



## Subject card

Subject name and code	Mathematical Analysis, PG_00037160						
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	Part-time studies	Mode of delivery			at the university		
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 Lech Kujawski					
	Teachers	dr Lech Kujawski					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	16.0	16.0	0.0	0.0	0.0	32
	E-learning hours included: 0.0						
	Adresy na platformie eNauczanie:						
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	32	10.0		108.0	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
	<p>[K6_U08] Has the ability to use mathematical and IT tools to analyse economic phenomena and make decisions by economic entities.</p>	<p>Students apply basic concepts and models of mathematical analysis. The student examines the functions and sketches their graphs. Student efficiently calculates integrals. Student uses mathematical analysis methods to examine the financial processes and solving economic issues. Student can use mathematical tables.</p>	<p>[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment</p>
	<p>[K6_W02] Knows how to describe economic phenomena using quantitative methods with the use of IT tools.</p>	<p>Student mentions basic properties of elementary functions. Student solves equations and inequalities with elementary functions. Student defines basic notions of differential calculus of one variable functions. Student examines functions of one variable, using the concept of limit, continuity and derivatives. Student applies the basic rules and techniques of integration to calculate indefinite integrals. Student uses definite integral to solve geometrical and economical tasks.</p> <p>Student analyses properties of a given function of two or three variables using differential calculus of several variables functions. Student studies convergence of number series Student uses power series in order to compute sums of number series. Student mentions basic properties of elementary functions. Student solves equations and inequalities with elementary functions. Student defines basic notions of differential calculus of one variable functions. Student examines functions of one variable, using the concept of limit, continuity and derivatives. Student applies the basic rules and techniques of integration to calculate indefinite integrals. Student uses definite integral to solve geometrical and economical tasks.</p> <p>Student analyses properties of a given function of two or three variables using differential calculus of several variables functions. Student studies convergence of number series. Student uses power series in order to compute sums of number series. Student solves differential and difference linear equations. Student determines local and global extremes of functions of several variables. Student determines local and global extrema of functions of several variables. Student uses the method of Lagrange multipliers to determine the constrained extrema.</p> <p>Student is able to process the acquired information, analyze and interpret it, draw conclusions and reason opinions.</p>	<p>[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge</p>

Subject contents	<p>LECTURES and TUTORIALS</p> <p>Functions of one variable and their properties. Elementary functions: absolute value, polynomials, rational, power, exponential, logarithmic, trigonometric, cyclometric - properties, graphs, solving equations and inequalities.</p> <p>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.</p> <p>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 applications. Improper integrals.</p> <p>Number and power series.</p> <p>Extrema of functions of two and several variables.</p> <p>Differential and difference linear equations.</p> <p>Constrained extrema.</p>														
Prerequisites and co-requisites	Knowledge of the high school mathematics.														
Assessment methods and criteria	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 40%;">Subject passing criteria</th> <th style="width: 30%;">Passing threshold</th> <th style="width: 30%;">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td>Written exam</td> <td>50.0%</td> <td>50.0%</td> </tr> <tr> <td>Midterm colloquium</td> <td>50.0%</td> <td>25.0%</td> </tr> <tr> <td>Class activity</td> <td>50.0%</td> <td>25.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Written exam	50.0%	50.0%	Midterm colloquium	50.0%	25.0%	Class activity	50.0%	25.0%
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Basic literature	<ol style="list-style-type: none"> <li>1. Wikeł B., Matematyka, Podstawy z elementami matematyki wyższej, Wydawnictwo PG, Gdańsk 2009</li> <li>2. Batóg B., Bieszk-Stolorz B., Foryś I., Guzowska M., Heberlein K., Matematyka dla kierunków ekonomicznych, Teoria, przykłady, zadania, Wydawnictwo Difin 2016</li> <li>3. Dymkowska J., Beger D., Rachunek całkowy w zadaniach, Wydawnictwo PG, 2015</li> </ol>														
Supplementary literature	<ol style="list-style-type: none"> <li>1. Dymkowska J., Beger D., Rachunek różniczkowy w zadaniach, Wydawnictwo PG, 2016</li> <li>2. Banaś J., Podstawy matematyki dla ekonomistów, Wydawnictwa Naukowo-Techniczne, Warszawa</li> <li>3. Gewert M., Skoczylas Z., Analiza matematyczna 1, Definicje, twierdzenia wzory, Wydawnictwo GiS, Wrocław</li> <li>4. Gewert M., Skoczylas Z., Analiza matematyczna 2, Definicje, twierdzenia wzory, Wydawnictwo GiS, Wrocław</li> <li>5. Jankowska K., Jankowski T., Zbiór zadań z matematyki, PG Gdańsk</li> </ol>														
eResources addresses															

<p>Example issues/ example questions/ tasks being completed</p>	<p>Find the derivatives of the following functions .</p> <p>Find local extremes and intervals of monotonicity of the following function <math>f(x)=</math> .</p> <p>Sketch the graph of the function <math>f(x)</math>. Identify any local extrema and points of inflection</p> <p>Evaluate the indefinite integral of the given rational function .</p> <p>Find the area between the two curves <math>y=</math> and <math>y=</math> from <math>x=</math> to <math>x=</math> .</p> <p>Calculate definite integrals of the following functions using methods of integration by parts or by substitution.</p> <p>Identify any local extremes of function of two/three variables.</p> <p>Find the absolute extrema of the function <math>f(x,y)</math> on the compact set <math>D</math>.</p> <p>Check whether the given series is convergent using the ratio test, the root test, the comparison test or the integral test.</p> <p>Determine radius and domain of convergence of a power series.</p> <p>Determine global extrema of functions of two / three variables on a convex set <math>D</math>.</p> <p>Solve the initial problem for linear differential equation of second order.</p>
<p>Work placement</p>	<p>Not applicable</p>

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