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INFORMATION ABOUT THE SCIENCE OF "ILM AL-KHANDAS" IN THE WORKS OF ABU NASR FARABI

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Abstract
The article provides information about the famous Central Asian scholar Abu Nasr al-Farabi in the IX-X centuries. Among the scientific treatises and manuscripts he wrote in several fields of science were manuscripts in mathematics, especially geometry, which at that time were called ilm al-handasa. The article provides information on these manuscripts, concepts and issues related to geometric constructions. It is recommended to use this information in the study of the history of modern graphic sciences and in solving problems.

Keywords: Abu Nasr Faroobi, manuscripts, "ilm al-handasa", geometry, line, square, triangle, circle, surface, body, geometric constructions.

Introduction

The article provides information about a prominent Central Asian scholar of the 9th-10th centuries Abu Nasr Farabi. Among the scientific treatises and manuscripts that he wrote in several fields of science, there are manuscripts in mathematics, especially geometry, which at that time was called “ilm al-handasa.”. The article provides information about these manuscripts, concepts and tasks devoted to geometric constructions. The use of this information in the study of the history of modern graphic disciplines and in solving problems is recommended.

Key words: Abu Nasr Farabi, manuscripts, “ilm al-handasa”, geometry. line, square, triangle, circle, surface, body, geometric constructions.

It is known that our world-famous ancestors Al-Khwarizmi, Farobi, Ibn Sino, Beruni, Ulugbek and others have made invaluable national wealth, written scientific pamphlets in various fields and made a great contribution to world scientific development. Studying it is an honorable duty of our people.

Historical architectural monuments, unique folk handicrafts, images in historical manuscripts, which are the beauty of our country, were created by people who know the science of "xandasa". In the Middle Ages, the science of "geometry" became a modern geometry and graphics - a science that teaches the theoretical and practical rules of drawing methods - "Engineering Graphics". In order to study the history of this science, we looked at it the information about the science of geometry in the historical manuscripts of Oriental scholars, graphic images, geometric constructions. It is known that Central Asian scientists who lived and worked in the Middle Ages conducted research in almost all areas of science, created innovations and wrote scientific pamphlets. Among such scholars is Abu Nasr al-Farabi.

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Farabi's full name was Abu Nasr Muhammad ibn Muhammad ibn Tarhan ibn Uzluk, and he was born in 870 in Farab (later Otrar), northwest of present-day Tashkent, at the confluence of the Aris and Syrdarya rivers. Abu Nasr receives his primary education in his own country. Then he passed Samarkand, Bukhara, Merv, Ray and went to Baghdad to continue his studies. During this period, Baghdad became the cultural and scientific center of its time. Here Farobi studied with Arabic, Persian and Greek scholars. He is especially interested in the theoretical sciences - logic, mathematics, medicine and philosophy. According to the sources, Farobi knew many languages, was aware of all the sciences that existed in his time, and gained great prestige among the scholars of his time. The scholar died in 950 at the Saif ul-Dawla Palace in Damascus. As a result of scientific research, it was determined that the number of works written by the scientist will reach 160. In the history of Central Asian and Eastern culture, Farobi was not only a famous philosopher, but also a mature naturalist and mathematician. Pharoah's Mathematical Mathematics, The Book of Volume and Quantity (Kitab al-madhal ila al-handasato vahmiyato mukhtasaran) (The Book of Introduction to Spatial Geometry). shows that mathematics played a major role in Farobi's work.

The scholar's book on the Origin of Knowledge (Ikhsa al-Ulum) is noteworthy. The section of this book devoted to mathematics was published in Arabic in Cairo in 1949, and its translation into Russian was published in 1972 (translated by A. Kubesov and I. Muhammad).

Manuscripts of this work are kept in the libraries of Paris, Istanbul and Madrid.

