University of Gdańsk

Subject card

Subject name and code	Mathematical Applications in Economics and Management, PG_00204867		
Field of study	International Economic Relations		
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	part-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	1	ECTS credits	9.0
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, prof. UG	
	Teachers	dr Marcin Brycz dr hab. Leszek Czerwonka, prof. UG	

Lesson types							
	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	20.0	20.0	0.0	0.0	0.0	40
	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	40	4.0	181.0	225

Subject objectives	Introducing students to the fundamentals of higher mathematics and its applications in economics and management.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[MSGL3_W10] has an advanced understanding of selected methods and tools, including IT tools and data acquisition techniques, which make it possible to describe and analyse economic entities operating on the international market; knows the processes and phenomena occurring in them and between them, and processes supporting decision-making	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, and is acquainted with processes and phenomena in and between them, as well as processes supporting decision-making.	[SW4] test/exam - oral or written
	[MSGL3_K05] correctly identifies, diagnoses and solves dilemmas and various options of solutions related to the profession	The student correctly identifies, diagnoses and resolves dilemmas and different solution options, based on knowledge of mathematical methods, related to the profession.	[SK4] test/exam - oral or written
	[MSGL3_U02] can assess economic and social phenomena occurring in an open economy, interpret necessary statistical data and economic indicators, as well as forecast economic phenomena and processes, using standard methods and tools applied in economic sciences	The student is able to evaluate economic and social phenomena taking place in an open economy, interpret statistical data and economic indicators necessary in this respect, as well as forecast economic phenomena and processes using standard methods and tools applied in economic sciences, in conjunction with knowledge of mathematical methods.	[SU4] test/exam - oral or written
	[MSGL3_W01] has an advanced knowledge of economic sciences, in particular of economics and its place in the system of sciences, including within related disciplines	The student has an advanced knowledge of economic sciences, in particular economics and its place in the system of sciences, including within related scientific disciplines and its relationship to mathematics.	[SW4] test/exam - oral or written

Subject contents	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) 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) 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 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 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 6. Difference and differential equations First order difference equations, cobweb model, differential equations, application of differential equations in economic growth models. Questions that arise during the reflection and repetition of the course content or interpretative problems accompanying it will also be addressed during office hours. To pass the course, students must achieve at least 51% of the total marks from the classes and 51% of the marks from the final exam. The final mark is awarded based on the total marks from both the class and lecture components.
Prerequisites and co-requisites	Knowledge and skills in secondary school mathematics.
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Assessment for the class is based on a test.	51.0%	50.0%
An exam is held on the lecture component, which takes the form of a written test.	51.0%	50.0%

Recommended reading	Basic literature	1. Babula E., Czerwonka L. (red.), Zastosowanie matematyki w ekonomii i zarządzaniu, Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk 2015. 2. Blajer-Gołębiewska A., Czerwonka L., Pankau E., Zielenkiewicz M., Ekonomia matematyczna w zadaniach, red. T. Kamińska, Wyd. UG, Gdańsk 2010.

	Supplementary literature	1. Czerwonka L., Matematyczne modele połączeń przedsiębiorstw uwzględniające czynniki menedżerskie, "Pieniądze i Więź. Kwartalnik Naukowy", 2009, nr 3, s. 81-88. 2. Czerwonka L., Zastosowanie matematycznych modeli fuzji egzogenicznych, "Pieniądze i Więź. Kwartalnik Naukowy", 2008, nr 1, s. 133-140. 3. Chiang A.C., Podstawy ekonomii matematycznej, PWE, Warszawa 1994. 4. Matłoka M., Matematyka dla ekonomistów, Wyd. AE w Poznaniu, Poznań 2008. 5. Ostoja-Ostaszewski A., Matematyka w ekonomii. Modele i metody t. 1 i 2, Wydawnictwo Naukowe PWN, Warszawa 2006. 6. Piszczała J., Matematyka i jej zastosowanie w naukach ekonomicznych, Wydawnictwo AE w Poznaniu, Poznań 2008.
	eResources addresses	
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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