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MATHEMATICAL TRAINING OF IT BACHELORS IN THE LUPIC PROJECT

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Abstract. This article addresses the issue of teaching mathematics in the training of IT specialists at higher education institutions. The rapid growth of information technology and its implementation in various sectors of the economy, manufacturing, education, and elsewhere requires continuous updating of fundamental knowledge and the acquisition of professional skills for IT graduates. The article notes the importance of improving teaching methods for mathematical disciplines and the resulting competencies, emphasizing the integration of interdisciplinary links aimed at developing professionally oriented training for bachelor's degree IT specialists. The research methods utilized the key principles of a practice-oriented approach and interdisciplinary relationships between fundamental mathematical and specialized disciplines. Based on the study, the authors conducted an analytical review of mathematics teaching methods and the integration of mathematical disciplines and IT to develop the necessary competencies of future information technology specialists. Based on the study, the authors found that integrating disciplines, particularly the sections "Linear Algebra and Analytic Geometry" and "Programming," improves the quality of acquired knowledge by developing analytical and mathematical logic, a deep understanding of algorithmic thinking, and strengthening the connections between them. This study demonstrated that teaching mathematics requires emphasizing the connection with professional disciplines, focusing on solving

practice-oriented applied problems, which will contribute to enhancing the required competencies of future IT bachelor's degree students.

Keywords: education, mathematics, IT specializations, competencies, interdisciplinary connections

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LURIC ЖОБАСЫНДА ІТ БАҒЫТТАҒЫ БАКАЛАВРЛАРДЫ МАТЕМАТИКАЛЫҚ ДАЯРЛАУ

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Аннотация. Бұл мақалада жоғары оқу орындарында ІТ мамандарын даярлауда математиканы оқыту мәселелері қарастырылды. Ақпараттық технологиялардың қарқынды өсуі және олардың экономиканың әртүрлі салаларында, өндірісте, білім беруде және өзге салаларда енгізілуі ІТ түлектерінен іргелі білімдерін үздіксіз жаңартып отыруды және кәсіби дағдыларды меңгеруді талап етеді. Мақалада математикалық пәндерді оқыту әдістемесін жетілдірудің және одан туындайтын құзыреттіліктерді дамытудың маңыздылығы атап өтіліп, бакалавриат деңгейіндегі ІТ мамандарын кәсіби бағдарланған даярлауға бағытталған пәнаралық байланыстарды күшейтуге баса назар аударылады. Зерттеу әдістері тәжірибеге бағытталған тәсілдің негізгі қағидаттарын және іргелі математикалық пен арнайы пәндер арасындағы пәнаралық байланыстарды қамтиды. Зерттеу барысында авторлар болашақ ақпараттық технологиялар мамандарының қажетті құзыреттіліктерін дамыту үшін математиканы оқыту әдістемесіне және математикалық пәндер мен ІТ пәндерінің интеграциясына аналитикалық шолу жүргізді. Нәтижесінде авторлар «Сызықтық алгебра және аналитикалық геометрия» мен «Бағдарламалау» пәндерінің бөлімдерін өзара интеграциялау аналитикалық және математикалық логиканы, алгоритмдік ойлауды терең түсінуді қамтамасыз етіп, олардың арасындағы байланысты нығайту арқылы алынған білімнің сапасын жақсартатынын анықтады. Бұл зерттеу математиканы оқытудың кәсіби пәндермен байланысын нығайтудың маңыздылығын атап өтеді, сондай-ақ практикаға бағытталған қолданбалы есептерді шешуге назар аудару болашақ ІТ бакалаврларының кәсіби құзыреттіліктерін арттыруға ықпал ететінін көрсетеді.

Түйін сөздер: білім, математика, IT салалары, құзыреттіліктер, пәнаралық байланыстар

