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EFFECTIVE METHODS OF TEACHING GEOMETRIC DESIGNS OF ABU NASR FARABI IN ENGINEERING GRAPHICS

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Abstract: This article provides information on the quick and easy execution of Abu Nasr Farabi's geometric designs in Engineering graphics through modern graphic programs, as well as the execution of computer graphics in Auto CAD graphic programs in the formation of curves and in animated views to improve the graphic literacy of students.

Key words: Abu Nasr Farabi, Central Asia, architecture, IX-XV centuries, "Ilmi Handasa", girih, Auto CAD, animation.

As in the development stages of any field, in the development of engineering graphics in the 9th-15th centuries in Central Asia, the science of geometry (geometry) was widely used in various fields of architecture and crafts. Through these geometric constructions, it is reflected in today's modern national architecture.

Abu Nasr Farabi, a Kumsu scientist who lived and worked in the 9th century, is considered one of the scientists who deeply studied the science of geometry in addition to several other sciences [1]. Let's see how one of its geometric constructions is performed in modern graphic programs.

Let's consider the formation of a regular octagon using an arbitrary given section AB [2].

It shows how to create a regular octagon using an arbitrary given straight line length (Figure 1), a process that is more complicated and time-consuming to do conventionally when done using a graphics program. It is very easy and convenient to do.

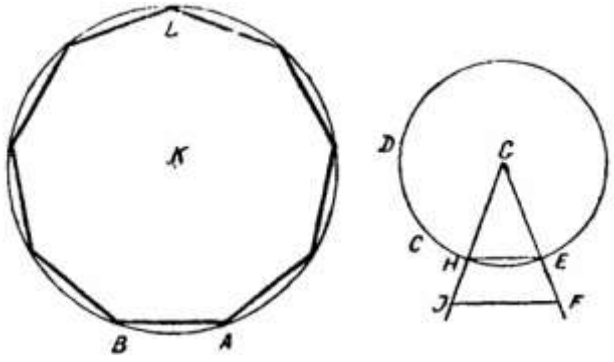

fig-1.

In order to increase students' graphic imagination, we use the Auto CAD graphic program to create a regular octagon equal to the length of the straight line AB (for example, 29 mm) of the above given regular octagon [3].

For this, a circle with an arbitrary radius is drawn (Fig. 2, a). When the command to draw a polygon is selected (Fig. 2, b), the number of sides is entered as nine, the center of the circle is marked and a size equal to the radius of the circle is entered (Fig. 2, c) and an internal

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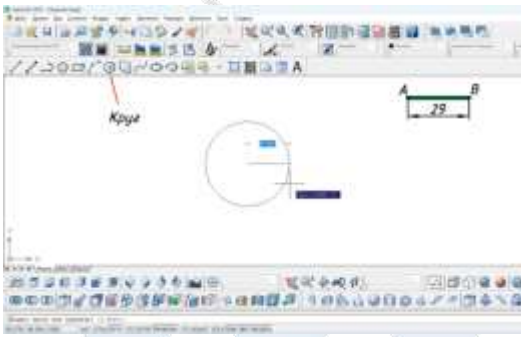
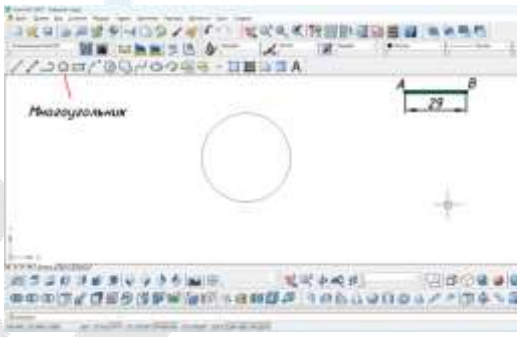
regular nine-cornered circle is formed. (Fig. 2, d), straight lines are drawn from the center of the circle to points 4 and 5, and a perpendicular line is drawn from the center to the section 4 5, a straight line equal to the length of the section AB is perpendicular to the drawn perpendicular is drawn (Fig. 2, e) and parallel straight lines are drawn from the ends A and B of the section AB to the straight lines passing through the ends of the section 4 5 drawn through the center of the circle to the perpendicular drawn from the center. The distance between the intersecting points is equal to the section AB (Fig. 2, e). A circle is drawn from the center of the polygon to the ends of the section AB. A regular octagon is formed if AB is rotated nine times around the cross-sectional circle using array commands (Fig. 2, k). If the vertices of a regular octagon are connected with straight lines in the sequence 1, 3, 5, 7, 9, 2, 4, 6, 8, 1, the base of a nine-angled gyri (star view) is formed. (Fig. 2, k). If parallel lines are drawn at a certain distance to the resulting nine-pointed star-shaped lines, a knot is formed (Fig. 2, l). Surplus lines are removed and the surfaces are colored (Fig. 2, m) [4].



a)



