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SOLVING FRACTIONAL LINE ECONOMIC ISSUES IN THE GEOGEBRA PROGRAM

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Abstract
This article provides tips on how to use the program “GeoGebra” to solve nonlinear economic problems. A graphical method was used to solve the problem.

Keywords: GeoGebra, linear programming, nonlinear programming, plane, profit function, cost function, objective function, mathematical model.

Introduction

In his research, the Indian scientist G. Rash[2] showed that the main purpose of teaching the subject of "Computer Graphics" should be to develop students' creative activity in designing production problems on a computer.

Although Spanish scientists L.T. Erig[3], H.J. Chery[4], R.L. David[5] have conducted research on the use of three-dimensional interactive graphics to teach equipment manufacturing processes, “He tried to use three-dimensional modeling in teaching the subject of "Computer Graphics", but did not study enough issues such as the development of spatial imagination of students, the development of creative activity in computer design.

The analysis of the research shows that the problem of developing a model for the development of creative activity of students and the design of a methodical system of teaching using various graphics software in the teaching of "Computer Graphics" in higher education institutions (HEIs) has not been studied. The lack of scientific and pedagogical solutions to these problems means that students do not fully understand the purpose and content of teaching computer graphics in universities, lack of spatial imagination in modeling issues of their specialization using the capabilities of various graphics programs, "Drawing geometry and Engineering Graphics” is an integral part of the subject “Computer Graphics”.

Korean scientist Z.Zuo[6] conducted research on the introduction of computer technology and improvement of teaching in the process studying "Computer Graphics". In his research, he argued that "Descriptive Geometry and Engineering Graphics" should be conducted in conjunction with "Computer Graphics."

B.C. Kornilov[7], in his dissertation research, believes that the most important task of pedagogy is to find, accumulate and analyze various technologies and ways of using teaching aids in the educational process in such a way as to give the training lessons technological features. The introduction of information learning technologies, in particular, computer mathematical packages, into the educational process, initiates the formation of computer visual thinking in students, which involves operating with images on a computer screen. Students are given the opportunity to actively and consciously comprehend various previously unfamiliar mathematical concepts; successfully solve educational math problems.

E.A. Dakher[8] believes that a computer mathematical package from the point of view of pedagogy is a didactic teaching tool, which, in the presence of an appropriate developed teaching methodology, allows to optimize the educational process, and from the point of view of informatics, a tool designed to automate the solution of mathematical problems in various fields of science, technology and education, integrating a modern user interface, analytical and numerical methods for solving various mathematical problems, means of visualizing the results of calculations. At the decision-making stage, such a tool allows you to more reliably analyze the results.

For professional self-education of students, it is necessary to use modern computer technologies. Interactive computer technologies allow you to get not only theoretical knowledge, but also practical skills. In the context of the introduction of new information technologies, this problem becomes particularly relevant[9].

Main Part

This article provides guidance on the advantages and disadvantages of GeoGebra over other math programs, as well as how to make it easier for students to imagine while teaching Mathematics for Economists using GeoGebra[10].

The article examines the geometric interpretation of economic problems using the "GeoGebra" program. In order to demonstrate the feasibility of using the program "GeoGebra" in practice, we studied the R^2 spatial geometric interpretation of linear and nonlinear problems, and gave methodological recommendations for the application of this program[11].

In the article the relevance of the use of mathematical packages in the educational process. Universal mathematical packages of the system are new ample

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opportunities for improving education at all, without exception, its stages. Also, problems associated with the use of mathematical packages and ways to solve these problems are noted in this article. As an example, the solution of a non-standard equation by a graphical method using the Maple program was considered[12].

Math packages greatly facilitate the learning activities of students. Their use makes it possible to refuse to perform manually large mathematical calculations, overcome difficulties in solving economic and mathematical problems and analyze the results obtained, it is easy to prepare reports on laboratory work, to present calculations in graphical form[13].

The issues of teaching first-year students in the study of the discipline "Higher Mathematics" with the use of computer programs are considered. The features of using various computer programs for multilevel preliminary training of trainees are considered. It is shown that computer packages are not used intensively enough in the teaching process despite their significant teaching potential. The possibilities of using both specialized mathematical packages and the most common office programs are analyzed. The possibility of using mathematical programs when studying the section "Linear Algebra" by first-year students of a technical university is substantiated[14].

Some aspects of the bilingual model of teaching mathematical disciplines to students of economic profile. To increase the competitiveness of graduates of an economic profile, it is proposed to introduce a bilingual model of teaching mathematical disciplines into the educational process. The objective reasons for its implementation are considered, the basis of the model and the unique possibilities of its implementation, the prospects for its introduction are presented[15].

Fractional linear economic problems are encountered in production problems. In solving such problems, the problem is to find the maximum and the minimum of the problem. If the function is complex, it is almost impossible to solve it analytically. In this case, it is advisable to solve the problem graphically. For example, let us consider the following problem in the work of I.L. Akulich[1].

