NJSC "K. Zhubanov Aktobe Regional University"

Modular guide
on educational program
7M01501-Mathematics

Aktobe
2025

Module 1-General Education

Module designation	HPS5201 History and philosophy of science (in Kazakh)
The semester(s) in which the module is taught	1
Responsible teacher	Sarsembin U. K.
Language of instruction	Kazakh
Connection with the curriculum	BD UC: University component (UC) in the cycle of basic disciplines (BD)
Forms of training	Lectures, practical lessons, IWMS-T (Independent Work of Master's Student with Teacher), IWMS (Independent Work of Master's Student)
Training load (including contact hours, SRS)	Total work load: 90 hours Contact hours: 30 hours (15 hours of lectures, 15 hours of practical lessons) Independent Study: 30 h IWMS-T, 30 h IWMS
ECTS	3
Prerequisites (Mandatory and Recommended)	"Science for studying the course" History and Philosophy", The master's student must have knowledge of the history and theory of philosophy, humanities, natural sciences, and specialized fields.
The purpose of the module/expected learning outcomes	is to promote students' development as future professionals and scientists. This section explains the history and philosophy of science, its role in the development of society, and its relationships with social institutions. Formation of skills that can deeply study the main problems of modern philosophy of science, state policy in the development of science and the main tasks facing society.
Content summary	philosophy of science and its formation, the main object of research. The main ideas of the philosophy of science, types and stages of the formation of science, the role of science in society, its activity as a social institution, the relationship between science and philosophy. The main categories of the philosophy of sciences, scientific research, the basic structure and methods of scientific knowledge, the features of modern science, and the role of science in society as a social institution are considered. The types and directions of the development of modern science, the development of science in Kazakh society, and state policy in the development of science.
Exam form	written
Requirements for teaching and exams	full mastery of the course topics, complete familiarity with the literature, an understanding of the specifics of each topic and its relevance, as well as deep knowledge of the history of science, methods of scientific knowledge, and research.

List of literature	**Core reading:** 1. Kenny, A. *Philosophy of Antiquity*. Almaty: National Translation Agency, 2018. – 364 p. 2. Johnston, D. *Brief History of Philosophy*. Almaty: National Translation Agency, 2018. – 224 p. 3. Kenny, E. *Filosofiya Srednevekovya* [Philosophy of the Middle Ages]. Almaty: National Translation Agency, 2018. – 352 p. 4. Hess, R. *Izbrannye 25 knigi filosofii* [Selected 25 Books of Philosophy]. Almaty: National Translation Agency, 2018. – 368 p. 5. Ryskaliev, T. H. *Review of the History of Philosophy*. Training Manual. Ural: Saga Publishing, 2005. – 382 p. 6. Abay. *The Black Word. Poems*. Almaty, 1993. – 272 p. 7. Mirovoe filosofskoe nasledie [World Philosophical Heritage]. In twenty volumes. Volume 4. *Philosophy of Al-Farabi and Ibn Sina*. Almaty: Pisatel Publishing, 2005. – 568 p. 8. Zapadnaya filosofiya [Western Philosophy]. Training Manual. Almaty: "Writer", 2009. – 480 p. 9. Nysanbayev, A. *History and Philosophy of Science*. Training Manual. Almaty: Evero Publishing House, 2013. 10. Dukenbayeva, Z. O., Talgatbek, M. M. *Al-Farabi and Al-Mashani Spiritual Continuity*: Scientific Publication. Almaty, 2017. 11. Abishev, K. *Filosofiya* [Philosophy]. Textbook for Students and Undergraduates. Almaty, 2000. 12. Asarov, A. *Filosofiya nauki* [Philosophy of Science]: Terminological Dictionary. Almaty: Medet Group, 2021. – 122 p. **Supplementary reading:** 1. Al-Ani, N. M. *Filosofskaya tekhnika* [Philosophical Technique]. St. Petersburg, 2004. 2. Gorokhov, V. G. *Osnovy filosofii tekhniki i tekhnicheskikh nauk* [Fundamentals of the Philosophy of Technology and Technical Sciences]. Moscow, 2007. 3. Istoriya informatiki i filosofiya informatsionnoi realii [History of Informatics and Philosophy of Information Reality]. Moscow, 2007. 4. Kazyutinsky, V. V. *Global Evolutionism and the Scientific Picture of the World*. Global Evolutionism (Philosophical Analysis). Moscow, 1994. 5. Karamova, O. V. *Filosofiya, metodologiya i istoriya ekonomicheskoi nauki* [Philosophy, Methodology, and History of Economic Science]. Moscow, 2007. 6. Lektorskiy, V. A. *Epistemologiya klassicheskaya i neklassicheskaya* [Classical and Non-Classical Epistemology]. Moscow, 2006. 7. Mukashev, Z. A. *Kontseptsii sovremennogo estestvoznaniya* [Concepts of Modern Natural Science]. Almaty, 2005. **Scientific libraries of Kazakhstan:** 1. Kazakhstan National Electronic Library – http://www.kazneb.kz 2. National Academic Library – http://www.nabrk.kz 3. Ultyk National Library of the Republic of Kazakhstan – http://www.nlrk.kz 4. Scientific Library of RSE "Gylym Ordasy" KN MES RK – http://www.library.kz 5. Russian Scientific Network – A scientific network of readers, an information system aimed at facilitating access to popular science and educational information. – http://nature.web.ru

Module designation	FL(P) 5202 Foreign language (professional) (in English)
The semester(s) in which the module is taught	1
Responsible teacher	Sarbassova A.E.
Language of instruction	English
Connection with the curriculum	BD UC: University component (UC) in the cycle of basic disciplines (BD)
Forms of training	Practical lessons, IWMS-T (Independent Work of Master's Student with Teacher), IWMS (Independent Work of Master's Student)
Training load (including contact hours, SRS)	Total hours: 90 h. Contact hours: 30 h. (30 h.of practical lessons) Independent Study: 15h.of IWMS-T, 45 h. of IWMS
ECTS	3
Prerequisites (Mandatory and Recommended)	English language (level B1)
The purpose of the module/expected learning outcomes	The main goal of the course is to develop students' intercultural communicative competence, with a focus on professionally-based intercultural communicative competence. This enables students to integrate into the international professional environment and use a professional foreign language as a tool for intercultural, scientific, and professional communication. 1. Ensures understanding of the socio-cultural aspects and national identity, as well as moral and ethical standards in the relationships between the countries where the language is taught. 2. Conducts bibliographic work, including searching, processing, and analyzing information using modern technologies. 3. Processes various types of information obtained from printed, audio, and video sources in a foreign language, within the framework of professional communication and in line with the established goals. 4. Applies legal and ethical standards when assessing the consequences of professional activities and when implementing socially significant projects. 1. Possesses the ability to independently use information from printed and electronic sources on international relations, world politics, and other relevant topics.
Content summary	The purpose of teaching English (professional) language is to enhance linguistic, communicative, and sociocultural competencies developed during earlier stages of foreign language study. This, in turn, facilitates the development of graduates' foreign professional communicative competence, necessary for business and professional communication. The course covers a wide range of topics essential for speaking, reading, and writing English at an advanced level, both in everyday situations and in the workplace.
Exam form	Oral (examination cards)
Requirements for teaching and exams	The final assessment is conducted in the form of an examination. The examination follows the university's academic integrity policy and examination regulations. Each examination card contains three questions based on Bloom's taxonomy, totaling 90 questions. In the case of plagiarism or cheating, the examination results will be automatically canceled, and the course will need to be retaken in the midsummer term.

Module designation	PHE 5203 Pedagogy of higher education (in English)
The semester(s) in which the module is taught	1
Responsible teacher	Ramazanova Dinara Zhubanyshevna
Language of instruction	English
Connection with the curriculum	BD UC: University component (UC) in the cycle of basic disciplines (BD)
Forms of training	Lectures, practical lessons, IWMS-T (Independent Work of Master's Student with Teacher), IWMS (Independent Work of Master's Student)
Training load (including contact hours, SRS)	Total work load: 90 hours Contact hours: 30 hours (15 hours of lectures, 15 hours of practical lessons) Independent Study: 15 h IWMS-T, 45 h IWMS
ECTS	3
Prerequisites (Mandatory and Recommended)	To master this module, you need knowledge, skills and abilities acquired during the study of the following courses: general pedagogy, general psychology, philosophy.
The purpose of the module/expected learning outcomes	The aim of studying this discipline is to address the theoretical and practical problems of higher professional education. Learning outcomes: A) Develops an algorithm for acquiring new knowledge in the field of physics, using modern educational technologies. B) Has the skills of organizing and managing scientific and innovative projects, planning and forecasting the work of the teaching staff. C) Understands the system of professional knowledge and concepts of the entire pedagogical process in higher education, its structure, content, forms and methods, educational tools, and new pedagogical training technologies. D) Has high skills in personal and professional activities, is able to use media education technologies, and has the ability to manage the process of socialization and emotional intelligence of the individual. E) Forms a competent specialist with a comprehensive and deep understanding of national values in the development of human capital, able to adhere to the continuity of classical innovative foundations, and has developed skills in the use of innovative (ICT) technologies in the management of education and training, as well as good communication skills, ensuring the training of highly cultured specialists.
Content summary	Higher education pedagogy studies the development of knowledge about the laws and principles of education, the means and methods of higher professional education. As a result of mastering the discipline, students will know the development of the higher education system in the Republic of Kazakhstan, as well as its key tasks. In addition, they will acquire knowledge about the scientific aspects of managing the pedagogical process and using modern pedagogical technologies.
Exam form	Blank test form
Requirements for teaching and exams	Mandatory attendance of classroom classes, active participation in the discussion of issues, preliminary preparation for lectures and practical classes, high-quality and timely completion of Independent Study tasks, and participation in all types of control are required. Students who have mastered the course material and scored at least 50% of the overall rating based on the results of the 1st and 2nd intermediate controls are allowed to take the final exam.

List of literature	1. Shalgynbaeva, K.K. et al. Higher School Pedagogy: Textbook. / K.K. Shalgynbaeva, N.P. Albytova, T.S. Slambekova. - Almaty: SSK, 2017. - 272 p. https://rmebrk.kz/book/1170382 2. Bitem, E. Rethinking Pedagogy in the Digital Age. Teaching Design in the 21st Century: Textbook / E. Bitem. - Almaty: National Translation Bureau, 2019. - 328 p. https://rmebrk.kz/book/1171570 3. Myngbaeva, A.K. et al. Fundamentals of Higher School Pedagogy: Textbook. / A.K. Myngbaeva, A.B. Aytbaeva, A.M. Kudaibergenova. - Almaty: Kazakh University, 2016. - 236 p. https://rmebrk.kz/book/1175282 4. Akbaeva, L.K., Akbaeva, A.N. Pedagogy of Higher Education. Psychology of Higher Education: Guidelines for Seminars for Undergraduates. Almaty: KazGASA Publ., 2012, 49 p. https://rmebrk.kz/book/1105614 5. Naghimzhanova, K.M. et al. The Modern Global Higher Education System: Lecture Collection. / K.M. Naghimzhanova, R.K. Dyusembinova, L.S. Kulzhabaeva. - Nur-Sultan: "Turan-Astana" University Press, 2019. - 138 p. https://rmebrk.kz/book/1179895 6. Jumataeva, E. Higher School Didactics: Monograph. - Pavlodar: EKO, 2006. - 316 p. https://rmebrk.kz/book/1165854 7. Jumataeva, E. The Application of Educational Technologies in Higher Education. // Bulletin of Pavlodar State University named after S. Toraygirov. Pedagogical Series, 2008. - No. 1. https://rmebrk.kz/book/15206 8. Kasymbaeva, G.N. Optimal Approaches for Using Interactive Teaching Methods in Higher Education. // The Role and Place of Young Scholars in the Dissemination of Kazakhstan's New Economic Policy: Proceedings of the International Satbayev Readings. Almaty: Kazakhstan Publ., 2015, vol. 1, pp. 547-550. https://rmebrk.kz/book/1152143 9. School Pedagogy: Educational and Methodological Complex (Syllabus). / Compiled by B.Ö. Qurbanaliyev. - Zhetisay: "Syrdariya" University, 2007. - 120 p. https://rmebrk.kz/search/ 10. Kudebaeva, Z.N. Higher School Pedagogy: Test Tasks: Textbook / Taraz State Pedagogical University. - Taraz: Format-Print, 2019. - 124 p. https://rmebrk.kz/search 11. Belykh, A.S. Pedagogy of Higher Education. Lugansk: Publishing House of V. Dahl LNU, 2018 – 248 p. http://dot.kostacademy.kz/bible/files/813849436.pdf

Module designation	MP 5204 Management psychology (in Russian)
The semester(s) in which the module is taught	1
Responsible teacher	Sautenkova M. Y.
Language of instruction	Russian
Connection with the curriculum	BD UC: University component (UC) in the cycle of basic disciplines (BD)
Forms of training	Lectures, practical lessons, IWMS-T (Independent Work of Master's Student with Teacher), IWMS (Independent Work of Master's Student)
Training load (including contact hours, SRS)	Total working hours: 90 hours Contact hours: 30 hours (15 hours of lectures, 15 hours of practical lessons) Independent Study: 30 hours of IWMS-T, 30 hours of IWMS
ECTS	3
Prerequisites (Mandatory and Recommended)	General psychology, age psychology, psychodiagnostics
The purpose of the module/expected learning outcomes	This discipline addresses the problems of the applied field of psychological science, focusing on the mandatory study and solution of management activities at the national level based on psychological knowledge and theories. Studying this discipline helps students master the psychology and culture of business communication and management activities as future specialists in the educational environment. During the course, special attention is given to the development of leadership, managerial, and reflective qualities of graduates in the field of educational management. It also involves direct participation in scientific activities, the development of leadership abilities, professional competencies, and the application of other management methods: A) The essence and psychological characteristics of managerial functions; B) Independent search, critical analysis, systematization, and generalization; C) Ability to manage a team and tolerate socio-psychological differences; D) Design, implement, and evaluate the educational process at the university and the educational environment in the training of psychological personnel; E) Assess the importance of self-development and self-realization in the use of creativity.
Content summary	The discipline studies the laws, principles, and methods of building and functioning an organization; the laws and principles underlying the activities of managers in managing an organization; the activities of managers in managing an organization; and the individual (physiological, psychological, and social) requirements that a manager must meet.
Exam form	Written (essay)
Requirements for teaching and exams	Regular attendance and active participation in lectures and practical lessons; timely completion of IWMS-T and IWMS assignments; independent preparation of essays and presentations; successful completion of the written exam (essay) demonstrating theoretical knowledge, analytical thinking, and practical application of management psychology concepts.

List of literature	**Core reading** 1. Konovalenko V. A., Konovalenko M. Yu., Solomatin A. A. Psychology of Personnel Management: A Textbook for Academic Bachelor / V. A. Konovalenko, M. Yu. Konovalenko, A. A. Solomatin. — Moscow: Yurayt Publishing House, 2015. - 477 p. - (Series: Bachelor. Academic Course). 2. Mambetalina A. S. HR-Personnel Management. Nur-Sultan, Gumilyov State University, 2021, 145 p. 3. Maltseva Yu. A., Yatsenko O. Yu. Psychology of Management. Yekaterinburg: Ural Publishing House. 4. Alieva M. B., Magomedova E. E., Radzhabova R. V., Umarieva S. Z., Tsakhaeva A. A. Psikhologiya Upravleniya [Psychology of Management]. Training Manual. Kiev, 2017. 5. Fundamentals of Management: Textbook / V. R. Vesnin. Moscow: Prospekt Publ., 2010, 97 p. 6. Psikhologiya Upravleniya: Uchebnoe Posobie [Psychology of Management: A Textbook]. INFRA-M, 2011. - 249 p. http://znanium.com/bookread.php?book=313827 7. Psychology of Personnel Management: Textbook and Practical Course for Academic Baccalaureate Book. Adeut: Bazarov T. Yu., 2015; Moscow, Publishing House: Yurayt. - 381 p. 8. Volkogonova O. D., Zub A. T., Managerial Psychology. Moscow: FORUM Publishing House-INFRA-Moscow, 2009. **Supplementary reading** 9. Avdeev V. V., Personnel Management. Optimization of Teamwork: Reengineering Technology: Practicum / V. V. Avdeev. - Moscow: FiS, 2008. - 256 p. 10. Morozyuk S. N. Psychology of Personality. Psychology of Character: A Textbook for Universities / S. N. Morozyuk. - Moscow: Yurayt Publishing House, 2024. - 217 p. - (Higher Education). - ISBN 978-5-534-06609-8. // Educational Platform Yurayt [Website]. - URL: https://urait.ru/bcode/540621 11. Ivanova V. S. Psikhologiya Upravleniya [Psychology of Management]. Training Manual. Tomsk Polytechnic University Publishing House. 2011 **Electronic resources:** 12. https://www.inter-nauka.com/uploads/public/15058901949362.pdf 13. Electronic Library of Dissertations of the RSL: http://diss.rsl.ru/. 14. LitRes Electronic Library: http://biblio.litres.ru.

Module designation	OPSR 5205 Organization and planning of scientific research (in English)
The semester(s) in which the module is taught	1
Responsible teacher	Isimov A.M.
Language of instruction	English
Connection with the curriculum	BD UC: University component (UC) in the cycle of basic disciplines (BD)
Forms of training	Lectures, practical lessons, IWMS-T (Independent Work of Master's Student with Teacher), IWMS (Independent Work of Master's Student)
Training load (including contact hours, SRS)	Total working hours: 90 hours Contact hours: 30 hours (15 hours of lectures, 15 hours of practical lessons) Independent Study: 30 hours of IWMS-T, 30 hours of IWMS
ECTS	3
Prerequisites (Mandatory and Recommended)	Bachelor subjects
The purpose of the module/expected learning outcomes	The purpose of Research Methodology is to help students who have mastered research skills and oral presentation in developing a scientific project.
Content summary	The subject content enhances knowledge of research methodology, R&D, research components, preparation of copyright documents, innovative research plans, the project's life cycle and its cost estimation, criteria for selecting ideas and determining quality. It also fosters the acquisition of practical skills for conducting research. The subject facilitates the development of essential skills and abilities for the effective use of artificial intelligence as an additional resource in research, thereby expanding learners' research capabilities.
Exam form	essay
Requirements for teaching and exams	A. To apply knowledge at a professional level, understand and demonstrate elements of advanced knowledge in one's field, demonstrate knowledge and understanding of research methodology; B. Compilation of conclusions and problem solving in the field, data collection, and implementing information to form scientific judgments; C. To classify lectures and scientific concepts, to apply the basic knowledge within the theoretical and applied linguistics framework in research and professional direction; D. Ability to conduct scientific analysis, write essays, plan, and use qualitative and quantitative methods in humanitarian research; E. To evaluate the importance of the course material and relevance of conclusions, quickly find, analyze, and contextually competently process scientific, technical, natural science, and general scientific information in accordance with problematic issues.

