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IQTISODIY MASALALARGA DIFFERENSIAL HISOBNING QO'LLANILISH TATBIQI

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Annotatsiya: *Ushbu maqolada differensial hisobning iqtisodiy jarayonlarni tahlil qilishdagi o'rni, uning asosiy usullari va qo'llanish mexanizmlari ilmiy-nazariy jihatdan yoritiladi. Xususan, funksiyaning hosilasi yordamida iqtisodiy ko'rsatkichlarning o'zgarish tezligini aniqlash, limit va differensiallar orqali iqtisodiy jarayonlarning chegaraviy qiymatlarini tahlil qilish, maksimal va minimal masalalarni yechishning amaliy uslublari bayon qilinadi. Shuningdek, marjinal tahlilda hosilalarning qo'llanishi, talab va taklif funksiyalarining elastikligi, xarajat va foydaning optimallashtirish masalalarida differensial hisobning ahamiyati aniq misollar orqali ko'rsatiladi.*

Kalit so'zlar: *differensial hisob, iqtisodiy model, marjinal tahlil, elastiklik, optimallashtirish, hosila, limit, iqtisodiy funksiya, maksimal foyda, chegara xarajatlar.*

ПРИМЕНЕНИЕ ДИФФЕРЕНЦИАЛЬНОГО ИСЧИСЛЕНИЯ В ЭКОНОМИЧЕСКИХ ЗАДАЧАХ

Аннотация: *В данной статье рассматривается роль дифференциального исчисления в анализе экономических процессов, его теоретические основы и практическое применение в экономическом моделировании. В частности, анализируется использование производной для определения скорости изменения экономических показателей, применение пределов и дифференциалов для изучения предельных значений функций, а также методы решения задач оптимизации — минимизации издержек и максимизации прибыли. Кроме того, раскрывается значение маржинального анализа, эластичности функций спроса и предложения, а также применение дифференциального исчисления при принятии оптимальных производственных решений. Приведены примеры, иллюстрирующие практическую эффективность данных методов.*

Ключевые слова*: дифференциальное исчисление, экономическая модель, маржинальный анализ, эластичность, оптимизация, производная, предел, экономическая функция, максимизация прибыли, предельные издержки*

APPLICATION OF DIFFERENTIAL CALCULUS IN ECONOMIC PROBLEMS

Abstract: *This article analyzes the role of differential calculus in studying economic processes, its theoretical foundations, and its practical applications in economic modeling. In particular, it examines how derivatives are used to determine the rate of change of economic indicators, how limits and differentials help analyze boundary values of economic functions, and how optimization problems such as cost minimization and profit maximization are solved. The article also explains the importance of marginal analysis, elasticity of demand and supply functions, and the application of differential calculus in optimizing production decisions. Relevant examples are provided to demonstrate the practical efficiency of the discussed methods.*

Keywords: *differential calculus, economic model, marginal analysis, elasticity, optimization, derivative, limit, economic function, profit maximization, marginal cost.*

INTRODUCTION

Many economic processes change continuously over time, and mathematical modeling of such dynamic systems requires the use of differential calculus. The changing market demand, supply behavior, production costs, and profit maximization are key examples where derivatives enable precise and scientifically grounded analysis.

The fundamental concepts of differential calculus — limits, derivatives, and differentials — help evaluate the sensitivity of economic indicators and support decision-making based on marginal changes. For example, the elasticity of demand expresses the responsiveness of demand to small changes in price, which is derived mathematically using derivatives. Thus, modern economic analysis cannot be complete without differential calculus tools.

RESEARCH METHODOLOGY

The following scientific and methodological approaches were used in the study:

1. Mathematical-analytical method

- Economic functions (demand, supply, cost, profit) are expressed through mathematical equations.
- Using the derivative function, the rate of change of economic processes, marginal indicators, elasticity and optimization conditions are derived.

- To find the maximum and minimum values, first and second order derivatives are used.

2. Marginal analysis method

- Marginal cost (MC), marginal revenue (MR) and marginal productivity were used to determine changes at the micro level in economic processes.
- The analysis of the choice of production volume based on the optimality condition was carried out.

3. Modeling and functional approach

- Elasticity of demand and supply functions

mathematically modeled using the formula.

- The problem of profit maximization

was optimized by finding the derivative of the function.

