CONTRIBUTION MUSLIM SCIENTISTS IN THE DEVELOPMENT OF MATHEMATICS

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ABSTRAK

Matematika adalah salah satu ilmu pengetahuan yang merupakan hasil dari pemikiran manusia. Oleh karena itu matematika tidak dapat terpisahkan dengan sejarahnya. Banyak tokoh atau ilmuwan muslim yang memiliki andil besar dalam perkembangan matematika, diantaranya adalah Muhammad ibn Musa al-Khwarizmi dan Thabit Ibn Qurra. Pemikiran serta karya yang diciptakannya mampu memberikan motivasi kepada Ilmuwan lain untuk mengkaji, menelaah hingga kemudian mengembangkan lagi menjadi ilmu yang lebih kompleks. Dalam hal ini penulis ingin berbagi informasi dengan peserta didik dan pendidik, ditingkat sekolah menengah dan perguruan tinggi mengenai latar belakang kehidupan dan kontribusi ilmuwan muslim tersebut dalam perkembangan ilmu matematika.

Kata kunci *: muslim, matematika, al-Khwarizmi, Thabit Ibn Qurra*

ABSTRACT

Mathematics is one of the sciences that is the result of human thought. Therefore mathematics cannot be separated from its history. Many Muslim figures or scientists have played a major role in the development of mathematics, including Muhammad ibn Musa al-Khwarizmi and Thabit Ibn Qurra. The thoughts and works created are able to motivate other scientists to study, examine and then develop again into a more complex science. In this case the author wants to share information with students and educators, at the high school and college level about the background of life and the contribution of these Muslim scientists in the development of mathematics.

Keywords*: muslim, mathematics, al-Khwarizmi, Thabit Ibn Qurra*

INTRODUCTION

Mathematics is a science that is familiar to our ears, because mathematics has been present for centuries in all aspects of our lives. Mathematics has become a guide and at the same time a source of every problem solving, ranging from problems related to economic, political, cultural, social, religious and other problems. Mathematics is also the main science of all kinds of other sciences as well as a branch of mathematics, so that in every science we study we will find mathematics (Mahmudah&Fikroh, 2021). The word mathematics comes from the Greek "matema" which means knowledge, thinking and learning.

The history of the development of mathematics is a tool (history as a tool) or a strategy to build meaningful learning. History is something that relates to the origin or creation of something. Klowss stated that using history in learning mathematics can make learning interesting because it can find out how the origins of mathematical theory, so students can be motivated in learning mathematics. In underlying research related to the perception of mathematics teachers on the application of the history of mathematics with three key keyword assumptions, namely: (1) the history of mathematics provides a deep foundation for understanding the evolution of mathematical concepts, (2) understanding why and how mathematical concepts were developed over many years with hard work. (3) learning the history of mathematics can increase students' interest and develop positive attitudes towards mathematics.

Mathematics has developed along with the development of human civilization. Mathematics has been placed at the top of the hierarchy of knowledge, this is marked by the many monumental discoveries by several Muslim figures or scholars that occurred during the heyday of Islam. The figures or Muslim scholars, among others, such as Al-Khwarizmi and Thabit Ibn Quro. Al-Khwarizmi and Thabit Ibn Quro were very instrumental in the development of mathematics and ultimately became the philosophical basis for developing new branches of science. The new knowledge includes branches in the fields of agriculture, animal husbandry, medicine, economics, education, technology and other fields. Therefore mathematics is a very important subject in the education system throughout the country.

The history of mathematics has explained as an example how Al-Khwarizmi developed the perfect square method for solving quadratic equations. Through the history of mathematics, mathematicians can find and develop a concept or solving a problem can be an inspirational story. Al-Khwarizmi also explained the proof of solving quadratic equations geometrically to solve quadratic equations in his book entitled Hisab al-jabr Wa'l muqabalah.

