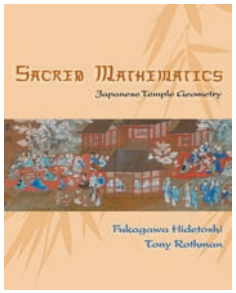
The art of *sangaku*



SACRED MATHEMATICS: JAPANESE TEMPLE GEOMETRY BY FUKAGAWA HIDETOSHI AND TONY ROTHMAN

Princeton Univ. Press: 2008. 392 pp. $35.00

Recreational puzzles have a long history in mathematics, yet despite this, mathematicians were taken by surprise when the *sudoko* phenomenon swept across the world in 2005. Suddenly it became popular to while away time with a mathematics puzzle. This is perhaps not so shocking as mathematics has always held a special place in society. Beyond providing the essential tools for the physical description of reality, mathematics can be a means in itself — the purest form of mathematics is more like art.

In this wonderful new book, Fukagawa Hidetoshi and Tony Rothman take us back to a time in Japan when people from all walks of life painted mathematics problems on beautiful wooden tablets called *sangaku* and hung them as offerings in Buddhist temples and Shinto shrines. This was the Edo period in which the Tokugawa shogunate isolated Japan from the West for the best part of three hundred years during the seventeenth to nineteenth centuries. The Dutch East India Company was allowed to trade from Deshima, a small man-made island built by the Portuguese in Nagasaki harbour. This was Japan's sole gateway to the West. As such, Fukagawa and Rothman point out that it is extremely unlikely that anyone in Japan learned about the creation of calculus by Newton and Leibniz during this period. Nevertheless, the stability provided by the *sakoku* 'closed country' policy of the Tokugawa shogunate led to a period of great peace and the flowering of the Japanese *Genroku* culture in which, among other arts, Noh dance, Kabuki and puppet theatre, tea ceremonies, flower arranging and garden architecture were on the ascendant.

It is against this background that traditional Japanese mathematics flourished in the mid- to-late seventeenth century. During the peace of the Edo period the Tokugawa transformed the samurai into a highly educated class. Small private schools abounded and were attended by children and adults alike. Fukagawa and Rothman describe these developments, along with the earlier Chinese influence on Japanese mathematics. The key Japanese mathematicians of the Edo period are covered, along with their biggest achievements. These include Seki Takakazu, who made many independent discoveries before his European counterparts, most notably the theory of determinants a decade before Leibniz.

Much of this delightful book is taken up with the translation and solution of nearly two hundred *sangaku* problems, which are mostly at the high school or college mathematics level. However, some of these problems are extremely difficult to solve. The *sangaku* temple offerings stated theorems or problems and were often left as challenges for others. The majority of these are problems in geometry and are classified into chapters of easier, harder and still harder problems. These are followed by what Freeman Dyson describes in the Foreword as the "crown jewel of the book". This is the chapter giving extracts from the never before published travel diary of the mathematician Yamaguchi Kanzan. Travel in the Edo period was very popular and many lovers of mathematics made *sangaku* pilgrimages around the country. Yamaguchi completed six long journeys across Japan between 1817 and 1828, recording details of eighty seven *sangaku* and their creators. Sadly only two of these wooden tablets are known to have survived. For several decades Fukagawa Hidetoshi himself has contributed greatly to the location and preservation of *sangaku*.

Sangaku are in themselves works of art. Each wooden tablet usually contains many illustrated problems. One of the most beautiful is the dragon-framed tablet dedicated by Irie Shinjun in 1873 to the Katayamahiko shrine of Murahisagun Okayama city. The book includes a number of colour plates of *sangaku* and related artwork from the Edo period. *Sacred Mathematics* can thus be enjoyed as an art book. It also provides scholarly insight into Japanese culture. Above all, it uniquely catalogues a wide and impressive range of original *sangaku* problems and their detailed solutions. The authors have provided a tremendous service by bringing the rich and inspiring mathematical art of *sangaku* more prominently into view.

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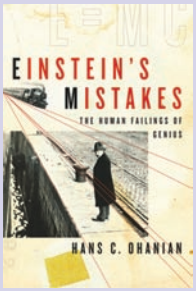
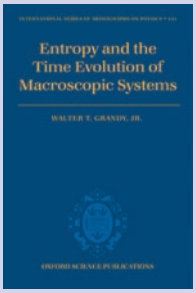


Einstein's Mistakes by Hans C. Ohanian
W. W. Norton & Company: 2008. 256 pp. £15.99

Ohanian explores lesser known aspects of Einstein's scientific endeavours, tracing how some of the discoveries came about, their link to works of those before him and the mistakes that he made in the process.



Entropy and the Time Evolution of Macroscopic Systems by Walter T. Grandy, Jr
Oxford Univ. Press: 2008. 224 pp. £55

Grandy's concise monograph on entropy presents insights on its meaning in equilibrium statistical mechanics and its connection to probability, before addressing its important extension to non-equilibrium systems.