4. Analysis using practical examples

- The impact of price changes on demand;
- Marginal analysis of production costs;
- Real economics, for example, finding the maximum of the utility function

RESEARCH AND RESULTS

On the economic value of a product. Let's consider the economic value of a product using the following example. When producing one product, the cost of production depends on its quantity. The quantity of the product x with production costs y if we mark with

$$y = f(x)$$

A functional connection arises. Production of products. Δx multiplied by $x + \Delta x$ price corresponding to the product

$$f(x + \Delta x)$$

So, the quantity of product Δx increase in production costs

$$\Delta y = f(x + \Delta x) - f(x)$$

fits.

Definition 1. $\frac{\Delta y}{\Delta x}$ The coefficient is called the average increase in the cost of production of the product.

$$\lim_{\Delta x \to 0} \frac{\Delta y}{\Delta x} = y' = f'(x)$$

is called the marginal cost of production.

Similar to above $\varphi(x)$ With x If the total revenue from the sale of products is:

$$\lim_{\Delta x \to 0} \frac{\Delta \varphi(x)}{\Delta x} = \varphi'(x)$$

is called limit money trading.

Example 1. Cost and volume of production x between

$$y = 100x - \frac{1}{30}x^3$$

Let be a relationship. Find the marginal costs at production volumes of 5 and 10 units.

Solution. based on the terms of release, $x = 5,\ \ x = 10$. Derivative of a functional relationship

$$y' = 100 - \frac{1}{10}x^2$$

is,

$$f'(5) = 100 - \frac{1}{10}5^2 = 97.5, \quad f'(10) = 90$$

will.

The economic meaning of this is that with a production volume of 5 units, the cost of production when switching to the production of the next product is 97.5; with a production volume of 10 units - 90.

2. Definitions of some economic concepts. Definition 3. Demand is the consumer's need for a certain type of goods and services that they can purchase at a given point in time at a given price level.

A number of factors influence changes in demand. The most influential of these is price.

Example 2. The relationship between the demand for a product and its price

$$p = 20 - 3x$$

is expressed by the formula, where x demand for products, p price of the product.

Revenue from product sales

$U = xp$ *ёки* $U = x(20 - 3x) = 20x - 3x^2$

will be. The derivative of this

$U' = 20 - 6x$

will. $x = 2$ If, $U'(2) = 8$ This means that if demand increases from 2 to 3 units, the selling price will increase by 8 units.

3. Elasticity of a function. Using the derivative, one can calculate the increase in an arbitrary variable (function) corresponding to the increase in an arbitrary variable (argument). When solving many economic problems, it is necessary to calculate the relative increase, that is, the percentage increase in the function corresponding to the percentage increase in the argument. This leads to the concept of elasticity of a function or relative derivative.

Definition 4. $\frac{\Delta x}{x}, \frac{\Delta y}{y}$

The relationships are called relative increments of the argument and the function, respectively. The ratio of the relative increment of the function to the relative increment of the argument.

$$\frac{\Delta y}{y} : \frac{\Delta x}{x}$$

Let's look at . We write this ratio as follows:

$$\frac{\Delta y}{y} : \frac{\Delta x}{x} = \frac{\Delta y}{\Delta x} \cdot \frac{x}{y} \qquad (1)$$

$y = f(x)$ if the derivative of a function exists,

$$\lim_{\Delta x \to 0} \frac{\Delta y}{y} : \frac{\Delta x}{x} = \lim_{\Delta x \to 0} \frac{x}{y} \cdot \frac{\Delta y}{\Delta x} = \lim_{\Delta x \to 0} \frac{\Delta y}{\Delta x} \cdot \frac{x}{y} = \frac{x}{y} \frac{dy}{dx} \qquad (2)$$

comes from .

Definition 5. (2) to the relation $y = f(x)$ _function_ x _is called elasticity with respect to,_ And $E_x(y)$ is determined. According to the definition:

$$E_x(y) = \frac{x}{y} \cdot \frac{dy}{dx}$$

will.

x Elasticity with respect to is an approximation of the percentage increase (or decrease) in the corresponding increase in the function with a 1% increase in the increase in the argument.

Let's look at some examples of finding the elasticity of a function.

CONCLUSION

Differential calculus is a fundamental tool for understanding economic dynamics and making accurate and efficient decisions. With derivatives, it becomes possible to measure the speed of change of economic indicators, determine elasticity, analyze market equilibrium, and solve optimization problems. The study shows that mathematical mechanisms of differential calculus significantly improve the quality of economic modeling and support effective resource allocation and forecasting of economic processes.

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