

Subject card

Subject name and code	Mathematical Analysis I, PG_00188701						
Field of study	Mathematics						
Date of commencement of studies	October 2026		Academic year of realisation of subject		2026/2027		
Education level	Bachelor's studies		Subject group		Obligatory subject group in the field of study Subject group related to scientific research in the field of study		
Mode of study	full-time studies		Mode of delivery		at the university		
Year of study	1		Language of instruction		Polish		
Semester of study	1		ECTS credits		11.0		
Learning profile	academic		Assessment form		exam		
Conducting unit	Institute of Mathematics -> Faculty of Mathematics, Physics and Informatics -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Adam Kwela				
	Teachers		dr Iwona Krzyżanowska dr Szymon Myga dr Aleksandra Nowel dr hab. Adam Kwela				
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	60.0	60.0	0.0	0.0	0.0	120
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	120		6.0		149.0	275
Subject objectives	The aim of the subject Mathematical Analysis I is to familiarize students with the basic concepts of the theory of real and function sequences and series, as well as concepts related to the continuity of real functions of one real variable.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[MATL3_U02] is able to correctly use the concepts of mathematical analysis, differential equations and measure theory, is able to apply the theorems and methods of these fields and is able to interpret the obtained results	The student is able to present correct mathematical reasoning and apply the theorems and methods learned when analyzing functions of one variable.	[SU3] text preparation/written work
	[MATL3_U06] can formulate definitions and theorems in an understandable manner, both orally and in writing, and present correct mathematical reasoning on the learned topics	The student is able to clearly present, in speech and writing, correct mathematical reasoning concerning the concepts of mathematical analysis - functions of one variable.	[SU4] test/exam - oral or written
	[MATL3_W07] knows and understands at an advanced level the role and importance of proof in mathematics, as well as the concept of the importance of assumptions	The student knows and understands the selected theorems and proofs of theorems concerning the concepts of mathematical analysis, studied during the course, concerning functions of one variable defined on subsets of the real line	[SW4] test/exam - oral or written
	[MATL3_W02] knows and understands at an advanced level selected concepts, methods and theorems of mathematical analysis, differential equations and measure theory, as well as basic examples both illustrating specific concepts in this field and allowing to refute false hypotheses or invalid reasoning	The student knows and understands theselected theorems and proofs of theorems concerning the concepts of mathematical analysis of functions of one variable defined on subsets of the real line	[SW4] test/exam - oral or written
Subject contents	1. Propositional calculus and the laws of predicate calculus. Basic elements of set theory and topology. 2. Real numbers. Axiomatics of real numbers. Limits of sets. Sequences of real numbers. The concept of a sequence, monotonic sequences, bounded sequences. The limit of a sequence, the theorem on the limits of sums, products, and quotients of convergent sequences, the theorem on three sequences, limits of monotonic sequences. Cauchy's condition. Accumulation points of a sequence, lower and upper limits. Improper limits. 3. Number series. Convergence and the sum of a series, geometric series. Necessary condition for convergence of a series. Harmonic series. Basic criteria for the convergence of series with nonnegative terms. Absolute, unconditional, and conditional convergence. Dirichlet, Abel, and Leibniz criteria. Multiplication of series. 4. Real functions of a real variable. Cauchy and Heine's definition of the limit and continuity of a function. Uniform continuity. Properties of a continuous function on a closed interval. Improper limits. 5. The derivative of a function of one variable. The derivative and its geometric meaning. Derivatives of elementary functions. The derivative of a sum, product, quotient, and superposition of functions, the derivative of an inverse function. Higher-order derivatives, functions of class C^n . Necessary and sufficient conditions for the existence of a local extremum. Applications of differential calculus to the study of the variability of functions. L'Hopital's rule.		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	tests and quizzes	51.0%	50.0%
	observation of the student's attitude	51.0%	0.0%
	exam	51.0%	50.0%

Recommended reading	Basic literature	A. Basic bibliography: A.1 used in classes K. Kuratowski "Rachunek różniczkowy i całkowy", PWN Warszawa 1973. K. Jankowska, T. Jankowski "Zbiór zadań z matematyki" Wydawnictwo Politechniki Gdańskiej 2003 K. Jankowska, T. Jankowski "Zadania z matematyki wyższej" Wydawnictwo Politechniki Gdańskiej 2011 J. Banaś, S. Wędrychowicz, Zbiór zadań z analizy matematycznej, Wydawnictwo Naukowo-Techniczne, Warszawa 2001. W. Marek, J. Onyszkiewicz "Elementy logiki i teorii mnogości w zadaniach", PWN Warszawa 1978 A.2 studiowana by a student W. Krywicki, L. Włodarski, Analiza matematyczna w zadaniach, część I i II, PWN Warszawa 1986.
	Supplementary literature	G.M. Fichtenholz, Rachunek różniczkowy i całkowy, tom I, II i III. PWN Warszawa 1978.
	eResources addresses	
	Example issues/ example questions/ tasks being completed	not included
Work placement	Not applicable	

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