AN INNOVATIVE DIDACTIC APPROACH TO TEACHING THE THEORY OF ELEMENTARY FUNCTIONS

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Abstract. *This paper presents an innovative pedagogical approach to teaching the elements of mathematical analysis in schools through the theory of elementary functions. The proposed approach modifies the traditional sequence of topics — limit of a sequence, limit of a function, derivative, and integral — into a new logical order based on the properties of continuous functions: limit of a sequence → limit, derivative, and integral of a continuous function. The key idea is to simplify the concept of function continuity by introducing a* ***didactic axiom*** *that affirms the continuity of elementary functions without formal proof. This makes it possible to present the limit, derivative, and integral as natural consequences of continuity, thus creating a more intuitive and logically connected learning process for students.*

Keywords: *Didactic axiom, continuous function, Heine's definition, elementary functions, pedagogical approach, limit, derivative, integral, methodology of teaching mathematics.*

Main Idea and Methodology

The proposed approach stems from the observation that the concept of a line in geometry predates the concept of a function. Every elementary function is represented by a continuous line within its domain. Therefore, continuity can be accepted as an intuitive and visual property rather than derived solely through analytical definitions such as Cauchy's or Heine's. Based on this assumption, the concept of a limit is introduced *after* continuity, but restricted to continuous functions.

This method employs Heine's sequence-based definition of a limit but adapts it for elementary functions. Specifically, in the continuity condition, the phrase "for any sequence approaching a point" is replaced by "for some sequence approaching a point," as all such sequences lead to the same limit for continuous functions. This adjustment not only simplifies theoretical explanations but also preserves mathematical rigor at the school level.

Results and Discussion

The study focuses on elementary functions — polynomial, trigonometric, exponential, and logarithmic — and demonstrates how their differential and integral calculus can be developed on the basis of the didactic axiom. Students can visualize continuous function graphs as unbroken lines and intuitively grasp the concepts of limit, derivative, and integral.

By first accepting continuity as a given property of elementary functions, the teaching process becomes conceptually smoother. The derivative and integral are then introduced as operations on continuous functions rather than abstract analytical constructs. This eliminates unnecessary theoretical difficulty while maintaining a solid logical foundation.

The proposed sequence — *sequence limit → continuous function limit → derivative → integral* — significantly enhances comprehension and aligns with A.N. Kolmogorov's idea that schools should teach only the theory of continuous functions, while higher education should handle the general theory of functions.

Conclusion

The improved pedagogical approach simplifies the traditional structure of mathematical analysis by grounding it in the intuitive notion of continuity. It enables students to form stronger conceptual links among fundamental ideas such as limit, derivative, and integral. Moreover, it bridges the gap between school and university mathematics, fostering students' creative and logical thinking abilities.

Implementing this approach in secondary and specialized schools may enhance both the quality of mathematical education and the readiness of students for advanced studies.

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