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ABOUT THE EMERGENCE OF GEOMETRY

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Annotation
This article provides brief historical information about the emergence of geometry, its development periods, and scientists who made a significant contribution to the development of geometry.

Keywords: Egypt, Greece, Babylonia, Moscow, papyri, hieroglyphs, antiquity, planimetry, stereometry, point, straight line, plane

Аннотация
В данной статье приведены краткие исторические сведения о возникновении геометрии, периодах ее развития и ученых, внесших значительный вклад в развитие геометрии.

Ключевые слова: Египет, Греция, Вавилония, Москва, папирусы, иероглифы, древность, планиметрия, стереометрия, точка, прямая, плоскость.

Introduction

The history of geometry begins in the distant past of the ancient world, but it undoubtedly originated in the countries of the East. The development of geometry can be characterized by four periods, but its limits cannot be separated by certain years.
The first period - the period of the emergence of geometry includes the period from BC to the 5th century BC and is closely related to the development of land surveying in ancient Egypt, Babylonia and Greece (the word geometry is also Greek: - earth and - is taken from the words olchayman, the dictionary meaning of which is to measure the land).
According to the information written down by the Greek historian Herodatus (about 465-425 BC), the first information about geometry began to be found in Egypt. It is said that the Kings distributed rectangular plots of land to the Egyptians for farming and collected taxes from the landowner accordingly. The areas damaged by the flooding of the Nile were re-measured and the corresponding tax amount was re-determined.
A number of necessities, such as the distribution of land, the determination of tax rates, the measurement of faces, the construction of irrigation facilities, contributed

to the formation of geometry in Egypt. Information about ancient Egyptian geometry is found in the Rynd and Moscow papyri. Papyrus was made by gluing the barks of perennial plants up to 3 m tall along the Egyptian rivers.

The first of the papyri was bought by the English tourist and Egyptologist Rhind in 1858 from the village of Luxor, located on the right bank of the Nile. The papyrus is 30 cm wide and 20 m long and contains 80 questions. Papyrus is also named after Axmes, who copied it. Until it was written down, the papyrus dates back to 2000-1800 BC. Of the 20 geometrical problems presented in the papyrus, 8 are devoted to calculating the volume, 7 to the surface, and 5 to the volume of an inclined pyramid. The text of the papyrus was first read by August Eisenlar (1805-1880), an Egyptologist at the University of Heidelberg, who translated it into German and published it with commentary. The papyrus is partially preserved today in the British and New York state museums. The second "Moscow" papyrus was discovered in 1893 by the Russian scientist and orientalist V.S. Golenishchev in the State Hermetage of St. Petersburg. In 1930, the source was translated into German by orientalist B.A. Toraev and V.V. Struve and published. The source is 8 cm wide and 5.44 m long, and it contains 18 arithmetical and 7 geometric problems. The papyrus is kept in the Museum of Fine Arts in Moscow.

The Rhind and Moscow papyri are written in ancient Egyptian script. Egyptians used hieroglyphs for writing. Pictures representing animals, birds, insects, people, and objects served as hieroglyphs. Hieroglyphs were replaced by hieratic writing after the discovery of papyrus as a paper. The Rhind and Moscow papyri are written in hieratic script, only the end of the Rhind papyrus is written in hieroglyphic script.

The analysis of the papyri shows that the Egyptians knew how to calculate the surface area of a square, an equilateral triangle, an equilateral trapezium, a circle, and the volume of a truncated pyramid with a square base. They were able to apply them to the calculation of the area of cultivated fields, the distribution of products, and the measurement of the capacity of warehouses and containers. They also knew how to solve a linear equation with one unknown. The Rhind papyrus contains 15 questions, and the Moscow papyrus contains 3 questions.

Another center of culture of antiquity is the culture between two rivers, the Euphrates and the Tigris. This culture is known in history as the Sumerian-Babylonian culture. Since papyrus did not grow between the two rivers, the Babylonians wrote the inscriptions on soft clay tablets using bamboo or bone and dried them in the sun or fire.

