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Number Theory from Fibonacci to 17th Century Safavid Persia: a question of transmission of knowledge

How much influence did Islamic mathematics have on Renaissance Europe and vice versa? This possible transmission of knowledge is an interesting and important topic for the historian. In this paper the question of transmission is examined with regard to selected problems in number theory, in particular the problem of congruent numbers. A congruent number k is an integer for which there exists a square such that the sum and difference of that square with k are themselves squares.

Congruent numbers can first be found in various works of classical Islamic mathematics, for example, in al-Karaji's early 11th century text, the *al-Fakhri*. Congruent numbers then resurface in the treatise *Liber Quadratorum* of Fibonacci. We then find congruent numbers in the influential 17th century work, *Khulasat al-Hisab* of Baha al-Din.

Was the work of Fibonacci known in the Islamic world? This is not easy to determine, since there is no direct reference to Fibonacci in Islamic sources. On the other hand, Edouard Lucas, in a major essay on Fibonacci, shows the existence of an intellectual thread, if not a clear historical thread, connecting Fibonacci and Baha al-Din.

To examine the problem of transmission, it is necessary to look at the cultural context for mathematics during the Safavid dynasty of 17th century Persia. The Safavid period represents, perhaps, the last flowering of classical Islamic science. Under the reign of the Safavid ruler Shah Abbas I, 1588–1629, a cultural renaissance occurred in the capital city of Isfahan. Especially important are Safavid accomplishments in the areas of mathematics, astronomy, scientific instrument making, carpet weaving, medicine, and architecture. Safavid mathematics is represented primarily through the work of Baha al-Din and Mohammad Baqir Yazdi (whose major work, the *Uyun al-Hisab*, also includes some interesting results in number theory).

It is well-known that many different Europeans spent time in the court of Shah Abbas. Adventurers, travelers, and missionaries were attracted by this center of learning. This paper examines possible sources of transmission. For example, it is known that the 17th century Italian traveler, Pietro Della Valle, did discuss current trends in astronomy with Persian scientists.

The discussion of the work of these Safavid scholars will hopefully contribute to a more complete picture of classical Islamic mathematics.