List of literature	**Core reading** 1. Dinaeva B.B., Sapina S.M. *Theoretical and Practical Foundations of Academic Literacy*. – Astana: "KazGUU Consulting" LLP, 2016. – 164 pages. 2. Isenova F. K. *Educational and Methodical Manual for Studying the Discipline "Academic Writing and Reading"* (Module 2: "Scientific Orientation"). – Astana: KAZGUU University Press, 2015. – 144 pages. (in Russian) 3. Korotkina I. *Academic Writing. Educational and Methodical Guide for School Leaders and Educational Specialists*. – Lap Lambert Academic Publishing GmbH & Co., Saarbrücken, Germany, 2011. – 179 pages. 4. Radaev V. V. *How to Organize and Present a Research Project: 75 Simple Rules*. – Moscow: HSE, INFRA-M, 2001. – 202 pages. (Electronic version: http://narod.ru/disk/2882665000/radaev.rar.html) **Supplementary reading** 1. Booth, W. K., Colomb, G. J., and Williams, J. M. *Research: Sixteen Lessons for Beginning Authors*. (Electronic version: http://aperlov.narod.ru/ar/posobija.htm) 2. Eco, U. *How to Write a Thesis*. Humanities. Educational and Methodical Manual / U. Eco. – Moscow: Universitet Publishing, 2001. – 240 pages. (Electronic version: www.hcc.ru/download/ef7ecacfa0bc050dea6287f39c7aa566.attach) **Web – Resources and Support** 1. www.refseek.com 2. www.worldcat.com 3. https://link.springer.com 4. www.bioline.org.br 5. https://repec.org 6. www.science.gov 7. www.pdfdrive.com 8. www.base-search.net

Module 2.1 – Methodology of Teaching Mathematics in Higher and Secondary Schools

Module designation	MTSMP 5206 Methods of teaching for solving math problems (in English)
The semester(s) in which the module is taught	1
Responsible teacher	Nugayeva Z.T.
Language of instruction	English
Connection with the curriculum	Basic Disciplines (BD), Elective Component (EC)
Forms of training	Lectures, practical lessons, IWMS-T (Independent Work of Master's Student with Teacher), IWMS (Independent Work of Master's Student)
Training load (including contact hours, SRS)	Total Academic Workload: 150 hours Contact Hours: 45 hours (Lectures: 15 hours, practical lessons: 30 hours) Independent Study: IWMS-T - 25 hours, IWMS - 80 hours
ECTS	5
Prerequisites (Mandatory and Recommended)	Elementary mathematics, foreign language, mathematical analysis, algebra and number theory, methodology of mathematics teaching.
The purpose of the module/expected learning outcomes	The course focuses on studying the main techniques, methods, and approaches to solving mathematical problems in English, and on developing the general mathematical culture of graduate students, which is essential for professional activities. This includes a deep understanding of both the core school mathematics curriculum and elective or optional courses. Learning Outcomes: A) Knows the theoretical foundations of the discipline necessary for solving applied mathematical problems; understands the main directions and perspectives in the methodology of teaching applied mathematics. B) Can utilize both domestic and international methodological approaches and modern concepts in teaching applied mathematics to solve practical methodological problems. C) Applies modern educational technologies. D) Possesses methods for solving applied mathematical problems. E) Analyzes professional knowledge and activities, evaluates their relevance to methodological theory, lesson objectives, and specific learning contexts for improvement and setting new goals; evaluates various ways of presenting material from pedagogical, psychological, and didactic perspectives.
Content summary	Study of key issues in mathematics didactics, the role of mathematical problems in teaching, and main methods of problem-solving. Introduction to school curricula, textbooks, and teaching materials. Topics also include specific teaching methods such as transformations of rational, irrational, exponential, logarithmic, and trigonometric expressions; equations and inequalities of the respective types and methods of solving them. Includes functions, elements of mathematical analysis, geometric transformations, coordinates, and

	measurement theory. Also includes the development of a creative approach to teaching problem-solving methodology.
Exam form	Test
Requirements for teaching and exams	Mandatory attendance of both in-person sessions, active participation in discussions, preliminary preparation for lectures and practicals, timely and quality completion of independent work, and participation in all forms of assessment.
List of literature	**Core reading** 1. Klein F. *Elementary Mathematics from a Higher Standpoint. Volume I: Arithmetic, Algebra, Analysis* / Translated by Gert Schubring. - Springer-Verlag Berlin Heidelberg, 2019. – 325 p. https://www.pdfdrive.com/elementary-mathematics-from-a-higher-standpoint-volume-i-arithmetic-algebraanalysis-e158185616.html 2. Klein F. *Elementary Mathematics from a Higher Standpoint. Volume III: Precision Mathematics and Approximation Mathematics* / Translated by Marta Menghini in collaboration with Anna Baccaglini-Frank; Mathematical advisor for the English translation: Gert Schubring. - Springer-Verlag Berlin Heidelberg, 2019. – 267 p. https://www.pdfdrive.com/elementary-mathematics-from-a-higher-standpoint-volume-iiiprecision-mathematics-and-approximation-mathematics-e158168172.html 3. Van Dyke J., Rogers J., Adams H. *Fundamentals of Mathematics* – 9th edition. - Portland Community College, 2020. – 823 p. https://www.pdfdrive.com/fundamentals-of-mathematics-9th-edition-e157003722.html 4. Chen W.W.L., Duong X.T. *Elementary Mathematics*. - W. W. L. Chen, X. T. Duong and Macquarie University, 1999, 2021. – 152 p. https://www.williamchen-mathematics.info/lnemfolder/em01.pdf 5. Burzynski D., Ellis W. *Fundamentals of Mathematics*. - Rice University, Houston, Texas, 2020. – 724 p. https://www.pdfdrive.com/fundamentals-of-mathematics-e19522418.html 6. Cem Giray. *Function*. – Zambak Publishing, 2020. - 493 p. https://www.pdfdrive.com/functions-zambakd165854242.html 7. Barbett Z., Keskinoglu S. *Applied Mathematics 10*. – Zambak Publishing, 2021. – 200 p. https://bok.asia/book/2568448/535fe1 8. Katirci Salih. *Logarithms*. – Zambak Publishing, 2021. – 156 p. https://www.pdfdrive.com/logarithmszambak-e165885133.html 9. Şükrü Kavlu & Aydın Sağlam. *Derivatives*. - Printed in Turkey, Distribution: Zambak Yayinlari, 2020. – 160 p. https://b-ok.asia/book/2473521/4a8f94?dsource=recommend 10. Tanturic Ilker. *Introduction to Trigonometry*. – Zambak Publishing, 2021. – 144 p. https://www.pdfdrive.com/introduction-to-trigonometry-zambak-e165904579.html 11. Şükrü Kavlu & Aydın Sağlam. *Integrals*. - Printed in Turkey, Distribution: Zambak Yayinlari, 2020. – 120 p. https://b-ok.asia/book/2473524/05575d?dsource=recommend 12. Lafcioglu A., Ersozogly I. *Quadratics: Equations, Inequalities, and Functions*. – Zambak Publishing, 2021. – 152 p.

	https://www.pdfdrive.com/quadratics-equations-inequalities-and-functions-zambake185361051.html **Supplementary reading** 1. A. Weaver. *ARITHMETIC: A*, Textbook for Math 01, 5th edition, 2015. 2. V. V. Konev. *The Elements of Mathematics*, textbook, published by Tomsk Polytechnic University, 2009. 3. V. V. Konev. *The Elements of Mathematics*, workbook, part 2, published by Tomsk Polytechnic University, 2009. 4. V. V. Konev. *Higher Mathematics*, textbook, part 2, published by Tomsk Polytechnic University, 2009. 5. V. V. Konev. *The Elements of Mathematics*, workbook, published by Tomsk Polytechnic University, 2009. 6. V. V. Konev. *Mathematics, Preparatory Course Algebra*, workbook, published by Tomsk Polytechnic University, 2009.

Module designation	IMTMHE 5207 Interactive Methods of Teaching Mathematics in Higher Education (in Russian)
The semester(s) in which the module is taught	2
Responsible teacher	Seilova R. D.
Language of instruction	Russian
Connection with the curriculum	Basic Disciplines (BD), Elective Component (EC)
Forms of training	Lectures, practical lessons, IWMS-T (Independent Work of Master's Student with Teacher), IWMS (Independent Work of Master's Student)
Training load (including contact hours, SRS)	Total workload: 150 hours Contact hours: 45 hours (15 hours of lectures, 30 hours of practical lessons) Independent Study: 25 h IWMS-T, 80 h IWMS
ECTS	5
Prerequisites (Mandatory and Recommended)	Pedagogy of higher education (in English), Management psychology (in Russian), Methods of teaching for solving math problems (in English)
The purpose of the module/expected learning outcomes	Training of professional mathematicians who possess up-to-date knowledge, methods and technologies for research and teaching activities in the system of higher professional education. Learning outcomes. A. Know the main problems of interactive methodology, the relationship between knowledge and dialogue, the conditions and rules of interactive learning, the characteristics of cognitive levels of Bloom's taxonomy in determining the goals of learning in interactive teaching/learning. Understand (know and understand) the need to design a lesson based on interactive methodology. B. Be able to apply the theoretical knowledge obtained during the course when designing the process of teaching mathematics on a specific topic. C. Carry out logical-didactic and logical-mathematical analysis of mathematical content in the course of mathematics and its main components; analyze educational materials and methods of presenting interactive forms of learning; choose interactive methods and techniques in accordance with the stages of the lesson on a specific topic, and analyze the features of interactive methods and techniques. D. Be able to draw conclusions and express his/her opinion on the use of interactive teaching methods. E. Assess the importance of self-education based on the development of interactive teaching methods and technologies, the availability of knowledge on higher mathematics and interactive teaching methods, the ability to assess the formation of subject knowledge and program content, and, based on this, determine the level of knowledge of the subject and the content of the program, as well as its further development trajectory.
Content summary	examines the compliance of the course structure with the requirements of the modern educational system and explores the features, principles, conditions, and rules of interactive teaching methods. It covers in detail the methods and technologies of interactive learning, including specific interactive methods, as well as the types and features of knowledge assessment used in this context.
Exam form	Project
Requirements for teaching and exams	Training requirements: systematic study of theory, active participation, task completion, independent work. Deep understanding and practical skills are necessary. The exam on "Interactive Methods of Teaching Mathematics in Higher Education" in the form of a project defense evaluates compliance with the topic, clarity of goals/tasks, validity of the choice of methods/technologies, practical significance, quality of materials (if any), presentation logic, understanding of theory, ability to argue, knowledge of terminology, compliance with regulations, and independence of implementation (with mandatory registration). The work will be checked for plagiarism via Turnitin, the results of which will be taken into account when evaluating.

List of literature	1. Stolyar, A. A. *Pedagogy of Mathematics*. Course of lectures: a textbook / A. A. Stolyar. - 2nd ed., reprint. and additional - Minsk: Higher School Publ., 1974, 382 p. 2. Kusainov G. M., Kagazbaeva A. K. et al. *Science of Teaching and New Educational Practice I, II Vols.*, 2019. 3. *Higher Mathematics: Textbook* / I. I. Bavrin, V. L. Matrosov. - Moscow: VLADOS, 2002. - 400 p. 4. *Higher Mathematics. Collection of Problems: A Textbook* / Ya. S. Bugrov, S. M. Nikolsky. - Rostov n\D.: Feniks Publ., 1997, 352 p. (in Russian) 5. *Higher Mathematics. Collection of Problems: A Textbook* / Ya. S. Bugrov, S. M. Nikolsky. - Rostov n\D.: Feniks Publ., 1997, 352 p. (in Russian) 6. *Teaching Interactive Forms and Methods of Teaching: An Educational and Methodological Manual*. Almanac, 2021. - 93 p. 7. *The Use of Active and Interactive Teaching Methods in the Educational Space of a University: An Educational and Methodological Guide* / L. T. Zembatova, Z. A. Khortyeva. - Vladikavkaz: [B. I.], 2011. - 76 p. 8. *Using Interactive Teaching Methods in the Educational Process: Methodological Recommendations for University Teachers* / G. D. Rysmaganbetova. - Aktobe: RIO ASU named after K. Zhubanov, 2006. - 30 p. **Supplementary reading** 9. Imzharova Z. U. *Innovative Pedagogical Technology "Debates"*, Aktobe, 2007. 10. *Interactive Methods of Teaching in Math Lessons* / A. D. Zhamanbayeva. - Text: direct // *Pedagogical Issues* - 2010. - No. 3. pp. 84-86 11. *Interactive Methods of Teaching in the Magistracy* / A. O. Blinov, O. S. Rudakova. - Text: direct // *Alma Mater-Bulletin of Higher School* - 2014. - No. 4. - pp. 45-48 12. *Collection of Reports of the Educational and Methodological Conference "Innovative Processes in Education. Interactive Methods in Teaching"*: to study the discipline / eki tilde. - Aktobe: 2004. - 128 p. 13. *Materials of the Republican Scientific and Practical Conference "Innovative Teaching Technologies and Interactive Methods in Higher Educational Institutions"* / Ed. board: Rysbekov. - Oral: [B. I.], 2006. - 340 p. 14. Verbitsky A. A. *Active Training in Higher Education. Contextual Approach: A Methodological Guide*, Moscow: Higher School. - 1991. - 207 p. **Electronic resources:** 15. *Active and Interactive Methods: A Textbook* / Ed. Grebenyukova. - Nizhnevartovsk: Nizhnevart State University Publishing House, 2014. - 155 p. https://neb.arsu.kz/kk/view?rid=10533&fid=10513 16. *Interactive Methods of Teaching in Higher Education Institutions and Schools: Theory, Methodology, Practice: Collection*. - Aktobe: ASU named after K. Zhubanov, 2010. - 161 p. + e-MAIL version. 17. Bekmukhanova, G. A. *Interactive Methods as a Means of Developing Cognitive Activity of Students*. https://rmebrk.kz/search/?search=&inlineRadioOptions=option2 18. Tasimova, A. A. *Project-based Method of Teaching in Schools of Kazakhstan as a Basis for Self-Actualization of the Student's Personality: to Study the Discipline* / A. A. Tasimova. - Aktobe: [B. I.], 2011. - 43 p. with electronic wholesale disk (CD-ROM). 19. *Information Technologies for a New School* Conference Proceedings: Saint Petersburg, 2011. https://neb.arsu.kz/kk/view?rid=5981&fid=5966

Module designation	TDLTPTM 5208 The development of logical thinking in the process of teaching mathematics (in Kazakh)
The semester(s) in which the module is taught	2
Responsible teacher	Tutkusheva Zh. S.
Language of instruction	Kazakh
Connection with the curriculum	Basic Disciplines (BD), Elective Component (EC)
Forms of training	Lectures, practical lessons, IWMS-T (Independent Work of Master's Student with Teacher), IWMS (Independent Work of Master's Student)
Training load (including contact hours, SRS)	Total workload: 150 hours Contact hours: 45 hours (15 hours of lectures, 30 hours of practical lessons) Independent Study: 25 h IWMS-T, 80 h IWMS
ECTS	5
Prerequisites (Mandatory and Recommended)	To master this discipline, you need the knowledge, skills, and abilities acquired during the study of the following courses: psychology, didactics, mathematical logic, mathematical disciplines, and methods of teaching mathematics.
The purpose of the module/expected learning outcomes	Goal: To reveal the psychological and pedagogical features of the development of logical thinking in the process of teaching mathematics and to teach students to select and solve problems aimed at developing logical, algorithmic, spatial imagination, and combinatorial abilities. As a result of studying the subject, the master's student: Recognizes: - Psychological foundations of mathematical abilities and creative thinking; - Development of logical, spatial, combinatorial, critical, heuristic, and creative thinking, as well as ways to develop graphic culture and artistic and visual business activity of students. Will be able to: - Conduct a conscious analysis of theories about the psychology and functioning of the individual; - Identify problems of learning at school from the point of view of developing students' logical thinking; - Apply knowledge about personality and social behavior when teaching mathematics at school. Learn to: Use learning theories, such as the theory of methods of action, step-by-step formation of thought processes, educational and developmental, and problem-based learning.
Content summary	The development of logical thinking in the process of teaching mathematics is one of the key disciplines in the professional training of specialists in pedagogical mathematics. The main sections of the course include: personality, personality psychology, the relationship between personality and action, the individual and action, the system of ideas about the structure and development of personality, combinations of algorithms, methods of interpretation, and the factors that influence the development of a person's mathematical abilities.
Exam form	Blank Test
Requirements for teaching and exams	Everyone must attend classes and arrive on time. If you are unable to attend for a valid reason, please notify us in advance. Tasks must be completed on time. Be able to argue your point of view, strive for professional growth. Master the skills of working with literature. Overdue tasks will not be accepted.

List of literature	**Core reading** 1. Voloshinov, A. V. *Matematika i iskusstvo* [Mathematics and Art]. Moscow: Prosveshchenie Publ., 200–399 p. 2. Boltyansky, V. G. *Matematicheskaya kul'tura i estetika* [Mathematical Culture and Aesthetics] // *Mathematics at School*, 1982. – No. 2. – pp. 40–43. 3. Galkin, E. V. *Nonstandard Problems in Mathematics. Problems of Logical Character*. Moscow: Prosveshchenie Publ., 1996. 4. Gnedenko, B. V. *Formirovanie mirovozzreniya uchashchikhsya v protsesse obucheniya matematike* [Formation of Students' Worldview in the Process of Teaching Mathematics]. Moscow: Pedagogika, 1980. 5. Kozhabayev, T. G. *Educational-Developmental Mathematics Education and Preparedness of Future Teachers* // Tutorial. Almaty, 2009, pp. 8–22. (in Russian) 6. Gingulis, E. J. *Development of Mathematical Abilities of Students*. Cheboksary: Cheboksary Pedagogical University, 2007, 139 p. 7. Gusev, V. A. *Psikhologo-pedagogicheskie osnovy obucheniya matematike* [Psychological and Pedagogical Foundations of Teaching Mathematics]: Uchebnoe posobie. Moscow: Akademiya Publ., 2004, 432 p. 8. Kulyutkin, E. N. *Heuristic Methods in the Structure of the Solution*. Moscow: Pedagogika Publ., 1970. 9. Smirnova, I. M. *On Measuring Interest in Math Lessons* // *Mathematics at School*. 1998. – No. 5. – pp. 56–58. 10. Polya, D. *Learning Through Tasks: On the Upgrade Paths of the School Course* // A Collection of Articles and Materials. Moscow: Prosveshchenie Publ., 1978, pp. 220–226. 11. Polya, D. *Matematicheskoe otkrytie* [Mathematical Discovery]. Moscow: Nauka Publ., 1970, 452 p. 12. Poincaré, H. *O nauke* [On Science]. Moscow: Nauka Publ., 1983, 560 p. 13. *Development of Children's Logical Thinking*. Yaroslavl: Gringo Publ., 1995; Moscow: Prosveshchenie Publ., 1982. 14. Thorndike, E. *New Methods of Teaching Arithmetic*. Moscow: Uchpedgiz Publ., 1932. 15. *Formirovanie priemov matematicheskogo myshleniya* [Formation of Methods of Mathematical Thinking]. Moscow: Ventana-Graf, 1995, 231 p. 16. Tsukar, A. Ya. *Razvitie prostranstvennogo myshleniya* [Development of Spatial Thinking]. SPT: Soyuz Publ., 2000. 17. Tamberg, Yu. G. *Development of Creative Thinking of the Child*. Saint Petersburg: Rech, 2002, 176 p. 18. Halpern, D. *Psychology of Critical Thinking*. Saint Petersburg: Peter, 2000, 512 p. 19. Yakimanskaya, I. S. *Razvitie prostranstvennogo myshleniya shkolnikov* [Development of Spatial Thinking of Schoolchildren]. 1980. **Supplementary reading** 1. Abel, E., Abel, M. *Virumaa Competitions in Mathematics 1995–1999*. Tartu: Estonian Mathematical Society, 1999. – 67 p. 2. Bavrin, I. I., Fribus, E. A. *Ancient Problems*. Moscow: Prosveshchenie, 1994. – 128 p. 3. Bradis, V. M. *Errors in Mathematical Reasoning* / V. M. Bradis. Moscow: Prosveshchenie, 1967. – 191 p. 4. Weil, G. *Matematicheskoe myshlenie* [Mathematical Thinking] / G. Weil. Moscow: Nauka Publ., 1989. – 400 p. 5. Gaibullaev, N. R., Dyrchenko, I. I. *Razvitie matematicheskikh sposobnostei uchashchikhsya* [Development of Mathematical Abilities of Students]. Tashkent: Ukituvchi Publ., 1988. – 248 p. 6. *Matematika – nauka i professiya* [Mathematics – Science and Profession]. Moscow: Nauka, 1988, pp. 22–41. 7. Shuba. *Mathematics – Science and Profession*. Moscow: Prosveshchenie, 1995. – 222 p.