Farobi discusses geometry in the mathematics section of this book. In "The Origin of Science" he writes that the science of geometry ("Ilm al-handasa") Farobi, from theoretical and practical geometry, carpenter is used to determine the lines and surfaces of wooden objects, blacksmith - iron bodies, bricklayer bricks, earth surveyor. Theoretical geometry studies lines, squares, triangles, circles, and other shapes, regardless of what they consist of, only as a geometric object. This science studies the interrelationships of geometric shapes, their dimensions, sizes, proportionality or non-proportionality, whether they have a common dimension, their various shapes, and so on. This science has penetrated other sciences. Geometry consists of two parts, confirms Farobi. One considers lines and planes, and the other - objects. The part that studies objects is, in turn, divided into objects: cube, cone, sphere, cylinder, prism, pyramid. According to Farobi, these two parts of geometry are studied in two ways: first, each geometric object is studied separately. For example, lines are separate, surfaces are separate, cubes are separate, cones are separate; second, by comparing geometric shapes with each other and determining their similarities and differences, they can be arranged in a series, for example, a line on a surface, a surface on a body, or a surface on a surface, or an object on a body. We see that the scientist's contribution to the history of the development of geometric knowledge is great.

Farobi describes the problems of constructive geometry in his book, The Book of Natural Secrets and Skillful Methods of Geometric Shapes (Kitab al-khiyal ar-ruhaiyya wa-asrar at-tabiyya fi dakaik al ashkal al-handasiyya). Systematically demonstrates geometric construction methods. This work has been translated into Russian by S.A. Krasnova and A. Translated by Kubesov. (Al-Farabi, Mathematical Treatise. Alma-Ata. 1972.)

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This book by Farobi consists of 10 chapters: The first chapter is called Determining the Center of a Circle, which shows 15 problems and ways to make them. From these we cite the following.

1. Fill the given AVS segment to the entire circle, i.e. find the center of the AVS arc.

Construction: Divide the given AVS arc into two equal points at point V (Figure 1). We conduct AV, VS watts. At points A and C we make right angles VAD and VSD. Pass the BD diameter and divide it into two equal parts. In this case, point E will be the center of the arc AV.

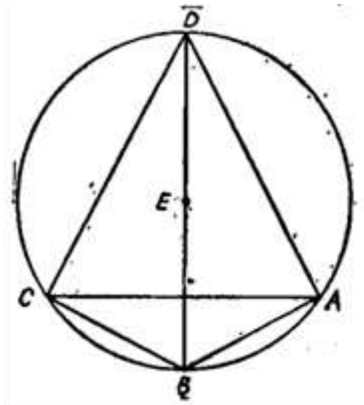

Figure 1

2. Make a triangle equal to the given triangle.

Construction: Let AVS be a triangle (Figure 2). We take a straight line DE, in which we place the sections GF equal to AV, GH equal to VS and HF equal to AS. We draw an arc with center G and radius GD, and arc with center H and radius HL. Let L be the point of intersection of these arcs. We draw the GL and HL lines. Then the sides of the GHL triangle are equal to the sides of the given triangle. This is the triangle you need to make.

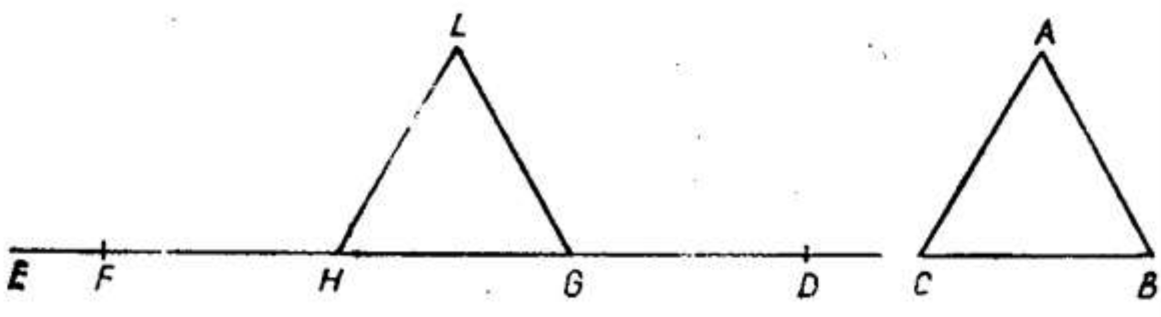

Figure 2

The method of making this is similar to that of Euclid in the 22nd sentence of his first book, The Fundamentals.

3. The angle is required to be equal to ten, i.e. the given AVS angle is to be equal to three equal to three pieces.

Construction: a) If the given angle AVS is right (Fig. 3), we construct a side DBC triangle whose side V is equal to VS. At that time, the AVD angle will be one-third of the right angle. Divide the SVD angle into two equal parts.

