The Muslim Weekly

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Science and Technology

Muslim World of Mathematics

Muslims have made immense contributions to almost all branches of the sciences and arts, but mathematics was their favourite subject and its development owes a great deal to the genius of Arab and persian scholars. The advancement in different branches of mathematical science commenced during the Caliphate of Omayyads.

Starting point

Arabic translations of the well-known mathematical works of those times gave the Arabs the sources to develop the science of mathematics to an admirably high degree and later scientists owe much to the Arab genius.

The Greeks are said to have invented algebra, but among them, as Oelsner has justly remarked, it was confined to furnishing amusement 'for the plays of the goblet'. The Muslims applied it to higher purposes, and thus gave it a value hitherto unknown.

Under Mamun they had discovered the equations of the second degree, and very soon after they developed the theory of quadratic aquations and the binomial theorem. Not only algebra geometry and arithmetic, but optics and mechanics made remarkable progress in the hands of the Muslims. They invented spherical trigonometry; they were the first to apply algebra to geometry, to introduce the tangent, and to substitute the sine for the arc in trigonometrical calculations.

Their progress in mathematical geography was no less remarkable. Even the so-called enlightened west which has at times taken pains to minimise the greatness of Muslim achievements in furthering the cause of human civilisation, had to admit, though half heartedly, the outstanding part played by the Arabs.

Creation of Zero

Arabic numerals including zero were the greatest contributions made by the Arabs to the mathematical science. The outstanding quality of Arabic numerals lies in the fact that they possess an absolute value.

The most significant numeral invented by the Arabs was zero which according to Carra De Vaux "was used by the Arabs at least 250 years before it became known in the west". Before the introduction of the zero it was necessary to arrange all figures in columns to differentiate between tens, hundreds, thousands, etc. The earliest use of the zero is given as 873 AD.

Arithmetic Greats

Arabs were the founders of every day arithmetic and taught the use of ciphers to the world.

Musa al-Khwarizmi (780—850 A.D.) was one of the greatest mathematicians of all times. George Sarton pays glowing tribute to this outstanding Muslim mathematician and considers him "one of the greatest scientists of his race and the greatest of his time".

Al-Nasavi's arithmetic explains the division of fractions and the extraction of square and cubic roots in an almost modern manner. He introduced the decimal system in place of sexagesimal system.

Abu Zakariya Muhammad Al-Hissar who probably lived in the 12th century AD was the first mathematician who started writing fractions in their present form with a horizontal line.

Nasir-ud-din Toosi, a versatile genius, who was a prolific writer and has written more than hundreds of valuable books to his credit, has the distinction of being one of the greatest scientists and mathematicians of Islam.

Algebra Originators

Algebra is a word derived from the Arabic source AlJabar and is the product of Arabic genius.

Al-Khwarizmi's outstanding work on algebra contains analytical solutions of linear and quadratic equations. He has the distinction of being one of the founders of algebra who developed this branch of science to an exceptionally high degree. He also gives geometric solutions of quadratic equations, e.g., $x2+10x=39$ an equation which was repeated by later mathematicians. Robert Chester was the first to translate this book into Latin in 1145 AD which introduced Algebra into Europe.

The Algebra written by Al-Khwarizmi is lucid and well-arranged. After dealing with equations of the second degree, the learned mathematician discussed

algebraic multiplications and divisions.

Omar Khayyam's algebra deals with the geometric and algebraic solution of equation of the second degree and includes an admirable classification of equations based on the number and different terms which they include. He recognises thirteen different forms of cubic equations. His solution of cubic and quadratic equations by the conic section method is probably the most advanced work of Arabic mathematics that has survived.

Abul Kamil improved upon the algebra of Khwarizmi. He dealt with quadratic equations, multiplication and division of algebraic quantities, addition and subtraction of radicals and the algebraic treatment of pentagons and decagons.

Geometry Giants

Geometry, like other branches of mathematics, made much headway in the hands of Muslims. The three famous brothers Muhammad, Ahmad and Hassan, sons of Musa bin Shakir, wrote an excellent work on geometry which was translated into Latin by Gerard of Cremona. This was later translated into German by M. Kurtaza.

Abul Wafa Al-Buzjani, (940-997, 998 A. D.) is the author of Kitab al-Hindusa which was rendered into Persian by one of his friends. "It had a large number of" says H. Suter, "geometrical problems…a number of these problems are solved by a single span of the compass, a condition which we find for the first time here."'

Nasir-ud-din Toosi, a great intellectual giant of Islam wrote Oawaid-ul-Hindasiya a book of geometry.

Arabs were much in advance of Hindus and Greeks in the development and use of arithmetic, algebra and geometry.

Trigonometry Founders

It has been universally acknowledged that plane and spherical trigonometry were founded by Muslims who developed it considerably. The Greeks and other advanced nations of the ancient world were ignorant of this essential branch of mathematics.

The nation of trigonometrical ratios, which is now prevalent, owes its birth to the mathematical talents of Al-Battani. The third chapter, of his astronomical work, dealing with trigonometry, was several times translated into Latin and Spanish languages.

Jabir Bin Afiah is the author of the celebrated book Kitab Elahia which deals with astronomy and trigonometry. "His book Kitab Elahia," says H. Suter, "is noteworthy for preparing the astronomical part with a special chapter on trigonometry. In his spherical trigonometry he takes the rule of the four magnitudes as the foundation for the deviations of his formulae and gives for the first time the fifth main formula of the right angled triangle." His work was translated in Latin by Gerard of Cremona.

Abul Wafa (939—997, 998 A.D.) born at Buzjan in Khorasan was one of the greatest mathematicians that Islam has produced. His Zijush Shamil (consolidated tables) is distinguished for their accurate observation and he introduced as well as popularised the use of the secant and tangent in trigonometry. "But this was not all" says Sedillot, "struck by the imperfection of the lunar theory of Ptolemy, he verified the ancient observations, and discovered, independently of the equation of the centre and the eviction, a third inequality, which is no other than the variation determined six centuries later by Tycho Brahe."

Abul Wafa was also an outstanding geometer who studied the quadrature of parabola and the volume of paraboloid. He was probably first to show the generality of sine theorem relative to spherical triangles. He gave a new method of constructing sine tables. He made a special study of tangent; calculated a table of tangents; introduced the secant and cosecant; knew those simple relations between the six trigonometric lines, which are now often used to define

Nasir-ud-din Toosi, a versatile genius, played no mean part in the development of trigonometry. His works on trigonometry mark the culmination of the advancement on the subject. His book remained to be the greatest work of its kind until De triangulurs of Regiomontenus two centuries later.

Such were the great mathematical giants which the Muslim world produced, who were not only the pioneers of mathematical science during mediaeval times, but are considered to be authorities on several mathematical problems even during the modern age. The development of mathematics owes a great deal to the genius of these Muslim luminaries.