Curves

AND A MATH MAVEN

BY SHIRLEY GRAY & BOB SKIPPER

WESTERN KENTUCKY UNIVERSITY STUDENTS LEARNING MATHEMATICS IN THE 1950S WERE PROBABLY UNAWARE THAT THEIR CALCULUS TEXT, ELEMENTS OF THE DIFFERENTIAL AND INTEGRAL CALCULUS, WAS A TRUE AMERICAN CLASSIC. WITH TWO WORLD WARS DISRUPTING PUBLISHING, AND FAR FEWER STUDENTS ENROLLED IN HIGHER-LEVEL MATHEMATICS, THE MARKET FOR UNIVERSITY TEXTS WAS SMALL. THE TEXT-BOOK WAS FIRST COPYRIGHTED IN THE SPARSE MARKET FOR UNIVERSITY TEXTS IN 1904.

The mathematics faculty at Western in the 1950s — Henry Yarborough, Hugh Johnson, Suzy Howard, and Perry Snell — are remembered with special admiration by students. This dedicated team taught students to respect those who had contributed to the depth and breadth of calculus, the cornerstone of a math, science, or engineering education. In particular, two students, Shirley Barnes ('57) and her future husband Harry Gray ('57), used the same text in successive semesters and still own their copy of "Granville." That background would lead Shirley on a special quest years later.

After graduating from Western, Shirley Barnes Gray remembers thriving on teaching and scholarly activities. "After years of extensive study and travel abroad with my husband, and having three children, I arrived at mid-life determined to achieve my goal of a Ph.D. I was lucky to win a small scholarship since women of my generation were not encouraged, especially in math-ematics," explained Gray.
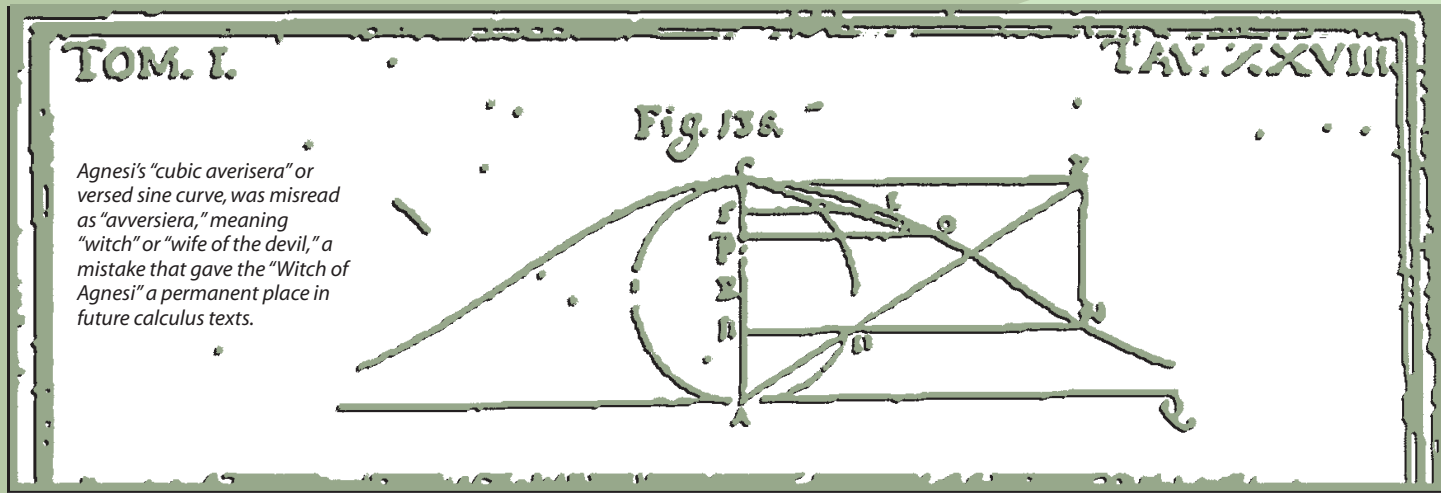
A few problems arose. Could she support a teenage son, take the Graduate Record Examination (GRE) at age fifty, complete a degree before she was too old to reap the subsequent benefits, and finally find employment near her home?

