Review of: "From Complex to Real Numbers: A Reverse Detour for Solving Polynomial Equations Using Complex Numbers"

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Potential competing interests: No potential competing interests to declare.

1. The review is the result of an invitation to review by the Review Team of Alberto Bedogni (Qeios) and the recommendation of Mr. Prof. Jakub Marcinowski.

2. General characteristics of the article

   The subject of the review is the analysis and evaluation of the use of arithmetic of complex numbers when solving polynomial equations of degree up to and including the fourth in the search for real solutions. The paper runs to a total of 22 pages. It includes an abstract and a bibliography, which consists of 10 source items. The content of the article has been edited in a four-point layout. The first point is the introduction, in which the author describes the history of solving the equations considered in the work, in particular, the use of complex numbers for the stated purpose, proving that their use is of considerable importance - for it remains possible to indicate the actual solutions, which cannot be carried out relying only on the set $\mathbb{R}$, and which was proven, for example, by S. del Ferro and G. Cardano. At the same time, it was pointed out that the topic is always relevant, and was taken up by the most famous mathematicians, including F. Viete, L. Euler and J. L. Lagrange. As such, the theme is still popular and considered by modern scientists.

   In the second section, the topic of solving the equations under study is taken up, and this constitutes the main thrust of the work. A method is presented with the help of which it is possible to arrive at the determination of the real roots of the equations under study, and proofs are provided that confirm its validity. Of course, which is in accordance with the subject of the article, the method is based on the arithmetic of complex numbers ($\mathbb{C}$).

   Although the evidence carried out shows the validity of the procedures presented, the author has approximated their application in specific numerical cases – the third point is a set of examples designed to further demonstrate the veracity of the methods used to solve the equations studied in the article, as well as to show their qualities.

   The fourth chapter is a summary and conclusions that emerge after carrying out the considerations in the subject of the work.

   The article closes with a bibliography.

3. *Evaluation of work*

There is no doubt that the reviewed article demonstrates the Author's extensive knowledge in the practiced scientific discipline and in a field without which it would be impossible to even carry out proofs, not to mention the development of new methods. Reading the publication requires proficiency in the basic methods of solving polynomial equations and in the arithmetic of complex numbers, which the author assumed, since it is impossible to carry out the considerations covered in the work without a thorough knowledge of them.

The well-documented analytical studies, i.e. the proofs and examples carried out, are a valuable complement to the main thrust of the work.

The topic that the Author has undertaken to study is undoubtedly important. Looking in detail, it should be emphasized that the work, in a way, tames with complex numbers, which, as the Author himself points out, seem to be counterintuitive, especially, when one is looking for the real roots of equations. I also think that it can be useful for all those who do not appreciate the power of complex numbers, and come to the aid of those who are just beginning their work with them. The main idea of the work undertaken is important not only from a practical point of view, that is, due to the development of another method for solving polynomial equations, but also for general and cognitive reasons, as it contributes to the development of science. In turn, no one needs to be convinced that learning more and more effective methods for solving any type of equations, or problems in general, is universally desirable.

The reviewer's only suggestion remains the comparison of the method presented in the paper with other solutions, especially those that have appeared in recent years – I believe that this would emphasize its effectiveness and strengthen it, so to speak.

4. *Final conclusion*

The conclusions raised in the review, despite the suggestion, which does not detract from its merits, constitute a positive assessment of the reviewed article. In conclusion, I state that the article of Mr. Ababu T. Tiruneh is a contribution to the development of science, while the methods presented in it are an original way of solving polynomial equations, and as such should be successfully applied in solving such problems.

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