	8. Yung, V. D. *How to Teach Mathematics* / V. D. Yung. Moscow–Petrograd: Gosizdat, 1923. – 302 p. **Online resources** 1. Htpp://www/mathnet.ru/, www.5ballov.ru 2. Http://www/mathelp.net/ 3. Http://almaty.ru/ 4. Http:// mat.1september.ru/ 5. Http://www/mathelp.by.ru/ 6. Http:/ ega-math.narod.ru/ 7. Http:// math.ru/ 8. Http://ilib.marror1.mccme.ru/

Module 2.2-Modern educational technologies

Module designation	MTSAMP 5206 Methodology of teaching on solving applied mathematical problems (in English)
The semester(s) in which the module is taught	1
Responsible teacher	Nugayeva Z.T.
Language of instruction	English
Connection with the curriculum	Basic Disciplines (BD), Elective Component (EC)
Forms of training	Lectures, practical lessons, IWMS-T (Independent Work of Master's Student with Teacher), IWMS (Independent Work of Master's Student)
Training load (including contact hours, SRS)	Total Academic Workload: 150 hours Contact Hours: 45 hours (Lectures: 15 hours, practical lessons: 30 hours) Independent Study: IWMS-T - 25 hours, IWMS - 80 hours
ECTS	5
Prerequisites (Mandatory and Recommended)	Elementary mathematics, foreign language, mathematical analysis, algebra and number theory, methodology of mathematics teaching.
The purpose of the module/expected learning outcomes	The purpose of this module is to develop students' competencies in teaching methods for solving applied mathematical problems, integrating theoretical and practical approaches. Upon successful completion of the course, students will be able to: design and apply methodological approaches for teaching applied mathematics; integrate ICT tools into problem-solving and teaching practices; critically analyze and evaluate different strategies for solving applied problems; demonstrate the ability to present, justify, and adapt problem-solving techniques in a teaching context; develop methodological materials for effective instruction in applied mathematics.
Content summary	The course focuses on the principles and methodology of teaching applied mathematical problem solving. Topics include: classification of applied mathematical problems; methodological approaches to their teaching; integration of ICT in problem-solving; development of logical and critical thinking skills; creation of educational and methodological materials; and strategies for fostering students' independent and research-oriented learning. Special attention is given to case studies, practical tasks, and the design of lesson plans that incorporate applied mathematical problems.
Exam form	Test
Requirements for teaching and exams	Regular attendance and active participation in lectures and practical classes; timely completion of independent work (individual and group tasks); preparation of teaching materials and lesson plans; submission of written assignments; successful completion of the exam demonstrating both theoretical knowledge and methodological application of teaching applied mathematical problem solving.

List of literature	**Core reading** 1. Klein F. *Elementary Mathematics from a Higher Standpoint. Volume I: Arithmetic, Algebra, Analysis* / Translated by Gert Schubring. - Springer-Verlag Berlin Heidelberg, 2019. – 325 p. https://www.pdfdrive.com/elementary-mathematics-from-a-higher-standpoint-volume-i-arithmetic-algebraanalysis-e158185616.html 2. Klein F. *Elementary Mathematics from a Higher Standpoint. Volume III: Precision Mathematics and Approximation Mathematics* / Translated by Marta Menghini in collaboration with Anna Baccaglini-Frank; Mathematical advisor for the English translation: Gert Schubring. - Springer-Verlag Berlin Heidelberg, 2019. – 267 p. https://www.pdfdrive.com/elementary-mathematics-from-a-higher-standpoint-volume-iiiprecision-mathematics-and-approximation-mathematics-e158168172.html 3. Van Dyke J., Rogers J., Adams H. *Fundamentals of Mathematics* – 9th edition. - Portland Community College, 2020. – 823 p. https://www.pdfdrive.com/fundamentals-of-mathematics-9th-edition-e157003722.html 4. Chen W.W.L., Duong X.T. *Elementary Mathematics*. - W. W. L. Chen, X. T. Duong and Macquarie University, 1999, 2021. – 152 p. https://www.williamchen-mathematics.info/lnemfolder/em01.pdf 5. Burzynski D., Ellis W. *Fundamentals of Mathematics*. - Rice University, Houston, Texas, 2020. – 724 p. https://www.pdfdrive.com/fundamentals-of-mathematics-e19522418.html 6. Cem Giray. *Function*. – Zambak Publishing, 2020. - 493 p. https://www.pdfdrive.com/functions-zambakd165854242.html 7. Barbett Z., Keskinoglu S. *Applied Mathematics 10*. – Zambak Publishing, 2021. – 200 p. https://bok.asia/book/2568448/535fe1 8. Katirci Salih. *Logarithms*. – Zambak Publishing, 2021. – 156 p. https://www.pdfdrive.com/logarithmszambak-e165885133.html 9. Şükrü Kavlu & Aydın Sağlam. *Derivatives*. - Printed in Turkey, Distribution: Zambak Yayinlari, 2020. – 160 p. https://b-ok.asia/book/2473521/4a8f94?dsource=recommend 10. Tanturic Ilker. *Introduction to Trigonometry*. – Zambak Publishing, 2021. – 144 p. https://www.pdfdrive.com/introduction-to-trigonometry-zambak-e165904579.html 11. Şükrü Kavlu & Aydın Sağlam. *Integrals*. - Printed in Turkey, Distribution: Zambak Yayinlari, 2020. – 120 p. https://b-ok.asia/book/2473524/05575d?dsource=recommend 12. Lafcioglu A., Ersozogly I. *Quadratics: Equations, Inequalities, and Functions*. – Zambak Publishing, 2021. – 152 p. https://www.pdfdrive.com/quadratics-equations-inequalities-and-functions-zambake185361051.html **Supplementary reading** 13. A. Weaver. *ARITHMETIC: A*, Textbook for Math 01, 5th edition, 2015. 14. V. V. Konev. *The Elements of Mathematics*, textbook, published by Tomsk Polytechnic University, 2009. 15. V. V. Konev. *The Elements of Mathematics*, workbook, part 2, published by Tomsk Polytechnic University, 2009. 16. V. V. Konev. *Higher Mathematics*, textbook, part 2, published by Tomsk Polytechnic University, 2009.

	17. V. V. Konev. *The Elements of Mathematics*, workbook, published by Tomsk Polytechnic University, 2009. 18. V. V. Konev. *Mathematics, Preparatory Course Algebra*, workbook, published by Tomsk Polytechnic University, 2009.

Module designation	MSPPC 5207 Methods for solving problems with practical content (in Russian)
The semester(s) in which the module is taught	2
Responsible teacher	Seilova R. D.
Language of instruction	Russian
Connection with the curriculum	Basic Disciplines (BD), Elective Component (EC)
Forms of training	Lectures, practical lessons, IWMS-T (Independent Work of Master's Student with Teacher), IWMS (Independent Work of Master's Student)
Training load (including contact hours, SRS)	Total workload: 150 hours Contact hours: 45 hours (15 hours of lectures, 30 hours of practical lessons) Independent Study: 25 h IWMS-T, 80 h IWMS
ECTS	5
Prerequisites (Mandatory and Recommended)	Pedagogy of higher education (in English), Management psychology (in Russian), Methods of teaching for solving math problems (in English)
The purpose of the module/expected learning outcomes	To develop professional and methodological competencies for selecting, developing, adapting, and applying practice-oriented tasks in teaching mathematics, and for organizing student activities to solve them in professional contexts using modern pedagogical approaches and ICT. Learning outcomes: A. Develop tasks relevant to the professional context and learning objectives, considering complexity and activity type. B. Use ICT tools (Excel, GeoGebra, MathCAD, etc.) to analyze, visualize, and solve problems. C. Integrate knowledge across disciplines for interdisciplinary and practical problem solving. D. Participate in project and team work; create and defend group solutions; organize effective collaboration. E. Critically evaluate solutions using criteria, rubrics, and checklists; conduct self-assessment.
Content summary	The module covers the theoretical and methodological basis of practice-oriented tasks in professional education, their creation, analysis, and solution methods. It includes modern approaches and technologies, methodological techniques, professional orientation, learning organization strategies, and assessment approaches.
Exam form	Project
Requirements for teaching and exams	Consistent theoretical study, active participation, task completion and independent work, deep understanding and practical skills, project-based exam assessing topic relevance, goal clarity, method justification, practical value, quality of materials, logical structure, theoretical understanding, argumentation, terminology, compliance with guidelines, and independence (Turnitin plagiarism check required).

List of literature	1. Dalinger, V. *Methods of Teaching Mathematics: Search and Research Activities of Students*, 2nd ed., revised and expanded. Litres, 2020. 2. Fomin, G. *Economic and Mathematical Methods and Models in Commercial Activity*, 4th ed., revised and expanded. Litres, 2015. 3. Shadrina, I. *Theory and Methodology of Mathematical Development*. Litres, 2016. 4. Egupova, M. V. Practice-Oriented Teaching of Mathematics in Schools: Problems and Research Prospects. *Science and School*, 2022, no. 4, pp. 85–95. 5. Tleubergenova, M. A., Serkan, K. Kh. Some Non-Standard Approaches to Solving Rational Equations of Higher Orders. *Bulletin of the Aktobe State Pedagogical Institute*, 2013, no. 2, pp. 55–58. 6. Polyakova, T. A. Problems with Practical Content in the Mathematics Course of a Technical University. *Concept*, 2016, no. 7, pp. 75–80. 7. Chikunova, O. I., Bobrovskaya, A. V. Teaching the Method of Mathematical Modeling in Solving Problems with Practical Content. *International Journal of Experimental Education*, 2016, no. 4-1, pp. 131–135. 8. Karpova, E. V., Matveeva, E. P. The Role of Formal and Practical Content of Mathematical Disciplines in Forming Students' Engineering Thinking, 2016, no. 6, pp. 50–54. 9. Mishenina, O. V., Oshchepkova, E. A. Applied Orientation of the Mathematics Course as a Means of Developing Professional Competence of Future Specialists. *Teacher Education in Russia*, 2016, no. 1, pp. 47–51. 10. Pozdnyakova, E. V., Fomina, A. V. Open Tasks as a Means of Developing "Soft" Skills in Math Lessons. *Scientific Result: Pedagogy and Psychology of Education*, 2021, vol. 7, no. 2, pp. 29–45. 11. Tamuova, G. S. *Theory and Methodology of Teaching Mathematics for the Specialty 050109 – "Mathematics": Educational and Methodological Complex*. Aktobe: AGPI Publ., 2011. 12. Shapiro, I. M. *Using Tasks with Practical Content in the Teaching of Mathematics: Teacher's Book*. Moscow: Prosveshchenie, 1990. – 96 p.

Module designation	MTMHS 5208 Modular teaching mathematics in high school (in Kazakh)
The semester(s) in which the module is taught	2
Responsible teacher	Kaydasov Zh.
Language of instruction	Kazakh
Connection with the curriculum	Basic Disciplines (BD), Elective Component (EC)
Forms of training	Lectures, practical lessons, IWMS-T (Independent Work of Master's Student with Teacher), IWMS (Independent Work of Master's Student)
Training load (including contact hours, SRS)	Total workload: 150 hours Contact hours: 45 hours (15 hours of lectures, 30 hours of practical lessons) Independent Study: 25 h IWMS-T, 80 h IWMS
ECTS	5
Prerequisites (Mandatory and Recommended)	Pedagogy of higher education (in English), Management psychology (in Russian), Methods of teaching for solving math problems (in English)
The purpose of the module/expected learning outcomes	The fundamental stage of designing a technology for modular mathematics education is the development of modules. The design of modules aimed at systematization of mathematical knowledge is based on the didactic principles of modular training identified by us: the principle of block structure, the principle of integrativity, the principle of updating the developing component of content, the principle of "open-ended", the principle of conscious perspective, the principle of cooperation. A) knows the specifics of secondary education; knows the main provisions of the modern theory of methodical science, has basic ideas of methods of teaching mathematics; B) is able to apply knowledge of the theoretical foundations and technologies of teaching mathematics; is able to conduct methodological analysis of educational materials and textbooks; C) is able to apply knowledge of theoretical, fundamental and applied mathematics; D) has work skills with the use of physical and mathematical apparatus, modern computer technologies for solving practical problems; E) is able to correctly apply knowledge and learning skills, is aware of the social significance of their future profession of a teacher.
Content summary	Integrate and differentiate the learning content by grouping problem-based modules of the teaching material that ensure the development of a mathematics course in full, abbreviated, and in-depth versions. Make students' independent choice of a particular version of the mathematics course, depending on the level of training, and ensure an individual pace of progress in the program. Use modules as scripts for creating pedagogical software tools. Focus the teacher's work on the consultative and coordinating functions of managing students' cognitive activity. Reduce the course of study without much prejudice to the completeness of the presentation and depth of assimilation of educational material based on an adequate set of methods and forms of training.
Exam form	Project

Requirements for teaching and exams	Training requirements: systematic theory study, active participation, task completion, independent work. Deep understanding and practical skills. Exam in the form of project defense, which evaluates: compliance with the topic, clarity of goals/tasks, validity of chosen methods/technologies, practical significance, quality of materials (if any), logical presentation, understanding of theory, ability to argue, knowledge of terminology, compliance with regulations, and independence of implementation (with mandatory plagiarism check through Turnitin, result considered in evaluation).
List of literature	1. Zankov L. V., Sergeev I. S. Modularnoe obuchenie: teoriya i praktika [Modular training: theory and Practice], Moscow: Pedagogika Publ., 2010. 2. Kazantseva T. V. Modular training in higher education: methodology and practice. St. Petersburg: Lan Publ., 2018. 3. Fadeev D. K. et al. Methods of teaching mathematics at a university, Moscow: Akademiya Publ., 2020. 4. Berezanskaya I. N., Chudinovskikh G. N. Kompetentnostny podkhod v obuchenii matematike v vuze [Competence approach in teaching mathematics at a university]. 5. Shapovalenko V. V. Proektirovanie uchebnogo podulya v vuze [Designing a training module in a university]. 6. Gavrilova N. A., Kurdyumov A.V. Digital technologies in modular teaching of mathematics. - Moscow.

Module 3.1 – Methodology of scientific research and advanced study of mathematics

Module designation	FQAGL 5301 Fundamental questions of algebra, geometry and logic (in Kazakh)
The semester(s) in which the module is taught	1
Responsible teacher	Kaydasov Zh.
Language of instruction	Kazakh
Connection with the curriculum	BD UC: University component (UC) in the cycle of basic disciplines (BD)
Forms of training	Lectures, practical lessons, IWMS-T (Independent Work of Master's Student with Teacher), IWMS (Independent Work of Master's Student)
Training load (including contact hours, SRS)	Total workload: 150 hours Contact hours: 45 hours (15 hours of lectures, 30 hours of practical lessons) Independent Study: 25 h IWMS-T, 80 h IWMS
ECTS	5
Prerequisites (Mandatory and Recommended)	Algebra and Number Theory, Analytical Geometry, Mathematical Analysis, Discrete Mathematics, Mathematical Logic, Differential Geometry
The purpose of the module/expected learning outcomes	The module aims to familiarize students with the basic concepts of algebra, geometry, and logic. It also develops students' skills in using these concepts in the learning process, acquiring new knowledge, and solving practical problems. Students will learn to participate in scientific seminars, make presentations on abstract topics, and apply acquired knowledge in teaching practice. They will also understand the principles of scientific research in algebra, geometry, and logic. A) Understand the basic concepts of algebra, geometry, and logic, as well as the role of mathematical language in science and mathematics education. B) Apply modern methods of algebra, geometry, and logic in scientific research, solving problems related to the unity of meaning and content structure in mathematics teaching. C) Apply knowledge to develop a culture of mathematical speech and understand the place of algebra, geometry, and logic in mathematical knowledge. D) Develop the ability for professional self-education and career planning. E) Apply knowledge and learning skills effectively and understand the significance of mathematical language in future professional activities.

Content summary	The module covers a variety of topics, including sets of real numbers, limits, and derivatives of functions. It explores how to investigate functions using derivatives and how to plot functions. Other topics include the root of the nth degree of a real number and its properties, solving irrational equations and their systems, derivatives, primitives, and indefinite integrals. It also includes applications of definite integrals in solving geometric and physical problems. Methods for solving inequalities and systems of inequalities, as well as equations and inequalities involving variables under the module sign with parameters, are studied. The module also discusses axioms of geometry, the structure and types of proofs of theorems, and metric problems related to polyhedron sections. It includes basic theoretical propositions of constructive geometry, the concept of random variables, and elements of sample methods, as well as fundamental concepts in mathematical logic.
Exam form	Written exam
Requirements for teaching and exams	Regular attendance of lectures and practical classes, punctuality, and active participation in discussions. Preparation for each class, independent study of theoretical material, and timely completion of IWMS and IWMS-T tasks. Ability to apply theoretical knowledge of algebra, geometry, and logic to solving mathematical and methodological problems. Development of skills in critical analysis, argumentation, and presentation of solutions. Mandatory submission of all assignments within the established deadlines (overdue work is not accepted). Participation in intermediate and final assessments; final exam in the form of a written. Compliance with academic integrity and use of proper references (plagiarism not allowed, work checked via Turnitin or equivalent system).
List of literature	1. Pogorelov A.V. Geometry 7-11 / A.V. Pogorelov. Prosveshchenie Publ., 2001, 453 p. (in Russian). 2. Kospanova K.K. Discrete Mathematics, RMEB-2015. 3. Yelubaev S. Difficult Problems in Elementary Mathematics, - Almaty: Evro, 2020. 4. Nugisova A. Elementary Mathematics and Its Problem-Solving Practice: Educational and Methodological Guide. – Taldykorgan: ZMU, 2010. **Electronic resources:** 1. Electronic Library of the ARU. Zhubanova – neb.arsu.kz.arsu.kz neb.arsu.kz 2. Epigraph database – epigraph-database.elib.kz 3. Multimedia textbooks "Epigraph" – mbook.kz.kz

Module designation	ICSQME 5302 International comparative studies of the quality of mathematical education(in Kazakh)
The semester(s) in which the module is taught	2
Responsible teacher	Aspet Kagazbayeva, Professor
Language of instruction	Kazakh
Connection to the curriculum	Profile discipline PD, university component UC
Forms of education	Lectures, practical lessons, IWMS-T (Independent Work of Master's Student with Teacher), IWMS (Independent Work of Master's Student)
Study load (including contact hours independent work of undergraduates (IWU))	Total workload: 150 hours Contact hours: 45 hours (15 hours of lectures, 30 hours of practical lessons) Independent Study: 25 h IWMS-T, 80 h IWMS
ECTS	5
Prerequisites (Mandatory and Recommended)	Organization and planning of scientific research (in English), Fundamental questions of algebra, geometry and logic (in Kazakh)
Module objectives/expected learning outcomes	Purpose: To familiarize students with the methodology for assessing the quality of mathematical knowledge in international comparative studies and to form the skills to use the knowledge gained to develop students' skills to apply knowledge in educational and diverse life situations (scientific, professional, social, personal). A. To know the features of international monitoring studies TIMSS, PISA, etc., to understand the social significance of international monitoring studies TIMSS, PISA in teaching mathematics. B. Based on knowledge of the features of the international TIMSS and PISA studies in the formation respectively of mathematical literacy and functional mathematical literacy among students, to be able to competently use test tasks for teaching and assessing the quality of mathematical knowledge of students in the context of the requirements of these programs. C. Be able to carry out a comprehensive analysis of tasks in a test format for the formation and assessment of the quality of students' knowledge in accordance with the requirements of the PISA program and analyze the step-by-step solution of test tasks in accordance with the stages of mathematical reasoning. D. Be able to establish continuity by identifying commonalities and differences between international comparative TIMSS and PISA studies. E. To be able to assess the importance of international comparative research in solving the problems of formation and development of functional mathematical literacy, as well as assessing the quality of students' meta-subject knowledge; to carry out professional and personal self-education, to design a further educational route and professional career.
Content summary	The regulatory framework for assessing the quality of mathematical education in the Republic of Kazakhstan. International comparative studies: basic conceptual framework (literacy, functional literacy, mathematical literacy, functional mathematical literacy, competencies, competence, computer literacy, etc.); features of international research PIRLS, TIMSS, PISA, TAILS, ICILS, PIAAS.

