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Philosophical Thought in Advanced Mathematics

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ABSTRACT

Mathematics and philosophy are both a kind of understanding formed by understanding and transforming nature in the process of human development, and they are closely related. As a discipline that reflects the spatial form of the real world and expresses the quantitative relationship in the real world, advanced mathematics itself is a under the interaction of certain contradictory unity, it occurs and develops according to certain laws. These laws can be explained by philosophical thoughts. This paper takes the philosophical thoughts in advanced mathematics as the research object, and analyzes and expounds the quantitative and qualitative changes, motion and stillness, straightness and curvature, universality and particularity, abstraction and Philosophical thoughts such as concreteness, approximation and precision.

Keywords: Advanced Mathematics; Philosophy Thought; Dialectic

INTRODUCTION

Mathematics is a science abstracted from the real world. It studies real problems from two aspects: quantitative relationship and spatial form. What it can study is not only stillness, but also movement and process. The great thinker and philosopher Engels once said: "In order to represent the state of motion, formation and development of matter, the only thing that can achieve or achieve this purpose is calculus." Marxist philosophy is a science about the universal laws of nature, society and the development of thinking, and it has a great guiding role for us to understand the laws of mathematics, master the laws of mathematics, apply the laws of mathematics and conduct dialectical thinking. The dialectical materialism in advanced mathematics expresses the relationship of unity of opposites between things. This relationship is reflected in all aspects of advanced mathematics. For example, in advanced mathematics, the relationship between the finite and the infinite, the relationship between the special and the general, the relationship between quantitative change and the accumulation of quantitative change to qualitative change, etc. It is in the process of resolving and discovering contradictions that advanced mathematics itself has also gained momentum and support for its forward development. Through the continuous realization of opposition and unity, negation of negation, quantitative change and qualitative change, advanced mathematics constantly shows us various dialectical relations in philosophy, making mathematics a real subject.

RESULTS

A. Quantitative and qualitative changes

Quality is the inherent determinacy of a thing that is different from other things, and quantity is the determinacy that can be expressed in quantity, such as the scale, degree, speed of a thing, and the spatial arrangement and combination of components that make up a thing. Everything has the stipulation of quality and quantity, and is the unity of quality and quantity.

The concept of limit is an example in advanced mathematics that can reflect the process from quantitative change to qualitative change. The limit is "the variable

is infinitely approached to the finite goal, resulting in the transformation from quantitative change to qualitative change".

For example, the principle of "cutting a circle" to find the area of a circle is to approximate the area of the circle with the area of the inscribed regular polygon. When the number of sides of a regular polygon increase, the area of a regular polygon becomes more and more similar to the area of a circle, but as long as the number of sides of a regular polygon is limited, the area of a regular polygon is always an approximation of the area of a circle, which reflects the quantitative change here; When the number of sides of a polygon increases infinitely, the area of a regular polygon is the area of a circle, which is a qualitative change. This is a typical example of the dialectical relationship between quantitative change and qualitative change in advanced mathematics. It reveals that quantitative change is an inevitable preparation for qualitative change. Qualitative change is the inevitable result of quantitative change, and the directional accumulation of quantity will lead to qualitative change and so on.

B. Constants and Variables (Motion and Rest)

A quantity that maintains a certain value in a process is called a constant, and a quantity that changes is called a variable. Constants and variables appear as a pair of contradictions in philosophy. Constants are static, and variables are motion. Marxist philosophy tells us that motion is absolute and unconditional, while static is relative and conditional. Things can only show temporary stillness under certain conditions. This condition is expressed in mathematics as a certain numerical range, beyond which the constant will change and become a variable. Therefore, "movement" and "stillness" are the unity of opposites. In the study of mathematical problems, sometimes moving is seeking stillness, and dynamic problems are temporarily in a static state to observe and analyze, and success can be achieved; Views to research will receive a multiplier effect.

For example, when calculating the area of a trapezoid with curved sides. The area originally sought is a definite constant for each specific situation, but this constant is difficult to calculate within the range of constant mathematics, and only after the variable mathematics is generated, the constant is regarded as the temporary state of the variable or the specific value or the stable trend (limit value) of the variable in the process of change, and the problem can be solved. The proofs of some numerical equations and numerical inequalities in advanced mathematics are accomplished by means of this dialectical relationship between constants and variables.