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МАТЕМАТИЧЕСКАЯ ПОДГОТОВКА БАКАЛАВРОВ IT НАПРАВЛЕНИЙ В ПРОЕКТЕ LUPIC

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Аннотация. Данная статья посвящена проблеме преподавания математических дисциплин при подготовке IT-специалистов в высших учебных заведениях. В связи с бурным ростом информационных технологий и их внедрением в различные сферы экономики, производства, образования и других областей возрастает необходимость постоянного обновления фундаментальных знаний и приобретения профессиональных навыков выпускниками IT-направлений. В статье отмечается актуальность совершенствования методик преподавания математических дисциплин и формирования соответствующих компетенций, с акцентом на интеграцию междисциплинарных связей, направленных на развитие профессионально-ориентированной подготовки бакалавров по IT-специальностям. Методологическую основу исследования составили основные положения практико-ориентированного подхода и междисциплинарных взаимосвязей между фундаментальными математическими и профильными дисциплинами. На основе проведённого анализа авторы выполнили аналитический обзор методик преподавания математики, а также вопросов интеграции математических дисциплин и IT для формирования необходимых компетенций будущих специалистов в области информационных технологий. Результаты исследования показали, что интеграция дисциплин, в частности разделов «Линейная алгебра и аналитическая геометрия» и «Программирование», способствует улучшению качества получаемых знаний за счёт развития аналитической и математической логики, глубокого понимания алгоритмического мышления и укрепления взаимосвязей между ними. Исследование продемонстрировало, что при преподавании математики важно уделять внимание взаимосвязи с профессиональными дисциплинами, акцентируя внимание на решении

практико-ориентированных прикладных задач, что способствует повышению уровня профессиональных компетенций будущих бакалавров ИТ-направлений.

Ключевые слова: образование, математика, ИТ направления, компетенции, междисциплинарные связи

Introduction. The quality of higher education plays a crucial role in the context of the digital economy. Today's employers seek specialists who not only possess creative thinking and the ability to bring innovative ideas to life but are also competent in their field and ready for continuous learning. Mathematical education is becoming key in various fields of knowledge. Therefore, improving the professional training of IT specialists in universities involves the development of new effective educational technologies and methodological approaches aimed at enhancing and improving the process of mastering important academic disciplines.

At the international technology forum Digital Bridge, President Kassym-Jomart Tokayev stated that one of Kazakhstan's strategies is to create major digital hubs in the Eurasian space and to train at least 100,000 highly qualified IT specialists (Oficial'nyj sajt Prezidenta Respubliki Kazahstan, 2025)

Within the framework of the Concept of Digital Transformation, the development of the information and communication technology sector, and cybersecurity for the years 2023 – 2029 (Postanovlenie Pravitel'stva Respubliki Kazahstan, 2023), the number of budget places for programs in the field of Information and Communication Technologies is increasing each year. For instance, 9,103 places were allocated for the 2022/2023 academic year, 10,103 for 2023/2024, and 10,903 for 2024/2025 (Nacional'nyj centr testirovaniya, 2025).

However, merely increasing the enrollment in IT specializations does not satisfy the demand for highly qualified IT specialists. There is a recognized need to improve the quality of mathematical professional training for students in fundamental mathematical disciplines (Myrzayev et al., 2024).

In the context of modern state educational standards for the field of Information and Communication Technologies, students are expected to master a broad spectrum of fundamental mathematical disciplines within a limited timeframe. This presents a significant challenge due to the disparity between the volume and content of the academic material and the time allocated for its mastery. The existing system of teaching mathematical disciplines and the associated methodological support do not always meet the growing competency requirements for IT graduates from employers. The insufficient connection of the mathematical disciplines cycle with related specialized disciplines negatively impacts the quality of the acquired professional competencies and the overall educational process. Considering these problems, the prioritization and improvement of teaching methods for mathematical disciplines and the competencies obtained, aimed at forming professionally-oriented training for bachelor-level IT specialists, is a priority task.

The goal of this article is to understand the overall structure and content of mathematical courses and their connections with core disciplines, which ensure

the targeted application of acquired mathematical competencies in real situations, making the learning process focused on practical application and the development of future professional skills.

Research materials and methods. To promote mutually beneficial cooperation in higher education between Korea and Kazakhstan, the "Leading University Project for International Cooperation" (LUPIC) was launched jointly with the "Computer Science" program of Korkyt Ata Kyzylorda University and Seoul National University of Science and Technology (SeoulTech). Officially started on April 1, 2023, LUPIC is planned for the period from 2023 to 2030. The LUPIC program aims to strengthen international cooperation in education and information technology, as well as to enhance teaching capabilities and introduce advanced educational practices.