Since dry tablets were more durable than papyri, texts written in "Mix letters" have survived more than papyri. Currently, about 560,000 ceramic texts belonging to the 3rd millennium BC are kept in museums of different countries of the world.

The Babylonians were also able to solve systems of equations and quadratic equations. Although Babylonian mathematics was more practical than Egyptian mathematics, they were able to perform algebraic transformations and apply them to solving equations.

The process of abstraction in Babylonian mathematics was much higher than that of the Egyptians. The further development of mathematics is related to Greece. Contacts with Egypt and the Babylonians brought to Greece accumulated mathematical concepts as well as culture. The Greeks not only mastered them, but tried to justify, summarize and prove them.

Geometric data in the VII century BC; According to Greek historians, it passed from Egypt and Babylonia to Greece. Greek philosophers began to study the works of Egyptian and Babylonian sages. It was from this time that the second period of the development of geometry began - the period of systematic description of geometry as a science, in which all sentences were proved.

They studied and developed mathematics in order to know the world, to understand existence and to determine the place of man in it. That is probably why the schools that were initially formed in Greece acquired a philosophical direction. In these schools, mathematics was developed in an integral relationship with philosophy. The first such school is the school of Miletus. The school was founded by the merchant Thales of Miletus (640-556 AD), who is considered the father of Greek mathematics, and who is credited with being able to measure the height of a circle by its shadow, determining the distance from a ship at sea to the shore, and being the first to use the compass. It is also recorded in historical sources that he predicted the solar eclipse that took place on May 28, 585 BC.

Pythagoras and his students made a significant contribution to the development of Greek mathematics. The Pythagorean school of philosophy had a high position. Pythagoras and his students proved the sum of the internal angles of a triangle, the theorem known to the world as the Pythagorean theorem, they determined that the number of regular polyhedra is five, and that there are non-dimensional sections.

Democritus (330-275 CE) created the "Indivisible Particles" method, which proposed the idea that the world is made up of indivisible particles-atoms. According to him, each geometric figure consists of a number of elementary parts, and the volume of the figure is equal to the sum of the volumes of the elementary figures.

Pythagoras put forward the idea that "The world is ruled by number", Plato (429-348 AD) put forward the idea that "Allah is the greatest and most famous geometer" hung up and recommended doing geometrya before doing philosophy.

In Plato's school, geometrical problems of construction were also solved. They solved the problem of doubling the volume of a cube, which cannot be solved using a compass and a ruler, using a device created by Plato. the method of solving geometrical problems in stages, the idea of geometric space, and a number of curves were created in this school.

Eudoxus (410-355 CE) was a representative of Plato's school and founded the theory of proportions. Unlike the concept of numerical ratio created by the followers of Pythagoras, he applied this theory to non-commensurate sections as well as to commensurate sections, as a result, he founded the concept of irrational number. Using the theory of proportions, he calculated the size of the pyramid and cone. The name of Eudox's student Menechmus is connected with the idea of conic sections. The great philosopher Aristotle makes a significant contribution to the development of the science of logic. Aristotle is credited as the founder of formalism and deductive reasoning.

The representatives of the philosophical school formed in Greece by the 3rd century BC developed them on the basis of a critical study of mathematical concepts and ideas created by the Egyptians and Babylonians. tried to create methods of judgment) and incorporated these methods until the systematization of existing concepts required an orderly statement.

The Greek scientist Euclid solved the deductive principle of geometry satisfactorily for his time and created a work entitled "Fundamentals" consisting of 13 books. Complete information about Euclid's life has not reached us. He lived in 300 BC. During the reign of Ptolemy, he taught mathematics in Alexandria and created the mathematics department of the museum organized by Horn.

It is said that one day the king summoned Euclid and asked, "Is there a shorter way to learn geometry than the Basics?" when asked, Euclid proudly said: "There is no special path for kings in geometry." In addition, Euclid's "Optics" and other works are also known. In the history of mankind, it is difficult to show a single work that can be compared with Euclid's work "Fundamentals" and has not lost its value, created on a deep scientific basis compared to its time.

