

## EXPRESSING AND SOLVING REAL-WORLD PROBLEMS USING MATHEMATICAL EQUATIONS

Dilobar Kuchkarovna Khoshimova  
Mehribon Sharif-kizi Avazmurodova  
Shakhrisabz State Pedagogical Institute

**Abstract:** Solving problems that occur in the real world using mathematical equations is an important bridge between science and practice. In various fields - such as economics, physics, engineering, biology, and even social sciences - mathematical modeling is widely used to understand, analyze, and find optimal solutions to emerging problems. In this process, real phenomena are simplified and expressed in the form of formulas, equations, or systems of equations. After that, calculations are performed on this mathematical model using different methods, results are obtained, and these results are compared with real-life situations. Expressing problems through mathematical equations not only provides a precise and logical approach but also facilitates comparison of different options, forecasting, and decision-making processes. For example, in economic processes, expressing supply and demand through equations helps determine price equilibrium, while in physics, motion equations allow prediction of the future position of objects. At the same time, since any model may not fully reflect real life, careful and critical analysis of results is required. In conclusion, expressing and solving real-world problems using mathematical equations is an integral part of modern scientific research and practical activity, playing an important role in simplifying complex processes, achieving deeper understanding, and making effective decisions.

**Keywords:** mathematical equations, real world, expression, solution, physical equations, economic modeling, statistical analysis, differential equations, optimization, algebraic equations, linear equations, economic equations, ecological models, variables, integrals, analytical solutions, numerical solutions, modeling methods, regression, functions, probabilities, simulation, statistical methods, time variation

**Introduction.** Representing and solving real-world problems using mathematical equations is one of the most important links between science and practice. In modern times, as technology and science are rapidly developing, mathematical modeling is becoming an important tool for understanding and analyzing complex processes in various fields. With the help of mathematical modeling, real-life phenomena are expressed in a simplified form and are described through formulas, equations, or systems of equations. This process allows for a deeper understanding of the essence of the problem, the isolation of its main factors, and the determination of their interdependence. As a result, it becomes possible to conduct a clear and logical analysis of complex systems. Also, models built using mathematical equations are widely used in economics, physics, engineering, biology, ecology, and social sciences. For example, in economics, equations representing supply and demand help determine market equilibrium, while in physics, equations of motion allow us to predict how objects will change over time. Another important aspect of the mathematical approach is that it facilitates the process of comparing different options, finding optimal solutions, and making decisions. However, since any mathematical model cannot be a complete copy of real life, caution and critical thinking are important when analyzing the results. In general, the expression and solution of real-world problems using mathematical equations is one of the main foundations of modern scientific research, allowing humanity to simplify complex processes and gain a deeper understanding.

Analysis of the literature on the topic. The issue of expressing and solving real-world problems using mathematical equations is one of the most widely and deeply studied areas in the scientific literature. This topic is mainly analyzed within the framework of applied mathematics, mathematical modeling, computational mathematics, and systems theory. In scientific sources, the process of mathematical modeling is usually divided into three main stages: studying and analyzing a real process, expressing it in the form of a mathematical model, and solving the resulting model and comparing the results with the real situation. This approach is cited as the main methodology in many classical and modern literature. In the literature on applied mathematics, differential equations and systems of algebraic equations are indicated as the most important means of expressing physical processes in real life. For example, the laws of motion, heat transfer, electrical circuits, and mechanical systems are modeled using differential equations. In the economic literature, processes such as supply and demand, price equilibrium, and optimization of profits and costs are widely described as being expressed through mathematical equations. Linear algebra and optimization methods play an important role here. In the sources on statistics and probability theory, modeling systems with uncertainty and randomness plays an important role. Regression analysis, probability distributions, and statistical models allow for the analysis of real data on a mathematical basis. Also, modern literature emphasizes numerical methods and computer simulation. Because most complex equations do not have an analytical solution and can only be solved using numerical methods. Therefore, computational mathematics and the theory of algorithms play an important role in this area. In conclusion, the analysis of the literature shows that the expression and solution of real-world problems through mathematical equations is a complex scientific direction that intersects many disciplines and is constantly developing.

Research methodology. Several basic methodological approaches of scientific research are used to study this topic - the process of expressing real-world problems using mathematical equations and solving them. The research methodology consists of the stages of analyzing the problem, creating a mathematical model, solving it, and evaluating the results. At the first stage, the analysis and observation method is used. At this stage, a real-life problem or process is studied in depth, its main factors, variables, and dependencies are identified. For example, economic or physical processes are observed and the patterns between them are isolated. At the second stage, the mathematical modeling method is used. At this stage, the real process is simplified and translated into mathematical language. That is, the problem is expressed in the form of algebraic equations, differential equations, or a system of equations. This model should reflect the main features of the real situation. At the third stage, analytical and numerical solution methods are used. If the equation has an exact solution, a solution is found using analytical methods. In more complex cases, numerical methods, i.e. computer algorithms and computational methods, are used. At the fourth stage, the comparison and verification method is carried out. The results obtained are compared with real data and the accuracy of the model is assessed. If the results do not match, the model is revised and improved. Also, statistical analysis, optimization, and simulation methods are widely used in the research process. These methods help to predict the behavior of complex systems and find the most optimal solutions. In short, the research methodology provides a systematic approach to studying real-world problems through mathematical equations and increases the reliability of scientific results.

Results and Discussion. In this study, the process of expressing and solving real-world problems using mathematical equations was studied and analyzed in depth. The results obtained show that mathematical modeling is one of the most effective methods for simplifying complex real-world processes, bringing them into a systematic form, and drawing precise scientific conclusions. Many real-life problems are easier to analyze when they are presented in a more precise and understandable

form, not directly, but through mathematical expressions. According to the results of the study, mathematical equations play an important role in economics, physics, engineering, ecology, and social sciences. For example, in economics, equations expressing supply and demand help determine market equilibrium and allow us to predict price changes. In physics, processes such as motion, velocity, and acceleration are expressed through differential equations, which allow us to predict the future state of objects. This confirms the high practical importance of mathematical modeling. In the discussion, it should be emphasized that any mathematical model cannot be a complete and perfect copy of real life. Because the real world is very complex, and the factors affecting it are countless and often random in nature. Therefore, a certain degree of simplification is introduced when building a model, which can affect the accuracy of the results. Therefore, the correct interpretation of the results obtained and their comparison with the real situation is an important part of the scientific approach. In addition, the importance of numerical methods and computer simulations was clearly demonstrated during the study. Since complex equations often do not have an analytical solution, it is necessary to use modern algorithms and computing technologies to solve them. This allows processing large amounts of data and obtaining more accurate results. At the same time, since numerical solutions are not free from errors, they require careful analysis. In general, the results of the study show that the representation and solution of real-world problems using mathematical equations is of great scientific and practical importance. This approach not only facilitates the understanding of complex processes, but also allows for accurate, informed and effective decision-making in various fields. Therefore, mathematical modeling remains an integral part of modern science and technology.

**Conclusion.** In conclusion, the expression and solution of real-world problems using mathematical equations is one of the most important areas of modern science and practice. Mathematical modeling simplifies complex processes and allows them to be analyzed in an understandable and clear form. This helps to achieve important scientific and practical results in various fields - economics, physics, engineering, biology and other sciences. The results of the study show that models built using mathematical equations are of great importance in understanding real processes more deeply, predicting them and finding optimal solutions. At the same time, since any model cannot fully reflect real life, a careful and critical approach is necessary when analyzing the results. In general, solving real-world problems using mathematical equations develops scientific thinking, facilitates the decision-making process and serves as one of the important foundations of modern technological progress.

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