Her first priority, like almost any woman graduating in the 1950s, had always been her family and her home. But she wanted to do something. She wanted to keep her private life in order, while also being able to pursue the demands of graduate educa-tion and then to earn tenure in an academic post.

"As a fifty-year-old who had not lived off a university campus since entering Western, I was often critical of the requirements. There were times when I truly struggled with some of the nonsense that goes into graduate education," Gray said. "But I was blessed with support from my family. Also, we now recognize that the Gray family had been blessed with good health during this period."

After completing her Ph.D. and finally arriving at her goal of a univer-sity position, she then had to ask herself what she should really do. Most young faculty members immediately

Fig. 13a

Agnesi's "cubic averisera" or versed sine curve, was misread as "avversiera," meaning "witch" or "wife of the devil," a mistake that gave the "Witch of Agnesi" a permanent place in future calculus texts.

think of writing a book, which she certainly could do, or producing a research paper. Shirley came to her decision from a slightly different perspective from that of most new faculty.

Shirley's husband, Harry, had already written fifteen books and more than 500 research papers.

The first surviving mathematical work written by a female mathematician, Maria Gaetana Agnesi.

He also had more Ph.D. students and postdocs (approximately 125) teaching in universities around the world than any other single U.S. professor. Shirley had been part and parcel of this process. She knew the struggles that go into juggling many distractions while trying to remain focused on a lengthy academic pursuit. She felt she had "been there, done that." Harry encouraged her to do something that

Shirley and her husband, Harry, at Oxford University.

was fun, to spend time on things she really enjoyed.

She had lots of positive feedback on her teaching. She had often been told she was a great teacher. The rewards of giving a good lecture, of being a popular instructor, were not lost on her. Students had often remarked that her enthusiasm for math was outstanding. For Harry and Shirley, to stand in front of students and not be well prepared is a sin. But her scholarly achievements apart from teaching took a more circuitous route.

In the 1990s, remembering "Curves for Reference" in the back or her Granville *Calculus* text from Western, she was intrigued by the curve known as "The Witch of Agnesi" and with Maria Gaetana Agnesi (1718-1799), the first woman to publish a surviving work of mathematics, *Instituzioni Analytiche* (1748). Earlier women may have published a book, or written a manuscript, but their work has simply not survived. Shirley has often wondered about identities of authors, "Surely some woman wrote something that exists in some library, but is assumed to be a man, or is disguised under a man's name. After all, the history of mathematics has documents spanning 3,000 years."

Equipped with legitimate scholarly credentials, Dr. Gray gained entrance

to rare sources and started building a large circle of professional friends. Taking advantage of Harry's travel, Shirley started to collect Agnesi materials from many of the world's great libraries. In particular, days in the British Library and at the Royal Society in London, the Bodleian Library at Oxford, and the University Library at Cambridge, will never be forgotten.

The extent of her cache of materials took on global proportions. For example, she examined photographs of the world's oldest copy of Archimedes in Denmark's *Det Kongelige Bibliotek.* She knew the great classical scholar Johan Heiberg had taken the pictures in 1906 in Istanbul. She had one of Harry's Ph.D. students take photos of the church in Turkey where the palimpsest had rested for several centuries. Shirley herself visited the library in Jerusalem where the palimpsest was moved after the Turks took Constantinople in 1453. Classical scholars were more than willing to help her.

Moreover, she was building a broad network of friends through attending conferences and workshops. "The lessons on this important aspect of building a professional career I learned from Harry," Shirley said. "Chemists thrive on knowing one another and working together. Students who major in lab sciences know they must have help from others. They have benefited from an apprentice system." She wishes this were more common among mathematicians.