	TIMSS is a tool for assessing the quality of students' subject mathematical literacy; a monitoring analysis of the quality of knowledge of participants (students) in a study based on research cycles; a methodology for compiling test tasks according to the TIMSS program and the functions of test tasks. Assessment of the quality of mathematical knowledge of students in this program. The PISA international study in the formation of functional mathematical literacy (FML) among students: the main components of the FML; the criterion scale for evaluating students' FML; levels of functional mathematical literacy; the methodology for composing test tasks according to the PISA program and the functions of test tasks; evaluation of the results of mathematical training of students in the context of meaningful blocks, types of educational, cognitive and competency-based activities; The practical implementation of the acquired knowledge is the development of test tasks for teaching and evaluating the quality of mathematical knowledge among students. Comparative analysis of TIMSS and PISA comparative research. Potentials and limitations of TIMSS and PISA research tools.
Exam form	Written work – project defense
Training and examination requirements	Each module of the subject requires the active participation of undergraduates in lectures and practical exercises. Participation in all types of activities requires prior preparation and activity. Assignments for all types of classes are performed weekly within the framework of modules and are evaluated at the level of a certain percentage of established points according to predefined criteria. The organization and conduct of the final control (exam) is carried out in accordance with the regulations on the interim certification (examination session) of students approved by the Chairman of the Board of the ARU named after K. Zhubanov: P12. Organization of the written exam. 12.3 Evaluation criteria 12.3.1 Written work is evaluated according to 5 different criteria (20 points are assigned to each section): 1) Knowledge and understanding of the topic (the ability to open a topic); 2) The level of research and analysis, conclusion; 3) The structure and sequence of the project; 4) The level of use of scientific sources; 5) Writing style (grammar) and conciseness of presentation.
List of literature	Basic literature: 1. Abilqasimova A.E. *The Theory and Methodology of Teaching Mathematics: Didactic and Methodological Foundations.* Study Guide. - Almaty: Mektep, 2014. - 224 p. 2. Abilqasimova A.E., Tuyakov E.A. *Methodological Foundations for Teaching Mathematical Problem Solving in General Education Schools.* Study Guide. - Almaty, 1919. - 340 p. 3. Kagazbaeva A.K. *Developing Students' Functional Mathematical Literacy.* Teaching and Methodological Guide. - Almaty: Otan Publishing, 2018. - 92 p. 4. *The Methodology of Designing Test Tasks in Mathematics in the Context of International PISA Research.* Methodological Guide / Kagazbaeva A.K. - Aktobe: Editorial and Publishing Department of the Branch of JSC National Center for Professional Development "Orleu," 2015. - 120 p. 5. *On the Approval of the State Program for the Development of Education and Science in the Republic of Kazakhstan for 2021-2025.* Decree No. 1118, dated December 7, 2010, of the President of the Republic of Kazakhstan. 6. *On the Approval of the State Program for the Development of Education and Science in the Republic of Kazakhstan for 2020-2025.* Resolution No. 988, dated December 27, 2019, of the Government of the Republic of Kazakhstan. - Astana, 2019.

7. Ministry of Education and Science of the Republic of Kazakhstan (2015).
8. *National Action Plan for the Development of Students' Functional Literacy for 2012-2016.* - Astana, June 25, 2012.
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10. *TIMSS International Study.* Methodological Guide. National Center for Educational and Evaluation Center. - Astana, 2013.
11. *PISA International Study.* Methodological Guide. National Center for Educational and Evaluation Center. - Astana, 2013.
12. *Developing Students' Functional Mathematical Literacy in the Context of PISA International Studies / Author: Kagazbaeva A.K.* - Aktobe: JSC National Center for Educational and Analytical Research "Orleu," 2015. - 69 p.
13. *PIRLS International Study: Texts and Question Samples.* Available at: http://www.orleu-uko.kz/?p=1909
14. *Current School Textbooks in the Field of Mathematics.* Available at: https://okulyk.kz/all-books/
15. *International Studies Provide an Objective Assessment of the Quality of Education in Kazakhstani Schools.* Available at: http://edunews.kz/lentnews/1066-halyaraly-zertteuler-azastan-mektepterndeg-blm-berusapasyn-dl-baalaydy
16. *About the PIAAC Study.* Available at: http://www.piaac.kz/kk-about.html
17. *International TIMSS Study:* Methodological Guide. - Astana: NCSO, 2012. - 75 p.
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19. *TIMSS Test Task Collection.* - JSC "Information and Analytical Center": Astana, 2016. - 175 p. ISBN 978-601-280-759-2.
20. *TIMSS – 2007 in Kazakhstan. National Report on the Results of the International Study.* / B.K. Dhamitov, S.Zh. Nogaybalanova, A.Zh. Bayzakova, B.G. Salimova. - Astana: NCSO, 2009. - 124 p.
21. *National Report on the Results of PISA-2009 International Research in Kazakhstan.* / T.M. Amreeva, U.M. Abdigapbarova, Z.R. Azmaganbetova, Zh.N. Bazarbekova, N.T. Baygelova. - Astana: NCSO, 2010. - 155 p.
22. *Results of the TIMSS-2011 International Study on the Assessment of the Academic Achievement of 4th and 8th Grade Students in Kazakhstan.* National Report. - Astana: NCSO, 2013. - 237 p.
23. *Results of Kazakhstan's Participation in the TIMSS-2015 Study*, 2017, National Report / S. Yrsaliyev, A. Kultumanova, B. Kartpaev, A. Baigulova, B. Yskakov. - Astana: "Information-Analytical Center" JSC, 2017. - 219 p.
24. *TIMSS-2019 Research Results.* Available at: https://fioco.ru › Default › Documents › MCI › R...
25. Kagazbaeva A.K., Rakhimova G. *Task Collection on the Development of Functional Mathematical and Mathematical Literacy of Students.* - Aktobe: K.Jubanova ARGU, 2020. - 64 p.
26. *Main Results of the PISA-2012 International Study on the Educational Achievements of 15-Year-Old Students.* / A. Kultumanova, G. Berdibaeva, B. Kartpaev, and others. - Astana: NCSO, 2013. - 283 p.
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28. *Potentials and Limitations of the Instruments in TIMSS and PISA Research.* Available at:

https://studwood.net/1067282/pedagogika/potentsialy_ogranicheniya_instrumentariev_issledovaniy_timss_pisa
29. *Analytical Report "Results of Kazakhstan in International Quality Education Research: Study of the Causes of Lagging."* - "Beles" Center for Analysis and Strategy, edited by S.I. Yrsaliyev, 2020. - 308 p.

Supplementary reading

30. *Monitoring the Quality of the Educational Process in General Education Schools, Taking into Account the Requirements of PIRLS, PISA, and TIMSS International Comparative Research.* Analytical Reference. – Astana: I. Altynsarin National Academy of Education, 2014. – 65 p.
31. *PIRLS International Study: Texts and Question Samples.* Available at: http://www.orleu-uko.kz/?p=1909
32. *Developing Students' Mathematical Literacy Based on Tasks from PISA and TIMSS Research.* Methodological Guide. – Astana: I. Altynsarin National Academy of Education, 2014. – 46 p.
33. Ayanambetov A. *Results of "PISA for Adults": In Kazakhstan, the Development of Skills in Young People is Not Higher Than in the Older Generation.* Available at: https://bilimdinews.kz/?p=79041
34. *Increasing Students' Mathematical Literacy Based on the Results of the TIMSS Research.* Available at: www.nao.kz; www.bilimstat.edu.kz
35. *Students' IT Competencies in the ICILS International Study: Collection.* – Astana: "Information and Analytical Center" JSC, 2016. – 254 p.
36. Kovaleva G.S., Koshelenko N.G., Krasnyanskaya K.A., Smirnova E.A. *Conceptual Approaches to Assessing Academic Achievement in Mathematics and Natural Sciences in the Context of International Comparative TIMSS Research.* – Moscow: ISMO TsOKO RAO, 2008. – pp. 15-23
37. *Developing Students' Mathematical Literacy Based on Tasks from PISA and TIMSS Research.* Methodological Guide. – Astana: I. Altynsarin National Academy of Education, 2014. – 46 p.
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39. *Kazakhstan Received International Assessment of the Academic Achievements of 15-Year-Old Students*. Available at: tandemt.ru/website/tandem/var/
40. *A Collection of Problems for Preparing Students for TIMSS and PISA International Studies*. – Astana: I. Altynsarin National Academy of Education, 2016. – 59 p.

Electronic resources

1. Features of organizing the educational process in general education organizations of the Republic of Kazakhstan in the 2018-2019 academic year. Methodical guidance letter. – Astana: National Academy of Education named after I. Altynsarin, 2018. – 258 p. //https://nao.kz/loader/fromorg/2/24?lang=kz
2. Abylkasimova A.E., Zhumagulova Z.A., Korchevsky V.E. Algebra, Algebra and the Fundamentals of Analysis.-Almaty: Mektep.-Electronic version.
3. Ayanambetov A. Results of “PISA for adults”: In Kazakhstan, the development of young people's skills is no higher than that of the older generation //https://bilimdinews.kz/?p=79041
4. Abylkasimova A., et al. Mathematics. Textbook for the 5th grade of general education schools: Consists of 2 parts / A. Abylkasimova, T. Kucher, Z. Zhumagulova.-Part 1.-Almaty: Mektep, 2017.-144 p. //http://online.anyflip.com/qmwb/cjvg/mobile/index.html#p=1
5. Abylkasimova A. Kucher T. Algebra. Textbook for the 7th grade of general education schools.- Almaty: Mektep, 2017// https://www.okulyk.kz/

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7. Abylkasimova A. Kucher T. Algebra. Textbook for the 9th grade of general education schools.- Almaty: Mektep, 2019/https://www.okulyk.kz/
8. Kazakhstan received international assessment of the academic achievements of 15-year-old students/ Online resource: tandemt.ru/website/tandem/var/...
9. Kamalova S.T. Evaluation of student learning outcomes in the classroom: educational and methodological tool. – Astana: Nazarbayev Intellectual Schools, 2014. – 44 p.//https://www.google.com/search?q
10. On approval of the state program for the development of education and science of the Republic of Kazakhstan for 2011-2020.- Decree of the President of the Republic of Kazakhstan dated December 7, 2010 No. 1118 http://adilet.zan.kz/kaz/docs/U1000001118.
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13. Kazakhstan's participation results in the TIMSS-2011 study, 2013, National report / S. Irsaliyev, A. K. Kultumanova, B. K. Kartpaev, A. B. Baigulova, B. Yskakov - Astana: Information-Analytical Center JSC, 2013 - 237 p. //http://iac.kz/sites/default/files/1_nac_otchet_tims_2015_kaz_pdf.pdf
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15. Mathematics, Part 1, 6th grade, T. Aldamuratova, T. S. Baisholanov, E. S. Baisholanov, 2015 //https://www.okulyk.kz/
16. Mathematics, Part 2, 6th grade, T. Aldamuratova, T. S. Baisholanov, E. S. Baisholanov, 2015 //https://www.okulyk.kz/
17. International TIMSS study: Methodological guide. – Astana: NCSO, 2012. – 75 p. //http://xn--11--5cd3cecte0b6d.xn--p1ai/files/2019-20/praktikum.pdf
18. National report on the results of the international PISA-2009 study in Kazakhstan //T.M. Amreeva, U.M. Abdigapbarova, Z.R. Azmaganbetova, Z.N. Bazarbekova, N.T. Baigelova. – Astana: NCSO, 2010. – 155 p. https://articlekz.com/article/19333
19. National Action Plan for the development of functional literacy of schoolchildren for 2012-2016.- Astana, 2012 //dilet.zan.kz/kaz/docs/P1200000832.
20. Key results of the international study of educational achievements of 15-year-old students PISA-2012/ Compilers: A. Kultumanova, G. Berdibaeva, B. Kartpaev, and others.- Astana: NCSO, 2013.- 283 p. http://iac.kz/sites/default/files/1_nac_otchet_tims_2015_kaz_pdf.pdf
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22. National Action Plan for the development of functional literacy of students for 2012 - 2016. - Astana, June 25, 2012 //http://adilet.zan.kz/kaz/docs/P1200000832

23. Updating the content of general education based on the experience of Nazarbayev Intellectual Schools. Methodical tool. – Astana: National Academy of Education named after I. Altynsarin, 2014. – 43 p. //https://emirsaba.org/metodicheskoe-posobie-astana-nacionalenaya-akademi
24. About the PIAAC study //http://www.piaac.kz/kk-about.html
25. PISA-2012 results of the international study of educational achievements of 15-year-old students. A. Kultumanova, G. Berdibaeva, B. Kartpaev, I. Imanbek, K. Sharbanova, M. Rakhimova, Z. Zhumabaeva, Z. Pirnepesova, B. Okenova, A. Uvalieva. – Astana: NBSBO, 2013 - 293 p. //https://emirsaba.org/metodicheskoe-posobie-astana-nacionalenaya-akademi
26. Methodological and scientific-methodological support for preparation for the PISA-2015 international study. Methodological collection. – Astana: National Academy of Education named after I. Altynsarin, 2015. – 118 p. //https://emirsaba.org/metodicheskoe-posobie-astana-nacionalenaya-akademi
27. PISA international studies Methodological tool. - Astana: NBSBO, 2012.-123 p. //https://emirsaba.org/metodicheskoe-posobie-astana-nacionalenaya-akademi.
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30. PIRLS international study: text and question samples //http://www.orleu-uko.kz/?p=1909
31. Collection of test tasks of TIMSS. – JSC “Information-Analytical Center”: Astana, 2016–175 p. ISBN 978 -601-280 -759-2 https://emirsaba.org/metodicheskoe-posobie-astana-nacionalenaya-akademi
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33. Solton G.N., Solton A.E. Zhumadylova A.Z. Educational-methodological complexes for Algebra and Geometry for 9th-grade students of general education schools of Kazakhstan under the updated curriculum.-Kokshetau: “Kelechek-230” publishing house - Electronic version.
34. TIMSS study results for improving students' mathematical literacy // www.nao.kz; www.bilimstat.edu.kz.
35. Tyumeneva Yu.A. et al. What do subject knowledge provide for the ability to apply them in a new context? // Online resource: vo.hse.ru›data/2014/03/23/1318104760/Tumeneva.pdf
36. International studies fairly assess the quality of education in Kazakhstan schools //http://edunews.kz/lentnews/1066-halyaraly-zertteuler-azastan-mektepterndeg-blm-berusapasyn-dl-baalaydy.

Module designation	FIA 5303 Fundamental issues of analysis (in English)
The semester(s) in which the module is taught	2
Responsible teacher	Tleubergenova M. A.
Language of instruction	English
Connection with the curriculum	Profile discipline (PD), komponent on choice (KV)
Forms of training	Lectures, practical exercises, SRSP, SRS.
Training load (incl. contact hours, SRS)	Total work load: 120 hours Contact hours: 40 hours (20 hours of lectures, 20 hours of practical lessons) Independent Study: 20 h IWMS-T, 60 h IWMS
ECTS	4
Prerequisites (Mandatory and Recommended)	Mathematical Analysis, Fundamental questions of algebra, geometry and logic (in Kazakh)
Module objectives / expected learning outcomes	In-depth study of the basic concepts of mathematical real and complex analysis (limit transition, continuity, differentiability, integrability), mastering the methods of mathematical analysis of functions of one and several real and complex variables, applying the acquired knowledge to the analysis of various mathematical models in the course of scientific research. A) knows the theoretical foundations of functions of a real variable and functions of a complex variable, basic methods of mathematical real and complex analysis; B) is able to solve typical problems of mathematical real and complex analysis; C) applies methods of mathematical real and complex analysis to proving theorems and solving problems; D) systematizes modern knowledge about analysis and its applications; D) implements research skills and abilities of independent analysis of applied problems, evaluates mathematical models of the studied processes using the methods of mathematical real and complex analysis.
Content summary	This discipline in-depth studies the known data of mathematical real and complex analysis, and also contributes to the formation of undergraduates' skills in using the acquired knowledge in practice, as well as skills in applying modern methods of fundamental analysis in the process of scientific research. The discipline examines the introduction to mathematical analysis, differential and integral calculus, series theory, and also studies methods, problems and theorems of the theory of functions of a complex variable, and their application to solving problems in applied mathematics.
Form of exam	Essay
Requirements for teaching and exams	Regular attendance and active participation in lectures and practical classes; timely completion of independent work (IWMS-T and IWMS); preparation of written assignments and essays; demonstration of theoretical knowledge and practical skills during the final exam.

List of literature	1. Fichtenholz, G. M. (2021). *Course of differential and integral calculus* (Vols. 1–3). Moscow: Lan Publishing. 2. Kudryavtsev, L. D. (2006). *Course of mathematical analysis* (Parts 1–2). Moscow: Nauka Publishing. 3. Kosyakov, S. P. (2015). *Klassicheskie metody analiza* [Classical methods of analysis]. Moscow: Moscow State University. 4. Krasnov, M. L., Kiselev, A. I., & Makarov, G. I. (2003). *Sbornik zadach po matematicheskomu analizu* [Collection of problems in mathematical analysis]. Moscow: Nauka. 5. Adams, R. A. (Ed.). (n.d.). *Calculus: A complete course* (8th ed.). [English]. 6. Chen, W. W. L., & Duong, X. T. (1999/2021). *Elementary mathematics* (152 p.). Macquarie University. Retrieved from https://www.williamchen-mathematics.info/lnemfolder/em01.pdf 7. Burzynski, D., & Ellis, W. (2020). *Fundamentals of mathematics* (724 p.). Rice University, Houston, Texas. Retrieved from https://www.pdfdrive.com/fundamentals-of-mathematics-e19522418.html 8. Giray, C. (2020). *Function* (493 p.). Zambak Publishing. Retrieved from https://www.pdfdrive.com/functions-zambak-d165854242.html 9. Barbett, Z., & Keskinoglu, S. (2021). *Applied mathematics 10* (200 p.). Zambak Publishing. Retrieved from https://b-ok.asia/book/2568448/535fe1 10. Katirci, S. (2021). *Logarithms* (156 p.). Zambak Publishing. Retrieved from https://www.pdfdrive.com/logarithms-zambak-e165885133.html 11. Kavlu, Ş., & Sağlam, A. (2020). *Derivatives* (160 p.). Istanbul: Zambak Yayinlari. Retrieved from https://b-ok.asia/book/2473521/4a8f94?dsource=recommend 12. Konev, V. V. (2009). *Higher mathematics* (Part 2). Tomsk: Tomsk Polytechnic University.

Module 3.2 – Theoretical foundations of mathematics education

Module designation	FQAGL 5301 Fundamental questions of algebra, geometry and logic (in Kazakh)
The semester(s) in which the module is taught	1
Responsible teacher	Kaydasov Zh.
Language of instruction	Kazakh
Connection with the curriculum	BD UC: University component (UC) in the cycle of basic disciplines (BD)
Forms of training	Lectures, practical lessons, IWMS-T (Independent Work of Master's Student with Teacher), IWMS (Independent Work of Master's Student)
Training load (including contact hours, SRS)	Total workload: 150 hours Contact hours: 45 hours (15 hours of lectures, 30 hours of practical lessons) Independent Study: 25 h IWMS-T, 80 h IWMS
ECTS	5
Prerequisites (Mandatory and Recommended)	Algebra and Number Theory, Analytical Geometry, Mathematical Analysis, Discrete Mathematics, Mathematical Logic, Differential Geometry
The purpose of the module/expected learning outcomes	The module aims to familiarize students with the basic concepts of algebra, geometry, and logic. It also develops students' skills in using these concepts in the learning process, acquiring new knowledge, and solving practical problems. Students will learn to participate in scientific seminars, make presentations on abstract topics, and apply acquired knowledge in teaching practice. They will also understand the principles of scientific research in algebra, geometry, and logic. A) Understand the basic concepts of algebra, geometry, and logic, as well as the role of mathematical language in science and mathematics education. B) Apply modern methods of algebra, geometry, and logic in scientific research, solving problems related to the unity of meaning and content structure in mathematics teaching. C) Apply knowledge to develop a culture of mathematical speech and understand the place of algebra, geometry, and logic in mathematical knowledge. D) Develop the ability for professional self-education and career planning. E) Apply knowledge and learning skills effectively and understand the significance of mathematical language in future professional activities.