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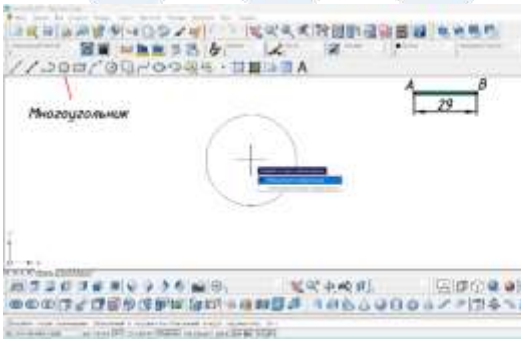
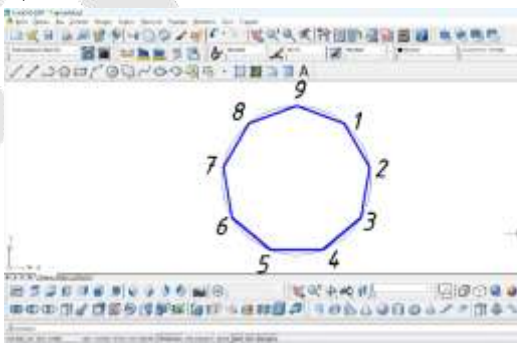
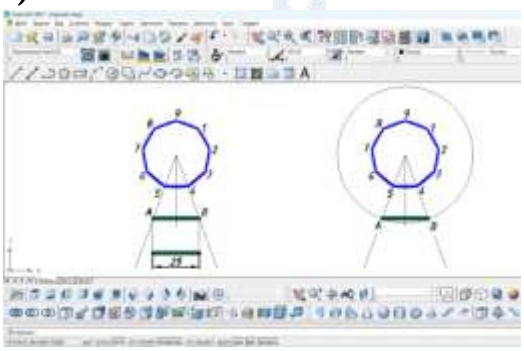


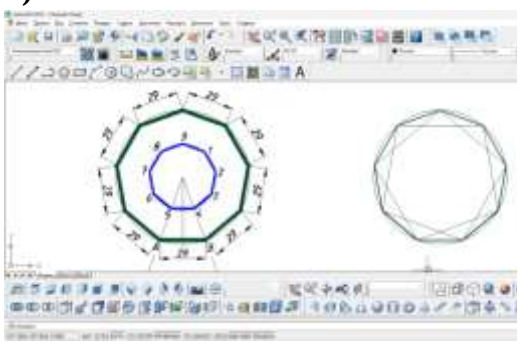
c)



d)



e)



k)

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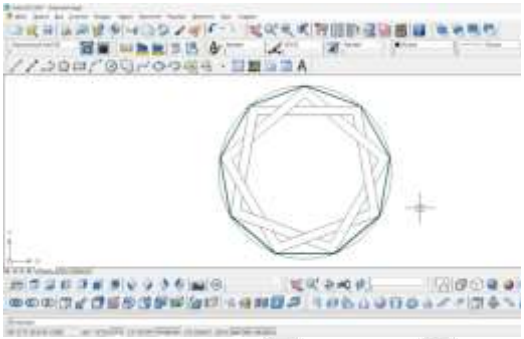

l)

m)

2-rasm.

We present this geometric creation in animated frames using the following practical methods when performing drawing tools (Fig. 3).