In the study, the authors followed the principles of a practice-oriented approach and interdisciplinary connections, the requirements of the state educational standards of the Republic of Kazakhstan for the field of information technology, and the educational programs developed within the framework of the LUPIC joint project. An analytical review of the integration of mathematics and IT was conducted, focusing on the role of mathematical education for future information technology specialists. Practically, the possibilities of applying the acquired mathematical skills to solve non-standard tasks encountered in core disciplines when training specialists in Artificial Intelligence (AI), Cybersecurity (CS), and Computer Science (CS) were studied, taking into account the advanced international educational experience of SeoulTech.

Results and Discussion. The training of students in the field of information technology is constantly evolving, undergoing changes, and responding to the emergence of new directions. Market demands are rapidly changing, necessitating continuous updates to the knowledge and skills of future IT specialists. For this reason, it is crucial to acquire a solid professional education from school through university to keep pace with current requirements. The significance of modern mathematics and computerization in ensuring the quality of future IT specialists' training cannot be overstated; this phenomenon is referred to as the digital revolution.

Scientific research indicates that mathematics plays a critical role in shaping the professional competence of students (Krasnyanskaya, 2022: 10). It serves as a universal language for describing and studying various objects and processes and contributes to the development of cognitive skills in future specialists. Considering this, mathematics education should be aimed not only at acquiring specific knowledge and skills but also at encouraging self-education using mathematical methods. The impact of mathematics on cognitive structure is linked to its ability to develop various cognitive processes such as comparison, analysis, synthesis, generalization, and others.

The transition from the school education system to university presents its own set of challenges. In the school system, the quality of mathematical education is significantly influenced by the ineffective use of classroom hours, adjustments in the depth of study, the redistribution of educational loads between algebra and

geometry, the qualifications of teachers, the availability of materials, the learning environment, teaching methodologies, individualized approaches, insufficient stimulation of interest in mathematics, the format of practical classes, and the quality of assignments, among other factors.

Adapting to the profession for first-year students in computer science is equally challenging. During university studies, each subject can contribute to the development of professional skills; however, we believe that mathematics plays a crucial role as a universal language for analyzing and studying objects and processes and as a means of forming a cognitive approach in future specialists.

The problems of mathematical education for future bachelor-level IT specialists lie in an inadequate foundation in mathematics, a lack of time for studying mathematics, the complexity of mathematical concepts, the need for in-depth study of sections of fundamental mathematics, and other issues.

The role of mathematical education and knowledge of basic mathematical disciplines for IT specialists is essential, and a strong foundational education is indispensable (Marchenko et al., 2018: 7, Balaba, 2023: 3). An educational approach based on the principles of sequence and continuity in the presentation of educational material, as well as effective allocation of study time, involves systematic testing to ensure comprehension. This supports the maintenance of a high pace in acquiring new knowledge and helps achieve high-quality educational outcomes (Semenova et al., 2018: 3).

Mathematics education plays a key role in the professional training of students in information technology fields. It provides not only a theoretical foundation but also practical skills necessary for developing well-grounded solutions in programming. Therefore, mathematical competencies are crucial in forming the professional qualifications of future IT specialists (Kenzhalieva et al., 2020: 3, Borisov, 2024: 9).

According to the study (Rozhkova et al., 2021: 8), the use of project-based learning in the process of studying mathematics in the first semester of study at a technical university contributes to increasing students' interest in the educational process. In (Hudzhina et al., 2019: 6), a project-based approach to teaching the discipline of "Mathematics" for IT students is proposed, which promotes the development of the ability to construct and analyze mathematical models.

The main directions of integrating information technology and mathematics, based on the authors' theory of modeling, are examined in (Mel'nikov et al., 2020: 7). In (Vlasov et al., 2020: 11), the authors present a selective course "Instrumental Methods of GeoGebra", created based on technological methods for developing educational materials. This course opens new horizons for using the computational and graphical functions of GeoGebra in teaching mathematical subjects to IT students, with an emphasis on visualization and active student participation in scientific and project work.

Mathematical education forms a crucial foundation for the professional training of students in IT fields. Studying mathematics not only establishes a theoretical base but also assists future programmers in developing well-grounded solutions to practical

problems in their professional activities. Therefore, mathematical competencies play a significant role in shaping the professional qualifications of future IT specialists. These competencies include skills and knowledge in mathematics that enable individuals to effectively solve mathematical problems, analyze information, and apply mathematical methods to various fields of science and everyday life. They encompass the ability to work with numbers, formulas, graphs, solve equations, conduct logical reasoning, and more. Proficiency in mathematical competencies substantially enhances the quality of thinking and fosters the development of logical and analytical reasoning.

