BOOKS & ARTS

A. SHINBUN

The blossoming of Japanese mathematics

A new compilation of the illustrated geometry problems that decorated shrines in seventeenth-century Japan provides puzzles that are still intriguing today, finds **Peter J. Lu**.

Sacred Mathematics: Japanese Temple Geometry
by Fukagawa Hidetoshi and Tony Rothman
Princeton University Press: 2008. 392 pp. $35.00, £19.95

At the beginning of the seventeenth century, Tokugawa Ieyasu completed the unification of Japan. His shogunate ruled for more than 250 years and oversaw a period of peace, but with restricted foreign contact. Poetry, music and literature flourished during this time of relative isolation. A unique form of Japanese culture of the period was *sangaku* — a combination of mathematics and art on votive tablets. Illustrated wooden shingles up to several metres across bearing geometry problems were hung from Shinto shrines and Buddhist temples for public display. Many historical *sangaku* answers appeared on tablets without proof, perhaps to demonstrate the mathematical prowess of the presenter. And their sacred context remains unclear: the tablets might have been educational or may have signalled gratitude for divine assistance in solving a mathematical problem. Of the thousands of tablets created, only a fraction survive, and they have received scant coverage in histories of Japanese mathematics.

Now Fukagawa Hidetoshi, a mathematics teacher, and writer Tony Rothman present a collection of *sangaku* problems in their book, *Sacred Mathematics*. The puzzles range from simple algebra within the grasp of any intermediate-school student, to challenging problems that require graduate-school mathematics to solve. Copious illustrations and many detailed solutions show the scope, complexity and beauty of what was tackled in Japan during the Tokugawa shogunate.

The book offers a feast for recreational geometers looking for fun new problems, presented and solved in clever ways. Yet the authors give little insight into how these problems were solved at the time, or whether unique Japanese methods were involved. The *sangaku* figures are mostly redrawn with modern notation, and solutions offered in the compact form of present-day Western mathematics. Illustrating traditional Japanese and modern Western methods side by side would have been instructive. The book thus achieves only limited success in showcasing *sangaku* as exemplars of a uniquely Japanese style of mathematics, because that style is never elucidated.

Fukagawa and Rothman illuminate the mathematics more than the history and context of the tablets. Citations to mathematical theorems abound, yet references supporting their historical claims are absent. More seriously, the historical commentary reflects a romantic bias that a unique Japanese culture flowered because of its complete isolation. The book states, for instance, that "a unique brand of homegrown mathematics flourished, one that was completely uninfluenced by developments in the western mathematics". This generalization is historically unsupported, and obstructs an accurate consideration of the interplay of factors that drove the development of Japanese mathematics.

Along similar lines, the authors also dismiss the millennium that preceded the seventeenth century as "a dark age" paralleling that in Europe, during which relatively little was accomplished in mathematics. By ignoring the medieval Islamic world, they fall into the same trap as Eurocentric mathematical historians who focus exclusively on ancient Greece and modern Europe. This omission undermines their discussion of the Chinese foundation of Japanese mathematics. World-leading achievements in mathematics, science and technology — even astronomers from Persia — reached China during the medieval period by the Silk Road and other routes. The book describes in great detail how Seki Takakazu, "Japan's most celebrated mathematician", calculated π to 11 digits in the eighteenth century. But it does not mention Jamshid Masʿud al-Kashi, who determined π correctly to 16 digits some three centuries earlier while residing in Samarkand (in what is now Uzbekistan), one of the most important cities along the Silk Road.

The complex events that followed Japan's opening to the West after the shogunate's end in the 1860s are given similarly short shrift. The response of Japanese mathematics to this influx of ideas is dispatched with the glib statement that "resistance was futile". By quoting a science-fiction character from *Star Trek* that annihilates everything in its path by assimilation, Fukagawa and Rothman trivialize Japan's complicated process of reintegration with the international community, and miss the opportunity to shed light on how its early mathematics contributed to Japan's present-day leadership in science and technology. ■

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