

**Subject card**

<b>Subject name and code</b>	Mathematical Applications in Economics and Management, PG_00200365						
<b>Field of study</b>	Logistics and Mobility						
<b>Date of commencement of studies</b>	October 2026	<b>Academic year of realisation of subject</b>			2026/2027		
<b>Education level</b>	Bachelor's studies	<b>Subject group</b>			Obligatory subject group in the field of study Subject group related to scientific research in the field of study		
<b>Mode of study</b>	full-time studies	<b>Mode of delivery</b>			at the university		
<b>Year of study</b>	1	<b>Language of instruction</b>			English		
<b>Semester of study</b>	1	<b>ECTS credits</b>			5.0		
<b>Learning profile</b>	academic	<b>Assessment form</b>			credit		
<b>Conducting unit</b>	Department of Microeconomics -> Faculty of Economics -> Rector						
<b>Name and surname of lecturer (lecturers)</b>	<b>Subject supervisor</b>		dr hab. Leszek Czerwonka				
	<b>Teachers</b>						
<b>Lesson types</b>	<b>Lesson type</b>	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	<b>Number of study hours</b>	15.0	30.0	0.0	30.0	0.0	75
	E-learning hours included: 0.0						
<b>Learning activity and number of study hours</b>	<b>Learning activity</b>	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	<b>Number of study hours</b>	75		0.0		50.0	125
<b>Subject objectives</b>	Acquainting students with the introduction to higher mathematics and its applications in economics and management. Use of academic English language, references and vocabulary.						
<b>Learning outcomes</b>	<b>Course outcome</b>		<b>Subject outcome</b>			<b>Method of verification</b>	
	[LML3_K04] is ready to think and act in an entrepreneurial manner; adapts to new situations and conditions, takes on the challenges of creative thinking, is resilient to failure, knows how to identify threats and assess the risk of their occurrence		A student is able to think analytically and take entrepreneurial action in solving mathematical problems in economics and management; can assess risk and adapt analytical methods to changing market and informational conditions. A student studies additional examples and tasks, which are discussed and reviewed during office hours with the teacher.			[SK1] oral statement/conversation/discussion [SK4] test/exam - oral or written	
	[LML3_W06] knows to an advanced degree selected methods and tools, including statistical techniques, to describe and model logistics and mobility processes and systems		A student knows selected mathematical and statistical methods used to describe and model economic processes and management systems, including those related to logistics and mobility.			[SW4] test/exam - oral or written	
	[LML3_U02] is able to use its theoretical knowledge and acquire data to analyze specific logistics and mobility processes and systems, and to analyze these processes and systems using methods developed in economics, finance, management science, logistics and mobility		A student is able to apply mathematical and statistical methods to analyze data describing economic processes and management systems, including in the areas of logistics and mobility. The student can acquire and interpret data using approaches appropriate to 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>Questions that arise during the reflection and repetition of the course content or interpretative problems accompanying it will also be addressed during office hours.</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	<table border="1" data-bbox="448 938 1477 1010"> <thead> <tr> <th data-bbox="448 938 794 969">Subject passing criteria</th> <th data-bbox="794 938 1141 969">Passing threshold</th> <th data-bbox="1141 938 1477 969">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="448 969 794 1010">Test</td> <td data-bbox="794 969 1141 1010">51.0%</td> <td data-bbox="1141 969 1477 1010">100.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Test	51.0%	100.0%
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Test	51.0%	100.0%							
Recommended reading	Basic literature	<ol style="list-style-type: none"> <li>1. Babula E., Czerwonka L. (ed.), Zastosowanie matematyki w ekonomii i zarządzaniu-Mathematical Applications in Economics and Management, Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk 2015.</li> <li>2. Bradley T., Essential mathematics for economics and business, Wiley, 2013.</li> <li>3. Wisniewski M., Mathematics for economics, Palgrave Macmillan, 2013.</li> <li>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.</li> <li>5. Werner F., Sotskov Y., Mathematics of Economics and Business, Routledge, Abingdon 2006.</li> </ol>							
	Supplementary literature	<ol style="list-style-type: none"> <li>1. Czerwonka L., Mathematical Models of Mergers: Conditions of Application and Conclusions [in:] Market Concentration and Economy, Series of Monographs, Vol. 7, Macro &amp; Microeconomics Case Studies, T. Bernat (ed.), Publishing House Volumina.pl Daniel Krzanowski, Szczecin 2010, pp. 206-219.</li> </ol>							
	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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