MATHEMATICS IN JAPAN

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Summary

Wasan or “Japanese Mathematics “ is the posthumous name given to a fertile tradition which originated from a handful of medieval Chinese treatises and reached its highest point during the Tokugawa period (1600-1868). The most ancient mathematical publications in Japanese date back to the 1620’s. They are mainly devoted to the use of Chinese abacus and commercial arithmetic. The decisive step was made by Seki Takakazu (?-1708) who transformed the instrumental algebra dating from Sung dynasty (960-1279) into an essential tool of mathematical research. Takebe Katahiro (1664-1739), his disciple, completed Seki’s work by introducing infinite series into the calculus. With its vast number of competing academies scattered in the major cities and in the countryside, *wasan* held a significant place in the cultural landscape of premodern Japan. Thousands of votive tablets with mathematical contents (*sangaku*) displayed under the roofs of temples and shrines provide compelling evidence of the intense communication which took place between the schools. The new educational system established by the Meiji State put an end to *wasan* as a scholarly practice. Mathematical research was conducted thereafter within the University of Tokyo, founded in 1877.

1. Introduction

Wasan or “Japanese Mathematics “ is the posthumous name given to a fertile tradition which developed in the framework of Chinese mathematical paradigm and met an increasing audience throughout Tokugawa period (1600-1868). Japanese contribution was the most remarkable in the fields of algebra and analysis. The decisive step was made by Seki Takakazu (?-1708) who turned the instrumental algebra dating from Sung

dynasty (960-1279) into an essential tool of mathematical research. Takebe Katahiro (1664-1739), his disciple, completed Seki's work by introducing infinite series into the calculus. With its vast number of competing academies scattered in the cities and in the countryside, *wasan* held a significant place in the cultural landscape of premodern Japan. Thousands of votive tablets with mathematical contents (*sangaku*) displayed under the roofs of temples and shrines provide a compelling evidence of the intense communication which took place between the schools. The education system established by the Meiji State put an end to *wasan* as a scholarly practice but the ease with which Japanese adopted Western mathematics is certainly due to the wide diffusion of mathematical practice during the previous centuries.

2. The Beginnings (Seventh to Sixteenth Century)

Few traces are left of the mathematical training which was established within the framework of the imperial bureaucracy imitating the Chinese Tang dynasty (618-907). As with other disciplines such as astronomy, medicine, and pharmaceutics, training was based on imported textbooks of Chinese and Korean origins. A body of Chinese methods of calculation, computational instruments and technical terminology was introduced at that time. In the beginning, mathematics education was available mainly to the sons of the aristocratic families, but during the following centuries, when the political power fell to warriors, mathematical knowledge gradually entered the lower layers of the society. However, the scope of the mathematical expertise never exceeded the elementary operations until the last decades of the sixteenth century when the economical and political context stimulated interest in mathematical instruction. The powerful warlords who controlled the country favored works of civil engineering and construction within their domains. Mathematics was also needed to conduct land surveys, to organize trade throughout the country, and to administer the increasing agricultural production. The international trade with Portuguese and Asian merchants provided a channel for transmission of foreign mathematical expertise to Japan. At the same time, the war waged against Korea in the late sixteenth century by Toyotomi Hideyoshi resulted in the transmission to Japan of old Chinese mathematical treatises preserved in Korea.

3. Textbooks of Commercial Arithmetic

The earliest extant vernacular textbooks of mathematics date from the 1620's. In many respects, the political and cultural background during the seventeenth century differed from the previous century. Under the rule of the Tokugawa shoguns, Japan entered a long period of peace and prosperity during which the social and economical organization was considerably rationalized. The refined culture which was previously the monopoly of court aristocrats and Buddhist monks spread widely amongst commoners. At the same time, the expulsion of the Portuguese merchants and the proscription of Chinese books produced under Jesuit supervision created difficult conditions for the Japanese *literati* interested in scientific matters. The proscribed books included the important collection of astronomical and mathematical treatises entitled *Chongzhen lishu* (Calender treatise for the reign of Chongzhen) compiled for the calendar reform of Chongzhen era (1628-1644). Western Science was accessible only through the books that merchants of the Dutch East India Company (*Vereenigde Oostindische Compagnie* or *VOC*), who had been granted the right of entry to the port

of Nagasaki, brought into Japan. However, despite the proscriptions, the Japanese mathematicians of the seventeenth century were well versed in Chinese treatises, especially those of the Yuan (1271-1368) and Ming (1368-1644) periods.