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b) If the given angle is smaller than the right angle (Fig. 4), we draw a DAC circle with radius VA centered at point V. Pass VD perpendicular to VS, continue SV to point E. Putting the ruler at point A, we rotate it so that the cross section HF is equal to the cross section DB. Let's make an EK arc to the FE arc. We draw a line KV, which intersects the circle at point L. Then the LBC angle is equal to one-third of the AVS angle.

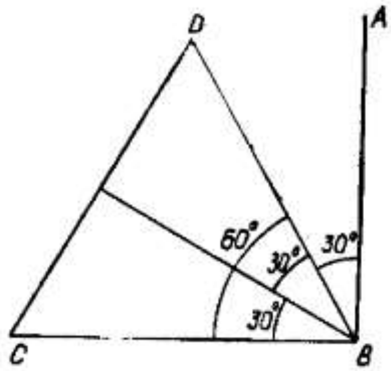
The second chapter describes the creation of equilateral shapes.

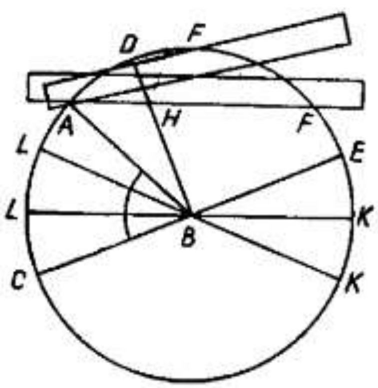
It describes 11 issues and ways to create them. Methods for making regular triangles, squares, regular pentagons, hexagons, hexagons, octagons, octagons, and hexagons are given.

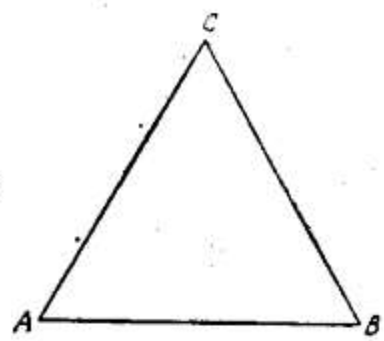
Here are some of them.

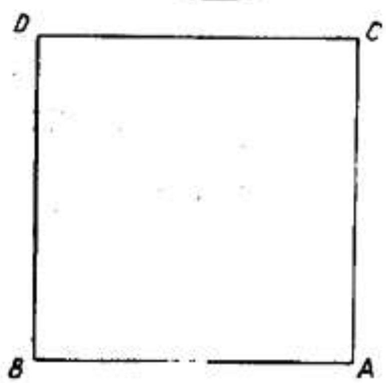
1. Construct a triangle whose sides are equal on a given AV line.

Construction: Draw arcs with radius centered at point A and then point B (Figure 5). They intersect at point C. We connect point C with points A and B. The resulting AVS triangle is an equilateral (regular) triangle.









2. On a given AV line, make a rectangle whose sides are equal and whose angles are equal and whose angles are equal.

Construction: From points A and B we draw a perpendicular to the straight line AV whose lengths are equal to AV (Fig. 6). Let them be AS and BD. We connect points C and D. The resulting AVSD rectangle is a regular rectangle, i.e. a square.

3. Construct a regular hexagon on a given AV line. Construction: On the AV line, we construct an equilateral triangle AVS (Figure 7). Continuing the sides AS and VS to points E and G, we separate AS

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= SE, VS = SG and pass EG. Let's do VS. In VS we construct an equilateral VSD triangle. Continuing DC, continuing CH, we obtain SN equal to SA. Passing the lines SN, AN, EG, DE, we form a regular hexagon ABDEGH.

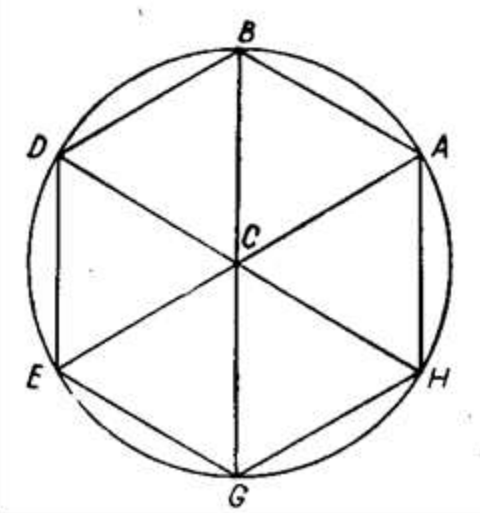

Figure 7 Create a regular hexagon on a given AV line.