Picture 1. Tsabit ibn Qurrah

METHOD

The research method used in this paper is a literature study by collecting written sources in the form of books, scientific reports, or journals that discuss the history of Islamic mathematics by Muhammad Ibn Musa al Khwarizmi, Thabit Ibn Quro', and Abu Kamil. Many studies refer to information from books and articles or journals, such as an article written by sumardyono, M.pd entitled Medieval Algebra Figures published by the P4TK Mathematics web in 2012. The journal written by Muhammad Hidayat, Hasrian Rudi Setiawan, Arwin Juli Rakhmadi entitled Mathematical Concepts by Muslim Scientists in 2019, as well as other books and journals discussing Islamic mathematics by Muhammad Ibn Musa al Khwarizmi, Thabit Ibn Quro' and Abu Kamil.

Collecting data in this study using secondary sources. Secondary sources are indirect sources of information that provide data to researchers or authors (Sugiyono, 2016). In this case the secondary sources in question are books, encyclopedias, or scientific reports contained in journals and articles relating to the history of Islamic mathematics and Islamic mathematicians.
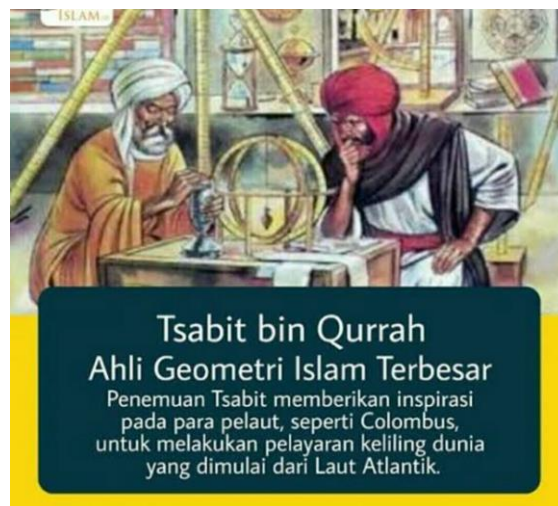
Picture 2. Al Khawarizmi
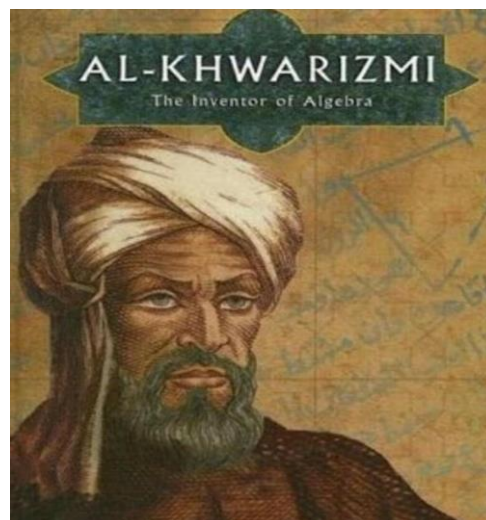
DISCUSSION
History of Islamic Mathematics

Philosophically, mathematics is the earliest known science to humans (Krantz, 2006). Mathematics is a science that uses numbers as symbols to make it easier to solve calculation problems. The existence of numbers that represent a certain

number of numbers, can be used to facilitate problem solving in everyday life. Because in essence, every life is a mathematical process, so mathematics is always used in everyday life.

From the 8th century or about 701 AD onwards the Islamic empires founded in Persia, Central Asia, the Middle East, North Africa, Liberia, and even parts of India, have made significant contributions to mathematics. However, there is a separate prohibition in Islam, namely the depiction of the human form, it has been stated in the hadith "The person who draws these pictures (pictures of animate creatures) will be punished on the Day of Judgment, and it will be said to them: 'Turn on what you make this" (Narrated by Bukhari and Muslim), therefore Islam has consequences on the widespread use of complex geometric patterns to decorate their buildings.

