Al-Khwarizmi

Al-Khwarizmi (780-850) is often a forgotten figure in the popular history of mathematics where the focus is mainly on the famous Greek and European mathematicians. His place as one of the greatest mathematicians is undeniable. Al-Khwarizmi's contributions in arithmetic and algebra profoundly affected future mathematicians especially in the West. The great European mathematicians owe much to the Islam and Hindu cultures. This manifests itself in Al-Khwarizmi's contributions to mathematics.

Al-Khwarizmi was one of the most important scholars in the House of Wisdom in Baghdad. The House of Wisdom had been set up by Caliph al-Mamun as a place where Greek philosophical and scientific works could be translated. The scholars also studied other topics such algebra, geometry and astronomy.[i] Al-Khwarizmi, similarly to other scholars before the modern era, studied and worked in a number of different fields. His principal contributions were in geography, astronomy, arithmetic, and algebra.[ii]

Al-Khwarizmi was part of team of astronomers that measured the length of one degree along a meridian. He also created a map of the known world which was far more accurate than previous maps created by Ptolemy. The map included the latitudes and longitudes of many important places of the ancient world. His contributions to astronomy included writing *Sindhind zij*, which was a book largely based on Indian astronomical works. This is a good example of the exchange of ideas between different cultures.

His contribution to arithmetic was introducing to the Islamic World and then to the Western World, the Hindu system of numeration. In his book entitled *Art of Hindu Reckoning*, Al-Khwarizmi explained the place-value system and demonstrated "the basic operations of addition, subtraction, multiplication, and division and showed how to work with fractions and how to extract square roots."[iii] Some historian believe the "the first use of zero as a place holder in positional base notation was probably due to al-Khwarizmi in this work".[iv] The Latin translation of the book and al-Khwarizmi's name gave us the word algorithm.[v]

Al-Khwarizmi's biggest contribution was in algebra. His book *Kitab al-jabr wa l-muqabala* (The Book of Restoring and Balancing) was the starting point of the subject of algebra. The Arabic word al-jabr in the title created the word algebra.[vi] Al-Khwarizmi "intended [his book] to be

highly practical and that algebra was introduced to solve real life problems that were part of everyday life in the Islam empire at that time."[vii]

Page from al-Khwarizmi's Kitab al-Jabr wal-Muqabala, the oldest Arabic work on algebra

9th century

http://www.superluminal.com/cookbook/gallery_alkhwarizmi_kitab.html

This is a **page from al-Khwarizmi's algebra text**, *Kitab al-jabr wa l-muqabala*

http://mathdl.maa.org/mathDL/46/?pa=content&sa=viewDocument&nodeId=2591&bodyId=2586

[i] O'Connor, J. J. and E. F. Robertson, Abu Ja'far Muhammad ibn Musa Al-Khwarizmi, (July 1999) Accessed September 7, 2010 http://www-history.mcs.st-and.ac.uk/Biographies/Al-Khwarizmi.html

[ii] Berggren, J.L., *Episodes in the Mathematics of Medieval Islam,* (New York: Springer-Verlag, 1986), p. 7.

[iii] Arndt, A. B., "Al-Khwarizmi", in *From Five Fingers to Infinity: A Journey through the History of Mathematics,* ed. Frank J. Swetz, (Peru, Illnois: Open Court Publishing Company, 1994), 291.

[iv] O'Connor.

[v] Cooke, Roger, *The History of Mathematics: A Brief Course,* (Toronto: John Wiley & Sons, Inc., 1997), 264.

[vi] Berggren, 7.

[vii] O'Conner