C. straight and curved

Straight and curved are also a pair of contradictions in advanced mathematics. Geometrically, the curvature of the former is zero, while the curvature of the latter is not zero; algebraically, the former is a linear equation and the latter is a nonlinear equation. The difference between straight and curved is very obvious, but they can be transformed under certain conditions. In calculus, finding the area of a trapezoid with curved sides embodies the dialectical thought of curved as straight and straight as curved.

The process of calculating the area of a curved-sided trapezoid is a process of first differentiation and then integration, that is, dividing the curved-sided trapezoid into many small curved-sided trapezoids, and in each small curved-sided trapezoid, the curved side is regarded as a straight side, so it can be The area of these small "straight-sided trapezoids" approximately represents the area of the original large curved-sided trapezoids, thereby realizing the transformation of local curvature into local straightness, that is, "substituting straight for curvature". Then the division is made thinner, and by taking the limit, the sum of the areas of the small straight-sided trapezoids can be converted into the area of

the original large curved-sided trapezoids. In this way, the local straightness is transformed into the overall curved shape, and finally the area of the curved-sided trapezoid is calculated. The transformation of this kind of curve into straight, the transformation of straight into curve, and the thought of dividing the whole to zero and the product of zero being the whole reflected from it, is the main method of calculus.

D. universality and particularity

Mathematics is actually a science that recognizes the quantitative relationship and combination forms and methods of the world. The real world is a complex world, full of universality and particularity, that is, individuality and commonality coexist. If we use the tools of mathematics to express this idea, it is the dialectical relationship between the specific and the general. Since the particularity is specific, it is relatively simple. Moreover, the particularity implies the universality, so the universality is usually understood through the particularity, and then the universality is used to guide the particularity. Looking back at the development of advanced mathematics, it is not difficult to find that the development of each concept or principle was initially drawn out through special circumstances. Through the detailed analysis of the special situation, a certain abstraction is formed, and then the relevant new mathematical concepts or principles are obtained.

For example, when learning the limit, the sequence y=f(n) is a special function that discretely takes all the natural variables. When learning the function limit, it differs from the sequence limit only in the description of the limit definition, but is similar in the property operation and proof method of the limit. It can be seen from this that the function limit is a further generalization of the concept of sequence limit, and the concept of sequence limit is a special case of the concept of function limit. But it should be recognized dialectically that the limit of a sequence is fundamentally different from the limit of a function. Not only in the value of the independent variable, but also in the way of change is very different. Gain a better understanding of the general concept of limits by learning about limits of functions.

E. Abstract and concrete

Mathematics has the characteristics of abstraction, and this characteristic of advanced mathematics is more prominent. But as long as you follow the rules of understanding from concrete to abstract, and then from abstract to concrete, you can not only master the relevant principles of advanced mathematics, but also apply them flexibly. For example, for the definition of derivatives, it is necessary to first correctly understand the two specific examples of the speed of the variable speed motion and the slope of the tangent at any point on the curve, and then learn to ignore the specific examples and models, and only abstract the pure quantitative relationship. The method of mathematical abstraction, and then the three main steps of the definition of derivative are obtained: ① Calculate the increment Δy, ② Calculate the ratio $\Delta y/\Delta x$, and ③ Take the $\lim \Delta y$. This is only the first leap of knowledge, and the purpose of knowledge is to practice, so it is necessary to return to practice and realize the second leap of knowledge, that is, from abstract to concrete, to solve specific problems.

F. Approximate and exact

Approximation and precision in advanced mathematics are also a contradictory unity in philosophical thought. Although it is a relationship of unity of opposites, it can also be transformed into each other to a certain extent, and this transformation is the core of advanced mathematics. In the process of advanced mathematics research, concepts such as "partial sum", "average velocity" and "area of a regular polygon inscribed in a circle" are essentially approximate concepts, and the "infinite series" is used. Sum", "instantaneous speed" and "circle area", etc.,

when using the concept of "limit", this "approximation" becomes "exact".

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