The experience of teaching mathematical disciplines in the educational process of IT specializations suggests a preference for teaching approaches that allow for work in small groups to solve specific problems, understand practical relevance, and promote the development of communication skills. Such a methodology helps maintain a relatively high pace of mastering new material and ensures a good quality of acquired knowledge.

A priority component of students' professional training is their mathematical training, which contributes to the development of professional and mathematical competence of graduates of technical universities (Abylkasymova et al., 2022: 16).

Key components of mathematical training include logical-content connections and the establishment of strong links between specific mathematical knowledge and its application in professional activities, along with an understanding of applied aspects. When developing mathematics curricula for students in IT fields, it is essential to consider the importance of interdisciplinary integrative connections for forming the necessary competencies. The content of the topics and the structure of the material should contribute to the formation of the skills and competencies required in professional activities. It is important to maintain the structural coherence of mathematics, including aspects that may not have a direct relation to the future profession but are crucial for understanding the subject as a whole.

According to the authors (Vintere et al., 2019: 7), the key goal of higher education is to develop competencies in future specialists, which are necessary for their successful professional growth and contribute to the socio-economic development of the country. Effective training of IT specialists requires the creation of a methodological system that includes the development of mathematical abilities and professional skills, as well as the formation of personal qualities through mathematics education.

In line with the directive of the President of the Republic of Kazakhstan, Kassym-Jomart Tokayev, regarding the establishment of branches of leading foreign universities in Kazakhstan, starting in 2025, students from Korkyt Ata Kyzylorda University will study at Seoul National University of Science and Technology (SeoulTech) under a dual-degree program. Students can earn a dual degree from SeoulTech and Korkyt Ata Kyzylorda University. Enrollment for this program will begin in the 2025-2026 academic year and will be available to students who have enrolled in the School of Artificial Intelligence and Informatics at Korkyt Ata Kyzylorda University. Given this, high requirements for English language proficiency (such as IELTS or TOEFL

certification) and scores on the National Testing Center (NTC), including subject-specific mathematics, will be in place for applicants to the educational programs "AI Architect" and "Data Management". This requirement is due to the fact that several core courses will be taught by the faculty of SeoulTech. Therefore, in the joint educational programs, the cycle of fundamental mathematical disciplines for IT students must be comprehensive and systematic to prevent it from becoming merely a collection of facts, formulas, and theoretical information intended only for narrow specialization.

Analysis of the certificates of the 2023 applicants to Korkyt Ata Kyzylorda University in the field of Information and Communication Technologies shows weak preparation in the subject of "Mathematics" (<https://platonus.korkyt.kz/>). Among those enrolled in the "6B06149 - Information systems" program, 23 applicants passed the subject "Mathematics" with a score of "Satisfactory" (6-29 points), 7 applicants received a "Good" score (30-39 points), while none achieved an "Excellent" score (40-45 points). In the "6B06150 - Computer equipment and software" program, 15 applicants passed with a "Satisfactory" score, and 2 with a "Good" score. For the "6B06152 - Information security systems" program, 69 applicants passed with a "Satisfactory" score, and 3 with a "Good" score (see Figure 1).

Among those enrolled in the "6B06149 – Information Systems" program, 76.6% achieved a "Satisfactory" score in Mathematics, while in the "6B06150 - Computer equipment and Software" program, 88.2% achieved this score, and in the "6B06152 - Information Security Systems" program, 95.8% achieved it. This indicates a lack of understanding of the material, teacher qualifications, and implementation of new teaching methods to stimulate students' interest in mathematics within the school education system.

