DESCRIPTION OF THE SUBJECT

FIELD OF STUDY	Management
SPECIALISATION	all
MODE OF STUDY	Full-time/ Part-time
SEMESTER	1 i 2

Name of the subject	**Mathematics**	
Hourly dimension of particular forms of classes	Full-time studies – 60 Part-time studies – 60	
• **lectures**	Full-time studies – 30; Part-time studies - 30	
• **other forms**	Full-time studies – 30; Part-time studies - 30	

Learning objectives:	− to become acquainted with basic concepts, their properties, operations, theorems and methods of selected branches of mathematics, the knowledge of which is necessary to solve various problems in subjects using the language and methods of mathematics, − to be able to use the knowledge they have acquired to solve tasks and to practise their problem-solving skills, − ability to construct a mathematical model in solving problems involving non-mathematical situations.

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Learning outcomes for the subject	

Number	Learning outcomes, A student who has successfully completed the course will be able to:	Reference of learning outcomes for the programme	The reference to the learning outcomes for the area
EK_W01	define basic concepts related to elementary functions, differential calculus of functions of one and two variables, integral calculus, matrix calculus and systems of equations	K_W01	P6S_WG
EK_W02	present: elementary properties of functions, formulas and theorems of differential calculus for solving problems, basic formulas and methods for calculating integrals, theorems and methods used in matrix calculus and calculating determinants, ways of solving systems of equations	K_W05	P6S_WG
EK_U03	determine the domain of functions, calculate derivatives and study the course of variation of functions of one and two variables, calculate integrals on the basis of formulas and integration rules	K_U11	P6S_UW

EK_U04	perform operations on matrices, determine inverse matrices, calculate determinants, solve systems of linear equations	K_U08	P6S_UW
EK_K05	perceive the usefulness of the acquired knowledge in solving various issues in economics and management and is able to solve these issues and correctly interpret the obtained solution	K_K01 K_K02	P6S_KK P6S_KO

Content number	Educational/ curricular content	Reference to learning outcomes for the subject
	Lectures	
T_01	Elementary functions: definitions, graphs, properties	EK_W01 EK_W02 EK_U03 EK_U04 EK_K05
T_02	Differential calculus of functions of one variable: definition of the derivative of a function at a point, derivative function, geometric and economic interpretation of the derivative, formulas and rules for calculating derivatives, relation of the derivative to the monotonicity of a function, extremum of a function, necessary and sufficient conditions, second derivative of a function, elasticity of a function - examples of applications in economics	EK_W01 EK_W02 EK_U03 EK_U04 EK_K05
T_03	Elements of differential calculus of functions of two variables: partial derivatives of order one and two and Schwarz's theorem, unconditional local extremum, Lagrange function and conditional extremum of functions of two variables	EK_W01 EK_W02 EK_U03 EK_U04 EK_K05
T_04	Elements of integral calculus: definition of the integral and its properties, basic formulas of integral calculus and methods of calculating the integral (from formulas, by substitution and by parts), the integral, its properties and geometrical interpretation, Newton-Leibniz formula and its applications, examples of applications of integrals in economics	EK_W01 EK_W02 EK_U03 EK_U04 EK_K05
T_05	Elements of matrix calculus: definition of a matrix and algebraic operations on matrices, square matrix and its determinant, minor and algebraic complement, calculation of determinants using Sarrus' method and Laplace's theorem, properties of determinants and their applications, singular and non-singular matrix, inverse matrix and methods of its determination (determinant method and the method of elementary operations)	EK_W01 EK_W02 EK_U03 EK_U04 EK_K05
T_06	Systems of linear equations: definition and concepts related to systems of linear equations, geometric interpretation in the plane of the system of two linear equations with two unknowns, Cramer system and methods for its solution, Gauss elimination method for solving systems of linear equations	EK_W01 EK_W02 EK_U03 EK_U04 EK_K05
	Exercises	
T_07	Elementary functions: determining the domain, sketching graphs, determining properties of functions, solving equations and inequalities	EK_W01 EK_W02 EK_U03 EK_U04

		EK_K05
T_08	Differential calculus of functions of one variable: calculation of derivatives of functions based on known formulas and rules, study of monotonicity and determination of stationary points of functions, determination of local extremes of functions and calculation of their values	EK_W01 EK_W02 EK_U03 EK_U04 EK_K05
T_09	Elements of differential calculus of functions of two variables: calculation of first-order partial derivatives and determination of stationary points, calculation of second-order partial derivatives, determination of unconditional local extremes and calculation of their values, creation of Lagrange functions and determination of conditional local extremes	EK_W01 EK_W02 EK_U03 EK_U04 EK_K05
T_10	Elements of integral calculus: calculation of indeterminate integrals using known methods, application of Newton-Leibniz formula to calculate determinate integrals	EK_W01 EK_W02 EK_U03 EK_U04 EK_K05
T_11	Matrix calculus: performing algebraic operations on matrices, calculating determinants by the known methods and using the properties of determinants, determining the inverse of a given matrix by two known methods	EK_W01 EK_W02 EK_U03 EK_U04 EK_K05

