

## 。 GDAŃSK UNIVERSITY OF TECHNOLOGY

## Subject card

Subject name and code	MATHEMATICS 1, PG_00061159									
Field of study	Management									
Date of commencement of studies	October 2023		Academic year of realisation of subject			2023/2024				
Education level	first-cycle studies		Subject group			Obligatory subject group 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	general academic profile		Assessment form			exam				
Conducting unit	Mathematics Center -> Vice-Rector for Education									
Name and surname	Subject supervisor		dr inż. Magdalena Łapińska							
of lecturer (lecturers)	Teachers	eachers		dr inż. Magdalena Łapińska						
Lesson types and methods	Lesson type	Lecture	Tutorial	Laboratory	Project	roject Semin		SUM		
of instruction	Number of study hours	30.0	30.0	0.0	0.0		0.0	60		
	E-learning hours included: 0.0									
Learning activity and number of study hours	Learning activity	Participation in classes includ plan	n didactic ed in study	Participation in consultation hours		Self-study		SUM		
	Number of study hours	60		12.0		53.0		125		
Subject objectives	Uses the apparatus of linear algebra and mathematical analysis to solve theoretical and practical problems occurring in social sciences									
Learning outcomes	Course outcome		Subject outcome			Method of verification				
	[K6_W02] demonstrates comprehensive preparation in terms of methods, techniques for formulating and solving problems		uses a mathematical apparatus to solve economic problems, combining knowledge of mathematics with knowledge of social sciences			[SW1] Assessment of factual knowledge				
	[K6_U04] formulates logical solutions to complex or unstructured problems		integrates the information obtained from solving complex problems, interpreting them, drawing conclusions and formulating and justifying opinions			[SU2] Assessment of ability to analyse information				
Subject contents	Matrices (definition, types of matrices, operations on matrices). Properties of matrices and operations on matrices Determinants and their properties. The inverse of a non-singular matrix. Methods of determining the inverse matrix Systems of linear equations. Cramer's theorem. Matrix row. The Kronecker-Capelli theorem. Gauss-Jordan elimination method Coordinate system on the plane. Basic definitions and properties of vectors. Scalar product, vector product and their applications. Angle between lines. Vectors in three-dimensional and n-dimensional space Equations of a straight line and a plane in space. Linear, metric and normed spaces, examples Examples of application in economics. Basket of goods, Leontief production model. Simple applications of linear programming in the economy Basics of logic and set theory - classical propositional calculus. Quantifiers, sentences, tautologies. Harvest and harvest operations. Cartesian product, relations, functions as relations Real functions of one variable: Functions and their properties: complex function, inverse function, inverse functions of elementary functions. Number sequences, limits of sequences, basic theorems. Ways of calculating limits. Function limit, one-sided limits, properties of limits. Continuous functions and their properties. Discontinuity points, examples Derivatives: Existence of a derivative, rules for determining derivatives, derivatives of complex and inverse functions. Derivative applications: L'Hôpital's rule, Unmarked expressions. Asymptotes. Monotonicity intervals, local and global extremes									
Prerequisites and co-requisites										

Assessment methods	Subject passing criteria	Passing threshold	Percentage of the final grade		
and criteria	Final exam	50.0%	50.0%		
	Midterm colloquium	50.0%	50.0%		
Recommended reading	Basic literature	Martin Anthony, Norman Biggs, Mathematics for Economics and Finance Methods and Modelling, Cambridge University Press ISBN: 0521559138 Hoffmann Laurence D., Bradley Gerald, Calculus for business, economics and the social and life sciences,New York, McGraw-Hill Company, 1986, ISBN 978-0077292737 T. Jankowski, Linear Algebra, Wydawnictwo Politechniki Gdańskiej, Gdańsk 2001, ISBN 83-88007-87-4			
	Supplementary literature				
	eResources addresses	Adresy na platformie eNauczanie: WZIE - BiM - Mathematics 1 2023/24 (M.Łapińska) - Moodle ID: 31280 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=31280			
Example issues/ example questions/ tasks being completed	<ol> <li>Suppose that an investor invests her money in three different assets and that three possible states can occur. Show that if the return matrix is R then Y and Z are arbitrage portfolios. Which of the two would you choose, given the choice?</li> <li>The production processes for three goods C1, C2, C3 are interlinked. To produce one dollar's worth of C1 requires \$0.1 worth of C1, \$0.2 worth of C2 and \$0.1 of C3. To produce one dollar's worth of C2 requires \$0.1 worth of C1, \$0.2 worth of C1, C2 and \$0.1 worth of C3, and to produce one dollar's worth of C3 requires \$0.1 worth of c1, C2 and \$0.2 worth of C3. Suppose that in a given period, there is an external demand for 200 dollars' worth of C1, 400 of C2 and 300 of C3. We wish to know the production levels x1, x2, x3 of C1, C2, C3 required to satisfy all demands in the given period.</li> <li>A firm manufactures 3 different types of some good 'A', 'B' and 'C'. The main ingredients in each are 'a', 'b' and 'c'. To produce 100 units of 'A' requires 1 units of 'a', a units of 'b' and 5 units of 'c'. To produce 100 units of 'C' requires 2 units of 'b' and 2 units of 'c'. To produce 100 units of 'C' requires 2 units of 'b' and 2 units of 'c'. The firm has supplies of 450 units of 'a', 360 of 'b' and 270 of 'c' each week (and as much as it wants of the other ingredients). How does the number of 'A' produced relate to the production level of the other two goods if the firm uses up its supply of 'a', 'b' and 'c'? Find the maximum possible weekly production of 'C'.</li> <li>Find the time-independent solution of the recurrent equation 4y<sub>1</sub>ey<sub>1</sub>(t-1) + 9, (t=1,2,3, Find the solution when yo=6, and describe its behaviour as t tends to infinity.</li> <li>Imagine you have \$200 000 to invest, at a constant rate of 5%, and that you want to withdraw a fixed amount I at the end of each year for next twenty years. What is the maximum possible value of I for which this is possible? Answer the same question if withdrawals of I are to be made at the beg</li></ol>				
Work placement	Not applicable				

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