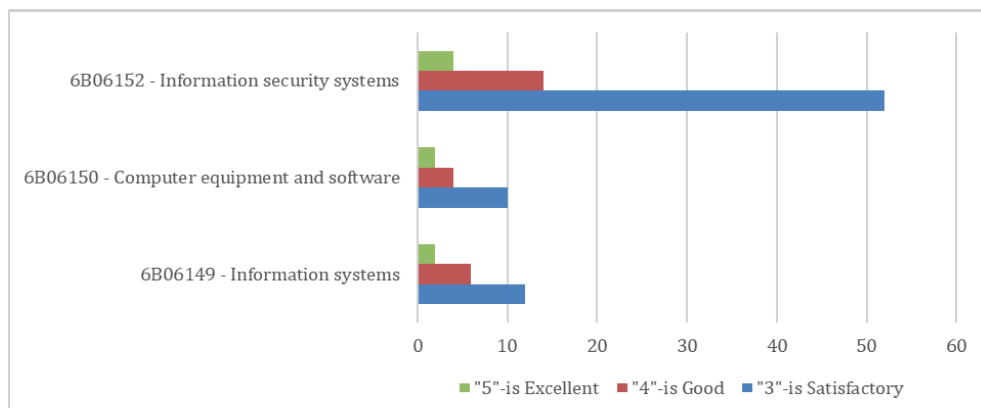


Figure 1 - Academic performance in the core subject "Mathematics" enrolled in 2023 in the field of information and communication technologies at the Korkyt Ata Kyzylorda University
Note: based on the National Testing Center certificate data" (<https://platonus.korkyt.kz/>, 2025)

Attention should also be directed to processes and phenomena described in sections of other professional disciplines, as they can significantly enrich the professional

development of students, emphasizing the role of interdisciplinary connections in applied training for future IT specialists. This need and insufficient correlation are well demonstrated during the learning process, where university students in IT fields annually participate in what is known as competitive programming olympiads.

Competitive programming (Federaciya sportivnogo programmirovaniya, 2025) is a form of competitive activity for IT students where participants solve programming problems within a limited time frame. Such competitions help develop skills in algorithmic thinking, efficient code writing, and solving complex mathematical and engineering problems, serving as a starting point for professional-oriented training during education. Participants compete individually or in teams, striving to achieve optimal results in solving the set tasks using online platforms like Codeforces, Topcoder, and others.

It should be noted that major IT companies such as Yandex, Google, Meta (Facebook) include competitive programming olympiad-style tasks during their employment interviews, serving as an indicator to assess the professional competencies of future IT specialists possessing logical, algorithmic, and mathematical skills, as well as creative thinking to solve complex applied mathematical problems and issues.

Competitive programming requires participants to have not only programming skills but also a deep understanding of several mathematical disciplines. Key areas of mathematics often used in competitive programming include:

- Linear, nonlinear, and dynamic programming, greedy algorithms, etc., necessary for determining optimal solutions.
- Number theory elements used in problems such as prime number determination, factorization, application of the Chinese remainder theorem, Fermat's theorem, and others.
- Combinatorics used for solving problems involving counting complex combinations of objects, permutations, combinations, and the principle of inclusion-exclusion.
- Graph theory necessary for choosing shortest path algorithms (Dijkstra's algorithm, Floyd-Warshall algorithm), topological sorting, finding bridges and articulation points, etc.
- Analytical geometry necessary for calculations involving points, lines, polygons, and circles, as well as using algorithms to determine convex hulls and calculate areas of figures.
- Elements of probability theory and mathematical statistics used for solving problems related to uncertainty and random processes, lottery ticket issues, winning combinations, etc.
- Game theory elements, numerical methods, operation research, etc.

All these branches of mathematics provide the necessary tools for analyzing and solving applied and practice-oriented problems. In turn, understanding these concepts and being able to apply them in practice are key to acquiring professional competencies.

We believe that the correlation between teaching mathematics and profile

disciplines, particularly the section of "Linear Algebra and Analytical Geometry," with an emphasis on logical consistency, improves students' knowledge quality in analytical and mathematical logic, algorithmic thinking through the implementation of a unified teaching approach, systematization of material, and strengthening links with the "Programming" discipline of the profile cycle. Activating students' independent work is achieved through the introduction of individual tasks, including solving typical problems and performing non-typical tasks encountered in competitive programming, which require a creative approach.

The discipline of "Linear Algebra and Analytical Geometry" not only forms the basis for preparing IT professionals but also provides a powerful toolkit for effectively solving a wide range of applied problems encountered in various fields of human activity.

