



## Subject card

Subject name and code	Mathematical Analysis, PG_00050156						
Field of study	Economic Analytics						
Date of commencement of studies	October 2021		Academic year of realisation of subject		2021/2022		
Education level	first-cycle studies		Subject group		Obligatory subject group in the field of study		
Mode of study	Full-time studies		Mode of delivery		blended-learning		
Year of study	1		Language of instruction		Polish		
Semester of study	2		ECTS credits		6.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Mathematics Center -> Vice-Rector for Education						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Natalia Jarzębkowska				
	Teachers		dr inż. Natalia Jarzębkowska				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	0.0	0.0	0.0	60
	E-learning hours included: 30.0						
	Adresy na platformie eNauczanie: WZiE - AG - Analiza matematyczna 2021/2022 (N.Jarzębkowska) - Moodle ID: 22532 <a href="https://enauczenie.pg.edu.pl/moodle/course/view.php?id=22532">https://enauczenie.pg.edu.pl/moodle/course/view.php?id=22532</a>						
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	60		12.0		78.0	150
Subject objectives	The aim of this subject is to obtain the students competence in the range of using the basic methods of mathematical analysis. Furthermore, the student is able to use this knowledge to solve simple theoretical and practical problems that can be found in finances, economic issues and in the fields of social sciences.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_W02] Knows how to describe economic phenomena using quantitative methods with the use of IT tools.	<p>Student names basic properties of elementary functions.</p> <p>Student defines the basic concepts of differential calculus of one variable function.</p> <p>Student defines the basic rules and techniques of integration to calculate indefinite integrals.</p> <p>Student defines the basic concepts of differential calculus of several variable function.</p> <p>Student defines the basic concepts of number series.</p> <p>Student combines knowledge of mathematics with knowledge from other fields.</p> <p>Student is able to process the acquired information, analyze and interpret it, draw conclusions and reason opinions.</p>	<p>[SW1] Assessment of factual knowledge</p> <p>[SW3] Assessment of knowledge contained in written work and projects</p>
	[K6_U08] Has the ability to use mathematical and IT tools to analyse economic phenomena and make decisions by economic entities.	<p>Students apply basic concepts and models of mathematical analysis</p> <p>Student solves equations and inequalities with elementary functions.</p> <p>Student solves exercises involving numerical sequences.</p> <p>Student evaluates the limits of functions.</p> <p>Student uses the first and second derivatives of a function to analyze its properties.</p> <p>Student applies the basic rules and techniques of integration to calculate indefinite integrals.</p> <p>Student uses definite integral to solve geometrical and economical problems.</p> <p>Student examines functions of several variables, using the concept of a limit, continuity and derivatives.</p> <p>Student determines convergence of number series.</p> <p>Student solves differential equations and difference linear equations.</p>	<p>[SU1] Assessment of task fulfilment</p> <p>[SU2] Assessment of ability to analyse information</p> <p>[SU4] Assessment of ability to use methods and tools</p>

Subject contents	LECTURES and TUTORIALS Functions of one variable and their properties. Elementary functions: absolute value, polynomials, rational, power, exponential, logarithmic, trigonometric, cyclometric - properties, graphs, solving equations and inequalities.  Infinite sequences - properties, limits. The limit and continuity of a function. Derivatives and differentials of first and higher orders. Rolle, Lagrange, de l'Hospital, Taylor-Maclaurin theorems. Monotonicity and local extrema. Convexity, concavity and inflexion points of a function. Asymptotes.  Integral calculus of one variable functions - antiderivatives. Fundamental rules of integration, substitution method, integration by parts. Integration of rational, trigonometric and irrational functions. Riemann definite integral. Newton-Leibniz theorem. Fundamental methods of definite integration. Geometric and economic examples of application. Improper integrals.  Number and power series.  Extrema of functions of two and several variables.  Differential and difference linear equations.  Constrained extrema.		
Prerequisites and co-requisites	Knowledge of the high school mathematics.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Class activity	50.0%	25.0%
	Midterm colloquium	50.0%	25.0%
	Final exam	50.0%	50.0%
Recommended reading	Basic literature	1. Wikieł B., Matematyka, Podstawy z elementami matematyki wyższej, Wydawnictwo PG, Gdańsk 2009  2. Dymkowska J., Beger D., Rachunek różniczkowy w zadaniach, Wydawnictwo PG, 2016  3. Dymkowska J., Beger D., Rachunek całkowy w zadaniach, Wydawnictwo PG, 2015  4. Batóg B., Bieszk-Stolorz B., Foryś I., Guzowska M., Heberlein K., Matematyka dla kierunków ekonomicznych, Teoria, przykłady, zadania, Wydawnictwo Difin 2016	
	Supplementary literature	1. Banaś J., Podstawy matematyki dla ekonomistów, Wydawnictwa Naukowo-Techniczne, Warszawa  2. Gewert M., Skoczylas Z., Analiza matematyczna 1, Definicje, twierdzenia wzory, Wydawnictwo GiS, Wrocław  3. Gewert M., Skoczylas Z., Analiza matematyczna 2, Definicje, twierdzenia wzory, Wydawnictwo GiS, Wrocław  4. Jankowska K., Jankowski T., Zbiór zadań z matematyki, PG Gdańsk	
	eResources addresses	WZiE - AG - Analiza matematyczna 2021/2022 (N.Jarzębkowska) - Moodle ID: 22532 <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=22532">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=22532</a>	
Example issues/ example questions/ tasks being completed	Find the derivatives of the following functions . Find local extremes and intervals of monotonicity of the following function $f(x)=$ . Sketch the graph of the function $f(x)$ . Identify any local extrema and points of inflection Evaluate the indefinite integral of the given rational function . Find the area between the two curves $y=$ and $y=$ from $x=$ to $x=$ . Calculate definite integrals of the following functions using methods of integration by parts or by substitution. Identify any local extremes of function of two/three variables. Find the absolute extrema of the function $f(x,y)$ on the compact set D. Check whether the given series is convergent using the ratio test, the root test, the comparison test or the integral test. Determine radius and domain of convergence of a power series. Determine global extrema of functions of two / three variables on a convex set D. Solve the initial problem for linear differential equation of second order.		
Work placement	Not applicable		