Content summary	The module covers a variety of topics, including sets of real numbers, limits, and derivatives of functions. It explores how to investigate functions using derivatives and how to plot functions. Other topics include the root of the nth degree of a real number and its properties, solving irrational equations and their systems, derivatives, primitives, and indefinite integrals. It also includes applications of definite integrals in solving geometric and physical problems. Methods for solving inequalities and systems of inequalities, as well as equations and inequalities involving variables under the module sign with parameters, are studied. The module also discusses axioms of geometry, the structure and types of proofs of theorems, and metric problems related to polyhedron sections. It includes basic theoretical propositions of constructive geometry, the concept of random variables, and elements of sample methods, as well as fundamental concepts in mathematical logic.
Exam form	Written exam
Requirements for teaching and exams	Regular attendance of lectures and practical classes, punctuality, and active participation in discussions. Preparation for each class, independent study of theoretical material, and timely completion of IWMS and IWMS-T tasks. Ability to apply theoretical knowledge of algebra, geometry, and logic to solving mathematical and methodological problems. Development of skills in critical analysis, argumentation, and presentation of solutions. Mandatory submission of all assignments within the established deadlines (overdue work is not accepted). Participation in intermediate and final assessments; final exam in the form of a written. Compliance with academic integrity and use of proper references (plagiarism not allowed, work checked via Turnitin or equivalent system).
List of literature	1. Pogorelov A.V. Geometry 7-11 / A.V. Pogorelov. Prosveshchenie Publ., 2001, 453 p. (in Russian). 2. Kospanova K.K. Discrete Mathematics, RMEB-2015. 3. Yelubaev S. Difficult Problems in Elementary Mathematics, - Almaty: Evro, 2020. 4. Nugisova A. Elementary Mathematics and Its Problem-Solving Practice: Educational and Methodological Guide. – Taldykorgan: ZMU, 2010. **Electronic resources:** 5. Electronic Library of the ARU. Zhubanova – neb.arsu.kz.arsu.kz neb.arsu.kz 6. Epigraph database – epigraph-database.elib.kz 7. Multimedia textbooks "Epigraph" – mbook.kz.kz

Module designation	ICSQME 5302 International comparative studies of the quality of mathematical education(in Kazakh)
The semester(s) in which the module is taught	2
Responsible teacher	Aspet Kagazbayeva, Professor
Language of instruction	Kazakh
Connection to the curriculum	Profile discipline PD, university component UC
Forms of education	Lectures, practical lessons, IWMS-T (Independent Work of Master's Student with Teacher), IWMS (Independent Work of Master's Student)
Study load (including contact hours independent work of undergraduates (IWU))	Total workload: 150 hours Contact hours: 45 hours (15 hours of lectures, 30 hours of practical lessons) Independent Study: 25 h IWMS-T, 80 h IWMS
ECTS	5
Prerequisites (Mandatory and Recommended)	Organization and planning of scientific research (in English), fundamental issues of algebra, geometry, and logic
Module objectives/expected learning outcomes	Purpose: To familiarize students with the methodology for assessing the quality of mathematical knowledge in international comparative studies and to form the skills to use the knowledge gained to develop students' skills to apply knowledge in educational and diverse life situations (scientific, professional, social, personal). A. To know the features of international monitoring studies TIMSS, PISA, etc., to understand the social significance of international monitoring studies TIMSS, PISA in teaching mathematics. B. Based on knowledge of the features of the international TIMSS and PISA studies in the formation respectively of mathematical literacy and functional mathematical literacy among students, to be able to competently use test tasks for teaching and assessing the quality of mathematical knowledge of students in the context of the requirements of these programs. C. Be able to carry out a comprehensive analysis of tasks in a test format for the formation and assessment of the quality of students' knowledge in accordance with the requirements of the PISA program and analyze the step-by-step solution of test tasks in accordance with the stages of mathematical reasoning. D. Be able to establish continuity by identifying commonalities and differences between international comparative TIMSS and PISA studies. E. To be able to assess the importance of international comparative research in solving the problems of formation and development of functional mathematical literacy, as well as assessing the quality of students' meta-subject knowledge; to carry out professional and personal self-education, to design a further educational route and professional career.
Content summary	The regulatory framework for assessing the quality of mathematical education in the Republic of Kazakhstan. International comparative studies: basic conceptual framework (literacy, functional literacy, mathematical literacy, functional mathematical literacy, competencies, competence, computer literacy, etc.); features of international research PIRLS, TIMSS, PISA, TAILS, ICILS, PIAAS.

	TIMSS is a tool for assessing the quality of students' subject mathematical literacy; a monitoring analysis of the quality of knowledge of participants (students) in a study based on research cycles; a methodology for compiling test tasks according to the TIMSS program and the functions of test tasks. Assessment of the quality of mathematical knowledge of students in this program. The PISA international study in the formation of functional mathematical literacy (FML) among students: the main components of the FML; the criterion scale for evaluating students' FML; levels of functional mathematical literacy; the methodology for composing test tasks according to the PISA program and the functions of test tasks; evaluation of the results of mathematical training of students in the context of meaningful blocks, types of educational, cognitive and competency-based activities; The practical implementation of the acquired knowledge is the development of test tasks for teaching and evaluating the quality of mathematical knowledge among students. Comparative analysis of TIMSS and PISA comparative research. Potentials and limitations of TIMSS and PISA research tools.
Exam form	Written work – project defense
Training and examination requirements	Each module of the subject requires the active participation of undergraduates in lectures and practical exercises. Participation in all types of activities requires prior preparation and activity. Assignments for all types of classes are performed weekly within the framework of modules and are evaluated at the level of a certain percentage of established points according to predefined criteria. The organization and conduct of the final control (exam) is carried out in accordance with the regulations on the interim certification (examination session) of students approved by the Chairman of the Board of the ARU named after K. Zhubanov: P12. Organization of the written exam. 12.3 Evaluation criteria 12.3.1 Written work is evaluated according to 5 different criteria (20 points are assigned to each section): 1) Knowledge and understanding of the topic (the ability to open a topic); 2) The level of research and analysis, conclusion; 3) The structure and sequence of the project; 4) The level of use of scientific sources; 5) Writing style (grammar) and conciseness of presentation.
List of literature	Basic literature: 1. Abilqasimova A.E. *The Theory and Methodology of Teaching Mathematics: Didactic and Methodological Foundations.* Study Guide. - Almaty: Mektep, 2014. - 224 p. 2. Abilqasimova A.E., Tuyakov E.A. *Methodological Foundations for Teaching Mathematical Problem Solving in General Education Schools.* Study Guide. - Almaty, 1919. - 340 p. 3. Kagazbaeva A.K. *Developing Students' Functional Mathematical Literacy.* Teaching and Methodological Guide. - Almaty: Otan Publishing, 2018. - 92 p. 4. *The Methodology of Designing Test Tasks in Mathematics in the Context of International PISA Research.* Methodological Guide / Kagazbaeva A.K. - Aktobe: Editorial and Publishing Department of the Branch of JSC National Center for Professional Development "Orleu," 2015. - 120 p. 5. *On the Approval of the State Program for the Development of Education and Science in the Republic of Kazakhstan for 2021-2025.* Decree No. 1118, dated December 7, 2010, of the President of the Republic of Kazakhstan. 6. *On the Approval of the State Program for the Development of Education and Science in the Republic of Kazakhstan for 2020-2025.* Resolution No. 988, dated December 27, 2019, of the Government of the Republic of Kazakhstan. - Astana, 2019.

7. Ministry of Education and Science of the Republic of Kazakhstan (2015).
8. *National Action Plan for the Development of Students' Functional Literacy for 2012-2016.* - Astana, June 25, 2012.
9. *Russian-Kazakh Explanatory Dictionary: Pedagogy* / O 74, Edited by PhD, Professor E. Arin - Pavlodar: "ECO" Publishing House, 2006. - 482 p. ISBN 9965-808-b.
10. *TIMSS International Study.* Methodological Guide. National Center for Educational and Evaluation Center. - Astana, 2013.
11. *PISA International Study.* Methodological Guide. National Center for Educational and Evaluation Center. - Astana, 2013.
12. *Developing Students' Functional Mathematical Literacy in the Context of PISA International Studies / Author: Kagazbaeva A.K.* - Aktobe: JSC National Center for Educational and Analytical Research "Orleu," 2015. - 69 p.
13. *PIRLS International Study: Texts and Question Samples.* Available at: http://www.orleu-uko.kz/?p=1909
14. *Current School Textbooks in the Field of Mathematics.* Available at: https://okulyk.kz/all-books/
15. *International Studies Provide an Objective Assessment of the Quality of Education in Kazakhstani Schools.* Available at: http://edunews.kz/lentnews/1066-halyaraly-zertteuler-azastan-mektepterndeg-blm-berusapasyn-dl-baalaydy
16. *About the PIAAC Study.* Available at: http://www.piaac.kz/kk-about.html
17. *International TIMSS Study:* Methodological Guide. - Astana: NCSO, 2012. - 75 p.
18. Kovaleva G.S., Koshelenko N.G., Krasnyanskaya K.A., Smirnova E.A. *Conceptual Approaches to Assessing Academic Achievement in Mathematics and Natural Sciences in the Context of International Comparative TIMSS Research.* - Moscow: ISMO TsOKO RAO, 2008. - pp. 15-23.
19. *TIMSS Test Task Collection.* - JSC "Information and Analytical Center": Astana, 2016. - 175 p. ISBN 978-601-280-759-2.
20. *TIMSS – 2007 in Kazakhstan. National Report on the Results of the International Study.* / B.K. Dhamitov, S.Zh. Nogaybalanova, A.Zh. Bayzakova, B.G. Salimova. - Astana: NCSO, 2009. - 124 p.
21. *National Report on the Results of PISA-2009 International Research in Kazakhstan.* / T.M. Amreeva, U.M. Abdigapbarova, Z.R. Azmaganbetova, Zh.N. Bazarbekova, N.T. Baygelova. - Astana: NCSO, 2010. - 155 p.
22. *Results of the TIMSS-2011 International Study on the Assessment of the Academic Achievement of 4th and 8th Grade Students in Kazakhstan.* National Report. - Astana: NCSO, 2013. - 237 p.
23. *Results of Kazakhstan's Participation in the TIMSS-2015 Study*, 2017, National Report / S. Yrsaliyev, A. Kultumanova, B. Kartpaev, A. Baigulova, B. Yskakov. - Astana: "Information-Analytical Center" JSC, 2017. - 219 p.
24. *TIMSS-2019 Research Results.* Available at: https://fioco.ru › Default › Documents › MCI › R...
25. Kagazbaeva A.K., Rakhimova G. *Task Collection on the Development of Functional Mathematical and Mathematical Literacy of Students.* - Aktobe: K.Jubanova ARGU, 2020. - 64 p.
26. *Main Results of the PISA-2012 International Study on the Educational Achievements of 15-Year-Old Students.* / A. Kultumanova, G. Berdibaeva, B. Kartpaev, and others. - Astana: NCSO, 2013. - 283 p.
27. Pentin A.Yu., Kovaleva G.S., Davydova E.I., Smirnova E.S. *Features of School Natural Science Education in Russia in the Context of International Studies TIMSS and PISA.* Available at: http://www.chem.msu.ru/rus/books/2018/science-education-2018/042.pdf
28. *Potentials and Limitations of the Instruments in TIMSS and PISA Research.* Available at:

https://studwood.net/1067282/pedagogika/potentsialy_ogranicheniya_instrumentariev_issledovaniy_timss_pisa
29. *Analytical Report "Results of Kazakhstan in International Quality Education Research: Study of the Causes of Lagging."* - "Beles" Center for Analysis and Strategy, edited by S.I. Yrsaliyev, 2020. - 308 p.

Supplementary reading

30. *Monitoring the Quality of the Educational Process in General Education Schools, Taking into Account the Requirements of PIRLS, PISA, and TIMSS International Comparative Research.* Analytical Reference. – Astana: I. Altynsarin National Academy of Education, 2014. – 65 p.
31. *PIRLS International Study: Texts and Question Samples.* Available at: http://www.orleu-uko.kz/?p=1909
32. *Developing Students' Mathematical Literacy Based on Tasks from PISA and TIMSS Research.* Methodological Guide. – Astana: I. Altynsarin National Academy of Education, 2014. – 46 p.
33. Ayanambetov A. *Results of "PISA for Adults": In Kazakhstan, the Development of Skills in Young People is Not Higher Than in the Older Generation.* Available at: https://bilimdinews.kz/?p=79041
34. *Increasing Students' Mathematical Literacy Based on the Results of the TIMSS Research.* Available at: www.nao.kz; www.bilimstat.edu.kz
35. *Students' IT Competencies in the ICILS International Study: Collection.* – Astana: "Information and Analytical Center" JSC, 2016. – 254 p.
36. Kovaleva G.S., Koshelenko N.G., Krasnyanskaya K.A., Smirnova E.A. *Conceptual Approaches to Assessing Academic Achievement in Mathematics and Natural Sciences in the Context of International Comparative TIMSS Research.* – Moscow: ISMO TsOKO RAO, 2008. – pp. 15-23
37. *Developing Students' Mathematical Literacy Based on Tasks from PISA and TIMSS Research.* Methodological Guide. – Astana: I. Altynsarin National Academy of Education, 2014. – 46 p.
38. *Results of Kazakhstan in the TIMSS-2015 International Study on the Quality of Natural-Mathematical Education.* Available at: https://present5.com/informacionno-analiticheskij-centr-rezultatykazaxstana-v-mezhdunarodnom-issledovanii-kachestva/
39. *Kazakhstan Received International Assessment of the Academic Achievements of 15-Year-Old Students.* Available at: tandemt.ru/website/tandem/var/
40. *A Collection of Problems for Preparing Students for TIMSS and PISA International Studies.* – Astana: I. Altynsarin National Academy of Education, 2016. – 59 p.

Electronic resources

41. Features of organizing the educational process in general education organizations of the Republic of Kazakhstan in the 2018-2019 academic year. Methodical guidance letter. – Astana: National Academy of Education named after I. Altynsarin, 2018. – 258 p. //https://nao.kz/loader/fromorg/2/24?lang=kz
42. Abylkasimova A.E., Zhumagulova Z.A., Korchevsky V.E. Algebra, Algebra and the Fundamentals of Analysis.-Almaty: Mektep.-Electronic version.
43. Ayanambetov A. Results of “PISA for adults”: In Kazakhstan, the development of young people's skills is no higher than that of the older generation //https://bilimdinews.kz/?p=79041
44. Abylkasimova A., et al. Mathematics. Textbook for the 5th grade of general education schools: Consists of 2 parts / A. Abylkasimova, T. Kucher, Z. Zhumagulova.-Part 1.-Almaty: Mektep, 2017.-144 p. //http://online.anyflip.com/qmwb/cjvg/mobile/index.html#p=1
45. Abylkasimova A. Kucher T. Algebra. Textbook for the 7th grade of general education schools.- Almaty: Mektep, 2017// https://www.okulyk.kz/

46. Abylkasimova A. Kucher T. Algebra. Textbook for the 8th grade of general education schools.- Almaty: Mektep, 2018//https://www.okulyk.kz/
47. Abylkasimova A. Kucher T. Algebra. Textbook for the 9th grade of general education schools.- Almaty: Mektep, 2019/https://www.okulyk.kz/
48. Kazakhstan received international assessment of the academic achievements of 15-year-old students/ Online resource: tandemt.ru/website/tandem/var/...
49. Kamalova S.T. Evaluation of student learning outcomes in the classroom: educational and methodological tool. – Astana: Nazarbayev Intellectual Schools, 2014. – 44 p.//https://www.google.com/search?q
50. On approval of the state program for the development of education and science of the Republic of Kazakhstan for 2011-2020.- Decree of the President of the Republic of Kazakhstan dated December 7, 2010 No. 1118 http://adilet.zan.kz/kaz/docs/U1000001118.
51. On approval of the state program for the development of education and science of the Republic of Kazakhstan for 2020-2025.- Decree of the Government of the Republic of Kazakhstan dated December 27, 2019 No. 988.- Astana, 2019 //http://adilet.zan.kz/kaz/docs/U1000001118.
52. The OBMS of the Republic of Kazakhstan / Ministry of Education and Science of the Republic of Kazakhstan.- Astana, 2015//. http://adilet.zan.kz/kaz/docs/U1000001118.
53. Kazakhstan's participation results in the TIMSS-2011 study, 2013, National report / S. Irsaliyev, A. K. Kultumanova, B. K. Kartpaev, A. B. Baigulova, B. Yskakov - Astana: Information-Analytical Center JSC, 2013 - 237 p. //http://iac.kz/sites/default/files/1_nac_otchet_tims_2015_kaz_pdf.pdf
54. "Kazakhstan's participation results in the TIMSS-2015 study", 2017, National report / S. Irsaliyev, A. K. Kultumanova, B. K. Kartpaev, A. B. Baigulova, B. Yskakov - Astana: Information-Analytical Center JSC, 2017 - 219 p. //http://iac.kz/sites/default/files/1_nac_otchet_tims_2015_kaz_pdf.pdf
55. Mathematics, Part 1, 6th grade, T. Aldamuratova, T. S. Baisholanov, E. S. Baisholanov, 2015 //https://www.okulyk.kz/
56. Mathematics, Part 2, 6th grade, T. Aldamuratova, T. S. Baisholanov, E. S. Baisholanov, 2015 //https://www.okulyk.kz/
57. International TIMSS study: Methodological guide. – Astana: NCSO, 2012. – 75 p. //http://xn--11--5cd3cecte0b6d.xn--p1ai/files/2019-20/praktikum.pdf
58. National report on the results of the international PISA-2009 study in Kazakhstan //T.M. Amreeva, U.M. Abdigapbarova, Z.R. Azmaganbetova, Z.N. Bazarbekova, N.T. Baigelova. – Astana: NCSO, 2010. – 155 p. https://articlekz.com/article/19333
59. National Action Plan for the development of functional literacy of schoolchildren for 2012-2016.- Astana, 2012 //dilet.zan.kz/kaz/docs/P1200000832.
60. Key results of the international study of educational achievements of 15-year-old students PISA-2012/ Compilers: A. Kultumanova, G. Berdibaeva, B. Kartpaev, and others.- Astana: NCSO, 2013.- 283 p. http://iac.kz/sites/default/files/1_nac_otchet_tims_2015_kaz_pdf.pdf
61. IT competencies of students in the ICILS international study. Collection. – Astana: Information-Analytical Center JSC, 2016. – 254 p. // http://iac.kz/sites/default/files/icils-160805052126.pdf
62. National Action Plan for the development of functional literacy of students for 2012 - 2016. - Astana, June 25, 2012 //http://adilet.zan.kz/kaz/docs/P1200000832

63. Updating the content of general education based on the experience of Nazarbayev Intellectual Schools. Methodical tool. – Astana: National Academy of Education named after I. Altynsarin, 2014. – 43 p. //https://emirsaba.org/metodicheskoe-posobie-astana-nacionalenaya-akademi
64. About the PIAAC study //http://www.piaac.kz/kk-about.html
65. PISA-2012 results of the international study of educational achievements of 15-year-old students. A. Kultumanova, G. Berdibaeva, B. Kartpaev, I. Imanbek, K. Sharbanova, M. Rakhimova, Z. Zhumabaeva, Z. Pirnepesova, B. Okenova, A. Uvalieva. – Astana: NBSBO, 2013 - 293 p. //https://emirsaba.org/metodicheskoe-posobie-astana-nacionalenaya-akademi
66. Methodological and scientific-methodological support for preparation for the PISA-2015 international study. Methodological collection. – Astana: National Academy of Education named after I. Altynsarin, 2015. – 118 p. //https://emirsaba.org/metodicheskoe-posobie-astana-nacionalenaya-akademi
67. PISA international studies Methodological tool. - Astana: NBSBO, 2012.-123 p. //https://emirsaba.org/metodicheskoe-posobie-astana-nacionalenaya-akademi.
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70. PIRLS international study: text and question samples //http://www.orleu-uko.kz/?p=1909
71. Collection of test tasks of TIMSS. – JSC “Information-Analytical Center”: Astana, 2016–175 p. ISBN 978 -601-280 -759-2 https://emirsaba.org/metodicheskoe-posobie-astana-nacionalenaya-akademi
72. Results of the international assessment of educational achievements of students in the 4th and 7th 8th grades of general education schools of Kazakhstan (TIMSS-2011): National report. – Astana: NCSO, 2013. – 237 p. //https://emirsaba.org/metodicheskoe-posobie-astana-nacionalenaya-akademi
73. Solton G.N., Solton A.E. Zhumadylova A.Z. Educational-methodological complexes for Algebra and Geometry for 9th-grade students of general education schools of Kazakhstan under the updated curriculum.-Kokshetau: “Kelechek-230” publishing house - Electronic version.
74. TIMSS study results for improving students' mathematical literacy // www.nao.kz; www.bilimstat.edu.kz.
75. Tyumeneva Yu.A. et al. What do subject knowledge provide for the ability to apply them in a new context? // Online resource: vo.hse.ru›data/2014/03/23/1318104760/Tumeneva.pdf
76. International studies fairly assess the quality of education in Kazakhstan schools //http://edunews.kz/lentnews/1066-halyaraly-zertteuler-azastan-mektepterndeg-blm-berusapasyn-dl-baalaydy.