As an example, let's consider some applied aspects of the elements of the discipline "Linear Algebra and Analytical Geometry" necessary for solving competitive programming olympiad problems, which are held annually among IT students of higher educational institutions (Bajarystanov et al., 2019: 5):

1. Understanding the representation of basic geometric objects on the plane, such as points, lines, segments, planes, circles, etc., is an important element of education, but it is also important to remember about space.
2. Finding the equation of a line connecting two given points.
3. Ability to determine the coordinates of the intersection point of two lines.
4. Knowledge of the perpendicular to a line and determination of the parallelism of lines for analyzing geometric constructions.
5. Knowledge of equations of geometric figures on the plane and in space.

I understand you want to translate the specific example of a geometric problem involving determining if a point lies inside a triangle formed by given vertices in a Cartesian coordinate system.

Among the key operations associated with geometric figures, one can highlight the task of determining the area of a polygon, the task of establishing whether a point belongs to a certain figure, and other similar tasks. When solving various computational geometry problems, there is a need to use scalar, vector, and cross products of vectors.

Let's consider problems encountered in competitive programming that involve elements of analytical geometry.

Example 1. In the Cartesian coordinate system on the plane, the coordinates of the vertices of a triangle and a point are given. It is required to determine whether this point belongs to the triangle formed by these three vertices.

Solution. Let's consider one of the ways to solve the problem (other solutions are also possible). Denoting the vertices of the triangle as points A, B, and C, we construct the triangle through these points by connecting the vertices. There are two possible configurations of point D, which are represented in figures 2a and 2b.

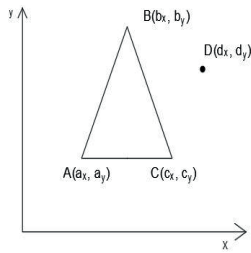


Figure 2a. The point is outside the triangle.

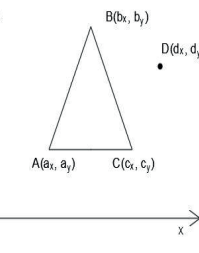
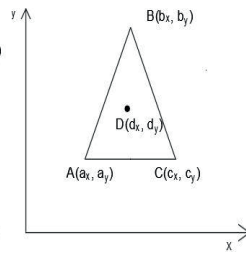


Figure 2b. The point is inside the triangle.

Let's connect points A, B, and C with point D. We then obtain the following three triangles $\triangle ABD$, $\triangle ADC$, $\triangle BDC$ (see figure 3a, 3b).

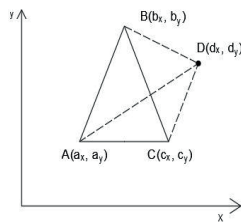


Figure 3a. The point is outside the triangle.

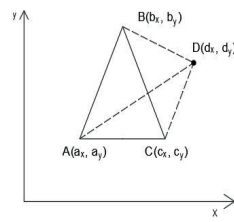
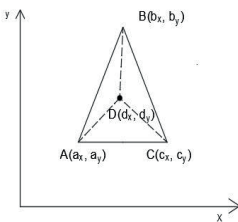


Figure 3b. The point is inside the triangle.

Knowing the coordinates of the triangle's vertices, we can find the lengths of its sides. In our case, the length of side AB:

$$\sqrt{(b_x - a_x)^2 + (b_y - a_y)^2}$$

Next, using this formula, it is necessary to find the lengths of sides AB, BC, CA, AD, CD, and BD. To find the corresponding areas of the triangles, we can use the Heron's formula:

$$S = \sqrt{p * (p - a) * (p - b) * (p - c)}$$

where, $p = (a + b + c)/2$, where a,b,c, and cc are the sides of the triangle. Therefore, solving the problem, i.e., determining whether the point is inside the triangle, involves checking the condition

$$|S_{\triangle ABC} - (S_{\triangle ABD} + S_{\triangle ADC} + S_{\triangle BDC})| < \varepsilon \quad (1)$$

where, $S_{\triangle ABC}$, $S_{\triangle ABD}$, $S_{\triangle ADC}$, $S_{\triangle BDC}$ the corresponding areas of the triangles, where ε is a specified tolerance (you can take $\varepsilon=0,00001$).

It should be noted that in equation (1), the condition check is explained by the fact that in program implementation, one often works with real data types such as real, float, and double depending on the programming language, which may not always guarantee exact equality.

