GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Mathematics, PG_00049709						
Field of study	Management						
Date of commencement of studies	October 2022			Academic year of realisation of subject		2022/2023	
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 of lecturer (lecturers)	Subject supervisor			dr inż. Magdalena Łapińska			
	Teachers			dr inż. Magdalena Łapińska			
Lesson types and methods of instruction	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						
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		12.0	53.0		125
Subject objectives	The aim of the course is to give students a thorough understanding of basic concepts of calculus and algebra so that they are able to use them at different areas of economics. After completing the course the student: 1. will be provided with the ability of understanding the concepts of mathematical notions introduced during the lectures; 2. will have developed competent skills and will be able to demonstrate problem solving skills at the areas of economics involving mathematical tools						

Learning outcomes	<table><tr><th>Course outcome</th><th>Subject outcome</th><th>Method of verification</th></tr><tr><td>[K6_W07] knows statistical and IT methods and tools that enable to obtain and present data on the organisation's resources</td><td>Student mentions basic properties of elementary functions. Student solves equations and inequalities with elementary functions. Student defines the basic concepts of differential calculus of one variable. Student determines intervals of monotonicity of a given functions and its extrema. Student analyses the properties of functions on the basis of an examination of its first and second derivatives. Student geometrically interprets the results of an examination of a graph of a function using the concept of limit, continuity and derivatives of functions. Student uses methods of mathematical description of phenomena in the economical processes.</td><td>[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge</td></tr><tr><td>[K6_U15] can improve oneself through the systematic acquisition of knowledge and skills</td><td>Student recognizes the importance of self-expanding knowledge. Student recognizes the importance of skillful use of basic mathematical apparatus in terms of study economics and finance.</td><td>[SU1] Assessment of task fulfilment</td></tr><tr><td>[K6_W08] has a basic knowledge of the methods and tools used to conduct research related to particular areas of business activity</td><td>Student combines knowledge of mathematics with knowledge from other fields.</td><td>[SW1] Assessment of factual knowledge</td></tr></table>
Subject contents	Matrices. Some types of matrices, equal matrices. Matrix addition, scalar multiplication, transpose of a matrix, matrix multiplication. Properties of matrix multiplication, examples. Determinants, properties of determinants. Invertible matrices, methods of obtaining the inverse of a square matrix. Systems of linear equations: Cramer's rule, method of matrix inversion. Rank of a matrix, row echelon form, elementary operations, fundamental theorem for systems of linear equations. Linear dependence and independence of rows and columns, method of Gaussian elimination. Rectangular coordinate system, vectors in R^2, length of a vector, scalar product, the angle between vectors. Vectors in R^3, lines, planes. Vectors in R^n, lines in R^n, hyperplanes, flats. Linear and metric spaces, examples. Normed spaces, examples. Examples of applications in economics. Commodity bundle, the Leontief open production model. A simple example of application of linear programming in industry. Basics of logic and set theory - Propositional calculus. Basic tautologies, statement forms, quantifiers. Sets and basic operations with sets, Cartesian products, relations, functions as relations. Real valued functions of one variable. Functions and their properties: composite functions, inverse functions, inverses of the elementary functions. Infinite sequences, limit of a sequence, the limits laws. Computational techniques. Limit of a function, one-sided limits, properties of limits. Computational techniques. Continuous functions and their properties, points of discontinuity, examples. Derivatives. Existence of derivatives, differentiation rules, the chain rule, derivatives of inverse functions. Calculation of derivatives of elementary functions and their inverses, derivatives of combinations of functions. Higher order derivatives. Taylor series for functions of one variable. Applications of derivatives . L'Hôpital's rule, Indeterminate forms. Asymptotes. Intervals of monotonicity, local and absolute extrema.
Prerequisites and co-requisites	No requirements
Assessment methods and criteria	<table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>Midterm colloquium</td><td>50.0%</td><td>60.0%</td></tr><tr><td>Final exam</td><td>50.0%</td><td>35.0%</td></tr><tr><td>e-Test</td><td>50.0%</td><td>5.0%</td></tr></table>

Recommended reading	Basic literature	1. Martin Anthony, Norman Biggs, Mathematics for Economics and Finance Methods and Modelling, Cambridge University Press ISBN:0521559138. 2. Hoffmann Laurence D., Bradley Gerald, Calculus for business, economics and the social and life sciences, New York, McGraw-Hill Company, 1986, ISBN 978-0077292737 3. T. Jankowski, Linear Algebra, Wydawnictwo Politechniki Gdańskiej, Gdańsk 2001, ISBN 83-88007-87-4
	Supplementary literature	No requirements
	eResources addresses	Adresy na platformie eNauczanie: WZiE - Z - Mathematics 2022/2023 (M.Łapińska) - Moodle ID: 24370 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=24370
Example issues/ example questions/ tasks being completed	1. 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? 2. The production processes for three goods C_1, C_2, C_3 are interlinked. To produce one dollar's worth of C_1 requires the input of \$0.2 worth of C_1, \$0.2 of C_2 and \$0.1 of C_3. To produce one dollar's worth of C_2 requires \$0.1 worth of C_1, \$0.2 worth of C_2 and \$0.1 worth of C_3, and to produce one dollar's worth of C_3 requires \$0.1 worth of each of C_1, C_2 and \$0.2 worth of C_3. Suppose that in a given period, there is an external demand for 200 dollars' worth of C_1, 400 of C_2 and 300 of C_3. We wish to know the production levels x_1, x_2, x_3 of C_1, C_2, C_3 required to satisfy all demands in the given period. 3. 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', 3 units of 'b' and 5 units of 'c'. To produce 100 units of 'B' requires 4 units of 'a', 3 units of 'b' and 2 units of 'c'. To produce 100 units of 'C' requires 2 units of 'a', 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'. 4. Find the time-independent solution of the recurrent equation $4y_t=y_{(t-1)} + 9$, (t=1,2,3,.... Find the solution when $y_0=6$, and describe its behaviour as t tends to infinity. 5. 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 beginning of each of the next twenty years (including the present year). 6. Find the local extrema of the given function $f(x)=x^2e^{-x}$ 7. The function g is given by $g(x)=x^3 - 6x^2 + 12x -1$. Show that g has only one critical point. Determine whether this point is a maximum, a minimum, or an inflection point. 8. Find asymptotes of the given function $y=x+2+1/(x-2)$. 9. Marginal cost function is defined to be the the derivative of the cost function. A manufacturer's cost function is $C(q)=1000 + 20q +q(1+q)^{0.5}$. Find the marginal cost function.	
Work placement	Not applicable	

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