Module designation	CMA 5303 Classical methods of analysis (in English)
The semester(s) in which the module is taught	2
Responsible teacher	Tleubergenova M. A.
Language of instruction	English
Connection with the curriculum	Profile discipline PD, university component UC
Forms of training	Lectures, practical lessons, IWMS-T (Independent Work of Master's Student with Teacher), IWMS (Independent Work of Master's Student)
Training load (including contact hours, SRS)	Total work load: 120 hours Contact hours: 40 hours (20 hours of lectures, 20 hours of practical lessons) Independent Study: 20 h IWMS-T, 60 h IWMS
ECTS	4
Prerequisites (Mandatory and Recommended)	Organization and planning of scientific research (in English), fundamental questions of algebra, geometry and logic.
The purpose of the module/expected learning outcomes	The goal of the discipline "Classical Methods of Analysis" is to develop students' deep understanding and confident mastery of classical analytical methods that provide a rigorous and effective analysis of the behavior of functions, structuring the solution space and proving key theorems of mathematical analysis. ● know the basic methods and techniques of classical mathematical analysis, including working with limits, series, integrals and functions; ● understand the basic theorems of analysis and the conditions for their application (Weierstrass, Bolzano-Cauchy, Cantor's theorems, etc.); ● know methods for studying functions of one and several variables, including extrema, convergence, uniform convergence, etc. ● apply classical analytical methods to solve typical and non-typical problems; ● analyze the behavior of functions, investigate the convergence of series, perform series expansion; ● calculate definite, improper, and multiple integrals using suitable transformations; ● strictly prove theorems and statements, formulate logically consistent proofs. ● apply the studied methods in more complex mathematical disciplines (for example, functional analysis, theory of differential equations, etc.).
Content summary	In-depth study of questions related to the basics of mathematical analysis in English: elements of set theory, limit and continuity of a function of one variable, derivative of a function of one variable and its applications functions of several variables and classical optimization methods, integral calculus and differential equations, numerical and power series. Study of methods, problems and theorems of the theory of the function of a real variable and the theory of the function of a complex variable in English, their application to solving problems of applied mathematics.
Exam form	essay
Requirements for teaching and exams	Proficiency in rigorous mathematical reasoning, ability to formulate definitions and prove statements, analysis of classical mathematical texts

List of literature	1. Fichtenholz, G. M. (2021). *Course of differential and integral calculus* (Vol. 1-3). Moscow: Lan Publ. 2. Kudryavtsev, L. D. (2006). *Course of mathematical analysis* (Part 1-2). Moscow: Nauka Publ. 3. Kosyakov, S. P. (2015). *Klassicheskie metody analiza* [Classical methods of analysis]. Moscow: MSU. 4. Krasnov, M. L., Kiselev, A. I., & Makarov, G. I. (2003). *Sbornik zadach po matematicheskomu analizu* [Collection of problems in mathematical analysis]. Moscow: Nauka. 5. Adams, R. A. (2009). *Calculus: A complete course* (8th ed.). (English). 6. Chen, W. W. L., & Duong, X. T. (1999, 2021). *Elementary Mathematics*. W W L Chen, X T Duong, and Macquarie University. 152 p. Retrieved from https://www.williamchen-mathematics.info/lnemfolder/em01.pdf 7. Burzynski, D., & Ellis, W. (2020). *Fundamentals of Mathematics*. Rice University, Houston, Texas. 724 p. Retrieved from https://www.pdfdrive.com/fundamentals-of-mathematics-e19522418.html 8. Giray, C. (2020). *Function*. Zambak Publishing. 493 p. Retrieved from https://www.pdfdrive.com/functions-zambak-d165854242.html 9. Barbett, Z., & Keskinoglu, S. (2021). *Applied Mathematics 10*. Zambak Publishing. 200 p. Retrieved from https://b-ok.asia/book/2568448/535fe1 10. Katirci, S. (2021). *Logarithms*. Zambak Publishing. 156 p. Retrieved from https://www.pdfdrive.com/logarithms-zambak-e165885133.html 11. Kavlu, Ş., & Sağlam, A. (2020). *Derivatives*. Printed in Turkey by Zambak Yayinlari. 160 p. Retrieved from https://b-ok.asia/book/2473521/4a8f94?dsource=recommend 12. Konev, V. V. (2009). *Higher mathematics* (Part 2). Tomsk Polytechnic University.

Module 4.1 – Development of mathematical abilities

Module designation	MPSOM 6304 Methods of preparing schoolchildren for Olympiads in mathematics (in Kazakh)
The semester(s) in which the module is taught	3
Responsible teacher	Imanchiev A. E.
Language of instruction	Kazakh
Connection with the curriculum	Profile discipline PD, university component UC
Forms of training	Lectures, practical lessons, IWMS-T (Independent Work of Master's Student with Teacher), IWMS (Independent Work of Master's Student)
Training load (including contact hours, SRS)	Total workload: 150 hours Contact hours: 45 hours (15 hours of lectures, 30 hours of practical lessons) Independent Study: 25 h IWMS-T, 80 h IWMS
ECTS	5
Prerequisites (Mandatory and Recommended)	Elementary mathematics, algebra and number theory, Methods of teaching for solving math problems (in English), The development of logical thinking in the process of teaching mathematics (in Kazakh)
The purpose of the module/expected learning outcomes	Ability to solve non-standard problems; ability to reason logically and correctly; ability to translate complex problems into mathematical language; ability to independently solve problems and understand underlying concepts; ability to correctly apply mathematical ideas. A) Knowledge of methods for solving standard problems; ability to solve Olympiad and non-standard problems. B) Ability to prove theorems and build mathematical models for problems arising in various fields; ability to apply acquired mathematical knowledge in practice. C) Ability to solve mathematical problems using classical methods; ability to apply geometric transformation methods; ability to use computer tools in problem solving. D) Ability to effectively work with information relevant to their specialty. E) Ability to communicate effectively in writing and to consider others' opinions.
Content summary	Vector algebra, analytic geometry, algebra, theory of functions of complex variables, operational calculus, derivative of continuity of a function and its applications. Diophantine equations and their types. The decay method for Diophantine equations. Legendre, Sophie-Gerin theorems. Pell equations and methods for its solution. Sum of squares. School and student Olympic reports.
Exam form	Essay
Requirements for teaching and exams	Proficiency in rigorous mathematical reasoning, ability to formulate definitions and prove statements, analysis of classical mathematical texts

List of literature	**Core reading** 1. Zhetpisov, K. *Mathematical Logic and Discrete Mathematics*, 2011. 2. Talipova, M. J. *Discrete Mathematics: A Collection of Short Lectures*, 2016. 3. Monsik, V. B., Skrynnikov, A. A. *Probability and Statistics: Textbook* (translated by S. Zh. Kabakbaev). Almaty, 2013. 4. Prasolov, V. V. *Problemy po planimetrii: Uchebnoe posobie* [Problems in Planimetry: Textbook]. 5th ed. Moscow: ICNMO, 2006. 640 p. 5. Prasolov, V. V. *Problems in Stereometry: A Textbook*. 2nd ed. Moscow: ICNMO, 2016. 352 p. 6. Shen, A. *Geometry in Problems*. 3rd ed. Moscow: ICNMO, 2017. 240 p. 7. Smirnova, E. S. *Planimetry: Types of Tasks and Methods of Their Solutions: An Elective Course for Students of Grades 9-11*. Moscow: ICNMO, 2016. 416 p. 8. Elubaev, S. *Logical Problems and Games in Mathematics: First Edition. Manual for Students of Higher Educational Institutions*. Almaty: Epigraph, 2016. 332 p. 9. Salgaraeva, G. I. *Teoriya Grafov* [Graph Theory]. Almaty: Era LLP, 2013. 256 p. 10. Dalinger, V. A. *Klassicheskie Neravnostei i Reshenie Zadach s ikh Ispol'zovaniem: Uchebnoe Posobie* [Classical Inequalities and Problem Solving with Their Use: A Textbook]. Omsk: Publishing House "Amphora", 2013. 130 p. **Supplementary reading** 11. Vinogradov, I. M. *Fundamentals of Number Theory*. Yurayt Publications, 2018. 12. Shakhmeister, A. H. *Geometrical Problems in Exams. Part 1. Planimetry*. St. Petersburg: "Petroglyph"; Moscow: "Victoria Plus", ICNMO, 2015. 392 p. 13. Prosvetov, G. *Functional Equations: Tasks and Solutions*. 2010. 14. Sadovnichy, Yu. *Solving Problems and Equations in Integers*. Exam Publishing House, 2015. 15. Larin, S. V. *Algebra: Polynomials: A Textbook for Academies, Bachelor Course*. 2nd ed. Moscow: Yurayt Publishing House, 2018. 136 p. 16. Suprun, V. P. *Matematika dlya Starsheklassnikov: Nonstandard Methods for Solving Problems*. Moscow: Book House "Librokom", 2009. 272 p. 17. Syusyukalov, A. I., Syusyukalova, E. A. *Izbrannye Nonstandard Problems in Mathematics: Training Manual*. Ryazan, 2012. **Electronic resources** 18. Electronic Library of APU named after K. Zhubanov – neb.arsu.kz 19. Epigraph Database – elib.kz 20. Multimedia Textbook "Epigraph" – mbook.kz 21. Smart Kitap – web.smart-kitap.kz 22. RZHOAEK Information System – rmebrk.kz 23. Republican Scientific and Technical Library – aktobe.rntb.kz 24. https://exponenta.ru 25. http://www.allmath.ru 26. https://math.ru 27. http://kazneb.kz – National Academic Library of the Republic of Kazakhstan 28. http://library.arsu.kz – Scientific Library of APU named after K. Zhubanov

Module designation	MSPPTMSUITT 6305 Methods of solving problems of probability theory and mathematical statistics using IT technology (in Russian)
The semester(s) in which the module is taught	3
Responsible teacher	Kokotova Yelena, Associate Professor of the Department of Mathematics
Language of instruction	Russian
Connection with the curriculum	Profile discipline (PD), elective component (EC)
Forms of training	Lectures, practical lessons, IWMS-T (Independent Work of Master's Student with Teacher), IWMS (Independent Work of Master's Student)
Training load (including contact hours, SRS)	Total workload: 150 hours Contact hours: 45 hours (15 hours of lectures, 30 hours of practical lessons) Independent Study: 25 h IWMS-T, 80 h IWMS
ECTS	5
Prerequisites (Mandatory and Recommended)	To master this module, students need the knowledge, skills, and abilities acquired during the course "Probability Theory and Mathematical Statistics."
The purpose of the module/expected learning outcomes	To master the methodology of solving problems in probability theory and mathematical statistics; to become acquainted with the possibilities of using information technology for solving probabilistic problems, processing, and analyzing statistical data; and to develop practical skills in applying information technology in solving problems related to probability theory and mathematical statistics. Upon completing the course, students will be able to: 1. Understand and apply the basic concepts and methods of probability theory and mathematical statistics to solve problems; master the methodology for solving the main types of problems in these fields. 2. Navigate and utilize modern information technologies used in mathematics education, including those relevant to probability theory and mathematical statistics. 3. Simulate virtual random experiments and random variables using the studied software tools. 4. Select appropriate information resources and technologies and apply them in learning how to solve problems in probability theory and mathematical statistics. 5. Present statistical data in various formats and analyze them using mathematical statistical methods supported by information technologies, including application software packages or specialized tools. 6. Apply software tools to process the results of pedagogical experiments using methods of mathematical statistics.

Content summary	Probabilistic and statistical line of the school mathematics course. About the content of the course of probability theory and mathematical statistics in higher education. The main types of problems in probability theory and mathematical statistics. Features of probabilistic and statistical problems. Information technologies used in teaching probability theory and mathematical statistics (interactive mathematical environments GeoGebra, Mathematical Constructor, Excel spreadsheet processor, virtual laboratory for probability theory portal 1C:Lesson", specialized application software packages for statistical data analysis). The use of applied computer software packages (Mathcad, MATLAB) during the course "Probability Theory and mathematical Statistics". Methods of solving problems in the sections "Probability of an event", "Basic theorems of probability theory", "Random variables". Simulation of a random experiment in the dynamic software environment "Mathematical constructor". Statistical methods of primary processing of experimental data. Using a computer when studying statistical material. Primary processing of sample data using computer software application packages. Random variable modeling and statistical sample processing in Mathcad. Statistical criteria for testing the hypothesis of pedagogical research. Processing the results of a pedagogical experiment using an Excel spreadsheet processor. Verification of statistical hypotheses about the parameters of the general population, verification of statistical hypotheses about the distribution law in Mathcad, MATLAB. Application of a specialized STADIUM product. Introduction to correlation and regression analysis. Solving problems of correlation and regression analysis using Excel, Mathcad.
Exam form	Project
Requirements for teaching and exams	Magistrants are required to attend all classes according to the schedule; preliminary preparation for classes, study of recommended literature; active participation in lectures, active work in practical classes, timely completion and delivery of independent work and homework assignments; passing all types of control.

List of literature	**Core reading** 1. Kiselev, G. M., & Bochkova, R. V. (2016). *Information Technologies in Teacher Education: Textbook*. Moscow: Publishing and Trading Corporation Dashkov & Co. 304 p. 2. Ministry of Education of the Republic of Kazakhstan. (2022). *On Approval of Standard Curricula in General Education Subjects, Elective Courses, and Electives for General Education Organizations* (Order No. 399, amended by No. 467 on 21.11.2022 and No. 199 on 05.07.2023). 3. Kaiyngbayeva, Z., Shuakaev, M., & Kossanov, B. (2018). The importance of teaching statistics and probability theory in secondary schools as part of the updated educational content. *KazNU Bulletin. Pedagogical Series*, 56(3), 70–79. 4. Gmurman, V. E. (2015). *Probability Theory and Mathematical Statistics: Textbook*. Moscow: Yurayt. 5. Gmurman, V. E. (2023). *A Guide to Solving Problems in Probability Theory and Mathematical Statistics. Statistics*. Moscow: Yurayt. 6. Trukhan, A. A., & Kudryashev, G. S. (2022). *Probability Theory in Engineering Applications: Textbook* (4th ed., rev. and add.). St. Petersburg: Lan Publishing House. 368 p. 7. Lebedev, A. V., & Fadeeva, L. N. (2018). *Probability Theory and Mathematical Statistics: Textbook*. Moscow. 480 p. 8. Dalinger, V. A., Simonzhenkov, S. D., & Galyukshov, B. S. (2016). *Probability Theory and Mathematical Statistics Using Mathcad: Textbook and Practical Course for Applied Bachelor's Degree*. Moscow: Yurayt Publishing House. 145 p. 9. Ivanovskiy, R. I. (2008). *Probability Theory and Mathematical Statistics: Fundamentals, Applied Aspects with Examples and Tasks in the Mathcad Environment*. St. Petersburg: BHV-Petersburg. 528 p. 10. Alibekov, I. Y. (2021). *Probability Theory and Mathematical Statistics in the MATLAB Environment: Textbook for Universities*. St. Petersburg: Lan. 184 p. 11. Iskakova, A. S. (2018). *Solving Problems of Probability Theory in the MATLAB System: Textbook for Students and Undergraduates*. Almaty: Technoerudit. 195 p. 12. Iglin, S. P. (2006). *Probability Theory and Mathematical Statistics Based on MATLAB*. Kharkov: Publishing House of NTU "KhPI". 612 p. 13. Starichenko, B. E. (2004). *Processing and Presentation of Pedagogical Research Data Using a Computer*. Yekaterinburg: Ural State Pedagogical University. 218 p. 14. Ivanova, O. V. (2014). The use of instrumental software in teaching pedagogical university students the elements of mathematical statistics. *Informatics and Education*, 9(258), 71–75. 15. Matalytskiy, M. A., & Khatskevich, G. A. (2017). *Probability Theory and Mathematical Statistics*. Minsk: Higher School. 16. Rakhimzhanova, S. K., & Karataeva, D. S. (2020). *Probability Theory and Mathematical Statistics: Educational and Methodological Guide*. Almaty: TechSmith. 192 p. 17. Dalinger, V. A. (2012). Information technologies in teaching students probability theory and mathematical statistics. *Modern Problems of Science and Education*, (4). 18. Andrafanova, N. V., & Guba, N. V. (2015). Application of information technologies in mathematical education. *OTO*, (4). 19. Kolmogorov, A. N. (2003). Probability theory. *Probability Theory and Its Applications*, 48(2), 211–248. 20. Abylkasymova, A., Kucher, T., Korchevsky, V., & Zhumagulova, Z. (2017). *Algebra: Textbook for the 7th Grade of Secondary Schools*. Almaty: Mektep 21. Abylkasymova, A., Kucher, T., Korchevsky, V., & Zhumagulova, Z. (2018). *Algebra: Textbook for the 8th Grade of Secondary Schools*. Almaty: Mektep.

22. Abylkasymova, A., Kucher, T., Korchevsky, V., & Zhumagulova, Z. (2019). *Algebra: A textbook for the 9th grade of secondary schools*. Almaty: Mektep.
23. Abylkasymova, A., Kucher, T., Korchevsky, V., & Zhumagulova, Z. (2019). *Algebra and the beginning of analysis: A textbook for the 10th grade of secondary schools of natural mathematics*. Almaty: Mektep.
24. Abylkasymova, A., Kucher, T., Korchevsky, V., & Zhumagulova, Z. (2020). *Algebra and the beginning of analysis: A textbook for the 11th grade of secondary schools of natural mathematics*. Almaty: Mektep.
25. Babenko, A. S. (2017). *Methods of teaching mathematics: The study of the probabilistic-statistical line in the school mathematics course* (56 p.). Kostroma: Kostroma State University.
26. Bulychev, V. A. (2014). Random experiment and its implementation in 1C: Mathematical Constructor 6.0. *Informatics and Education*, (3).
27. Bulychev, V. A. (2018). Using the dynamic capabilities of the 1C: Mathematical Constructor environment in studying the basics of probability theory and mathematical statistics. *Informatics and Education*, (3), 61–65.
28. Bulychev, V. A., & Bulycheva, O. G. (2017). Dynamic statistics in the 1C environment: Mathematical Constructor. *Electronic Journal: Science, Technology and Education*, (4), 16.
29. Bunimovich, E. A., & Bulychev, V. A. (2006). *Probability and statistics in the mathematics course of secondary schools: Lectures 1–4*. Moscow: Pedagogical University "The First of September".
30. Bunimovich, E. A., & Bulychev, V. A. (2006). *Probability and statistics in the mathematics course of secondary schools: Lectures 5–8*. Moscow: Pedagogical University "The First of September".
31. Bunimovich, E. A., & Bulychev, V. A. (2008). *Fundamentals of statistics and probability. Grades 5–11: Manual for general education institutions* (286 p.). Moscow: Bustard.
32. Gorelova, G. V., & Katsko, I. A. (2006). *Probability theory and mathematical statistics in examples and problems using Excel* (478 p.). Rostov-on-Don: Phoenix.
33. Kostenko, I. P. (2012). *Probability and statistics: A course of lectures and exercises* (380 p.). Izhevsk.
34. Lyutikas, V. S. (1990). *Elective course in mathematics: Probability theory*. Moscow: Prosveshchenie.
35. Mordkovich, A. G., & Semenov, P. V. (2002). Events, probabilities, statistical data processing. *Mathematics (Supplement to The First of September)*, (11), 9–11.
36. Tyurin, Y. N., Makarov, A. A., Vysotsky, I. R., & Yashchenko, I. V. (2008). *Probability theory and statistics* (256 p.). Moscow: ICNMO; JSC "Moscow Textbooks".
37. Tyurin, Y. N., Makarov, A. A., Vysotsky, I. R., & Yashchenko, I. V. (2014). *Probability theory and statistics: Methodical manual for teachers* (56 p.). Moscow: ICNMO.
38. Vadzinsky, R. (2008). *Statistical calculations in the Excel environment. The user's library* (608 p.). St. Petersburg: Peter.

Supplementary reading

39. Abylkasymova, A. E. (2020). *Algebra and the beginning of analysis: A methodological guide. 11th grade* (136 p.). Almaty: Mektep.
40. Averina, N. D., & Mishina, T. G. (2013). The use of ICT in probability theory and statistics lessons in grades 8–9 of the physico-mathematical profile. In *Theory and practice of education in the modern world: Proceedings of the III International Scientific Conference* (pp. 78–79). Saint Petersburg: Renome.
41. Minkovich, T. V. (2012). Information technologies: Conceptual and terminological aspect. *OTO*, (2).
42. Pestova, M. S. (2013). Information technologies in the study of probability theory. *Concept*, 1(17).
43. Vdovenko, Y. S., & Skoromnov, V. M. (n.d.). The use of information technologies in mathematics lessons to solve problems in probability theory and mathematical statistics.

