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 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

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. Derivatives of elementary functions. Higher order derivatives. Taylor series of functions of one variable. Derivative applications: L'Hôpital's rule, Unmarked expressions. Asymptotes. Monotonicity intervals, local and global extremes

Prerequisites and co-requisites

<table>
<tr><td rowspan="3">Assessment methods and criteria</td><td>Subject passing criteria</td><td>Passing threshold</td><td>Percentage of the final grade</td></tr>
<tr><td>Final exam</td><td>50.0%</td><td>50.0%</td></tr>
<tr><td>Midterm colloquium</td><td>50.0%</td><td>50.0%</td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">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</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">.</td></tr>
<tr><td>eResources addresses</td><td colspan="2">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</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3">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 manufacturers cost function is $C(q)=1000 + 20q +q(1+q)^{0.5}$. Find the marginal cost function.</td></tr>
<tr><td>Work placement</td><td colspan="3">Not applicable</td></tr>
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