In some problems, it's also required to determine if a point lies on a side of the triangle. In such cases, we need to find the equation of the line passing through two given points. For instance, for side AB

$$\frac{x - a_x}{b_x - a_x} = \frac{y - a_y}{b_y - a_y}$$

After the transformations, we obtain

$$y = \frac{b_y - a_y}{b_x - a_x} \times (x - a_x) + a_y$$

For the other sides, the calculations are similar. So, to determine whether the point lies on a side, it is necessary to substitute the coordinates of point D (d_x , d_y) into this equation.

Example 2. Given two circles, each defined by the coordinates of its center (P1 and P2) and radius (r_1 and r_2). The task is to find all their intersection points (either one, two, none, or the circles coincide).

Solution. Let r_1 and r_2 be the radii of the circles respectively. To begin with, we find the distance between the centers of the circles, $d = |P1 - P2|$. If $d > r_1 + r_2$, then there are no solutions; the circles are separate. Conversely, if $d < |r_1 - r_2|$, there are also no solutions, as one circle lies completely within the other. To determine the intersection points, we can relocate the center of the first circle to the origin. Then we obtain a system of two equations:

$$\{x^2 + y^2 = r_1^2 \quad (x - x_2)^2 + (y - y_2)^2 = r_2^2$$

Subtracting the first equation from the second, we obtain

$$\{x^2 + y^2 = r_1^2 \quad -2xx_2 - 2yy_2 + (x_2^2 + y_2^2 + r_1^2 - r_2^2) = 0$$

So, we reduced our problem to the intersection of the first circle with the following line:

$$Ax + By + C = 0,$$

$$A = -2x_2, B = -2y_2, C = x_2^2 + y_2^2 + r_1^2 - r_2^2$$

Solving this problem will find the intersection points, which will be the answer to the question. The organized work in this way is aimed at effectively forming knowledge and practical skills in the fundamental sections of analytic geometry

in an optimal time. A distinctive feature is the concise, compact, and accessible presentation of material with a unified teaching methodology, where acquired competencies are applied to solve non-standard problems involving specialized disciplines. The fact that subject interconnections play a key role in aligning mathematics teaching methods with professional disciplines specific to the IT sphere is extremely important. These connections facilitate interaction between different topics and sections within a discipline, as well as across different disciplines, promoting a professionally oriented approach to the learning process. In our opinion, such an approach enables students to develop necessary skills and apply them in new areas, as well as tackle complex applied problems in their professional practice, using the full range of mathematical knowledge. It should be noted that direct integration connections identify the mathematical knowledge necessary for programmers to successfully master specialized disciplines and apply them in professional activities. At the same time, feedback helps determine the value and place of mathematical topics and content within the context of general professional disciplines. Thus, for students in IT-related fields, mathematics should be viewed as an element of professional training rather than a component of general culture. Mathematics is used to demonstrate the capabilities of IT, to describe algorithms and other components of IT, as they are interconnected and complement each other, opening up new opportunities for technology and science development. Taking the above into account, in our opinion, integration of mathematics and IT develops the following skills and professional competencies:

- Algorithmic thinking, where mathematics teaches abstract thinking and IT provides tools for implementing these thoughts in the form of programs.
- Methods of effective problem solving, where the combination of IT and mathematics allows for the development of efficient algorithms for solving complex applied problems.
- Modeling and data analysis, where mathematical methods help create data models, while IT provides opportunities for their analysis and processing.
- Competence in cybersecurity, where mathematical methods are used to create ciphers and protect information.
- Combining mathematical knowledge with general professional disciplines to create innovative products and methods for their solution.

Conclusion. The pace of development of information technology and the volume of theoretical information in the education of IT specialists at the university require the development of additional methods for more effective acquisition of new knowledge. The work considers an approach to teaching sections of mathematics focused on integrating relationships with specialized disciplines. This approach helps to rationally organize educational activities. The advantage of this methodology lies in the efficient development of practical problem-solving skills alongside the acquisition of theoretical knowledge. Such an organization of the educational process can be applied when studying various mathematical disciplines with the appropriate methodological support. Thus, understanding all the material studied

allows for the conscious application of various mathematical methods in real life, making education more practice-oriented and should be balanced taking into account the future qualifications of IT bachelor's degrees. Therefore, the development and improvement of existing methodologies that include interdisciplinary relationships contribute to defining the goals of practice-oriented education and help adapt to work with a large volume of knowledge, opening up new opportunities for the development of professional competencies of IT specialists.

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