



RULES FOR CALCULATING DERIVATIVES

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Abstract: The rules for calculating the derivative are one of the most important and fundamental rules in mathematics. These rules are widely used, especially in algebra, mathematical analysis and various other mathematical fields, and are a fundamental tool in solving many problems. The derivative is a value that represents how a function changes with respect to its variable, and it shows the rate of increase or decrease of the function at a point, as well as the slope of its graph. The concept of derivative is of great importance in mathematics and its applications. It is of great theoretical and practical importance, especially in studying the changes in processes, such as speed (distance and time), acceleration (speed and time), and many other physical, economic, or social processes.

Keywords: derivative, derivative of a function, derivative of a sum, derivative of a product, derivative of a quotient, chain rule, differentiation, mathematical analysis, extremum, monotonicity.

By using the rules for calculating derivatives, many problems, such as creating a mathematical model for functions, analyzing them, and finding the shortest path and optimal result, can be easily solved. Studying these rules has an important place, especially in higher mathematics courses. To calculate a derivative, several step-by-step rules and formulas are usually used. There are several basic properties of the derivative, which are reflected in each mathematical operation, especially when performing operations on complex functions. The most important rules for calculating derivatives are the product rule, the product rule, the quotient rule, and the chain rule. The product rule of differentiation states that the derivative of the sum



of two or more functions is equal to the sum of their derivatives. This rule serves as one of the main tools when performing additional, boundary, and combinatorial operations, and solving complex examples with multiple functions. The product rule, which is used to find the derivative of the product of two or more functions. The importance of this rule is that it is used to express and solve problems encountered in many fields of physics, engineering, and economics in mathematical language. The quotient rule is used to calculate the derivative of a quotient of functions, and it is used to simplify many complex expressions [1].

The chain rule is designed to work with complex and interconnected functions. This rule provides an infinite number of possibilities, especially when calculating the derivative of a function with respect to a function, expanding the possibilities for working with expressions of arbitrary complexity. The derivatives of some special functions are also of great importance in calculating derivatives. For example, the derivatives of algebraic, trigonometric, exponential, and logarithmic functions make it easy to identify relationships between them and facilitate practical work. The calculation of the derivative for these special functions is based on extended formulas and ready-made results. When finding the derivative of a function, first of all, it is necessary to determine the domain of the function, its type, and the interval of the variable. The existence of a derivative in the field of accuracy of this function is also studied. In special cases, i.e. if the function is unchanged at a certain point or is non-differentiable, the derivative may not exist. In such cases, incremental limits and special circumstances are considered. The derivative exists only at points where the function is differentiable. This condition is one of the important steps in the process of calculating the derivative. Each of the rules for calculating the derivative has its own purpose and is designed based on a specific algorithm. Mastering them deeply develops mathematical thinking and analytical thinking. Using the product rule of the sum, you can easily and quickly find the derivative of multi-function expressions, and the product rule and division rule can easily solve complex



expressions. The chain rule is important in calculating derivatives of function compositions [2].

When calculating the derivative, there are also various practical rules and approaches. With them, it is possible to facilitate the issue, simplify and get results in a short time. All of these rules are widely used in mathematical analysis, especially in the analysis of functions, in finding maximums and minimums, and in plotting graphs. The derivative serves as a powerful tool in analysis, not only for determining the extremum of a function at a given point, but also for checking the monotonicity of a function, inflection points on a curve, the shape of its graph, and many other situations. In this regard, the rules for calculating derivatives are essential knowledge and skills for every mathematician, engineer, economist, or scientist in the natural and social sciences. The rules for calculating derivatives are deeply grounded in both theory and practice. As a result of their precise algorithmic formulation, it is possible to find the derivative of any mathematical expression or function. If you always follow the rules of algorithm, order, and consistency when calculating a derivative, the result will be correct and accurate. It also allows for the analysis of the interdependence of each subpart, based on the rules for calculating derivatives, briefly simplifying mathematical problems, studying complex expressions. For example, in economics, derivative calculation skills are important for determining the most favorable volume of production, maximizing profit, minimizing costs, or determining optimal actions in the scientific and technical fields [3].

In addition to the general rules of differentiation, it is also necessary to study some of its properties. These include higher-order derivatives, that is, the second, third, and higher-order derivatives of a function. Using these derivatives, a more detailed analysis of the graph of a function can be performed, determining its smoothness, growth, and decrease more precisely. In addition, there are special derivative rules that are mainly used on complex or composite functions. As a result of modern scientific and technological progress, derivative calculation rules have



also been widely introduced into everyday life. In electrical engineering, mechanics, computer science, economics, and other fields, derivatives and related rules are used to solve various control and management problems and to perform optimization tasks. Today, mastering the rules for calculating derivatives is of particular importance for young people studying in higher and secondary specialized educational institutions, especially in the fields of mathematics, physics, engineering, finance, and economics. When necessary, representatives of each field must be able to confidently perform operations on complex functions or mathematical models. The difficulties that arise when calculating derivatives can only be overcome with a deep understanding of the theory and practical skills [4].

The concept of derivatives and the rules for calculating them are one of the most important achievements of human development. It is an important tool for solving various problems not only in mathematics, but also in everyday life, technical production, economic analysis, and even natural sciences. Using derivatives, the dynamics of complex processes, states of change, extremes, and optimal results are determined and a scientific approach to the problem is taken. Summarizing the topic, it should be noted that the rules for calculating derivatives are the foundation and foundation of mathematics. Based on these rules, students will have a solid theoretical and practical foundation for solving not only mathematical problems, but also a number of problems in other fields. A deep study of the rules for calculating derivatives is a vital necessity for every representative of a field and a guarantee of scientific progress. Through regular training, thorough theoretical knowledge, rigorous practice, these rules can be perfectly mastered.

Conclusion:

The rules for calculating derivatives are one of the most fundamental sections of higher mathematics, and their mastery is a necessary knowledge and skill for a modern specialist. A thorough understanding of these rules is essential not only for effectively solving mathematical problems, but also for solving complex problems



in other natural and social sciences using a scientific approach. A professional who has mastered the derivative and its calculation rules can find a place in any field. With these mathematical rules, it is possible to strive for new achievements at each stage of human development, while the rules for calculating the derivative provide a solid theoretical foundation for this.

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