To write a long biography of Agnesi would have taken several months of combing archives in Italy. While this would be a challenge, she had no desire to leave her home in California for an extensive period of time. But she was modern enough,

(from left) Jane Lovell Pfingston, Shirley Barnes Gray and Pat Hooper were roommates in McLean Hall in the 1950s. On Labor Day of 2004, the ladies reunited in Morganfield.

and proficient enough with new technology, that she immediately recognized that a web site would be a perfect medium to display her Agnesi collection. This resulted in http://instructional1.calstatela.edu/sgray/Agnesi. The site keeps collecting hits as the search for women in mathematics broadens. The materials were part of a display in the main New York Public Library during the summer of 2004.

But having learned to enjoy the new mathematics-related software programs, web development tools, and graphing calculators — the visual communication of mathematics — Shirley

realized there was more to be done than merely commemorating Agnesi. In 2001 she proposed to the National Science Foundation (NSF) the idea of building a national math archive. Europe has several. The United States has only recently "caught the wave" of looking into its reltively short mathematical history and supporting Yankee scholarship. This includes everything from Granville, Smith, and Longley's classical text to Tom Lehrer, baseball, and Mandelbrot's fractal geometry. NSF funding has resulted in http://curvebank.calstatela.edu.

The National Curve Bank (NCB) Project is designed as a resource for students of mathematics. Dr. Gray, as director of the NCB, strives to provide features on the web — for example, animation and interaction — that a printed page cannot offer. She hopes to bridge the gap between traditional math classroom instruction and computer media, the dominant technology of the current generation of students.

"The printing press has controlled mathematics communication for almost 500 years," she said. "Our notation is awkward, often a mystery, even for mathematicians not working directly in a given field. This is certain to change. Free web information will inevitably illustrate and support chalkboard instruction where appropriate. The sciences are thriving on technology. Math is certain to move in this direction."

What now? The National Science Foundation encouraged the NCB project to focus on undergraduate topics. The project is taking on a life of its own as the number of "deposits" in the Bank builds and the archive expands.

Current Western math faculty members, Tom Richmond and Bettina Richmond have made a contribution to the NCB and Wanda Weidemann serves on the National Advisory Board. Long-time Western faculty member Pat Hooper was Shirley's roommate in McLean Hall. "Patsy will certainly tell me if something is wrong," quipped Dr. Gray. The NSF and the NCB Board are now encouraging building in the area of Calculus surfaces. Collaborators in Computer Science want to add pages using JAVA.

Shirley's students at Cal State Los Angeles are providing much of the expertise that goes into polishing the contributions to the National Curve Bank Project. Shirley encourages the faculty at Western and their many graduates in high schools across Kentucky to work with their students. On many aspects, Shirley says she has learned from, rather than taught, her 20-year-old students. "At this point many college students have much to offer older faculty members," she declared. "Many undergraduates may not be so well versed in the classics but they have never read a line of code that did not interest them."

The collection of materials and the network of friends continue to expand as new invitations arrive. Harry has plans to go to Rome in the fall. Shirley is already plotting to get herself admitted to the Vatican Library to see the only two very old copies of Euclid's *Elements* in the world. She has read the D'Orville 301 (888 AD) Euclid at the Bodleian. But the Vatican has another Euclid, which may be older, and is slightly different. Naturally she wants to compare the two.

But seeing the Vatican's Euclid, which she considers as one of the great treasures of civilization, is only her first stop. She has been in communication with *Il Direttore* of the *Divisione Filatelia* of the Italian postal service. Shirley thinks Italy should issue a stamp in Agnesi's honor. She will try to arrange a meeting with the officers to present the credentials for an Italian woman, well represented in American mathematics texts and well know to American students, but not well-known in her native country.

Needless to say, Dr. Gray is pleased that an illustration she saw in the back of a math text in the 1950s at Western is still very much a part of her scholarly life.