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METHODOLOGY OF TEACHING ADVANCED EQUATIONS IN ACADEMIC LYCEUMS

Aroev Dilshod Davronovich
Associate Professor,
Head of the Mathematics Department of Kokand SPI, PhD ,

Arabova Azizaxon Abdug'affor qizi
Student of Kokand SPI

Annotation
This article provides recommendations for expanding the understanding of real and complex roots of higher order equations in academic lyceums.

Keywords: real and complex numbers, polynomial, equation, root of equation, homogeneous equation, binomial equation.

Introduction
It is known that mathematics has been identified as one of the priority areas of science development in our country in 2020. During the past period, a number of systematic works aimed at bringing the science and education of mathematics to a new level of quality have been carried out. This process was further strengthened by the decision of the President of the Republic of Uzbekistan dated May 7, 2020 No. PQ-4708 "On measures to improve the quality of education in the field of mathematics and develop scientific researches". One of the priority tasks of this decision is aimed at improving the quality of teaching mathematics in general secondary and secondary special educational institutions [1].
This article also provides information that can be effective in teaching higher level equations topics in academic high schools so that students can have a complete understanding of the roots of the equation.
The main part. Higher order equations are studied in academic high school after complex number theory. This allows for a deeper study of the basic ideas about the roots of higher-order equations. In this unit, students learn that the number of real and complex roots of a polynomial depends on the degree of that polynomial.
In this article, we would like to express our opinion on improving the study of higher order equations in academic lyceums.
The concept of the root of a polynomial is closely related to the division of polynomials, especially the division into linear polynomials . Therefore, the following equations are presented in the textbook "Fundamentals of Algebra and Mathematical Analysis" of the academic lyceum:

$$x^5 - a^5 = (x-a)(x^4 + ax^3 + a^2x^2 + a^3x + a^4)$$
$$x^5 + a^5 = (x+a)(x^4 - ax^3 + a^2x^2 - a^3x + a^4)$$

etc. [2] .
After these equalities, the following comment is written: "from these it can be seen that the division is necessarily homogeneous...", but according to the definition of a homogeneous polynomial in the topic

"Polynomials" of this book, the division polynomial is not homogeneous, because $x^4+ax^3+a^2x^2+a^3x+a^4$ if we take the polynomial of the form, it is a polynomial of degree 4 with one variable is, it does not satisfy the condition of homogeneity. Therefore, we think that it is appropriate to make an appropriate change in the statement of this topic, that is, to remove the concept of the same-sex plural in this phrase.

In this textbook, it is planned to study the topic "Complex roots of algebraic equations" . First, the main theorem of algebra is presented without proof, and an important theorem about the complex roots of a polynomial with real coefficients is proved. At the same time, the following conclusion is presented as a result.

An n- degree $P_n(x)$polynomial consists of the product $x-a$ of binomials and x^2+px+qquadratic trinomials with negative discriminant of the form

$$P_n(x)=a_0(x-a)^k\ldots(x^2+px+q)^m \tag{1}$$

here $k\in\{0,1,2,\ldots\}$, $m\in\{0,1,2,\ldots\}$.

We believe that an analytical presentation of this result is more appropriate for the purpose of writing. For example, the above expression

$$P_n(x)=a_0(x-\alpha_1)^{k_1}\cdot\ldots\cdot(x-\alpha_s)^{k_s}(x^2+p_1x+q_1)^{m_1}\cdot\ldots\cdot(x^2+p_lx+q_l)^{m_l}$$

here $k_i\in\{0,1,2,\ldots\}, m_i\in\{0,1,2,\ldots\}, \alpha_i\in R,\ j=1,2,\ldots,s,\ p_i,q_i\in P,\ i=1,2,\ldots l.$, all real roots of the polynomial and its complex roots are clearly visible which quadratic roots are the roots.

In order to improve the teaching of this section, we would like to express the following opinion: it is appropriate to present the ideas related to finding the roots of an algebraic equation of higher degree, that is, the degree of which is more than two. More specifically, it is appropriate to explain to students that there are formulas that express the roots of an algebraic equation of degree 3 and 4 in terms of its coefficients, while such a formula does not generally exist for algebraic equations of degree 5 or higher.

We also mention the following points regarding the study of higher order equations.

$n\geq 5$ it is possible to find the roots of some of the higher-order equations, and we will consider some of them.

I. Two-dimensional equations.

$$ax^n+b=0\ (n\geq 3) \tag{2}$$

An equation of the form (2) is called a two-dimensional equation, and its roots can be found. Even looking at the coefficients of this equation, you can tell whether it has a real root or not. When solving binomial equations, it is appropriate to consider the following cases separately. By the above assumption $\grave{a}\neq 0$, it can always be taken as a positive number, otherwise it can be achieved by multiplying both sides of the given equation by (-1). So, the solutions of the two-dimensional equation n depend on the even or oddness of and the sign of the number b.

1) if $b=0$, then equation (2) $x=0$ has only one root, and we call this root *an n -fold root.* In this case, the root of equation (2) is found independently of n.

2) if $n=2k$ (even number) $b<0$, then equation (2).

$$x^{2k} = \frac{b}{a}$$

can be written as In this case $\frac{b}{a} > 0$, the last equation $2k$ has a common root. Two of them are real numbers, and the rest are complex numbers (the abstract part of which is different from zero), i.e.

$$x = \pm\sqrt[2k]{\frac{b}{a}}$$

and these values $\sqrt[2k]{\frac{b}{a}}$ consist of complex numbers formed by dividing a circle with a radius equal to , centered at the coordinate origin, into equal parts . $2k$ Its first dividing point will be the point (, 0) in the Cartesian coordinate system . $\sqrt[2k]{\frac{b}{a}}$ So, in this case, the given binomial equation will have only two real roots.

3) if $n = 2k+1$ (odd number) $b < 0$, equation (2).

$$x^{2k+1} = \frac{b}{a} > 0 \text{ or } x = \sqrt[2k+1]{\frac{b}{a}}$$

can be written as In this case, the last equation consists of a complex number with one real root $\sqrt[2k+1]{\frac{b}{a}}$ and a non-zero abstract part. $2k$

4) if $n = 2k$ (even number) $b > 0$. Then $\frac{b}{a} < 0$ equation (2) becomes

$$x = \sqrt[2k]{\frac{b}{a}}$$

can be written as $\frac{b}{a} < 0$ if we take into account that $\sqrt[2k]{\frac{b}{a}}$ a complex number cannot be a real number. Hence, the given equation $2k$ has complex (unreal) roots.

5) if $n = 2k+1$ (odd number), $b > 0$ be In that case

$$x = \sqrt[2k+1]{\frac{b}{a}} \text{ to be (in this } \frac{b}{a} < 0\text{)}$$

The given equation will have only one real root. This value $(-1)\cdot\sqrt[2k+1]{-\frac{b}{a}}$ is equal to a real number $-\frac{b}{a} > 0$ because

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Summary

The information given on the topic statement of binomial equations in the textbook may not allow to draw a complete conclusion about the roots of the binomial equation. But we believe that the information we have recommended above will provide students with a complete idea of the roots of the two-dimensional equation.

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