Methods and forms of teaching	**Educational and curricular content**
Lecture with multimedia presentation of selected issues	
Conversation lecture	
Problem-based lecture	
Informative lecture	T_01 – T_11
Discussion	
Work with text	
Case study method	
Problem-based learning	
Didactic/simulation game	
Exercise method	
Workshop method	
Project method	
Multimedia presentation	
Audio and/or video demonstration	
Activating methods (e.g. brainstorming, SWOT analysis technique, decision tree technique, snowball method, constructing mind maps)	
Other (which ones?) - solving tasks	T_01 – T_11
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Evaluation criteria in relation to particular learning outcomes	

Learning outcome	For the assessment 2	For the assessment 3	For the assessment 4	For the assessment 5
EK_W01	The student is able to carry out at most one of the four indicated requirements	The student is able to correctly carry out only two of the four indicated requirements.	The student is able to correctly carry out exactly three of the four indicated requirements	The student is able to correctly carry out all requirements indicated
EK_W02	The student is able to carry out at most one of the four tasks indicated.	The student is able to correctly carry out only two of the four indicated tasks.	The student is able to correctly carry out exactly three of the four tasks indicated.	The student is able to correctly carry out all the indicated tasks
EK_U03	The student is able to demonstrate at most one skill out of the four indicated	The student is able to demonstrate exactly two skills out of the four indicated	The student is able to demonstrate exactly three skills out of the four indicated	The student is able to demonstrate all the skills indicated
EK_U04	The student is able to solve at most one of the four tasks indicated.	The student is able to correctly solve exactly two tasks out of four indicated.	The student is able to correctly solve exactly three tasks out of four indicated.	Student is able to correctly solve all indicated tasks.
EK_K05	The student is able to give the correct answer to at most one of the four tasks.	The student is able to give the correct answer to only two out of four tasks.	The student is able to give the correct answer to three out of four tasks.	The student is able to give a correct answer to all the given tasks.

Verification of learning outcomes	Symbols EK for the module/subject				
	W01	W02	U03	U04	K05
Written test	X	X	X	X	
Oral exam					
Written credit	X	X	X	X	X
Oral credit					
Written colloquium					
Oral colloquium					
Test					
Project					
Written work					
Report					
Multimedia presentation					
Work during exercises	X	X	X	X	X
Other (which ones?) -					

Hourly teaching load and student workload	Full-time studies	Part-time studies
1. Lectures (joint participation of academic teachers and students)	30	30
2. Other forms (joint participation of academic teachers and students)	30	30
3. Consultations with the teacher	30	30
Total 1+2+3	**90**	**90**
4. Practical training (carried out by students on their own)	-	-
5. Student's own work (including homework and project work, preparation for a credit/examination)	160	160
Total 4+5	**160**	**160**

SUMMARY 1+2+3+4+5	250	250
Total ECTS credits according to the study plan	10	

Reference literature	1. Bażańska T., Nykowska M., *Matematyka w zadaniach dla wyższych zawodowych uczelni ekonomicznych,* Oficyna Wydawnicza Branta*,* Bydgoszcz-Warszawa 2004.
	2. Gryglaszewska A., Kosiorowska M., Paszek B., Rusek M.,
	2a. *Zadania z matematyki,* Wydawnictwo Uniwersytetu Ekonomicznego w Krakowie, Kraków 2012,
	2b. *Zadania z matematyki stosowanej*, Wydawnictwo Uniwersytetu Ekonomicznego w Krakowie, Kraków 2013.
	3. Kasprowicz A., Romański J., *Matematyka z elementami zastosowań w ekonomii, tom I i II,* Uniwersytet Mikołaja Kopernika, Toruń 1997.
	4. Sozański B., Dziedzic I., *Algebra i analiza w zagadnieniach ekonomicznych,* Wydawnictwo Bila, Rzeszów 2007.
	5. Michalska E., Kopińska-Bródka D., *Niezbędnik matematyczny dla studentów I roku studiów ekonomicznych,* Wydawnictwo Uniwersytetu Ekonomicznego w Katowicach, Katowice 2013.
Complementary literature	1. Flisowski A., Grzymkowski R., *Matematyka – przewodnik po wykładach*, Wydawnictwo Pracowni Komputerowej Jacka Skalmierskiego, Gliwice 1999.
	2. Paluchiewicz B., *Analiza matematyczna,* Wyższa Szkoła Informatyki i Zarządzania, Bielsko-Biala 2003.
	3. Kokoszka J., *Zastosowanie matematyki w ekonomii*, (Studentmaks) 2004.