University of Gdańsk

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, prof. UG	
	Teachers	dr hab. Leszek Czerwonka, prof. UG dr Elżbieta Babula	

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_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.	[SU2] presentation/project/paper/ report [SU4] test/exam - oral or written
[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 [SW2] presentation/project/paper/ report

<table>
<tr><td>Subject contents</td><td>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. Differential equations
Differential equations, application of differential equations in economic growth models.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Recommended knowledge in mathematics: Functions of One Variable, Functions of Many Variables, Foundations of Differential Calculus, Solving Systems of Linear Equations</td></tr>
<tr><td>Assessment methods and criteria</td><td><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Classes – continuous assessment based on problem-solving and calculation tasks completed during classes and short tests/quizzes.</td><td>51.0%</td><td>40.0%</td></tr>
<tr><td>Project – individual tasks in Moodle</td><td>51.0%</td><td>20.0%</td></tr>
<tr><td>Lectures - written exam</td><td>51.0%</td><td>40.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>1. Babula E., Czerwonka L. (ed.), Zastosowanie matematyki w ekonomii i zarządzaniu-Mathematical Applications in Economics and Management, Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk 2015.
2. Bradley T., Essential mathematics for economics and business, Wiley, 2013.
3. Wisniewski M., Mathematics for economics, Palgrave Macmillan, 2013.
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.
5. Werner F., Sotskov Y., Mathematics of Economics and Business, Routledge, Abingdon 2006.</td></tr>
<tr><td>Supplementary literature</td><td>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.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>The determinant of matrix of order (n 1) obtained by deleting row i and column j of matrix A of order n is called ...</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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