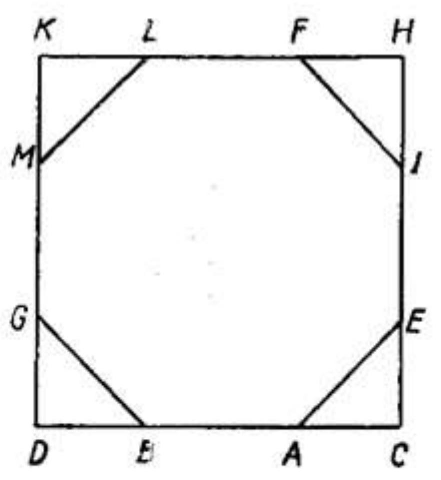

Figure 7 Make a regular octagon on a given AV line.

The method of construction given above by Farobi is based on the construction of an equilateral triangle.

4. Create a regular octagon on a given AV line.

Construction: Continuing AV to points S and D, we make semi-right angles EAS and GBD at points A and B (Figure 8). In this case, we take AE = AV, BG = AB and draw E and G perpendicular to the DC line. Let's make a CHKD square. We divide the sections HI, HF, KL, KM into SE. If we connect the points I and F, L and M, a regular octagon is formed.

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In conclusion, it can be said that Farobi "ilm al-handasa" - knowledge of the science of geometry, confirmed its place in life - its application in practice, the purpose of geometry, the division of the studied geometric shapes into two parts - modern planimetry and stereometry. His pamphlets and manuscripts, as in his time, served as a study guide or guide for craftsmen, architects, carpenters, and builders who created works of applied art in Central Asia. His methods of teaching geometry - from simple to complex, step - by - step, separate study of geometric shapes, their interrelationships and interactions, the methods of drawing geometric shapes using geometric construction can be observed elements of the science of descriptive geometry.

In the teaching of modern geometry and graphic sciences, the use of Farobi's work, his proposed geometric constructions and problems - it is expedient to introduce students to the historical values and use them in the teaching process.

Farobi's works can be found in manuscript collections in almost all major libraries around the world. The scientist, thinker Farobi made a great contribution to human culture by fighting for the triumph of the ideas of science and humanity in the Middle Ages. Figures 9 and 10 show examples of pages in Farobi's manuscripts.

Figure 9. Farobi's geometric constructions

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The first page of a dedicated manuscript

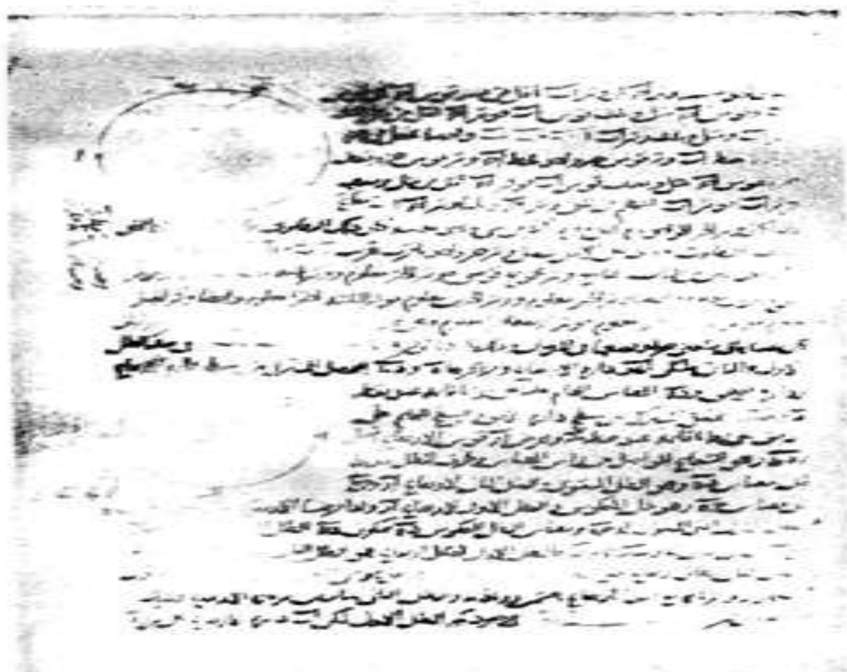

Figure 10. Page of Farobi's Manuscript

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