIFFICULT

That keyboarding project, which took Keith four years, involved extensive editing and consultation with Specht, who, as a reward, made him a co-author of the work.

The fourth author, Donald Rhoads, chaired the Andrews University Department of Mathematics for six years, retiring in 2006. Shortly afterward, Specht asked him to finish a chapter on the Jordan Curve Theorem—a theorem which is uncommonly hard to prove from axioms, but which, according to some wags, every cow knows—she knows that if she's in the pasture and wants to get out, she has to cross the fence.

When Specht made him a co-author of the book, Don decided that if his name was to be on it he should see what was in it. "I came into the project intending to be a high-powered stenographer—one who knows the difference between a good and a bad proof," he says. "But it turned into a lot more than that. Being retired, I had time to be the penman for the final set of revisions—whereas Keith was still working full-time." Ironically, the original chapter for which Specht enlisted Don's help does not appear in the book; it is available online as a supplement.

Henson continues, "Don Rhoads and Keith Calkins have accomplished a herculean task. Finishing a book written by another mathematician is unbelievably difficult. One must eventually rediscover every theorem and proof for oneself, obtain new results to plug up holes, find an academic publisher, persist through the arduous and seemingly interminable task of responding to reviews and making revisions, and finally check every line and symbol of the galley proofs."

Don's chief graduate school mentor, Professor Arlen Brown, of Indiana University, told him once, "Given the great influence that Euclidean geometry has had on western civilization, someone ought to do it right!" The new book is a major attempt at doing just that. For Keith Calkins and Don Rhoads, it is also an homage to two greatly beloved teachers and colleagues.

Meredith Jones Gray, current chair and professor of English, says, "It's very rewarding to see Ed Specht's and my father's lifelong work finally in print. My dad dedicated his professional career to Emmanuel Missionary College and Andrews University. As was true of so many of the Andrews scholars of his era, his service to the University—his administrative and faculty duties and especially his teaching—always came first—before his own research and publication. We owe a huge debt of gratitude to Don and Keith for bringing this project to fruition and enriching Ed's and my father's legacy."

Henson concludes by saying, "The book 'Euclidean Geometry and its Subgeometries' is pure mathematics at its best: a clean modern approach to Euclid's work, beginning with primitive notions, definitions, and axioms, and rigorously rebuilding the edifice of Euclidean geometry. It is for researchers and graduate students, and it can be used as a textbook for a high-level undergraduate course in geometry, as well." ∎

HAROLD JONES

ED SPECHT

DON RHOADS

KEITH CALKINS