One of the 9th century Persian mathematicians who was the early Director of the House of Wisdom Muhammad Al Khwarizmi, he had a very important contribution in mathematics, namely a firm defense of the Hindu numeric system (numbers 1 to 9 and 0), besides that he also contributed to the method algebra in mathematics. In the 10th century the first person to use the method of proof by mathematical induction was known as Muhammad Al-Karaji.

In this case, it is clear that many Islamic scientists have contributed to the development of science, one of which is mathematics, where mathematics is very much attached to everyday life, besides that there are many other sciences that have developed from the basic concepts of mathematical science (maratus: 2016).). It's no wonder that mathematics is called the queen of education according to the 19th century mathematician Gauss.

Muhammad Ibn Musa Al-Khwarizmi

Abu Ja'far Muhammad Al-Khwarizmi or commonly known as Al-Khwarizmi. The name al-khwarizmi refers to his birthplace, a small town on the banks of the Oxus river (Ammu Darya), namely khwarizm (khanate of khiva) (Juhriyansyah, 2006).

Mathematician who lived during the Abbasid caliphate. Where he could reach the golden peak during the reign of Al-Ma'mun. a caliph who was very fond of science and even focused a lot of his mind on science. The science books he got from Baghdad, India, Greece, and Persia were then translated into Arabic. One of the people he trusted to translate books was Al-Khwarizmi.

Al-Khwarizmi was one of the first directors of the policy house in Baghdad in the early 9th century, as well as a scientist in mathematics, astronomy, geography, geosciences, and the arts of music. In mathematics, AL-Khwarizmi is known as a scientist who introduced the concept of Algorithm (Juhriyansyah, 2006). The word "algorithm" comes from the Latinization of its name, besides that

Al-Khwarizmi introduced the Fundamental Algebra method.

Al-Khwarizmi's contribution to mathematics is a strong defense of the Hindu numeric system (1-9 and 0), which Al-Khwarizmi admits has the power and efficiency needed to revolutionize Islamic and Western mathematics.

Another important contribution of Al-Khwarizmi is finding a problem solving technique in mathematical form. The technique is called algebra (Murtiningsih, 2011), Algebra comes from the title of a math book he published around 820 AD called "Al-Kitab al-mukhtasar fi hisab al-jabr wa'l-muqabala" ("Compendative Book on Calculations with Solutions". and Balancing"). His book is considered a book on the foundations of modern algebra, although he did not use the type of algebraic notation used today (he used words to describe problems, and diagrams to solve them). polynomial equations to the second degree, and introduced for the first time the basic algebraic methods of "subtraction" (rewriting the equation in a simpler form), "solving" (moving negative values from one side of the equation to the other and changing the sign) and "balancing" (subtracting equal numbers from both sides of the equation, and canceling equal terms on the same side) opposite) (Muhtar, 2014, p. 90).

described standard forms in terms of "square" (now called " x^2"), "root" (which is now "x") and "number" (a regular constant, such as 42), and identified six types such as: square root is equal to ($a^2 = bx$), square is equal to number ($ax^2 = c$), root is equal to number ($bx = c$), squared and root is equal to ($ax^2 + bx = c$), the square and the number equal to the root ($a^2 + c = bx$), and the root and the number squared are the same ($bx + c = ax^2$).

Algebra discussed in the book of reckoning Al-Jabr contains 800 examples of problems. These examples are used as guidelines for solving problems in everyday life. Such as housing, inheritance, division of property, trade, and others. Another book he wrote was *Al-jem wa'l Tafraq bi Hisab al-Hind.* Books that discuss the use of numbers in mathematics for the first time. Where the number is related to other mathematical problems such as basic mathematical operations.

In addition to his work in mathematics, Al-Khwarizmi made important contributions to astronomy, also largely based on methods from India, and he developed the first quadrant (an instrument used to determine time by observing the Sun or stars), the second quadrant the most widely used astronomical instrument. during the Middle Ages after the astrolabe. He also produced a revised and complete version of Ptolemy's "Geography", which consists of a list of 2,402 coordinates of known cities around the world.