Problem

Three types of equipment are used to produce two types of products, A and B. Each of the products must be processed in each type of equipment. The processing

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times of each product on this type of equipment are given in the table below. The table also shows the costs associated with producing one product of each type.

The types of equipment	Time spent on processing a product (h)	
	A	B
I	2	8
II	1	1
III	12	3
The cost of production product (currency)	2	3

Type I and III equipment may not be used for more than 26 and 39 hours. However, it is advisable to use type II equipment for at least 4 hours. Make a plan of how much each type of product will cost and keep costs to a minimum.

Solution

The mathematical model of the problem is constructed as follows

$$\begin{cases} 2x+8y \le 26 \\ x+y \ge 4 \\ 12x+3y \le 39 \\ x \ge 0, y \ge 0. \end{cases}$$

$$F = \frac{2x+3y}{x+y} \to \min$$

We use “GeoGebra” to solve the problem graphically. This program is included in the category of free software and can be downloaded from: https://www.geogebra.org/download. We launch the GeoGebra program and enter the conditions in the field “Input” of the program window to create a field (Figure 1).

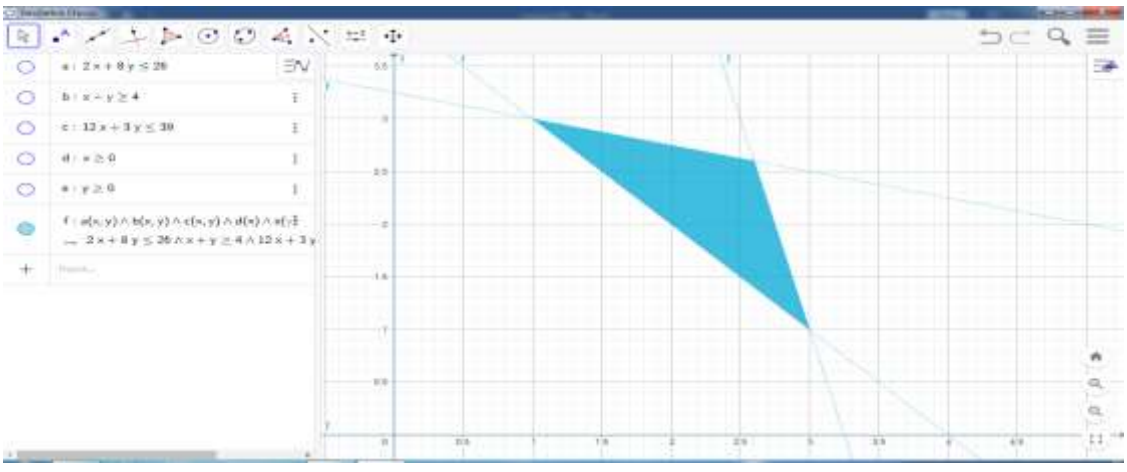

Figure 1. Field.

INNOVATIVE TECHNOLOGICA
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Using the command “Slider”, we express the values of the target function using the g parameter. By changing the g parameter, we show that the target function reaches a minimum value within the field (Figure 2).

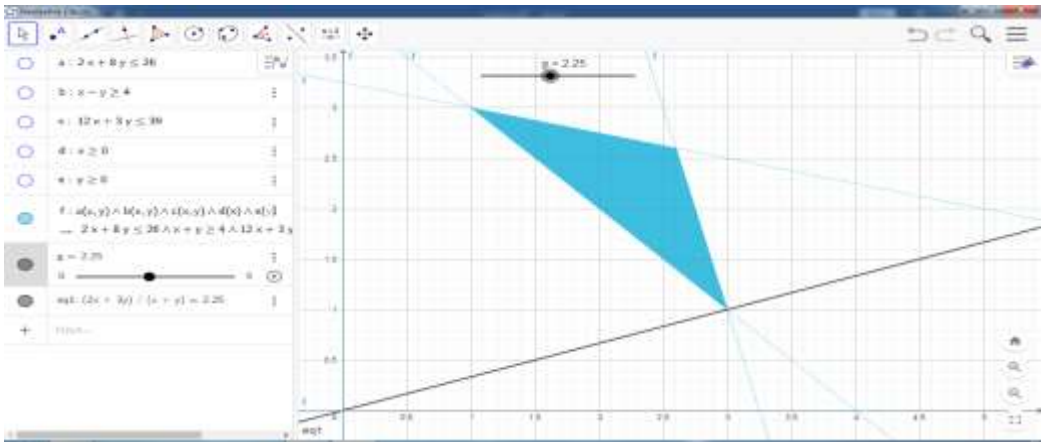

Figure 2. Optimal solution.

Figure 2 shows that when 3 units from the first product and 1 unit from the second product are produced, the minimum cost is 2.25.

Conclusion

Passing lessons using the GeoGebra program in teaching mathematics for economists creates some convenience for economists in comparison with other mathematical programs. Economists often speculate about earning a lot at low cost. This should be within the scope of some opportunity to do. If there is a circle of opportunity, it forms some kind of Sphere. The use of GeoGebra software to all the universities teaching mathematics for economists will greatly help students to awaken imagination.

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