ISSN NO: 2770-0003
Date of Publication: 26-05-2023

Mathematical Methods in Modern Scientific Knowledge and Mathematical Style of Thinking

Xo'jayev Allayor Maxmudjon o'g'li
Teacher of the of Jizzakh State Pedagogical University
Gadayev Doniyor Rajabovich
Teacher of the of Jizzakh State Pedagogical University

Abstract: Mathematical methods in the modern theory of knowledge are considered, the possibilities of applying mathematics in various fields of science are shown.

Key words: mathematics, philosophical problems, history of mathematics, modern theory of knowledge.

Mathematical conclusions, theorems and formulas are not an arbitrary invention of the human mind, but reflect the real patterns of the surrounding world. Abstraction contains the enormous possibilities of mathematics, the generality of its methods. Different sciences today are mathematized to varying degrees. The rapid development of mathematics, the emergence of modern computer technologies and the resulting mathematization of sciences that were previously very far from the use of mathematical methods -

Medicine and pedagogy, jurisprudence and psychology, linguistics and art theory - all this increased interest in the philosophical issues of mathematics. Today it has become clear that the solution of these questions contributes to a deeper knowledge of the nature and essence, methods and structure of mathematics.

F. Engels in his work “Dialectics of Nature” wrote about the need for a consistent study of the development of individual branches of natural science “first, astronomy, already because of the seasons, is absolutely necessary for pastoral and agricultural peoples. Astronomy can only develop with the help of mathematics” [1, p. 147]. With the development of large cities and crafts, mechanics, legal proceedings, and military affairs develop, which “need the help of mathematics and thus contribute to its development” [1, p. 147]. Historians of mathematics trace step by step how practical needs

People lead to the development of arithmetic, then algebra, calculus, and so on. Gradually, mathematical theories and concepts become more and more abstract, they “break away” from physical reality to such an extent that the illusion is created that these are not connected things in any way. But no matter how abstract modern mathematical theories become, no matter how much the share of

Logical proofs in mathematics, it does not become due to this an a priori science, does not lose its connection with the objective world and practice.

In the first half of the XVII century. a completely new branch of mathematics arose - analytic geometry, establishing a connection between lines on a plane and in space with algebraic equations. Philosopher Rene Descartes in 1637 wrote a treatise "Reasoning about the method, in order to correctly direct your mind and find the truth in the sciences." The treatise contained 5 appendices. And one of them was called "Geometry". So, in an unchanged form, the treatise of Rene Descartes has come down to our days. A rather rare event in the development of science took place, when a large, completely new direction appeared in one or two centuries. But it was no accident. The transition in Europe to a new capitalist form of production required fundamental changes in scientific knowledge. The powerful development of long-distance navigation persistently demanded discoveries in astronomy and mechanics. Military affairs needed mechanics. Galileo, Newton, Kepler and other scientists began to create the foundations of modern mechanics. In all areas of natural science, experimental data were accumulated, means of observation were improved, and new ones were created instead of obsolete theories.

In astronomy, the teachings of Copernicus triumphed. The ellipse and parabola, whose geometric properties were known to the ancient Greeks, ceased to be only objects of geometry, as they were in antiquity. After Kepler discovered that the planets revolve around the Sun in ellipses, and Galileo - that a thrown stone flies along a parabola, it was necessary to calculate these ellipses and find those parabolas along which cannon balls fly, and it was necessary to find the law according to which decreasing

ISSN NO: 2770-0003
Date of Publication: 26-05-2023

atmospheric pressure, discovered by Pascal. The ingenious conjecture of Greek philosophy is that “all nature, starting from its smallest particles, starting from a grain of sand and ending with the Sun, starting from the protist and ending with man, is in eternal emergence and destruction, in continuous flow, in relentless movement and change” [1, p. 13], in mathematics is the result of rigorous scientific research. “The turning point in the development of mathematics was the Cartesian variable. Thanks to this, movement and thus dialectics entered mathematics. And thanks to this, differential and integral calculus immediately became necessary” [1, p. 208].

The beginning of modern mathematics dates back to the middle of the 19th century, when the theory became so abstract that it overstepped the boundaries of the classical concept of mathematics, considering numbers and figures as its subject. Classical mathematics came into conflict with the real the state of science in the nineteenth century. Such concepts as matrices, quaternions, tensors, n-dimensional spaces, Boolean algebra, etc. appeared. XIX-XX centuries characterized by the development of numerical methods, growing into an independent science - computational mathematics. They began to attach great importance to the construction of models. The abstract nature of mathematical concepts, the exclusive role of logical evidence gave the conclusions of mathematics the character of universality and necessity.