Tsabit Ibn Qurrah

His full name is Abu al Hasan Thabit bin Qurrah bin Marwah al-Sabi al-Harrani. He is a member of the

Sabians - a star worship group. In his time this sect had produced many qualified astronomers and mathematicians.

Thabit has shown his intelligence since childhood, when he was still studying. There are several historical records which state that Thabit was a money changer when he was young, but some historians disagree with that (Bun Yamin, 2014).

Armed with his intelligence, the Muslim scientist who is diamond has actually made a series of discoveries that are very important for the development of mathematics. Thabit bin qurrah played an important role in the discovery of integral computation, analytic geometry, calculus, theorems of circular trigonometry, the concept of real numbers and proposed several theories that led to the construction of non-euclidean geometry.

Mathematicians consider the solution made by Thabit bin Qurrah to be very creative. Of course, this is because Thabit bin Qurrah is very familiar with all the books by foreign scientists that he has translated. Thabit bin Qurrah has also written a number of equations to the second power (square), equations to the cube (cubic), and several deepening of formulas to anticipate the development of integral calculus. In addition, he conducted a number of studies on the parabola, before developing it. In his book entitled Quadrature of Parabola, he uses the form of integral computation to find a plane of a parabola.

The Muslim mathematician, known as Thabit, is also one of the leading Muslim scientists in the field of geometry. One of Thabit's phenomenal works in the field of geometry is his book entitled *The composition of Ratios*. In the book, Thabit applies arithmetic to the ratio of geometric quantities. This thinking, far beyond the discoveries of ancient Greek scientists in the field of geometry.

One of the important discoveries inherited by Thabit Ibn Qurra for modern human civilization is the theory of friendly numbers (amicable numbers). That is, a pair of numbers that has the unique property of two numbers, each of which is the sum of the true divisors of the other number. Thabit created the formula for friendly numbers as follows:

$p = 3 \times 2n11$

$q = 3 \times 2n1$

$r = 9 \times 22n11$

Thabit ibn qurra also proved the Pythagorean theorem, which is as follows:

1. Make a rectangle with lengths a and b, then arrange them side by side
2. The area of the shape above is a large square and a small square, namely $a^2 + b^2$
3. We combine the square above, then make a line in such a way that it will look like the image below, where side c becomes the hypotenuse.

4. Next we cut the triangle and place it on the other side, namely the right side and the top.

CONCLUSION

Mathematics is the main science of all kinds of other sciences, so that in every science studied will encounter mathematics. With the development of the times, the science of mathematics has developed marked by many monumental discoveries by several Muslim intellectuals during the heyday of Islam. One of them is Al-Khwarizmi and Thabit Ibn Qurra who became the basis of a philosophy of a new branch of science.

Abu Ja'far Muhammad Al-Khwarizmi commonly known as Al-Khwarizmi was born in a small town called Khwarizmi who lived during the Abbasids. Al-Khwarizmi is the originator of the Hindu numerical system (1-9 and 0). The word algebra is taken from the famous work of Al-Khwarizmi with the title "Al-Kitab al-mukhtasar fi hisab al-jabr wa'l-muqabala" which became the basis of modern algebra, so that Al-Khwarizmi is known as the father of world algebra.

Abu al hasan Thabit bin Qurrah bin Marwah al-Sabi al-Harrani is often called Thabit Ibn Qurra. In a series of important discoveries in the development of mathematics, Thabit Ibn Qurra played an important role in the discovery of several theories that led to the development of non-euclidian geometry. One of his phenomenal works in the field of geometry, entitled "The Composition of Ratios". In this book, Thabit Ibn Qurrah applies arithmetic to the ratio of geometric quantities. Thabit Ibn Qurra also left a legacy for modern human civilization in the form of amicable number theory.

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