University of Gdańsk

Subject card

Subject name and code	Mathematical Applications in Economics and Management, PG_00204864		
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	full-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 Elżbieta Babula	
	Teachers	dr Marcin Brycz dr Elżbieta Babula	

Lesson types

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: 0.0

eNauczanie source addresses:

Moodle ID: 13719 WE-MSG-(2026/2027) Zastosowanie matematyki Wykład
https://mdl.ug.edu.pl/course/view.php?id=13719

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	4.0	161.0	225

Subject objectives

Acquainting students with the introduction to 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 has knowledge of functions of one and many variables and knows the elements of differential and integral calculus. He knows the methods of unconditional and conditional optimization and their applications in modeling enterprise decisions. Has basic knowledge of modeling the dynamics of economic processes.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion [SW5] implementation of a problem task
[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	Using the elements of differential calculus, he/she is able to carry out optimization of functions of one and many variables in the problems of the theory of the firm and market organization. He/she can use basic methods and tools to diagnose economic processes and on this basis make appropriate economic decisions. Can determine integrals of elementary functions and apply them to solve tasks based on marginal values. The student is ready to participate in the office hours to verify his/her ability of solve tasks, as well as in discussions on the applications of selected methods.	[SU1] oral statement/conversation/ discussion [SU4] test/exam - oral or written [SU5] implementation of a problem task
[MSGL3_K05] correctly identifies, diagnoses and solves dilemmas and various options of solutions related to the profession	The student correctly identifies, diagnoses and solves dilemmas and possibilities regarding economic problems related to the use of mathematical methods.	[SK1] oral statement/conversation/ discussion [SK4] test/exam - oral or written [SK5] implementation of a problem task
[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 knowledge of basic economic models such as market equilibrium models, the firm, the consumer, and the national income model. The student also knows the applications of differential equations in economic growth models.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion [SW5] implementation of a problem task

Subject contents

Lecture:

1. Algebra of matrices: operations on matrices, basic properties of determinants, finding the inverse matrix, Cramer's formula, linear dependence and independence of vectors and systems of equations; the rank of a matrix; the number of degrees of freedom of a system of equations, the verification of existence of the solution; solving systems with redundant equations - solutions with parameters; application to market models
2. Elements of differential calculus: rules of differentiation for functions of one variable, local extrema of functions of one variable, elasticity of functions, rules of differentiation of functions of many variables, optimization of functions of many variables, bounded optimization
3. Integral calculus: concept of primary function, definite and indefinite integral, method of integration by parts, method of integration by substitution
4. Applications of derivatives and integrals in economics and finance: marginal calculus in economics and maximization of profit by the firm; minimization of costs using Lagrange multipliers method, applications of integrals in profit maximization model
5. Difference and differential equations: first-order difference equations, cobweb model, differential equations, application of differential equations in economic growth models

Class:

1. Algebra of matrices: operations on matrices, basic properties of determinants, finding the inverse matrix, Cramer's formula, linear dependence and independence of vectors and systems of equations; the rank of a matrix; the number of degrees of freedom of a system of equations, the verification of existence of the solution; solving systems with redundant equations - solutions with parameters; application to market models
2. Elements of differential calculus: rules of differentiation for functions of one variable, local extrema of functions of one variable, elasticity of functions, rules of differentiation of functions of many variables, optimization of functions of many variables, bounded optimization
3. Integral calculus: concept of primary function, definite and indefinite integral, method of integration by parts, method of integration by substitution
4. Applications of derivatives and integrals in economics and finance: marginal calculus in economics and maximization of profit by the firm; minimization of costs using Lagrange multipliers method, applications of integrals in profit maximization model

Prerequisites and co-requisites

Knowledge and skills in mathematics from high school

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
In-class activities and group work (20%), out-of-class assignments and quizzes (20%), written test (60%)	51.0%	50.0%
Written exam and discussion during office hours	51.0%	50.0%

Recommended reading

Basic literature

1. E. Babula, L. Czerwonka (red.), Zastosowanie matematyki w ekonomii i zarzadzaniu, Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk 2015

2. A. Blajer-Gołębiewska, L. Czerwonka, E. Pankau, M. Zielenkiewicz, Ekonomia matematyczna w zadaniach, red. T. Kamińska, Wyd. UG, Gdańsk 2010

3. M. Wisniewski, Mathematics for economics, Palgrave Macmillan, 2013

	Supplementary literature	1. K. Sydsaeter, P. Hammond, A. Strom, Essential mathematics for economic analysis, Pearson Education Limited, Harlow 2012 2. B. Batog, B. Bieszk-Stolorz, I. Forys, M. Guzowska, K. Heberlein, Mathematics for students of economics, finance and management, Difin, Warszawa 2021 3. T. Bradley, Essential mathematics for economics and business, Wiley, 2013 4. A.C. Chiang, Podstawy ekonomii matematycznej, PWE, Warszawa 1994 5. L. Czerwonka, Matematyczne modele połaczen przedsiebiorstw uwzgledniajace czynniki menedzerskie, Pieniadze i Wiez. Kwartalnik Naukowy, Nr 3/2009, s. 81-88 6. L. Czerwonka, Zastosowanie matematycznych modeli fuzji egzogenicznych, Pieniadze i Wiez. Kwartalnik Naukowy, Nr 1/2008, s. 133-140 7. M. Matłoka, Matematyka dla ekonomistow, Wyd. AE w Poznaniu, Poznan 2008 8. A. Ostoja-Ostaszewski, Matematyka w ekonomii. Modele i metody t. 1 i 2, Wydawnictwo Naukowe PWN, Warszawa2006 9. J. Piszczała, Matematyka i jej zastosowanie w naukach ekonomicznych, Wydawnictwo AE w Poznaniu, Poznan 2008 10. R.A. Barnett, M.R. Ziegler, K.E. Byleen, College Mathematics for Business, Economics, Life Sciences, and Social Sciences, Pearson Prentice Hall, Upper Saddle River, New Jersey 2008
	eResources addresses	Basic https://mdl.ug.edu.pl/course/view.php?id=13719 - Materials available on the e-learning platform.
Example issues/ example questions/ tasks being completed	Open tasks	
Work placement	Not applicable	

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