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Wiesław Wójcik, *Uniwersalność matematyki w ujęciu historycznym* Częstochowa: Uniwersytet Humanistyczno-Przyrodniczy im. Jana Długosza w Częstochowie, 2021, 306 pp.

In his monograph *Uniwersalność matematyki w ujęciu historycznym* [Universality of Mathematics in Historical Perspective], Professor Wiesław Wójcik aims to present the universal quality of mathematics from historical and philosophical research perspective. The author explains various aspects of the universality of mathematics that appeared throughout particular historical periods. Wójcik asserts that the development of mathematics is the foundation of cultural and civilizational changes. In his analyses of selected mathematical discoveries, the author shows that mathematics has enabled civilization to enter a higher stage of its development. Owing to mathematical discoveries, many areas (aspects) of reality have been revealed and made accessible to humanity.

The author's reflection on mathematics goes back to the very beginning of mathematical thinking. The emergence of mathematics was primarily driven by the need to solve practical problems, including various trading tasks, land surveying and division, construction, and measuring time. The history of mathematics traces back as far as the prehistoric times when the first abstract mathematical concepts, the natural numbers, were created. Mathematics saw great development in ancient Greece, where geometry, describing spatial relation was rather advanced.

The earliest traces of geometry can be found in ancient Egypt. From experience or perhaps intuitively, humans describe space using the same properties

that can also be described by the axioms of geometry. From these axioms, and definitions of point, line, curve, surfaces, and solids, the theorems that make up the theory of geometry are then derived. The next stage in the rapid development of mathematics was the early modern period, when the foundations of mathematical analysis were laid, notably by René Descartes. Later, the work of Isaac Newton, Gottfried Wilhelm Leibniz, Leonhard Euler, Carl Friedrich Gauss, and other eminent mathematicians presented impressive results in the field of analysis, especially by laying foundations of differential and integral calculus. Another important milestone in the history of mathematics was the turn of the 19th and 20th centuries, when the investigation of the provability of propositions gained a firm and formal footing through the discoveries in the field of mathematical logic and the introduction of axiomatic theory of sets. In this period, abstract structures also began to be explored. This allowed to verify mathematical statements for a wide group of mathematical objects using one proof. This trend culminated in the mid-20th century with the emergence of the theory of categories, which is considered the most general and abstract mathematical discipline.

Wójcik emphasizes that the universality of mathematics has been present since the beginning of the development of civilization, and was already recognized by some ancient Greek thinkers. One of the elements of this universality became the necessity of teaching mathematics for the formation of proper intellectual, moral, and social attitudes. The methods of proof used in mathematics became a model of strict and rational argumentation. It also became apparent that contradictions perceived in the natural world and in culture could be resolved by the development of mathematics.

Mathematical discoveries are the basis of many inventions, and technical and economic progress. The discovery of mathematical concepts and skills is linked to the individual's development and the development of human species as a whole. The author defends the thesis that the world of values, such as beauty, order, harmony, precision of thought, accuracy or rationality, as well as various social and ethical values, is constantly enriched and expanded thanks to mathematics. Wójcik argues that without the inspirations of mathematics the European culture as we know it would not have emerged. Mathematics has a special place in culture. It is neither a simple science nor art, but it belongs to both at the same time. Art often provides the motivation for the work of mathematicians. Mathematical constructions, structures, and proofs are largely based on aesthetic criteria. Some advanced mathematical theories find applications in technical, natural or social sciences. These sciences make use of mathematics. However, it is difficult to determine the exact line where these sciences begin and where mathematics ends.

In many cases, this connection between mathematics and other sciences is very close, and therefore it is possible to speak of one group of mathematical-natural or even mathematical-natural-technical sciences. Of course, Wojcik is conscious of the development of mathematical sciences, as well as the mathema-

tization of science and culture being permanent. It is therefore difficult to define mathematics as such as well as the extent of its influence.

The patterns in art, music, architecture and literature were defined using mathematical procedures. Logic has been generated according to the pattern of mathematical method, too. Many fundamental issues and questions concerning the essence and nature of humankind and the world have been inspired by mathematical problems and investigations. Mathematics contributes to the definition and direction of research in various philosophical projects. It demystifies many false ideas within philosophical and religious doctrines, clarifies their foundations, and allows for a better and more complete understanding of them. Mathematics promotes precision in reasoning, emphasizes the value of proof and rationality, and speaks out against unauthorized authority, customs, and superstition. Mathematics induces confidence in human abilities because of the effectiveness of its proofs and methods. The beauty of mathematical constructions has great aesthetic value, like other works of human culture.

The author declares that maintaining an adequate level of mathematical knowledge, even at the cost of great intellectual and organizational effort, is necessary to maintain at least the status quo of civilization. Not everyone needs to know and master mathematical structures and techniques of mathematical proof. However, education should show everyone the meaning and value of mathematical activity and provide an opportunity to understand, at least in a minimal way, the place of mathematics in social and civilizational development. It is about maintaining a mathematical culture in society, which, unfortunately, tends to disappear even today.

The reviewed book is very well balanced in content and its scope meets the demanding qualitative and quantitative criteria of a scientific monograph. It is written in a clear and lucid manner and it is also stylistically attractive. The book is well organized and aesthetically pleasing. It consists of six chapters in which the author presents the development of concrete mathematics in the context of Greek paideia, abstract mathematics, the development of mathematics as general algorithmic knowledge, modern mathematics and its new dimensions of universality, and, finally, the formation of research programs in modern mathematics and possible further directions for its development.

Contentwise, the individual chapters of the publication aim to clarify the universality of mathematics. The appropriately designed structure of the volume enhances the natural gradation of the development of the main idea of the monograph. The professional, scientific, and didactic level of the reviewed monograph is high. The publication is suitable for not only experts in mathematics, history of science and philosophy, but also for students in teaching training and those showing interest in mathematics and culture.

Together with the pluralistic paradigm of postmodern culture, the fundamental ethical question of moral justification has resurfaced again. In the postmod-

ern context, it is necessary to rethink the need to interiorize values of a moral nature, especially those concerning the way of life of both the individual and community and consequently also the interpersonal coexistence.

The author concludes by referring to Hugo Steinhaus's core belief that mathematics is part of reality, not only in relation to nature but also to the cultural world and to every human being. Being interested in mathematics increases intellectual prowess and improves the quality of life. The message of Wiesław Wójcik's new book can be summed up in a few sentences: Looking at some of the discoveries in the history of mathematics, we can see that mathematics enables us to eliminate the contradictions that might appear in the process of learning about the world. As a result, it opens up the way to a fuller and more comprehensive knowledge of reality. Mathematics allows us to perceive the rational structures in that reality and introduces its new dimensions. Mathematics thus becomes the primary object of our thinking in relation to all types of reality, both sensory and ideal.

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