

Subject card

Subject name and code	Mathematical Applications in Economics and Management, PG_00198726						
Field of study	International Business						
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			English		
Semester of study	1	ECTS credits			5.0		
Learning profile	academic	Assessment form			exam		
Conducting unit	Department of Microeconomics -> Faculty of Economics -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Leszek Czerwonka				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	30.0	0.0	30.0	0.0	75
	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	75		0.0		50.0	125
Subject objectives	Acquainting students with the introduction to higher mathematics and its applications in economics and management. Use of academic English language, references and vocabulary.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[[IBL3_W03] knows and understands at an advanced level selected research methods and tools, including information technologies and techniques for data collection and analysis used in the study of economic and business phenomena.		The student is acquainted with selected methods and tools, including IT tools and data acquisition techniques, as well as mathematical methods that make it possible to describe and analyse economic entities operating on the international market.		[SW4] test/exam - oral or written		
	[[IBL3_U02] is able to formulate and solve complex problems related to international business by applying quantitative and qualitative research methods used in economics, finance and international business.		The student is able to formulate and solve complex and unusual problems related to international business, using mathematical methods and tools as well as advanced information techniques also applied in the field of international business, economics and finance.		[SU4] test/exam - oral or written		

Subject contents	<p>1. Matrix algebra Matrix operations, basic properties of determinants, finding the inverse matrix, Cramer's formula, application to market and national income models (matrix notation and model solution)</p> <p>2. Sequences and series Concept of a numerical sequence, arithmetic and geometric sequences, convergence of a sequence, operations on the limits of sequences, concept of a numerical series, sum of a series, application to the calculation of the present value of cash flows (elements of financial mathematics)</p> <p>3. Functions of one and many variables Basic elementary functions, graph of a function, inverse representation, monotonicity, limit of a function, continuity of a function, convexity and concavity of a function</p> <p>4. Elements of differential calculus Rules of differentiation for functions of one variable, local extrema of functions of one variable, elasticity of functions, marginal calculus, maximisation of economic result, rules of differentiation for functions of many variables, optimisation of functions of many variables, conditional extremum, minimisation of costs by Lagrange multipliers method</p> <p>5. Integral calculus Concept of primary function, definite and indefinite integral, method of integration by parts, method of integration by substitution, applications in marginal calculus and financial mathematics</p> <p>6. Differential equations Differential equations, application of differential equations in economic growth models.</p> <p>As part of supporting the learning process, consultations will be used to clarify more complex issues related to the lecture topics.</p>		
Prerequisites and co-requisites	Recommended knowledge in mathematics: Functions of One Variable, Functions of Many Variables, Foundations of Differential Calculus, Solving Systems of Linear Equations		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
		51.0%	100.0%
Recommended reading	<p>Basic literature</p> <p>Supplementary literature</p> <p>eResources addresses</p>	<p>1. Babula E., Czerwonka L. (ed.), Zastosowanie matematyki w ekonomii i zarządzaniu-Mathematical Applications in Economics and Management, Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk 2015.</p> <p>2. Bradley T., Essential mathematics for economics and business, Wiley, 2013.</p> <p>3. Wisniewski M., Mathematics for economics, Palgrave Macmillan, 2013.</p> <p>4. Barnett R.A., Ziegler M.R., Byleen K.E., College Mathematics for Business, Economics, Life Sciences, and Social Sciences, Pearson Prentice Hall, Upper Saddle River, New Jersey 2008.</p> <p>5. Werner F., Sotskov Y., Mathematics of Economics and Business, Routledge, Abingdon 2006.</p> <p>1. Czerwonka L., Mathematical Models of Mergers: Conditions of Application and Conclusions [in:] Market Concentration and Economy, Series of Monographs, Vol. 7, Macro & Microeconomics Case Studies, T. Bernat (ed.), Publishing House Volumina.pl Daniel Krzanowski, Szczecin 2010, pp. 206-219.</p>	
Example issues/ example questions/ tasks being completed	The determinant of matrix of order $(n - 1)$ obtained by deleting row i and column j of matrix A of order n is called ...		
Work placement	Not applicable		

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