



## Subject card

Subject name and code	Mathematics, PG_00049710						
Field of study	Management						
Date of commencement of studies	October 2020	Academic year of realisation of subject			2020/2021		
Education level	first-cycle studies	Subject group			Obligatory subject group in the field of study		
Mode of study	Full-time studies	Mode of delivery			e-learning		
Year of study	1	Language of instruction			English		
Semester of study	2	ECTS credits			5.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Mathematics Center -> Vice-Rector for Education						
Name and surname of lecturer (lecturers)	Subject supervisor		dr Magdalena Musielak				
	Teachers		dr Magdalena Musielak				
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: 60.0						
WZiE - Management sem.2 - Mathematics 2020/21 (M.Musielak) - Moodle ID: 13302 <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=13302">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=13302</a>							
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	<p>The aim of the course is to give students a thorough understanding of basic concepts of calculus, algebra, probability and statistics so that they are able to use them at different areas of economics.</p> <p>After completing the course the student:</p> <ol style="list-style-type: none"> <li>will be provided with the ability of understanding the concepts of mathematical notions introduced during the lectures;</li> <li>will have developed competent skills and will be able to demonstrate problem solving skills at the areas of economics involving mathematical tools</li> </ol>						
Learning outcomes	Course outcome		Subject outcome			Method of verification	
	[K6_W07] knows statistical and IT methods and tools that enable to obtain and present data on the organisation's resources		<p>Student lists geometrical applications of definite integrals. Student distinguishes between types of improper integrals.</p> <p>Student gives the definition of basic notions of probability theory. Student describes the basic types of distributions of random variable.</p>			[SW1] Assessment of factual knowledge	
	[K6_U15] can improve oneself through the systematic acquisition of knowledge and skills		The student combines knowledge of mathematics with knowledge from other fields. Student recognizes the importance of skilful use of basic mathematical apparatus in terms of study in future.			[SU4] Assessment of ability to use methods and tools	
[K6_W08] has a basic knowledge of the methods and tools used to conduct research related to particular areas of business activity		Student defines the basic concepts of the demand theory and production theory using mathematical notation.			[SW1] Assessment of factual knowledge		

Subject contents	Intervals of concavity, points of inflection. Analysis of functions and their graphs. Examples of application of functions and derivatives in economics. Demand functions, logistic function, marginal cost, revenue and profit function. Elasticity of demand, the basic principle of economics. Infinite series. Partial sums, convergence of a series, geometric series, harmonic series. Convergence tests, p-series. Integral calculus. Antiderivatives, indefinite integrals, the basic formulae. Integration by substitution. Integration by parts. Integration of rational functions. Definite integral. Properties of definite integrals. Integration by substitution and by parts in the case of definite integrals. Applications of definite integrals. Improper integrals. Multivariable differential calculus. Functions of two or more variables, limits and continuity. Partial derivatives, differentiability and chain rules. Maxima and minima of functions of two variables. Absolute extrema on closed and bounded sets. Gradient. Lagrange method of multipliers. Repeated and double integrals. Probability, random variables. Basic concepts in probability theory: definition of probability, axioms, joint probability, independence. Discrete random variable; probability density function. Continuous random variable, probability density function. Probability distribution function, expectations, variances and standard deviations. Basic distributions of random variables. The binomial distribution. Poisson distribution. Normal distribution.		
Prerequisites and co-requisites	No requirements		
Assessment methods and criteria	Subject passing criteria		Passing threshold
	Homework assignments		0.0%
	Final exam		50.0%
Recommended reading	Basic literature		<ol style="list-style-type: none"> <li>1. Martin Anthony, Norman Biggs, Mathematics for Economics and Finance Methods and Modelling, Cambridge University Press ISBN:0521559138.</li> <li>2. Ken Binmore and Joan Davies, CALCULUS: Concepts and methods, Cambridge University Press ISBN: 0521775418</li> <li>3. T. Jankowski, Linear Algebra, Wydawnictwo Politechniki Gdańskiej, Gdańsk 2001, ISBN 83-88007-87-4</li> </ol>
	Supplementary literature		<ol style="list-style-type: none"> <li>1. Hwei Hsu, Schaum's Outline of Probability, Random Variables, and Random Processes, Second Edition, McGraw-Hill; 2 edition ISBN: 978-0071632898</li> </ol>
	eResources addresses		
Example issues/ example questions/ tasks being completed	<ul style="list-style-type: none"> <li>• Prove convergence of the series and find the sum.</li> <li>• Is the given series absolutely convergent, conditionally convergent or divergent?</li> <li>• Compute the improper integral or prove its divergence</li> <li>• Find the area of the figure bounded by <math>y=e^x</math>, <math>y=e^{2x}</math>, <math>x=1</math>.</li> <li>• Find the integral <math>x^3 \ln x \, dx</math></li> <li>• Find the points of extremum of the function <math>f(x,y)=x^2+xy+y^2+x-y+1</math></li> <li>• Find the greatest and the least value of the function <math>f(x,y)=x^2-y^2</math> within the circle <math>x^2+y^2=4</math>. To find stationary points on the boundary of the domain use the method of relative extrema.</li> <li>• Find the area of the indicated domain using double integration. The domain is bounded by the parabolas <math>y=x</math>, <math>y=2x</math> and straight line <math>x=4</math>.</li> <li>• Given the probability function of the random variable <math>X</math>: <math>p(-5)=0.1</math>, <math>p(-2)=0.2</math>, <math>p(0)=0.1</math>, <math>p(1)=0.2</math>, <math>p(3)=c</math>, <math>p(8)=0.1</math> find: <ol style="list-style-type: none"> <li>1. the graph of the probability function</li> <li>2. the distribution function and its graph (<math>F(x)=P(X \leq x)</math>)</li> <li>3. probabilities <math>P(X=1)</math>, <math>P(X=2)</math>, <math>P(X &lt; 3)</math>, <math>P(X &lt; 2)</math>, <math>P(X &lt; 0)</math>, <math>P(-2 &lt; X &lt; 1)</math>,</li> <li>4. mean value</li> <li>5. variance and standard deviation</li> </ol> </li> <li>• Find: mean value, variance, the distribution function and <math>P(X &gt; 1)</math> if the density function of the random variable <math>X</math> is of the form <math>f(x)=\frac{3}{4}(2x-x^2)</math> if <math>0 \leq x \leq 2</math> and <math>f(x)=0</math> otherwise.</li> <li>• A consumer buys apples and bananas and has utility function <math>u(x_1, x_2)=x_1 x_2^2</math>, where <math>x_1</math> is the number of apples and <math>x_2</math> the number of bananas. Suppose that he has \$1.80 to spend on the bundle of apples and bananas, and that apples cost \$0.12 each, bananas cost \$0.20 each. Write down the budget equations and the Lagrangean for the problem of finding the optimal bundle. What is the optimal bundle?</li> </ul>		
Work placement	Not applicable		