

LEARNING OUTCOMES FOR *MATHEMATICS*

studies of second degree; education profile: general academic

Placing the field of *mathematics* within other disciplines

The field of *mathematics* offered by Faculty of Mathematics, Computer Science and Econometrics at the University of Zielona Góra, has been placed within the discipline of Formal Sciences.

Code	Upon successful completion of second degree studies in the field of <i>mathematics</i> , students:	Relation to discipline-specific learning outcomes
KNOWLEDGE		
K_W01	demonstrate deepened knowledge of basic branches of mathematics	X2A_W01
K_W02	know different proving techniques; understand the significance of proof in mathematics	X2A_W01 X2A_W03
K_W03	are familiar with basic theorems from main branches of mathematics	X2A_W01
K_W04	demonstrate in-depth knowledge of a selected branch of theoretical or applied mathematics, in particular 1) know most of classical definitions and theorems and proofs for them	X2A_W01
K_W05	2) understand concepts and issues of research in progress	X2A_W06
K_W06	3) know relations between a selected academic discipline and other branches of theoretical and applied mathematics	X2A_W02
K_W07	are familiar with and understand basic concepts of real complex analysis, such as: Lebesgue measure and integral, Laurent and Fourier series, residue	X2A_W01 X2A_W02 X2A_W03 X2A_W04
K_W08	are familiar with and understand basic concepts of functional analysis, such as: Hilbert space, Banach space, linear continuous spectrum operator	X2A_W01 X2A_W02 X2A_W03

K_W09	are familiar with and understand basic concepts of algebraic topology and differential geometry, such as: simplicial division, basic group, Euler characteristics, parallel transport, curvature	X2A_W01 X2A_W02 X2A_W03
K_W10	are familiar with and understand basic concepts and methods of solving partial differential equations; know applications of such equations	X2A_W01 X2A_W02 X2A_W03 X2A_W04
K_W11	know numerical methods used to find approximate solutions to mathematical problems (e.g. differential equations) raised by applied sciences, such as: industrial technologies, management	X2A_W02 X2A_W05
K_W12	are familiar with basic concepts and methods of discrete mathematics used in computer science; know what a Turing machine is and understand the significance of the concept	X2A_W01 X2A_W02 X2A_W03 X2A_W04
K_W13	have achieved English language proficiency equivalent to level B2 of European Framework of Reference for Languages and are familiar with specialist terminology used in mathematical papers	X2A_W01 X2A_W06
K_W14	demonstrate knowledge of principles of occupational health and safety sufficient to carry out tasks of a mathematician	X2A_W07
K_W15	have basic knowledge of the law and ethics related to scientific research activities, teaching, and copyright law	X2A_W08 X2A_W09
SKILLS		
K_U01	demonstrate the ability to construct a line of mathematical reasoning; prove theorems and refute hypotheses by means of generating and choosing counterarguments	X2A_U01 X2A_U02 X2A_U05
K_U02	demonstrate the ability to present mathematical issues, both in speech and writing, in mathematical texts of different types	X2A_U03 X2A_U05
K_U03	demonstrate the ability to check correctness of conclusions established while constructing formal proofs	X2A_U01 X2A_U02
K_U04	recognize, in mathematical problems, formal structures relating to basic branches of mathematics and understand the significance of their properties	X2A_U03
K_U05	can effectively use tools of analysis, such as differential and integral calculus (in particular curvature and area integral), elements of complex and Fourier analysis	X2A_U01
K_U06	know methods of solving classical ordinary and partial differential equations, can apply them to typical practical issues	X2A_U01
K_U07	are familiar with Lebesgue measure and integral; can apply concepts of measure theory to typical theoretical and practical issues	X2A_U01

K_U08	recognize topological structures in mathematical objects occurring in geometry or mathematical analysis; have the ability to use basic topological properties of sets, functions and transformations	X2A_U01
K_U09	use the language and methods of functional analysis and demonstrate the ability to apply them to problems in mathematical analysis and its applications, in particular use the properties of classical Banach and Hilbert spaces	X2A_U01
K_U10	can apply algebraic methods (in particular linear algebra) to solving problems relating to different branches of mathematics and practical problems	X2A_U01
K_U11	can find simple characteristic numbers, local and global, of a surface, such as Ricci curvature, Gauss curvature, Euler characteristic	X2A_U01
K_U12	have achieved English language proficiency relevant to the language of mathematics and equivalent to level B2 of the Common European Framework of Reference for Languages	X2A_U08 X2A_U09 X2A_U10
K_U13	can - on an advanced level including modern mathematics – apply and present both in speech and writing methods of at least one of the following branches of mathematics: mathematical analysis, functional analysis, differential equation and dynamic system theories, algebra, number theory, geometry and topology, probability theory and statistics, discrete mathematics and graph theory, logic and multiplicity theory	X2A_U01 X2A_U05 X2A_U08 X2A_U09
K_U14	are able to construct proofs in a selected branch of mathematics, and if necessary use tools from other branches of mathematics	X2A_U01
K_U15	can apply tools used in computer science to solve mathematical problems, e.g. partial differential equations problems	X2A_U01 X2A_U02
K_U16	recognize mathematical structures (e.g. algebraic, geometric) in physical theories	X2A_U04
K_U17	demonstrate the ability to popularize achievements in the field of higher mathematics	X2A_U06
K_U18	are able to obtain information concerning latest achievements in mathematics independently, also in foreign languages	X2A_U07
K_U19	are able to precisely formulate questions which will be used to deepen their understanding of a given topic or to find missing elements of reasoning	X2A_U02
SOCIAL COMPETENCES		
K_K01	understand the need for lifelong education, are able to organize learning process of other people	X2A_K01

K_K02	are able to work in a team; understand the importance of systematic work on long term projects	X2A_K02 X2A_K05 X2A_K06
K_K03	understand the significance of intellectual honesty, both in their own and in other people's activities; demonstrate ethical behavior	X2A_K03 X2A_K04
K_K04	demonstrate the ability to formulate opinions concerning important mathematical issues	X2A_K07