The great role of independence in relation to material reality and practice, the role of symbolism in its development - all this increases interest in the philosophical questions of mathematics. It is impossible for a mathematician to do without such philosophical categories as generalization and idealization, form - content, finite - infinite, concrete and abstract, similarity - difference, etc. The main philosophical question of mathematics is the question of the relation of mathematical concepts, axioms, theories, rules and conclusions to the real world. F. Engels wrote: “Whatever pose natural scientists take, philosophy appears above them. The only question is whether they want to be dominated by bad fashionable philosophy, or whether they want to be guided by a form of human thinking that is based on acquaintance with the history of thinking and its achievements” [1, p. 267].

Mathematics, reflecting certain aspects of the real world ("spatial forms and quantitative relations"), has a very real material origin. At the same time, the material and its study take an abstract form. This allows you to apply mathematics to a variety of objects of nature and society. An axiomatically constructed formal theory ceases to be hypothetical only if meaningful interpretations are found for it either in the form of objects of reality or in the form of other theories that have already found application in practice. "All the greatest achievements of the last 100 years - the theory of electromagnetic fields, the theory of relativity and quantum mechanics - make extensive use of modern mathematics" [2, p. 387].

Breaking away from practice and rising to the heights of abstraction, mathematical theory builds formal models for possible objects of reality, and these objects, as a rule, are found in the further development of science. Examples: non-Euclidean geometry has been used to develop the theory of modern physics; abstract Boolean algebra - for designing relay-contact circuits, computers; group theory - in crystallography. Le Verrier discovered the planet Neptune "at the tip of a pen." Scientific abstraction is a distraction from unimportant secondary features, highlighting the most significant features inherent in the phenomenon under study. Speaking at the II International Mathematical Congress, D. Hilbert said: “What happiness to be a mathematician! Everywhere mathematics is growing, putting out new shoots. Its applications to natural science are becoming increasingly important” [3].

The value of mathematics for raising the technical level of industry depends on the successful application of mathematical modeling methods in various scientific disciplines that form the basis of modern technology. The connection between mathematics and technology has become so strong that we can say that we live in a time when mathematics is forced to intervene in solving most serious technical problems [4]. It suffices to give a few examples to show the role and possibilities of mathematical methods and techniques in modern technical and economic development.

1. Space exploration, launches of artificial Earth satellites confirm the fruitfulness of the use of mathematics in the study of natural phenomena and mastering them. However, the new problems posed by space flights required an improvement in the mathematical model (the need to take into account a number of factors - the influence of the Earth's rotation on the launch of satellites and on the permanent connection between the Earth and the Moon, the Earth and the planets). The launch of rockets and satellites into given

ISSN NO: 2770-0003
Date of Publication: 26-05-2023

areas requires space ballistics to solve problems of choosing the optimal flight trajectory. The problem of optimal control appears.

2. The emergence and development of the methods of probability theory and mathematical statistics make it possible to trace causal relationships, to predict the result in the study of random phenomena. The existence of accidents around us is explained by one of the basic laws - the law of the universal connection of phenomena. Probability theory studies the action of a large number of causes, introducing numerical characteristics for this. Mathematical statistics establishes the rules for processing the results of observations.

The need to apply the theory of probability and mathematical statistics also arose in aviation technology. If earlier the terms of repairs and inspections were set “by eye”, now it is a scientific organization of control, operation and maintenance of aviation equipment. Intensive work is underway to apply the theory of probability and mathematical statistics to substantiate the provisions for the operation of aviation equipment.

3. The educational process is one of the oldest controlled processes. Nevertheless, it causes a lot of criticism: the leading universities of Russia are engaged in the optimization of the educational process. Among the new forms of education, special attention is drawn to the organization of the educational process using computer technology, in which the main didactic principles are clearly expressed: individualization, activity, independent learning [5].

Mathematics is characterized by a logical scheme of reasoning. It allows you to monitor the correctness of the flow of thought to the maximum extent. Therefore, the skills acquired in mathematics classes are essential for improving the general culture of thinking. Such characteristic features of the mathematical style of thinking as laconicism, the need to observe symbolic records with impeccable accuracy, become a habit, lead to the development of a general style of thinking.

Thus, we can talk about the unity of the process of teaching and education in mathematics classes, about the impact on the culture of thinking of students.

References:

1. Engels F. Dialectics of nature. - M.: Ogiz, State Publishing House of Political Literature, 1946.
2. Kline M. Mathematics. Loss of uncertainty. - M.: Mir, 1984.
3. Hilbert D. Mathematical problems: Speech at the II International Mathematical Congress // Life of Science. - M.: Science, 1973.
4. Zhuleva L.D. Some philosophical questions of mathematics / Civil aviation at the present stage of development of science, Technology and Society: Intern. sci.-tech. Conf. dedicated to the 85th anniversary of Russian civil aviation. - M.: MGTU GA, 2008.
5. Zhuleva L.D. Philosophical problems of mathematics: the role of mathematical abstractions in the development of modern science and technology // Scientific Bulletin of MSTU GA. - 2010. - No. 155. - S. 49-53.