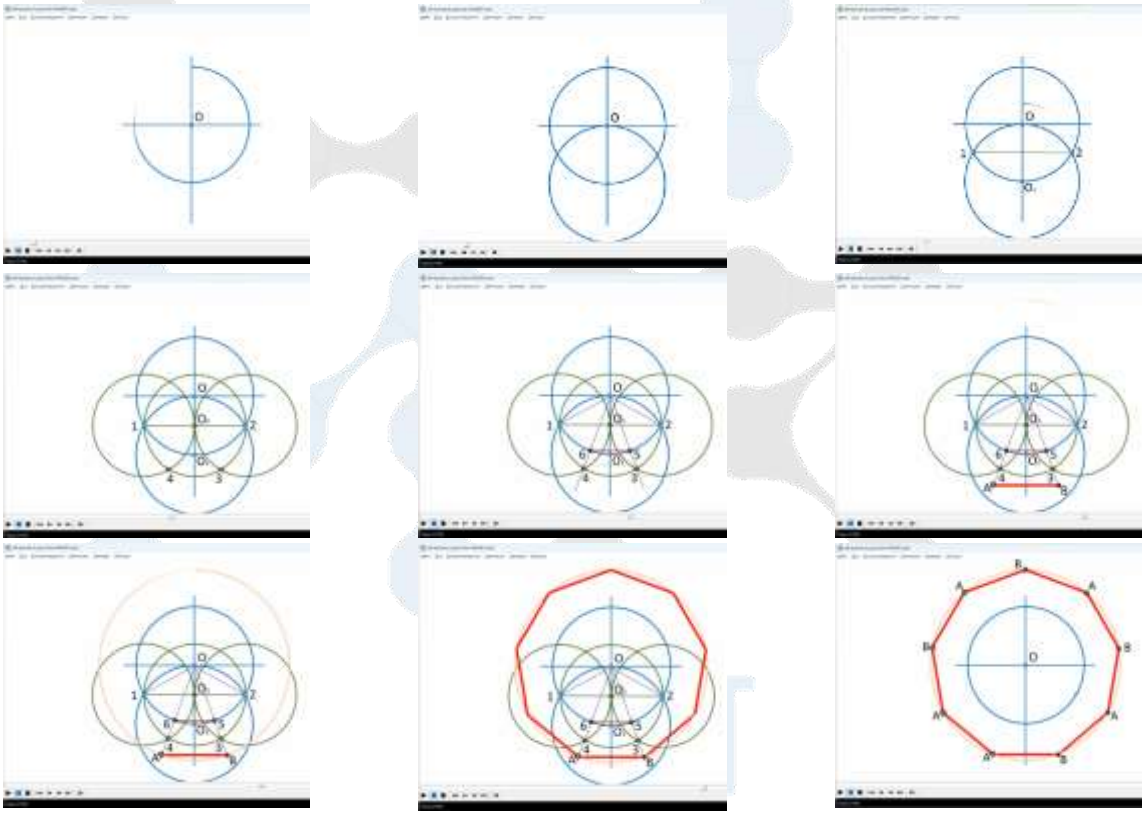

fig-3.

We have recommended the following practical method for teaching the regular octagon with sides equal to the length of the section AB, depicted in the animation frames above, in the science of engineering graphics.

First of all, intersecting perpendicular straight lines are drawn and an arbitrary circle is drawn from the point of intersection. Without changing the radius of this circle, a circle is drawn trying to reach its center from the lower point where it intersects with the center line, and if the intersecting points 1 and 2 of the two circles are marked and joined by a straight line, the center O2 is determined. A circle is drawn at a distance of 1 point from the center O2. Without changing the radius of this circle, circles are drawn from points 1 and 2 and points 3 and 4 are determined. Straight lines are drawn from the center O to points 3 and 4, and points 5 and 6 intersecting the first drawn circle are determined and connected with a straight line. A cross section AB is drawn

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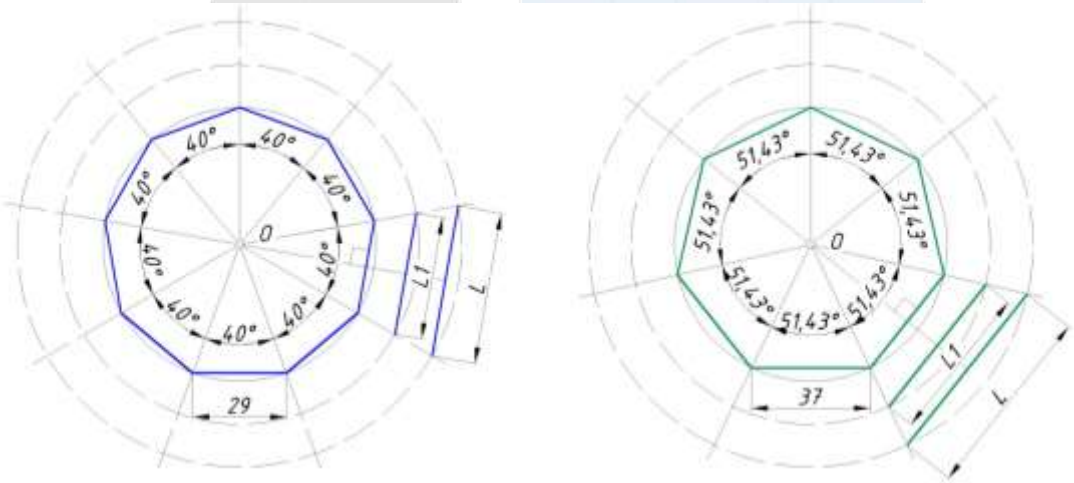
parallel to sections 5 and 6. A circle is drawn from the center O to the intersection points AB. A regular octagon is formed if circular arcs equal to AB are drawn on top of this circle and their points are marked and connected by straight lines.

In the practical method above, as another addition, if the circle starts from one point and ends at this point, it is 3600, which is equal to 400 when divided by the vertex, and if the intermediate distances are combined, a regular octagon is formed. (Fig. 4, a), it is possible to make a regular octagon from a straight line of any length (L1, L, ...) passing perpendicular to one side from the center, or if dividing by seven is done in the same way, the angles between them is 51,430 (Fig. 4, b).



a) b)

fig-4.

This method can be applied to any polyhedron, making it a convenient and effective tool for students in engineering graphics to divide a circle into equal parts and make any polyhedron from any length of section.

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