THE CONCEPT OF THE IMPORTANCE OF DIFFERENTIAL EQUATIONS FOR STUDENTS

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In the Decree "On Education" and the "National Personnel Training Program" all sections of the stage of lifelong education (preschool education, primary education, secondary school, secondary specialized vocational education. Vocational education, higher education, improvement and retraining (advanced training in universities), master's degree, doctoral studies) set a number of tasks. A phased development is determined, each teacher, as a specialist, deeply masters his subject from a scientific and practical point of view. In the program "Mathematics in Higher Education" it is planned to study modern sections of mathematics, mainly the section "Differential Equations". One of the most important issues is the development of a methodology for teaching students "Differential Equations", different from the methodology of higher education, based on the achievements of pedagogy and psychology. [1]

In accordance with the tasks set by higher educational institutions, to increase the activity of the educational phase of educational institutions through the practical application of the latest achievements of science, to enable the researcher to think freely in all respects, to be spiritually rich and educated. Modern scientists use the methods of mathematical analysis, regression analysis, game theory, linear programming, matrix and vector calculus, etc. to study economic processes, which in turn are components of mathematical modeling. One of the most important sections of mathematics, which is of great practical importance, is the section "Ordinary differential equations". In addition to general mathematical and theoretical interest, differential equations find wide practical application. For example, when solving problems related to optimal management, the economic activity of a firm or enterprise, the organization of the production process, etc. Relationships between economic variables, such as prices, wages, capital, interest rates, etc., are written in the form of differential equations. The basis of economic theory is economic laws expressed as quantitative relationships between quantities that characterize an economic system or process. Such laws make it possible to explore real economic systems based on mathematical models. The construction and study of these models is the subject of mathematical economics, which considers the economy as a complex dynamic system.

Mathematics itself is a peculiar phenomenon in the system of knowledge. I would like to point out that when studying mathematics, solving problems and equations is very important. Even Newton expressed the opinion that this side of the case is more important than the assimilation of theory. Of course, it is impossible to agree with this completely, but there is no doubt that for the study of mathematics only theoretical acquaintance with the material would not be enough. Therefore, we must combine the study of theoretical material with the solution of problems and equations. If many people think that mathematics is just a collection of incomprehensible formulas and expressions that they will never understand, then considering the studied and obtained knowledge in examples, equations and problems, from everyday life, helps expand the outlook, think widely, helps to look at the "queen of sciences" with different eyes. Mathematics deals not only with directly abstracted quantitative relations and spatial forms, but also with those that are logically possible, i.e., those that are deduced by logical rules from previously known relations and formulas. Problem solving gives students broad thinking, which develops his human brain and broadens his horizons. Thus, it develops the students' creative abilities. It is not without reason that they say that mathematics is called "gymnastics of the mind" In this regard, put forward by us, the goal is to strengthen mathematical knowledge, based on theoretical and widely used practical skills in everyday life. "The primary goal of mathematical education should be to foster the ability to investigate phenomena of the real world mathematically." Solving different types of equations gradually trains memory, wit, and quick reactions, as well as fosters creativity and a love of mathematics.

In the case of a point moving in a straight line under the action of a force proportional to its distance from the center of gravity, Newton solves the equation

$$\frac{d^2x}{dt^2} + k^2x = 0$$

Newton's second law is defined by the differential equation

$\frac{d(mv)}{dt}$=F

Newton is also interested in a point moving in a straight line in a medium whose resistance is proportional to the square of the velocity

$\frac{d^2x}{dt^2}$=m$\pm n$

The differential equation and its solution have a simple geometric meaning. Suppose that the function $f(x,y)$ is defined in the domain D. M $(x,\ y)$ $\in D$ the point of the function f $(x,\ y)$, f(x,y)=k, determines the angular coefficient of the tangent curve passing through point M.

$$y' = f(x,y)$$

the differential equation determines the direction in the XOY plane.In the differential equation

$y' = f(x,y)$, the ratio $\frac{dy}{dx} = C$, $(f(x,y) = C)$is called the geometric place of points. In the equation $\frac{dy}{dx} = -\frac{y}{x}$, $y = -Cx$

Newton mainly uses the method of series approximation, in which he finds the solution of a differential equation in the form of a power series. Some equations are integrated in quadrature, others are reduced to less learned transcendental functions. [2]

G. Leibniz and the Bernoulli brothers developed the integration of the differential equation in a different way. They formed the basis of the classification of simple differential equations and methods of their solution as a result of the systematic counting of infinitely many people. In the nineteenth century, a fundamentally new stage in the theory of simple differential equations was inextricably linked to Cauchy's research. Cauchy radically revised the foundations of mathematical analysis and took the theory of differential equations to a new level.

Instead of finding a general solution of a differential equation, the problem of finding a solution that satisfies the initial conditions (the Cauchy problem) was put forward. Cauchy began to study the local and global properties of equations and the differences in their solutions. Because of the need for mechanics and mathematical physics, linear differential equations were radically studied in the nineteenth century. The solution of special forms of such equations using straight lines led to the introduction and deeper study of unilinear transcendental functions (cylindrical, spherical, Lamé, Mathieu functions, etc.) These, in turn, enriched analysis. Eminent scientists noted that "the Great Book of Nature is written in the language of mathematics" (Galileo Galilei), "Mathematics is the means by which people control nature and themselves" (A.N. Kolmogorov). This can be explained by the fact that often the objective laws to which certain processes (phenomena) obey can be written in the form of differential equations, and thus these equations are a means of quantifying these laws. Thus, given the important role that differential equations play in mathematics and the natural sciences (physics, astronomy, chemistry, biology, medicine, economics, and others), the availability of a clear understanding of this role, it seems highly relevant to familiarize students with elements of theory and applications of these equations. There is a need and expediency of teaching the solution of differential equations and problems on the physical and geometric sense of the derivative, solved by differential equations in the system of additional education [4]. At the forefront is not only the ability to compose a differential equation describing a real process, but also knowledge of ways to solve the simplest classes of differential equations such as: equations with separating variables, homogeneous equations, linear differential equations, Bernoulli equations, etc. Consequently, the solution of any problem reducible to a differential equation consists of two stages: creative (composing the differential equation) and technical (solving the differential equation).

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