Thabit

Thabit ibn Qurra al-Harrani (826 – 901), also known by the spelling **Thebit** in the West, is considered the Arabic counterpoint of Pappus. He was a commentator on higher mathematics and one of the most brilliant and accomplished Arab scholars. He produced translations into Arabic of many important Greek works, including those of Euclid, Apollonius, Archimedes, and Ptolemy. Had it not been for his efforts, the number of existing Greek mathematical works would be significantly and sadly fewer. He revised many of the translated Greek works and was one of the first reformers of Ptolemy's system. In his book on mechanics, *Kitab fi'l-garastun* (The book on the beam balance), he discussed and proved the principles of levers in equilibrium by using a center of mass method in describing the loads. His observations of the apparent motion of the Sun and Moon across the sky led him to the conjecture that the Sun's motion contained an undiscovered element that affected the ecliptic, the apparent path of the Sun relative to the stars. He was a pioneer in extending the concept of traditional geometry to geometrical algebra. He proposed theories that led to the development of non-Euclidean geometry, spherical trigonometry, integral calculus, and real numbers.

Born in Harran in northern Mesopotamia (now in Turkey), Thabit was a member of the star worshipping Sabian sect. He came from a wealthy and prominent family, and inherited a large family fortune. Because of his impressive command of languages he was persuaded by the great Muslim mathematician Muhammad Ibn Musa Al-Khwarizmi to go Baghdad to study mathematics and medicine, a combination that was quite common for scholars of the time. Wishing to make use of Thabit's great skills in language and mathematics to translate Greek works, the Abbasid Caliph al-

Mu'tadid appointed him court astronomer. Thabit was not only an important translator; he made many important mathematical discoveries. He proposed important improvements in some of Euclid's theorems. He applied arithmetical terminology to geometric quantities and studied several aspects of conic sections, notably those of the parabola and ellipse. With his computations designed to determine the surface areas and volumes of certain solids Thabit helped develop an early form of integral calculus. He made important contributions to number theory, in particular with amicable numbers.

Thabit gave a nice proof of the Pythagorean theorem. He begins with a right triangle ABC, with A the right angle [Figure 9.13]. Next a square is constructed on the hypotenuse CB, and the original triangle ABC is translated along this square to obtain a congruent triangle HKG inside the square, so that its hypotenuse GK is the other side of the square. Draw perpendiculars KE and GF from the points K and G to the line AC. Draw a line DB to complete the square ABDE, which is on the leg AC of the original triangle. In addition, the square EFGH has side GH that equals AC, so EFGH equals a square on the leg AC. What remains to be shown is that the square BCGK is equal to the sum of the squares ABDE and EFGH, which can be accomplished by a mathematical equivalent process to cutting and pasting. Beginning with square EFGH, translate the triangle HKG back across the square to triangle ABC and translate the triangle BDK across the square to the congruent triangle FCG. Pasting the pieces together, one sees that the squares ABDE and EFGH are completely covered with no overlap. Thus, as required, = + . Like Pappus, Thabit generalized the Pythagorean Theorem to arbitrary triangles.

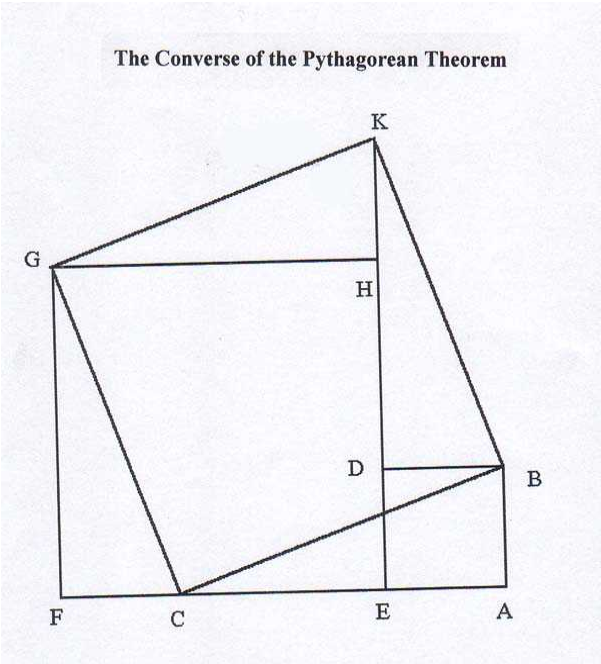

Figure 9.13

Thabit also wrote on philosophy, logic, psychology, ethics, and the classification of sciences, languages, politics, religion and the customs of the Sabians. In philosophy, his concept of number is similar to that of Plato, in that he believes that numbers exist, whether someone knows them or not, but he disagreed with the theories of Plato and Aristotle regarding motion. Thabit and his grandson Ibrahim ibn Sinan studied the curves needed for making sundials. After a long career of scholarship, Thabit died at Baghdad in 901. A large number of his books in mathematics, astronomy and medicine survived. During the Middle Ages, Gerard of Cremona translated some of Thabit's books into Latin.

Quotation of the Day: "The work and responsibility of preserving the great achievements of the Greeks and making further contributions to the sciences and mathematics was carried out by the Arabs, who welcomed scholars of all nationalities into their society." – Calvin C. Clawson