Euclid included in the book "Fundamentals" the most important information of the scientists who passed before him and gave a reasonable proof of the rules that did not satisfy him in geometry. There is no doubt that Euclid himself discovered some of the theorems in "Fundamentals". But the main merit of the author in the book

"Fundamentals" is that he put all the geometrical knowledge accumulated over the centuries into such a system that this system became an example of precision and rigor for a long time. No other scientific book has survived as long as Euclid's Fundamentals.

This book was first copied many times by hand, and then it was published again and again in all languages of the world. This work of Euclid was published 460 times in world languages between 1482-1880. Of these, 155 are Latin, 142 are English, 48 are German, 38 are French, 27 are Italian, 14 are Dutch, 5 are Russian, 2 are Polish, and the rest are translated into other languages.

Summary of the book "Fundamentals".

Book 1 consists of 34 rules and 48 theorems, and talks about the conditions of equality of triangles, the relationship between the sides and angles of a triangle, the faces of a parallelogram and a triangle, and the Pythagorean theorem.

Book 2 consists of 2 rules and 14 theorems, and similar expressions are interpreted in geometric form.

Book 3 is devoted to the circle. In this case, it mainly considers the cutting, product, central angles, internal drawn angles transferred to a circle.

Book 4 looks at polygons inscribed inside and outside a circle and shows how to make regular rectangles, pentagons, hexagons, and decagons.

Book 5 deals mainly with the theory of trapezoids.

In the 6th book, as an application of the theory of proportions, the theory of similarity of triangles and finding the faces of polygons are given.

Books 7-9 are devoted to arithmetic and number theory.

Book 10 deals with the theory of irrational quantities.

Books 11-13 are devoted to stereometry, and give information about polyhedra and regular polyhedra.

Euclid's work "Fundamentals" is very important for the gradual development of mathematics. Inability to correctly overcome the difficulties that arose with the emergence of the concepts of non-dimensional sections and irrationality in Greek mathematics, that is, the concept of irrational number, the problem of expanding numerical sets and creating a theory of real numbers. the inability to solve them leads to the search for their solution in geometry, or rather in the making of geometry.

The collapse of the ancient slave system led to the cessation of the development of geometry in Greece, but geometry continued to develop in the countries of the Arab East, Central Asia and India.

The emergence of capitalism in Europe led to a new, third era of the development of geometry; The creation of analytical geometry by Descartes and Fermat in the first half of the 17th century belongs to this period.

Analytical geometry examines the properties of geometric shapes based on the method of coordinates based on their algebraic equations. Differential geometry was created in the 18th century in the works of Euler and Monge in connection with the investigation of differential calculus and properties of geometric shapes of a local nature (around a given point). In the first half of the 17th century, projective geometry began to appear in the works of J. Desargue and B. Pascal, this geometry first appeared in the study of depicting perspectives, and then in the study of the invariant properties of forms when projecting one plane from one point of space to another. 'ldi and finally improved in the works of J. Ponsele.

The fourth period of the development of geometry is marked by the creation of non-Euclidean geometries. The first of these geometries is the Lobachevsky geometry, which was created by Lobachevsky in the verification of the justification of geometry, including the verification of the axiom of parallel straight lines. N. I. Lobachevsky first presented the content of his geometry in 1826. He stated at the meeting of the Faculty of Physics and Mathematics of Kazan University. His work was published in 1829. was announced at Hungarian mathematician Janos Boyan did a somewhat cruder work on this problem in 1832. announced at Since the creation of Lobachevsky's art of geometry, the importance of the axiomatic method in mathematics, including geometry, has become important. Euclidean geometry (the usual elementary geometry taught in schools) was later axiomatically justified. Lobachevsky geometry, projective geometry, affine geometry, multidimensional (dimensional) Euclidean geometry and other geometries were also axiomatically based.

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