44. Akhmetova, F. Kh., Laskovaya, T. A., & Chigireva, O. Yu. (2016). Methods of processing experimental results using the MATLAB system in the course "Mathematical statistics". *Engineering Bulletin*, (4), 1001–1011.
45. Andronov, A. M., Kopytov, E. A., & Gringlaz, L. Ya. (2004). *Probability theory and mathematical statistics*. St. Petersburg: Peter. 461 p.
46. Bulychev, V. A. (2020). Statistical modeling as a means of developing the information and mathematical culture of schoolchildren. *Informatics at School*, 8(161), 4–11.
47. Bunimovich, E. A. (2009). On probability theory and statistics in the school course. *Mathematics at School*, (7), 3–14.
48. Bunimovich, E. A. (2017). Combinatorics, probability and statistics in the Russian school. In A. P. Karp & B. Vogeli (Eds.), *Russian mathematical education* (pp. xx–xx). Moscow: Moscow State University. 576 p.
49. Gefan, G. D., & Kuzmin, O. V. (2014). Active use of computer technologies in teaching probability and statistical disciplines at a technical university. *Bulletin of the KSPU named after V. P. Astafiev*, 1(27), 57–61.
50. Gnedenko, B. V. (2001). *Course of probability theory: Textbook*. Moscow: Editorial URSS. 320 p.
51. Litvinova, A. A. (2018). Methodology for introducing definitions of probability in the mathematics course of secondary school. In *Modern education: Current issues, achievements and innovations. XIII International Scientific and Practical Conference* (pp. 26–28).
52. Mansurova, E. P. (2014). The continuity of mathematics education in school and university on the example of the topic "Probability and statistics" (from the work experience). In *XII Yemelyanov readings. Materials of the All-Russian Scientific and Practical conference of the Mari State University* (pp. 134–137).
53. Mugallimova, S. R. (2019). *The use of computer tools in teaching mathematics: Textbook-methodical stipend*. Surgut: Surgut State Pedagogical University. 55 p.
54. Nigmatulin, R. M., Martynova, E. V., & Vagina, M. Y. (2022). The use of visual statistical modeling in the GEOGEBRA system in teaching probability theory to future mathematics teachers. In *Fundamental problems of teaching mathematics, computer science and informatization of education. Collection of abstracts of the International Scientific Conference* (pp. 148–152). Yelets.
55. Patronova, N. N., & Teplyakov, V. V. (2013). Implementation of technology for developing probability theory education in a pedagogical university. *Modern Problems of Science and Education*, (4).
56. Troitskaya, O. N., & Ryabova, A. F. (2016). Features of the application of interactive models of the creative computer environment "1C: Mathematical constructor" when studying stochastics at school. *Scientific Notes of IUO RAO*, 4(60).
57. Vlasova, E. A., Mezhennaya, N. M., & Popov, V. S. (2018). Methodological aspects of ensuring the discipline "Mathematical Statistics" at the technical university. *Bulletin of Moscow State University. Series: Pedagogy*, (2).
58. Vukolov, E. A. (2008). *Fundamentals of statistical analysis: A workshop on statistical methods and operations research using the Statistica and Excel packages* (2nd ed.). Moscow: Forum. 464 p.
59. *Methods and technology of teaching mathematics. A course of lectures: A manual for universities* (2nd ed., revised). (2008). Ed. N. L. Stefanova, H. S. Podkhodova. Moscow: Bustard. 415 p.
60. *Towards a methodology for solving elementary problems in probability theory*. (2004). In *Actual problems of teaching mathematics in pedagogical universities and secondary schools: Abstracts of the XXIII All-Russian seminar of teachers of mathematics at universities and pedagogical universities* (pp. 111–113). Chelyabinsk; Moscow.

61. Kozhanov R. V., Artemova A. D., Kelpler M. A. Calculation of statistical indicators using the mathematical package Matlab // *Young Scientist*. — 2015. — № 6 (86). — Pp. 175-181.
62. Bolotyuk V. A. On the experience of using the Excel spreadsheet processor in the preparation and conduct of classes in probability theory and mathematical statistics // *Young Scientist*. — 2009. — № 4 (4). — Pp. 237-241.
63. Vlasova E. A., Mezhennaya N. M., Popov V. S., Pugachev O. V. The use of mathematical packages in the framework of methodological support for probabilistic disciplines at a technical university // *Bulletin of the Moscow State Regional University. Series: Physics-mathematics*. 2017. No. 4. pp. 114-128.
64. Borovikov V. P. *A popular introduction to modern data analysis in the STATISTICA system*. Moscow: Hotline — Telecom, 2013. 288 p.
65. Khalafyan A. A., Borovikov V. P., Kalaidina G. V. *Probability theory, mathematical statistics and data analysis: fundamentals of theory and practice on a computer. STATISTICA. EXCEL*. 2017. 320 p.
66. Shpakov P. S., Popov V. N. *Statistical processing of experimental data*. Moscow: MGSU, 2003.

Electronic resources:

1. *1C: Mathematical Constructor* – Software environment for creating interactive mathematical models.
Available at: https://obr.1c.ru/mathkit/
2. *User's Guide for the Dynamic Software Environment "Mathematical Constructor"*
Available at: https://obr.1c.ru/mathkit/help/manual/index.html
3. *Virtual Laboratories on Probability Theory* – 1C portal: "The Lesson".
Available at: https://urok.1c.ru/library/mathematics/virtualnye_laboratorii_po_matematike_7_11_kl/teoriya_veroyatnostey/
4. *Desmos Graphing Calculator* – Web application.
Available at: https://www.desmos.com/calculator?lang=ru
5. *GeoGebra Calculators* – Probabilistic, scientific, and graphical calculators.
Available at: https://www.geogebra.org/calculator
6. *STATISTICA* – Trial version of specialized statistical software.
Available at: https://statsoftstatistica.ru/
7. *Mathcad Prime* – Free 30-day trial of Mathcad Express.
Available at: https://www.mathcad.com/en/try-and-buy/mathcad-express-free-download
8. *MATLAB* – Free 30-day trial.
Available at: https://www.mathworks.com/campaigns/products/trials.html
9. Revinskaya O. G. *MATLAB: Programming. Practical Training*. Video lectures.
Available at: https://www.youtube.com/playlist?list=PLLhZUUoVATUxOBne06GUm1eUteBH3bAdV
10. *Introduction to MATLAB* – Tutorial video series.
Available at: https://www.youtube.com/playlist?list=PLmu_y3-DV2_nKd7epECPEbTVamsmEmMMI
11. *STADIA 8.0* – Free version for self-learning in statistics.
Available at: http://statsoft.msu.ru/Podr2~1.htm
12. *MATLAB Statistics Toolbox* – List of functions.
Available at: https://hub.exponenta.ru/post/funktsii-statistics-toolbox392
13. *MATLAB Documentation*
Available at: https://docs.exponenta.ru/stats/index.html
14. *PTC Mathcad Prime Help Center* – Information about features and functions. Available at: https://support.ptc.com/help/mathcad/r9.0/ru/index.html#page/PTC_Mathcad_Help/about_the_mathcad_help_center.html#

Module designation	GQTDE 6306 Geometric and qualitative theory of differential equations (in Kazakh)
The semester(s) in which the module is taught	4
Responsible teacher	Mynbayeva S. T., PhD, Associate Professor
Language of instruction	Kazakh
Connection with the curriculum	Profile discipline (PD), elective component (EC)
Forms of training	Lectures, practical lessons, IWMS-T (Independent Work of Master's Student with Teacher), IWMS (Independent Work of Master's Student)
Training load (including contact hours, SRS)	Total workload: 150 hours Contact hours: 45 hours (15 hours of lectures, 30 hours of practical lessons) Independent Study: 25 h IWMS-T, 80 h IWMS
ECTS	5
Prerequisites (Mandatory and Recommended)	Mathematical Analysis, Differential Equations, Fundamental Issues of Analysis (in English)
The purpose of the module/expected learning outcomes	Equations for a system of differential equations, integral-differential equations, and a system of integral-differential equations for solving linear boundary value problems: The focus is on solving problems through the parametrization of solutions, providing effective support for parametrization methods, and modern methods for solving linear boundary value problems. This includes methods for solving Cauchy problems, methods for approximating definable integrals for a system of differential equations, etc. It will also teach you to find solutions with effective support for systems of integral-differential equations using construction methods and Cauchy problems, as well as methods for approximating integrals efficiently. 1. For systems of ordinary differential equations and systems of integral-differential equations, it is necessary to know the method of parametrization for solving linear two-point boundary value problems for these systems. Understanding the geometric meaning of the method and the theoretical and practical aspects of mathematics is essential. You should have basic knowledge in the field of theoretical and applied mathematics, including both understanding and applying this knowledge. 2. For systems of ordinary differential equations and systems of integral-differential equations, the use of the parametrization method is important. The ability to analyze and draw conclusions when solving linear two-point boundary value problems is required. The student will learn to apply the method of parametrization and analyze the results. This involves evaluating and applying the solution appropriately. 3. For systems of ordinary differential equations and systems of integral-differential equations, students will be trained to implement algorithms for solving linear two-point boundary value problems. The ability to solve intermediate Cauchy problems in various scientific, technical, and management fields, as well as in economics, business, and the humanities, will be developed. The students will master mathematical and algorithmic modeling methods for analyzing and solving practical problems. 4. Inclusion of read material: Students will be able to work independently with the main methods of the studied material, including drawing up new analytical documents, formulating plans, and solving the presented tasks. They will be able to find solutions to problems using independent methods, synthesizing approaches based on the material studied. 5. Assessing the significance of the course material: The student will be able to evaluate the importance of the material, formulate conclusions, and conduct assessments.
Content summary	In this course on systems of ordinary differential equations and systems of integral-differential equations, we will consider linear two-point boundary value problems for these systems, particularly

	linear integral-differential equations. Boundary value problems will be studied with methods that include the parametrization method, and the method of differential or dual parameters. These methods divide the differential or integral-differential alignment of the considered interval into two parts, adding additional parameters for more detailed analysis.
Exam form	Essay
Requirements for teaching and exams	The final assessment will take place in the form of an exam, specifically in an essay format. The exam follows the University's Academic Integrity policy and is conducted in accordance with the academic rules. If plagiarism or copying is detected, the results of the exam will be voided, and the magistrant will have to retake the course during the summer semester. Preparation for the exam will be based on predefined topics provided before the exam, aligning with the course syllabus.
List of literature	1. Venkateshan, S. P., & Swaminathan, P. (2014). Boundary Value Problems (ODE). Computational Methods in Engineering, 447-512, Chapter 11. 2. Yang, W. (2014). Reflection Seismology: Integral Solutions of the Wave Equation with Boundary and Initial Value Conditions: Theory, Data Processing, and Interpretation. 107-134, Chapter 5. 3. Fletcher, S. J. (2023). Numerical Solutions to Initial Value Problems. Data Assimilation for the Geosciences (Second edition): From Theory to Application, 285-326, Chapter 8. 4. Tikhonov, A. N., Vasilyeva, A. B., & Sveshnikov, A. G. (2001). Differential Equations. Moscow: Nauka Publ. 232 p. 5. Naimark, M. A. (2000). Linear Differential Operators. Moscow: Nauka Publ. 526 p. (in Russian). 6. Samoylenko, A. M., & Ronto, N. I. (1986). Chislenno-analiticheskie metody issledovaniya resheniy kraevykh zadach [Numerical and analytical methods for studying solutions to boundary value problems]. Kiev: Naukova dumka Publ. 384 p. 7. Dzhumabaev, D. S. (1989). Signs of unambiguous solvability of a linear boundary value problem for an ordinary differential equation. Vychisl. Matem. i Matem. Fiz., 29(1), 50-66. 8. On the correct solvability of a two-point boundary value problem for loaded differential equations. Matematicheskiy Zhurnal Almaty, 2007, 5(4), 25-33. 9. Algorithms for finding an approximate solution of a linear two-point boundary value problem for systems of integro-differential equations. Dokl. of the International Conference "Differential Equations Mathematical Models of Electrical Phenomena", Almaty, KBTU, January 13-15, 2009, p. 15. 10. On the unique solvability of a two-point boundary value problem for systems of integro-differential equations. Izvestiya NAS RK Ser. Fiz.-Matem., 2009, 5, 47-51. 11. Ministry of Education and Science of the Republic of Kazakhstan. Retrieved from http://www.edu.gov.kz/ru 12. Electronic library of APU named after K. Zhubanov. Retrieved from https://neb.arsu.kz 13. Epigraph database Kora. Retrieved from elib.kz 14. Multimedia textbook "Epigraph". Retrieved from mbook.kz 15. Smart Kitap. Retrieved from web.smart-kitap.kz 16. RZHOAEK Information System. Retrieved from rmebrk.kz 17. Republican Scientific and Technical Library. Retrieved from aktobe.rntb.kz 18. Variatsiyalyk kisap methods of variational slope and adisterislope and efficiency. RMEB, 2009. 19. Kazakh National Academic Library. Retrieved from http://kazneb.kz 20. Scientific Library of APU named after K. Zhubanov. Retrieved from http://library.arsu.kz 21. Besbaev, G. A., & Meldebekova, S. K. (2020). Variational and effective bias and methods for improving efficiency. 142 p. Retrieved from https://elib.kz 22. Ettel, V. A. (2020). Optimization methods. 81 p.

Module designation	SCPUITT 6307 Solving construction problems using IT technology (in Kazakh)
The semester(s) in which the module is taught	4
Responsible teacher	Nugayeva Z.T.
Language of instruction	Kazakh
Connection with the curriculum	Profile discipline (PD), elective component (EC)
Forms of training	Lectures, practical lessons, IWMS-T (Independent Work of Master's Student with Teacher), IWMS (Independent Work of Master's Student)
Training load (including contact hours, SRS)	Total workload: 150 hours Contact hours: 45 hours (15 hours of lectures, 30 hours of practical lessons) Independent Study: 25 h IWMS-T, 80 h IWMS
ECTS	5
Prerequisites (Mandatory and Recommended)	Methodology of teaching mathematical problem solving (in English). Interactive methods of teaching mathematics in higher education (in Russian). Development of logical thinking in the process of teaching mathematics (in Kazakh)
The purpose of the module/expected learning outcomes	Systematization of theoretical material and its application in problem solving using IT technologies. Learning Outcomes: A) Knows geometry, including planimetry and stereometry; understands the basic principles of modern methodological science theories; familiar with key ideas in the methodology of teaching mathematics. B) Able to prove theorems; understands the facts and methods of the discipline; demonstrates creativity and initiative; capable of design work; able to conduct methodological analysis of teaching materials and textbooks. C) Knows the basics of professional speech culture—both oral and written. D) Ready to cooperate and work in a team. E) Ready to apply modern methodologies and technologies, including information technologies, to ensure the quality of the educational process at a specific level of education in a particular institution.
Content summary	The course covers the theoretical foundations of geometry and graphics used for constructing two-dimensional and three-dimensional images, as well as practical methods for drafting technical drawings using IT technologies. It provides a detailed overview of spatial image theory, particularly the construction of basic geometric shapes and methods for transforming images. Additionally, the course explores methods of geometric modeling in space that underpin automated solutions to applied geometry problems.
Exam form	Project defense.
Requirements for teaching and exams	Mandatory attendance of both in-person sessions, active participation in discussions, preliminary preparation for lectures and practicals,

	timely and quality completion of independent work, and participation in all forms of assessment.
List of literature	**Core reading** 1. Khan D. I. *Selected Theorems of Planimetry, Construction Problems: A Textbook*. – Astana: Foliant, 2013. – 336 p. 2. Nestorovich N. M. *Geometric Constructions in the Lobachevsky Plane: With 423 Problems on Calculation and Construction*. – Moscow: Gostekhizdat, 1951. – 304 p. 3. Klimukhin A. G. *Collection of Problems in Descriptive Geometry: A Textbook*. – Moscow: Stroyizdat, 1982. – 216 p. 4. Kiselev G. M., Bochkova R. V. *Information Technologies in Pedagogical Education*. [Online resource] https://neb.arsu.kz/kk/view?rid=5531&fid=5516 5. Pashchenko O. I. *Information Technologies in Education*. [Online resource] https://neb.arsu.kz/kk/view?rid=5516&fid=5501 6. Uvarov A. Yu. *On the Path to Digital Transformation of the School*. [Online resource] https://neb.arsu.kz/kk/view?rid=9425&fid=9406 **Supplementary reading** 7. Ivanchuk N. V., Eyken O. V., Martynova E. V., Samylova Yu. V., Danko O. E. *Using the GeoGebra Software in Mathematics Lessons in Grades 7–11: A Methodological Guide*. – Murmansk: MGPU, 2008. – 36 p. 8. Dalinger V. A. *Geometry: Stereometric Construction Problems: A Textbook for Secondary Vocational Education*. — 2nd ed. — Moscow: Yurayt Publishing, 2024. 9. Bekboev I., Abdiev A., Qaidasov Zh., Dosmaganbetova G. *Geometry. Grade 7*. – Almaty: "Mektep", 2016. 10. Shynybekov Ä. N. *Geometry. Grades 8, 9*. – Almaty: "Atamura", 2019. 11. Alexandrov I. I. *Collection of Geometric Construction Problems (with Solutions)* / Edited by N. V. Naumovich. 20th ed. — Moscow: KomKniga, 2010. — 176 p

Module 4.2-Modern Mathematical Education

Module designation	MPSOM 6304 Methods of preparing schoolchildren for Olympiads in mathematics (in Kazakh)
The semester(s) in which the module is taught	3
Responsible teacher	Imanchiev A. E.
Language of instruction	Kazakh
Connection with the curriculum	Profile discipline PD, university component UC
Forms of training	Lectures, practical lessons, IWMS-T (Independent Work of Master's Student with Teacher), IWMS (Independent Work of Master's Student)
Training load (including contact hours, SRS)	Total workload: 150 hours Contact hours: 45 hours (15 hours of lectures, 30 hours of practical lessons) Independent Study: 25 h IWMS-T, 80 h IWMS
ECTS	5
Prerequisites (Mandatory and Recommended)	Elementary mathematics, algebra, number theory, teaching methods for solving mathematical problems (in English), development of logical thinking in the process of teaching mathematics.
The purpose of the module/expected learning outcomes	Solving non-standard problems, developing the ability to think logically, translating complex problems into the language of mathematics, and independently solving problems, a solid understanding of mathematical concepts and the ability to correctly apply theoretical ideas. A) knows methods for solving standard problems; is able to solve Olympiad and non-standard problems; B) is able to prove theorems; is able to build mathematical models for problems arising in various fields; is able to apply acquired mathematical knowledge in practice; C) is able to solve mathematical problems using classical methods; is able to apply geometric transformation techniques and use computer tools effectively; D) is able to work with information related to the specialty; E) is able to communicate in writing and take others' opinions into account.
Content summary	Vector algebra. Analytic geometry. Algebra. Theory of functions of a complex variable. Operational calculus. Derivative and continuity of a function and their applications. Diophantine equations and their types. The decay method for Diophantine equations. Legendre's and Sophie Germain's theorems. Pell's equations and methods for their solution. Sum of squares. School and student Olympiad reports.
Exam form	Essay
Requirements for teaching and exams	Regular attendance and active participation in lectures and practical lessons; timely completion of IWMS-T and IWMS tasks; preparation of essays and problem-solving reports; demonstration of theoretical knowledge and problem-solving skills during the final exam.

