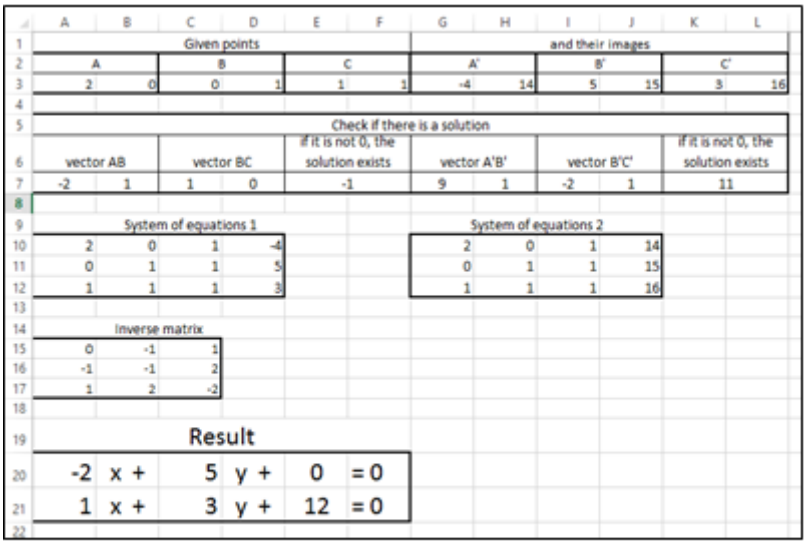

figure 1

But before solving the problem, we need to check whether it has a solution. Therefore, we find the coordinates of the vectors $\vec{AB}$, $\vec{BC}$, $\vec{A'B'}$, $\vec{B'C'}$ and check that $\vec{AB} || \vec{BC}$ and $\vec{A'B'} || \vec{B'C'}$ 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.

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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.

The main purpose of the work is to highlight the role and potential of information technologies in the process of teaching academic discipline «Graph Theory».

Material and methods. The research materials include professional educational resources for graph visualization (e.g., Graph Online) as well as the computerized mathematical system Wolfram Mathematica. Research methods: analysis of sources and existing tools, study and synthesis of information.

Results and their discussion. Modern information technologies make the learning process more interactive, intuitive and adaptable to the needs of different groups of students. An important point is that these technologies help to develop students' independent learning skills.

There are a variety of online educational resources for graph visualization, such as Graph Online, a web-based, open-source graph visualization platform that allows students to visualize graph structures and work with large datasets to deepen their understanding of the nature and structure of graphs. Users can construct graphs using adjacency or incidence matrices, find shortest paths, or explore connected components. The platform supports the manipulation of directed, undirected, and weighted graphs.

The Wolfram Mathematica Computing System provides real-time graph modeling and problem solving capabilities, making it ideal for self-directed learning. In addition, the system integrates data analysis and sophisticated graph visualization tools (based on a variety of algorithms) that help deepen the understanding of graph structures and how they work. Wolfram Mathematica's ability to interact cross-lingually with other tools and platforms (Python, MATLAB, etc.) makes it a flexible and versatile solution for teaching and researching graph theory.

In summary, using information technology to teach graph theory has the following advantages:

Interactivity: students can intuitively manipulate graph structures, test algorithms, and instantly observe results, making abstract concepts easy to understand. In traditional teaching, the graph traversal process (e.g., depth-first search) must be deduced step-by-step on the blackboard, and students may lose interest due to the cumbersome steps. With Graph Online's animation feature, the execution of the algorithm can be shown step by step.

Personalized Learning: supports learning at an individual pace. There are learning differences between students: some need to learn basic concepts while others need to solve higher-order problems. IT tools can be used to meet these needs. Wolfram Mathematica provides «smart hints»; for example, when a student tries to solve a Hamiltonian circuit problem, the system pushes different review materials based on the type of error. On Graphs Online, students are free to design graph structures, test theoretical hypotheses, and deepen their understanding of the practical applications of graph theory.

Knowledge Accessibility: compared to traditional teaching, it can get rid of the limitation of space. Through cloud platforms and mobile applications, students can access educational resources at any time. For example, instructors can record operations courses and upload them to the online learning platform, and students can independently complete post-course exercises with video playback and code samples.

Conclusion. Information technology has opened up new horizons for teaching graph theory and has become an important bridge for translating abstract theory into concrete practice. The tools discussed in this paper lower the threshold of learning through dynamic visualization and real-time interaction, and cultivate students' practical ability. However, the application of technology needs to be combined with traditional theoretical teaching to avoid over-reliance on tools and neglect of basic principles.

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