TEACHING AND METHODOLOGICAL MATERIALS ON THE TOPIC OF PLANE TRANSFORMATIONS

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The purpose of this work: to tell about the development of teaching and methodological materials on the subject "Geometric constructions of figures and plane transformations" in English, intended for work with Chinese master's students. These teaching materials will form a part of the author's master thesis.

Material and methods. The main source is the lectures of the scientific supervisor and the textbook published under the stamp of the Ministry of Education of the Republic of Belarus, one of the authors of which is the scientific supervisor [1].

Findings and their discussion. For the successful work with master students studying in English, it is necessary to have electronic educational and methodological materials posted in the distance learning system of VSU https://tfc.vsu.by . The beginning of this work was laid in the master's dissertation of Yang Shumin, defended in 2024. The dissertation contained lecture materials on the section "Plane Transformations" and covered the topic of "Plane Motions".

The first part of the electronic teaching and methodological materials developed by the author consists of lecture notes, which include the topics "Similarity Transformation", "Perspective-affine Transformations", "Inversion". The notes also contain examples of solving problems and applying plane transformations to solving problems from the school mathematics course. A large number of drawings that help master the educational material accompanies the theoretical material.

The second part of the teaching and methodological materials is devoted to practical classes. It contains control questions and assignments, problems to be solved in practical classes with answers to them, as well as assignments for independent solution. This part also includes assignments on the topic of "Plane motions".

In continuation of work on teaching and methodological materials, it is planned to develop several versions of test assignments in English, place the assignments in the distance learning system and form tests from them.

In addition, the author has developed an Excel workbook that can be used to solve the following problem. The coordinates of three points A, B, C that do not lie on the same line and the coordinates of their three images A', B', C' are given. Write down formulas according to which the affine transformation operates, which transfers the first three points to the second three points in the same order.

As is known, an affine transformation of a plane is given by the formulas

$$\begin{cases} x' = a_{11}x + a_{12}y + x_0, \\ y' = a_{21}x + a_{22}y + y_0. \end{cases}$$

In the given problem, we have six unknown coefficients: a_{11} , a_{12} , x_0 , a_{21} , a_{22} , y_0 .

Figure 1 shows a screenshot of the workbook. In the third row, we have fields for entering the coordinates of the given points. The system of equations for finding unknown coefficients consists of six equations, but it is divided into two systems of three equations each with the same matrix. Therefore, we find only one inverse matrix. With the help of the inverse matrix, we solve both systems. In lines with numbers 20 and 21 we see the answer. There the formulas of the affine transformation are written down.

.4	A	В		с	0		E	F	G	н	1	J	K	L	
1	Given points									and their images					
2	A			8			C		A	A'		8'		C'	
3	2		0	0		1		1 1	-4	14	5	15	3	16	
4						_									
5	Check if there is a solution														
	vector AB		vector BC		a ne la selución	on exists	with wertor A'B'		vector B'C'		solution exists				
;	-2 1		+	1 0			-1		9 1		-2 1		11		
ŝГ		-	-			_		-	-	-		-			
9		\$	ystem	of equati	ions 1			5	System of equations 2						
10	2		0	1		-4			2	0	1	14			
11	0		1	1		5			0	1	1	15			
12	1		1	1		3			1	1	1	16			
13															
4	inverse matrix														
15	0		-1	1											
0	-1		-1	2											
18	1		2	-2											
10															
19		Result													
20	-2	х	+	5	У	+	0	= 0							
21	1	х	+	3	y	+	12	= 0							
2			_	_	-	_									



But before solving the problem, we need to check whether it has a solution. Therefore, we find the coordinates of the vectors \overrightarrow{AB} , \overrightarrow{BC} , $\overrightarrow{A'B'}$, $\overrightarrow{B'C'}$ and check that $\overrightarrow{AB} || \overrightarrow{BC}$ and $\overrightarrow{A'B'} || \overrightarrow{B'C'}$ are not satisfied.

We plan to continue the work and develop workbooks for solving other problems in the theory of plane transformations (for example, for solving the problem of finding invariant straight lines).

Conclusion. We have developed electronic teaching and methodological materials that will form part of the master's thesis and will be very useful to other master's students when studying this subject and working on their theses.

1. Гриб, Н.В. Геометрические построения фигур и преобразования плоскости: учебное пособие / Н.В. Гриб, М.Н. Подоксёнов. – Витебск: ВГУ имени П.М. Машерова, 2024. – 111 с. https://rep.vsu.by/handle/123456789/44608.

INFORMATION TECHNOLOGIES IN TEACHING GRAPH THEORY

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Graph theory is an important branch of discrete mathematics that provides a mathematical foundation for modeling complex systems by studying the associative relationships between vertices and edges. Its applications span many disciplines: in computer science, graph theory supports the design of algorithms (e.g., shortest path algorithms). In logistics, graph theory facilitates transportation route planning and supply chain network modeling. In social network analysis, graph theory can reveal user relationships, information dissemination patterns, and community clustering characteristics. In addition, knowledge of graph theory is indispensable for gene interaction networks in bioinformatics and signal transmission optimization in communications engineering. In recent years, the introduction of information technology has significantly changed the way graph theory is taught, making education more interactive and effective.