List of literature	**Core reading** 1. Zhetpisov, K. Mathematical Logic and Discrete Mathematics, 2011. 2. Talipova, M. J. Discrete Mathematics: A Collection of Short Lectures, 2016. 3. Monsik, V. B., & Skrynnikov, A. A. Probability and Statistics: Textbook (translated by S. Zh. Kabakbaev). Almaty, 2013. 4. Prasolov, V. V. Problemy po Planimetrii: Uchebnoe Posobie (5th ed.). Moscow: ICNMO, 2006. 640 p. 5. Prasolov, V. V. Problems in Stereometry: A Textbook (2nd ed.). Moscow: ICNMO, 2016. 352 p. 6. Shen, A. Geometry in Problems (3rd ed.). Moscow: ICNMO, 2017. 240 p. 7. Smirnova, E. S. Planimetry: Types of Tasks and Methods of Their Solutions: An Elective Course for Students of Grades 9-11. Moscow: ICNMO, 2016. 416 p. 8. Elubaev, S. Logical Problems and Games in Mathematics: First Edition. Manual for students of higher educational institutions. Almaty: Epigraph, 2016. 332 p. 9. Salgaraeva, G. I. Teoriya Grafov. Almaty: Era LLP, 2013. 256 p. 10. Dalinger, V. A. Klassicheskie Neravnosti i Reshenie Zadach s Ikh Ispol'zovaniem: Uchebnoe Posobie [Classical Inequalities and Problem Solving with Their Use: A Textbook]. Omsk: Publishing House "Amphora", 2013. 130 p. **Supplementary reading** 11. Vinogradov, I. M. Fundamentals of Number Theory. Moscow: Yurayt, 2018. 12. Shakhmeister, A. H. Geometrical Problems in Exams. Part 1: Planimetry. St. Petersburg: "Petroglyph", "Victoria Plus", Moscow: ICNMO, 2015. 392 p. 13. Prosvetov, G. Functional Equations: Tasks and Solutions, 2010. 14. Sadovnichy, Yu. Solving Problems and Equations in Integers. Moscow: Exam Publishing House, 2015. 15. Larin, S. V. Algebra: Polynomials: A Textbook for Academies, Bachelor Course (2nd ed.). Moscow: Yurayt Publishing House, 2018. 136 p. 16. Suprun, V. P. Matematika dlya Starsheklassnikov: Nonstandard Methods for Solving Problems. Moscow: Book House "Librokom", 2009. 272 p. 17. Syusyukalov, A. I., & Syusyukalova, E. A. Izbrannye Nonstandard Problems in Mathematics: Training Manual. Ryazan, 2012. **Electronic resources** 18. Electronic Library of APU Named After K. Zhubanov - neb.arsu.kz 19. Epigraph Database - elib.kz 20. Multimedia Textbook "Epigraph" - mbook.kz 21. Smart Kitap - web.smart-kitap.kz 22. RZHOAEK Information System - rmebrk.kz 23. Republican Scientific and Technical Library - aktobe.rntb.kz 24. Exponenta - https://exponenta.ru 25. AllMath - http://www.allmath.ru 26. Math.ru - https://math.ru 27. National Academic Library of the Republic of Kazakhstan - http://kazneb.kz 28. Scientific Library of APU Named After K. Zhubanov - http://library.arsu.kz

Module Title	MMSPE 6305 Methods of mathematical statistics in pedagogical experiment(in Russian)
The semester(s) in which the module is taught	3
Instructor Responsible	Kokotova Yelena, Associate Professor of the Department of Mathematics
Language of Instruction	Russian
Curriculum Association	Profile discipline (PD), elective component (EC)
Modes of Instruction	Lectures, practical lessons, IWMS-T (Independent Work of Master's Student with Teacher), IWMS (Independent Work of Master's Student)
Workload (Including Contact Hours and Independent Study)	Total workload: 150 hours Contact hours: 45 hours (15 hours of lectures, 30 hours of practical lessons) Independent Study: 25 h IWMS-T, 80 h IWMS
ECTS	5
Prerequisites (Mandatory and Recommended)	To master this module, you need the knowledge, skills, and abilities acquired during the following course: "Probability Theory and Mathematical Statistics".
Module Objectives / Expected Learning Outcomes	The aim is to master the methods of statistical processing of the results of pedagogical research and to become acquainted with the possibilities of using information technologies in the processing of statistical data. The statistical criteria used in testing statistical hypotheses in the course of pedagogical research are studied. Undergraduates will become familiar with the methods of statistical processing of the results of pedagogical experiments, both parametric and nonparametric, and the possibilities of implementing calculations using software tools. It is expected that after completing the course, undergraduates should: 1. be able to present statistical data in various ways and analyze them using methods of mathematical statistics; 2. be able to apply statistical methods to test hypotheses, analyze, and interpret the results of pedagogical experiments; 3. be able to use software tools when processing the results of pedagogical experiments using methods of mathematical statistics.
Content summary	Statistical methods in pedagogical research. Pedagogical conditions for the use of statistical methods in research. Sampling methods in pedagogical research. The use of measurement scales in pedagogical research. Typical data analysis tasks. Descriptive statistics indicators and their interpretation. Graphical representation of data. The concept of hypotheses in pedagogical research. Statistical criteria for hypothesis testing in pedagogical research. Identifying differences in the level of a trait. Assessing the reliability of a trait level shift. The Mann–Whitney U-test. Jonckheere's trend test. The sign test. The Wilcoxon signed-rank test. Page's trend test. Identifying differences in trait distributions. Pearson's chi-squared test. The Kolmogorov–Smirnov test. Multifactorial tests. Fisher's F-test (angular transformation). Parametric statistical methods. Student's t-test for independent and dependent samples. Capabilities of the MS Excel spreadsheet processor and Mathcad environment for calculating statistical characteristics and testing hypotheses. Calculating descriptive statistics using the "Pedagogical Statistics" program. Specialized software for statistical data processing (STADIA, STATISTICA). Fundamentals of regression and correlation analysis. One-way and two-way analysis of variance. Implementation using the Data Analysis Toolpak in MS Excel.
Examination Format	Essay
Learning and Examination Requirements	Magistrants are required to attend all classes according to the schedule; preliminary preparation for classes, study of recommended literature; active participation in lectures, active work in practical classes, timely completion and delivery of independent work and homework assignments; passing all types of control.

List of literature	**Core reading** 1. Gmurman V. E. *Probability Theory and Mathematical Statistics: Textbook*. Moscow: Higher Education; Yurayt, 2015. 2. Gmurman V. E. *A Guide to Solving Problems in Probability Theory and Mathematical Statistics*. Moscow: Yurayt, 2023. 3. Lebedev A. V., Fadeeva L. N. *Probability Theory and Mathematical Statistics: Textbook*. Moscow, 2018. – 480 p. 4. Shpakov P. S., Popov V. N. *Statistical Processing of Experimental Data*. Moscow: MGSU, 2003. 5. Starichenko B. E. *Processing and Presentation of Pedagogical Research Data Using a Computer*. Ural State Pedagogical University. Yekaterinburg, 2004. – 218 p. 6. Novikov D. A. *Statistical Methods in Pedagogical Research*. Moscow: MZ-Press, 2004. 7. Ivanchuk N. V. *Mathematical Methods in Pedagogical Research*. Murmansk: UIA Publishing House, 2024. 8. Khristidis T. V., Navashina M. S. *Methods of Mathematical Statistics in Pedagogical Research: Theory and Practice of Application // Bulletin of the Moscow State University of Culture and Arts*. 2023. No. 2 (112). pp. 111–122. 9. Matalytskiy M. A., Khatskevich G. A. *Probability Theory and Mathematical Statistics*. Minsk: Higher School, 2017. 10. Plis A. I., Slivina N. A. *Mathcad Mathematical Workshop for Engineers and Economists*. Moscow: Finance and Statistics, 2003. 11. Vadzinsky R. *Statistical Calculations in the Excel Environment. The User's Library*. St. Petersburg: Peter, 2008. – 608 p. 12. Gorelova G. V., Katsko I. A. *Probability Theory and Mathematical Statistics in Examples and Problems Using Excel*. Rostov-on-Don: Phoenix, 2006. – 478 p. 13. Lyalin A. V. *Application for Statistical Analysis in Pedagogy // Modern Scientific Research and Innovations*. 2018. No. 1. [Electronic resource]. URL: https://web.snauka.ru/issues/2018/01/85640 14. Dalinger V. A., Simonzhenkov S. D., Galyukshov B. S. *Probability Theory and Mathematical Statistics Using Mathcad: Textbook and Practical Course for Applied Bachelor's Degree*. Moscow: Yurayt Publishing House, 2016. – 145 p. 15. Ivanovskiy R. I. *Probability Theory and Mathematical Statistics: Fundamentals, Applied Aspects with Examples and Tasks in the Mathcad Environment*. St. Petersburg: BHV-Petersburg, 2008. – 528 p. **Supplementary reading** 16. Andronov A. M., Kopytov E. A., Gringlaz L. Ya. *Probability Theory and Mathematical Statistics*. St. Petersburg: Peter, 2004. – 461 p. 17. Grabar M. I., Krasnianskaya K. A. *Application of Mathematical Statistics in Pedagogical Research: Nonparametric Methods*. Moscow: Pedagogika, 1977. 18. Vukolov E. A. *Fundamentals of Statistical Analysis: A Workshop on Statistical Methods and Operations Research Using the STATISTICA and Excel Packages: Textbook*. 2nd ed., revised and expanded. Moscow: Forum, 2008. – 464 p. 19. Borovikov V. P. *A Popular Introduction to Modern Data Analysis in the STATISTICA System*. Moscow: Hotline–Telecom, 2013. – 288 p. 20. Khalafyan A. A., Borovikov V. P., Kalaidina G. V. *Probability Theory, Mathematical Statistics and Data Analysis: Fundamentals of Theory and Practice on a Computer. STATISTICA. EXCEL*. 2017. – 320 p. **Electronic resources:** 1. Computer program *Statistics in Pedagogy*. URL: http://www.mtas.ru/uploads/stat.zip 2. Desmos Graphing Calculator. A web application. URL: https://www.desmos.com/calculator?lang=ru

	3. GEOGEBRA – Probabilistic, Scientific, Graphical Calculator. URL: https://www.geogebra.org/calculator 4. Trial version of specialized STATISTICA products. URL: https://statsoftstatistica.ru/ 5. Free 30-day trial of *Mathcad Prime*. URL: https://www.mathcad.com/en/try-and-buy/mathcad-express-free-download 6. Free version for self-learning – *STADIA 8.0*. URL: http://statsoft.msu.ru/Podr2~1.htm 7. Help Center – Information about the features and functions of PTC Mathcad Prime. URL: https://support.ptc.com/help/mathcad/r9.0/ru/index.html#page/PTC_Mathcad_Help/about_the_mathcad_help_center.html#

Module designation	AMSPDE 6306 Approximate methods for solving problems of differential equations
The semester(s) in which the module is taught	4
Responsible teacher	Mynbayeva S. T.
Language of instruction	Kazakh
Connection with the curriculum	Profile discipline (PD), elective component (EC)
Forms of training	Lectures, practical lessons, IWMS-T (Independent Work of Master's Student with Teacher), IWMS (Independent Work of Master's Student)
Training load (including contact hours, SRS)	Total workload: 150 hours Contact hours: 45 hours (15 hours of lectures, 30 hours of practical lessons) Independent Study: 25 h IWMS-T, 80 h IWMS
ECTS	5
Prerequisites (Mandatory and Recommended)	Digital Technologies in Education (in Russian), differential equations(in English), fundamental problems of algebra, geometry and logic, fundamental problems of analysis (in English language)
The purpose of the module/expected learning outcomes	outcomes of students, approximation methods for solving applied problems, methods of mathematical modeling, sources of errors and methods of accuracy of results. A) Knows the basic concepts of approximate and numerical methods; is able to design algorithms for solving problems approximately; can compare the results of fundamental computational mathematics ideas; is capable of formulating results using approximate and numerical methods. B) Is able to prove theorems; knows the facts and methods related to the discipline; can demonstrate creativity, initiative, and design skills; is able to apply educational materials and conduct methodological analysis. C) Understands the basics of professional speech culture, both orally and in writing. D) Is ready to collaborate with colleagues and work in a team. E) Knows algorithms for solving various problems using differential equations to ensure the quality of the educational process at a particular stage of education in a specific institution; is prepared to use approximate and numerical methods
Content summary	Approximate methods for solving problems of differential equations" is one of the most important disciplines in the professional training of mathematicians. To address problems that arise in various fields of science, we explore the concepts of approximate solution methods and the challenges of their quantitative implementation using mathematical modeling and computational experiments.
Exam form	Essay
Requirements for teaching and exams	Regular attendance and active participation in lectures and practical lessons; timely completion of IWMS-T and IWMS assignments; preparation of essays and individual tasks; demonstration of theoretical knowledge and practical skills in applying approximate and numerical methods during the final exam.

List of literature	**Core reading** 1. Egorov, A. I. (2005). *Ordinary Differential Equations with Applications*. Moscow: FIZMATLIT. — 384 p. ISBN 5-9221-0553-1. (In Russian) 2. Nemytsky, V. V., & Stepanov, V. V. (1949). *Qualitative Theory of Differential Equations*. Moscow: Gos. Izd. Tehn. Teoriya Lit. — 551 p. (In Russian) 3. Arnold, V. I. (2012). *Geometric Methods in the Theory of Ordinary Differential Equations*. Moscow: ICNMO. (In Russian) 4. Mumford, D. (1966). *Lectures on Curves on Algebraic Surfaces*. Retrieved from https://rmebrk.kz/book/1158107 5. Berdishchev, A., & Kadykulov, B. (2007). *Educational and Methodical Complex on the Discipline Additional Chapters of Differential Equations*. Retrieved from https://rmebrk.kz/book/1158107 6. *Additional Chapters of Geometry*. (2012). (In Russian). Retrieved from https://rmebrk.kz/book/1143967 7. Zuev, A. L., & Buryachenko, E. A. (2007). *Qualitative Theory of Differential Equations*. Donetsk: DonNU Publishing. — 50 p. (In Russian) 8. Ulanov, B. V. (2011). *Questions of Teaching Methods for the Elective Discipline "Additional Chapters of Differential Geometry and Topology"*. (In Russian). Retrieved from https://rmebrk.kz/book/38542 9. Venkateshan, S. P., & Swaminathan, P. (2014). *Boundary Value Problems (ODE)*. In *Computational Methods in Engineering* (Chapter 11, pp. 447–512). 10. Yang, W. (2014). *Reflection Seismology: Integral Solutions of the Wave Equation with Boundary and Initial Value Conditions—Theory, Data Processing, and Interpretation* (Chapter 5, pp. 107–134). 11. Fletcher, S. J. (2023). *Numerical Solutions to Initial Value Problems*. In *Data Assimilation for the Geosciences: From Theory to Application* (Second Edition, Chapter 8, pp. 285–326). **Supplementary reading** 12. Tikhonov, A. N., Vasilyeva, A. B., & Sveshnikov, A. G. (2001). *Differential Equations*. Moscow: Nauka Publishing. — 232 p. 13. Naimark, M. A. (2000). *Linear Differential Operators*. Moscow: Nauka Publishing. — 526 p. (In Russian) 14. Samoylenko, A. M., & Ronto, N. I. (1986). *Numerical and Analytical Methods for Studying Solutions to Boundary Value Problems* [*Chislenno-analiticheskie metody issledovaniya resheniy kraevykh zadach*]. Kiev: Naukova Dumka Publishing. — 384 p. 15. Dzhumabaev, D. S. (1989). Signs of Unambiguous Solvability of a Linear Boundary Value Problem for an Ordinary Differential Equation. *Matematika i Matematicheskaya Fizika*, 29(1), 50–66. 16. (2007). On the Correct Solvability of a Two-Point Boundary Value Problem for Loaded Differential Equations. *Mathematical Journal of Almaty*, 5(4), 25–33. 17. (2009). Algorithms for Finding an Approximate Solution of a Linear Two-Point Boundary Value Problem for Systems of Integro-Differential Equations. In *Proceedings of the International Conference "Differential Equations and Mathematical Models of Electrical Phenomena"*, Almaty: KBTU, January 13–15, p. 15. 18. (2009). On the Unique Solvability of a Two-Point Boundary Value Problem for Systems of Integro-Differential Equations. *Izvestiya of the National Academy of Sciences of the Republic of Kazakhstan. Series of Physical and Mathematical Sciences*, (5), 47–51. **Electronic resources:** 19. Ministry of Education of the Republic of Kazakhstan — http://www.edu.gov.kz/ru/19 20. Electronic Library of APU named after K. Zhubanov — https://neb.arsu.kz 21. Epigraph Digital Library Database — https://elib.kz 22. Multimedia Textbook "Epigraph" — https://mbook.kz 23. "Smart Kitap" Interactive Platform — https://web.smart-kitap.kz 24. RZHOAEK Information System — https://rmebrk.kz 25. Republican Scientific and Technical Library — https://aktobe.rntb.kz 26. *Methods of Variational Slope and Efficiency*. RMEB, 2009.

	27. National Academic Library of the Republic of Kazakhstan — http://kazneb.kz 28. Scientific Library of APU named after K. Zhubanov — http://library.arsu.kz 29. Besbaev, G. A., & Meldebekova, S. K. (2020). *Scientific Library of APU named after K. Zhubanov* (in Russian). 142 p. Available at: https://elib.kz 30. Ettel, V. A. (2020). *Optimization Methods*. 81 p.

Module designation	AAAMM 6307 Applied aspect of the application of mathematical methods (in Kazakh)
The semester(s) in which the module is taught	4
Responsible teacher	Nugayeva Z.T.
Language of instruction	Kazakh
Connection with the curriculum	Profile discipline (PD), elective component (EC)
Forms of training	Lectures, practical lessons, IWMS-T (Independent Work of Master's Student with Teacher), IWMS (Independent Work of Master's Student)
Training load (including contact hours, SRS)	Total workload: 150 hours Contact hours: 45 hours (15 hours of lectures, 30 hours of practical lessons) Independent Study: 25 h IWMS-T, 80 h IWMS
ECTS	5
Prerequisites (Mandatory and Recommended)	Interactive Methods of Teaching Mathematics in Higher Education (in Russian); Fundamental questions of algebra, geometry and logic (in Kazakh).
The purpose of the module/expected learning outcomes	The course aims to reveal the essence of the applied aspect of mathematical methods and to develop skills in solving applied problems using mathematical methods. Learning Outcomes: A) Understand the concept of "mathematical methods", their role and significance in science and the educational process; B) Be able to apply mathematical modeling methods in solving various applied problems and issues of mathematics education; C) Be able to use the axiomatic method in constructing minor theories; D) Possess the ability for professional and independent learning, as well as for designing a further educational trajectory in the chosen field; E) Be able to competently apply knowledge and skills, and understand the importance of acquired knowledge for one's future profession.
Content summary	Classification of mathematical methods. Role and significance of mathematical methods in science. Role and significance of mathematical methods in mathematics education. Mathematical modeling method and examples of its application. Axiomatic method and examples of its application, construction of minor theories. Project defense.
Exam form	Project defense
Requirements for teaching and exams	Mandatory attendance of both online and in-person classes, active participation in discussions, prior preparation for lectures and practical classes, timely and high-quality completion of assignments, and participation in all forms of assessment.

List of literature	**Core reading** 1. Khan, D. I. (2013). *Selected Theorems in Planimetry and Construction Problems: A Textbook*. Astana: Foliant. — 336 p. 2. Nestorovich, N. M. (1951). *Geometric Constructions in the Lobachevsky Plane: With 423 Problems on Calculation and Construction*. Moscow: Gostekhizdat. — 304 p. 3. Klimukhin, A. G. (1982). *Problem Book on Descriptive Geometry: A Textbook*. Moscow: Stroyizdat. — 216 p. 4. Kiselev, G. M., & Bochkova, R. V. *Information Technologies in Pedagogical Education*. Retrieved from https://neb.arsu.kz/kk/view?rid=5531&fid=5516 5. Pashchenko, O. I. *Information Technologies in Education*. Retrieved from https://neb.arsu.kz/kk/view?rid=5516&fid=5501 6. Uvarov, A. Yu. *On the Path to Digital Transformation of Schools*. Retrieved from https://neb.arsu.kz/kk/view?rid=9425&fid=9406 **Supplementary reading** 1. Ivanchuk, N. V., Eyken, O. V., Martynova, E. V., Samylova, Yu. V., & Danko, O. E. (2008). *Using the GeoGebra Software in Mathematics Lessons for Grades 7–11: A Methodological Guide*. Murmansk: Murmansk State Pedagogical University. — 36 p. 2. Dalinger, V. A. (2024). *Geometry: Stereometric Construction Problems: A Textbook for Secondary Vocational Education* (2nd ed.). Moscow: Yurayt Publishing. 3. Bekboev, I., Abdiev, A., Qaydasov, Zh., & Dosmagambetova, G. (2016). *Geometry. Grade 7*. Almaty: Mektep. 4. Shynybekov, Á. N. (2019). *Geometry. Grades 8 and 9*. Almaty: Atamura. 5. Alexandrov, I. I. (2010). *Collection of Geometric Construction Problems (with Solutions)* (20th ed., Edited by N. V. Naumovich). Moscow: KomKniga. — 176 p.