Among the first vernacular textbooks of commercial arithmetic, the *Jinkôki* (The Unalterable treatise), published in 1627, is particularly noteworthy for the wealth of its contents and the quality of its editorial work. It reflected the extreme vitality of the merchant class of Kyoto and the economical context of the revival of mathematics. It also revealed a strong concern for pedagogy: beautifully illustrated and enriched with recreational problems, the *Jinkôki* described thoroughly the process for calculating with the abacus (*soroban*)(Figure 1), a mathematical instrument imported from China into Japan at the end of the sixteenth century. It also showed concrete scenes of daily life in which calculation was needed. The number of problems borrowed from the *Suanfa tongzong* (Systematic Treatise on Mathematics) (1592) increased with the repeated editions but the book kept a wide audience until the nineteenth century.

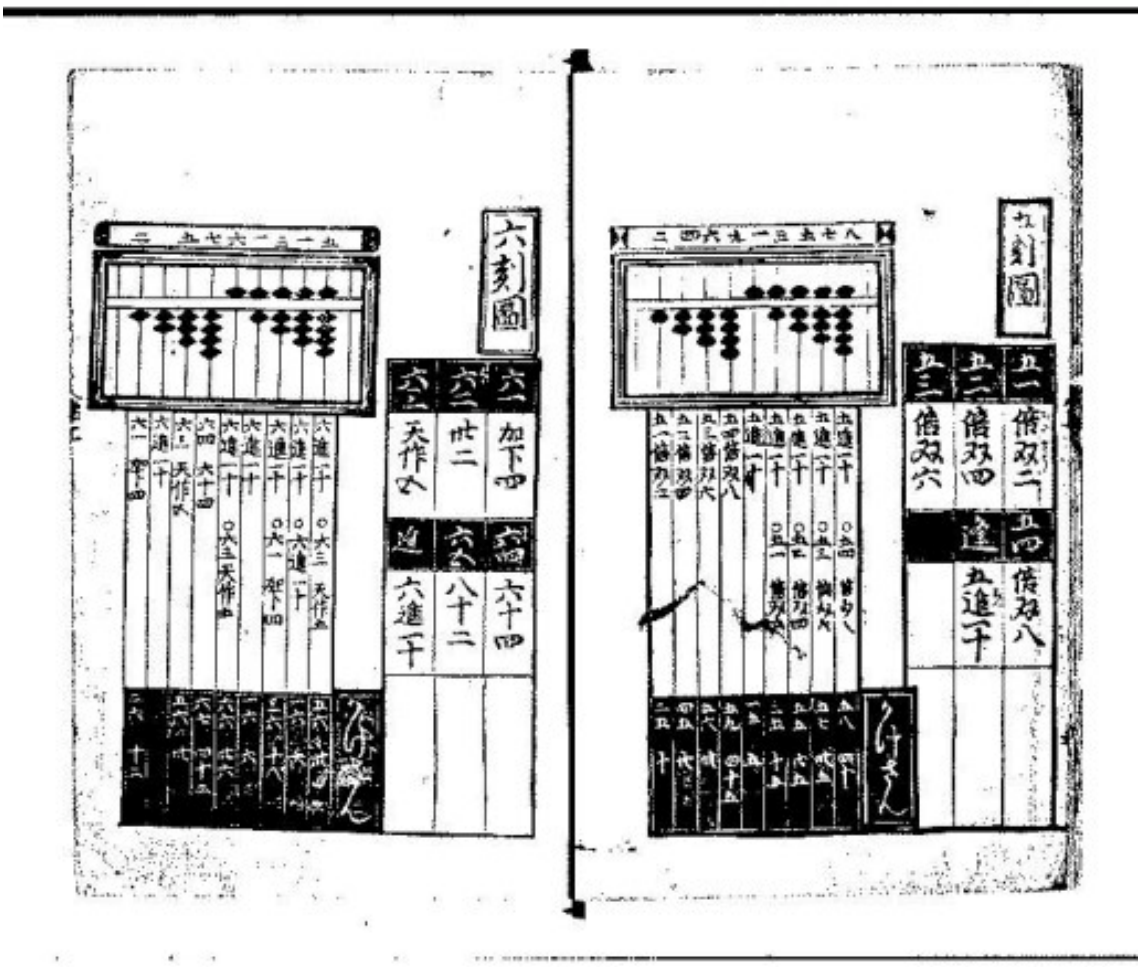

Figure 1 A view of the *Jinkôki* (1627), the Inalterable Treatise, describing the procedure of division of the number 123456789 by 5 (page on the right) and by 6 (page on the left) as performed on the abacus (*soroban*). Manuscript preserved at the Tôhoku University (Okamoto Collection).
Ref: http://www2.library.tohoku.ac.jp/wasan/wsn-dtl.php?id=000184&cls=j

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Biographical Sketch

Annick Horiuchi, Professor of intellectual history in Japan at the University Paris Diderot, specializes in premodern Japan. She received her Ph. D from University Paris Diderot in 1990. Her publications include:
- *Les mathématiques japonaises à l'époque d'Edo (1600-1868) — une étude des travaux de Seki Takakazu (?-1708) et de Takebe Katahiro (1664-1739)*, (1994).
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