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AN OVERVIEW OF THE HISTORY OF MATHEMATICAL THOUGHT

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ANNOTATION

The article scientifically analyzes the process of historical formation of mathematical thinking, its roots and stages of development. The system of mathematical knowledge, which began with practical calculation methods in ancient Egyptian, Mesopotamia, Indian and Chinese civilizations, later gained a logical and scientific basis through the theoretical methods of Greek scientists, especially Euclid.At the same time, it is emphasized that the scientific legacy of Central Asian scholars during the Islamic Renaissance - Al-Khwarizmi, Al-Biruni, Omar Khayyam, and Nasir al-Din al-Tusi - raised mathematical thinking to a new level.The role of women in science and their achievements in the field of mathematical analysis are highlighted using the work of Sofia Kovalevskaya in the 19th century. The development of mathematics in modern times, in close connection with the fields of information technology, artificial intelligence, and analysis, is also analyzed.The article presents scientific and philosophical conclusions about the role of mathematical thought in human thinking and spiritual development.

Keywords: mathematical thinking, history, Euclid, Sofia Kovalevskaya, Al-Khwarizmi, Islamic Renaissance, logical thinking, scientific heritage, mathematical analysis, artificial intelligence, development of science.

At all stages of human development, the importance of science, especially mathematics, has been incomparable. Mathematical thinking forms a person's ability to think logically and directs him to a scientific understanding of the surrounding reality. Therefore, the history of mathematical ideas shows not only the consistent process of the development of scientific discoveries, but also the stages of development of the thinking culture of mankind.

This article examines at the historical formation process of mathematical thinking, analyzes the early sources of mathematics, its theoretical founders, and the lives and activities of scientists who made a great contribution to its scientific traditions. In particular, scientific and philosophical considerations regarding the formation and development of mathematical thinking are presented using the examples of the great Greek mathematician Euclid and the work of Sofia Kovalevskaya, who left a deep mark on history as the first female mathematician.

The roots of mathematical thinking go back to the earliest times of human civilization. The peoples of the ancient world—Egypt, Mesopotamia, India, and China—created basic knowledge of calculation, measurement, and geometry based on practical needs.This knowledge was created in the primitive society on the basis of needs such as dividing plots of land, calculating harvests, building buildings, and determining quantitative relationships in trade.

In ancient Egypt, geometry played an important role in measuring the land and building pyramids, while in Mesopotamia, astronomy and timekeeping systems were developed based on the system of calculus. India introduced the concept of zero and the decimal system, which is considered one of the most important steps in the history of mathematics. Chinese scientists, on the other hand, developed practical methods of calculation using counting boards and symbols.

In this way, the simple calculations that emerged through observation and experience gradually turned into abstract thinking based on logical deduction and generalization. This process created the scientific and theoretical foundations of mathematical thinking and later laid the groundwork for the scientific research of Greek mathematicians.

The ancient Greek mathematician Euclid (IV–III centuries BC) lived in Alexandria and occupies a special place in the history of world science as the scientist who created the theoretical foundations of mathematics. His most famous work, "Elements" (Stoicheia), is one of the most influential scientific books of all time and is considered the first example of the scientific systematization of geometry.

In his work, Euclid demonstrated the logical order of scientific thought in a perfect form: through the system of definition → axiom → theorem → proof, he strengthened geometry as a theoretical science. His method was based on logical

deduction, with each conclusion being derived from previous axioms and proven theorems. This approach established a logical model not only for geometry but also for all of scientific thought.

Euclidean geometry served as the theoretical foundation for architecture, astronomy, engineering, and education for more than two thousand years. His scientific method has become the methodological basis of modern science and has shown what should be the consistent and logical nature of mathematical thinking.

The Islamic Renaissance or the Eastern Renaissance (9th–12th centuries) is a period in the history of human thought marked by the rapid development of science. During this period, mathematics reached a new level, and great achievements were made in its theoretical and practical fields.

In this process, great scholars from Central Asia played a special role. Muhammad al-Khwarizmi (9th century) formed algebra as an independent science and outlined its basic concepts and rules in his work "Al-Jabr wa-l-Muqabala". This work marked the beginning of a new era in mathematics not only in the Islamic world but also in Europe. Al-Biruni, through his research in geometry and trigonometry, refined mathematical methods and applied them to astronomy and geography.

Omar Khayyam improved the theory of algebraic equations, proposed logical methods for solving cubic equations, and at the same time created a scientific school that combined geometry and philosophical thought. And Nasiruddin al-Tusi developed mathematical analysis and trigonometry as an independent science and put forward the theory of "Tusi pair".

Thus, scientific centers such as Khorezm, Samarkand, and Bukhara not only preserved Greek science but also enriched it with new ideas and methods. The scientific legacy of Central Asian scholars later served as a source of inspiration for the scientific awakening in Europe.

In the history of 19th-century science, the name of Sofya Vasilyevna Kovalevskaya (1850–1891) stands out as a symbol of women's intellectual potential and dedication to science. She was the first woman in Europe to receive a doctorate in mathematics, and through her scientific research, she made a significant contribution not only to the development of mathematics, but also to the ideas of gender equality in society.

Kovalevskaya's scientific work was mainly devoted to the fields of differential equations and analytic geometry, and her research entitled "The Problem of Rotation of a Rotating Body" is one of the scientific achievements in this field. Her developments paved the way for the creation of new methods in the theory of equations of motion.

However, her scientific path was not easy: in the 19th century, women were severely restricted from obtaining higher education and engaging in scientific activities. Sofia Kovalevskaya overcame these obstacles through spiritual courage, clear goals, and intellectual will. Her life is considered a shining example of perseverance and intellectual strength in the pursuit of knowledge.

From an analytical point of view, Kovalevskaya's work represents the ideas of equality in scientific thought, freedom of thought and maturity through knowledge. She was a source of inspiration not only for women of her time, but also for subsequent generations of mathematicians. Sofia Kovalevskaya's scientific legacy still demonstrates the universal value of science and the boundless possibilities of human thought and will.

The 19th–21st centuries represent a new stage in the history of mathematical thought. During this period, algebra, calculus theory, mathematical analysis, and systems of logical thinking developed on a deep scientific basis. Mathematics has developed not only as a theoretical science, but also as a practical science, inextricably linked with engineering, economics, physics, and information technology.

The development of fields such as computers, programming, artificial intelligence, and data science has been based on mathematical modeling and algorithmization methods. Thus, mathematics has become the scientific language of modern technologies.

In Uzbekistan, mathematical education and research are also supported at the level of state policy. Increasing the country's intellectual potential by increasing mathematical literacy in the school and higher education systems and developing a culture of scientific thinking is an important priority.

Mathematical thinking is the highest expression of human thought, and the history of its development is a history of reason, research, and creativity. From the pyramids

of ancient Egypt to modern artificial intelligence systems, mathematics has demonstrated the unlimited possibilities of the human mind.

It has progressed from the earliest practical needs to the most advanced forms of abstract thinking and logical analysis.

While great minds like Euclid led science to perfection through logical order and proof, Sofia Kovalevskaya enriched it with human will, equality, and scientific courage. Their legacy proves that mathematical thought is not only a scientific but also a spiritual value.

In today's world, mathematics is a bridge between logic and creativity, precision and beauty, knowledge and progress. It encourages people to think, discover, and innovate. In this sense, the evolution of mathematical thinking is humanity's ongoing journey toward spiritual and intellectual maturity.

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