Mathematician Monday

How has Islam contributed to the study of Mathematics?

How were Greek and Hindu conjectures/theorems translated?

Who is the most famous Muslim mathematician and why is he most famous?

Who first used the concept of **Zero**?

How was the concept of "Algebra" developed?

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How has Islam contributed to the study of Mathematics?

Islamic Mathematics

Overview

Islamic Mathematics is the term used to refer to the mathematics done in the Islamic world between the 8th and 13th centuries CE. Mathematics from the medieval Middle East is very important to the mathematics we use today. While Europe endured its "Dark Ages," the Middle East preserved and expanded the arithmetic, geometry, trigonometry, and astronomy from the ancient Greek philosophers, such as Euclid. The most important contribution may be the invention of algebra, which originated in Baghdad in the House of Wisdom (*bayt al-hikma*).

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How were Greek and Hindu conjectures/theorems translated?

House of Wisdom

The House of Wisdom was primarily a library and a place for translation and research. Scholars would work here in translating Greek and Hindu treatises to Arabic, and also conducted their own research and wrote original treatises. The House of Wisdom was established in the early 9th century, by Caliph al-Rashid. His son, Caliph al-Ma'mun, was the ruler who made the House of Wisdom so important. Al-Ma'mun had a dream in which Aristotle appeared to him; after this dream, al-Ma'mun wanted to translate as many Greek manuscripts as he could! He commissioned scholars to begin translating Greek, Hindu, Syriac-Persian, and Hebrew texts into Arabic. Most of these texts dealt with philosophy or mathematics and science.

Norman MacDonald/Saudi Aramco World/PADIA

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Who is the most famous Muslim mathematician and why is he the most famous?

Al-Khwārizmī

Muhammad ibn Mūsā al-Khwārizmī is probably the most famous Muslim mathematician. He lived about 800-847 CE. Al-Khwārizmī was born in Qutrubull, an area near Baghdad between the Tigris and Euphrates rives, but was brought to work at the House of Wisdom by the Caliph al-Ma'mun. He popularized a number of mathematical concepts, including the use of Hindu-Arabic numbers and the number zero, algebra, and the use of geometry to demonstrate and prove algebraic results. Many of his works deal with astronomy, but he also wrote about the Jewish calendar, arithmetic, and algebra.

Picture of al-Khwārizmī on a Russian stamp, issued in 1983

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Who invented the concept of **Zero**?

Arithmetic

Al-Khwārizmī wrote a very important treatise on Hindu-Arabic numerals, which made the use of these numbers popular. The introduction of the number zero was especially important for mathematics, and the number 0 was used for about 250 years throughout the Islamic world before Europe ever heard of it! He also introduced the Hindu concept of decimal positioning notation to the Arab and European worlds, which we still use today!

Hindu-Arabic Numbers	Arabic-language Numbers
0	٠
1	١
2	٢
3	٣
4	٤
5	٥
6	٦
7	٧
8	٨
9	٩

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How was the concept of "Algebra" developed?

Algebraic Operations

Al-Khwārizmī wrote a treatise entitled *Kitab al-jabr wa'l-muqabalah*. The treatise actually had a very practical reason behind it: the longest chapter of the treatise teaches people how to apply algebra to Islamic inheritance laws! The words *al-jabr* and *al-muqabalah* were operations used by Al-Khwārizmī, much like addition, subtraction, multiplication, and division. *Al-jabr* means something like "restoration" or "completion," and was the operation used to add equal terms to both sides of an equation to get rid of a negative term.

"Al-jabr": loosely translates to "restoration" or "completion", "the operation used to add equal terms to both sides of an equation to get rid of a negative term.

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How was the concept of "Algebra" developed?

Applying "al-jabr"

For example, with the equation

$$x^2 = 40x - 4x^2,$$

al-Khwārizmī uses *al-jabr* to add $4x^2$ to both sides of the equation, getting the result:

$$5x^2 = 40x.$$

He can then complete the problem by division

$$x^2 = 8x$$
$$x = 8$$

Though we now know x = 0 & 8, Al-Khwārizmī never allows a variable to equal zero.

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How was the concept of "Algebra" developed?

Al-muqabalah means something like "balancing," and was the operation used to subtract equal terms from both sides of an equation. For example, al-Khwārizmī has the equation:

$$50 + x^2 = 29 + 10x,$$

so he uses *al-muqabalah* to subtract 29 from each side, getting the result:

$$21 + x^2 = 10x.$$

<u>Al-muqabalah:</u> "Balancing", used to subtract equal terms from both sides of an equation.

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How was the concept of "Algebra" developed?

From here, al-Khwārizmī can then complete the problem:

$$x^2 - 10x + 21 = 0$$
$$(x - 7)(x - 3) = 0$$
$$x = 3, 7$$

As you can see, *al-muqabalah* and *al-jabr* were operations defined by al-Khwārizmī which we still use today, though we don't call them the same thing! His operation *al-jabr*, adding equal amounts to both sides of the equation, is where our word "algebra" comes from!

The operation "*al-jabr*" is where our word "Algebra" comes from!

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