UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO

DIPARTIMENTO DI ECONOMIA, MANAGEMENT E DIRITTO DELL'IMPRESA

General information	
Academic subject	Mathematics for Economics (Group LZ)
Degree course	Marketing and Business Communication
Academic Year	2021-2022
European Credit Transfer and Accumulation System (ECTS)	10
Language	Italian
Academic calendar	I semester
Attendance	no

Professor/ Lecturer	
Name and Surname	Viviana Fanelli
E-mail	viviana.fanelli@uniba.it
Telephone	
Department and address	Department of Economics, Management and Business Law
Virtual headquarters	Microsoft Team code: ykuv59x
Tutoring (time and day)	Tuesday h 9:30 online (Microsoft Teams code: kbzl3r4)

Syllabus	
Learning Objectives	Providing the main mathematical tools frequently occurring in problems related to business administration, economics and finance; developing suitable techniques of quantitative analysis to face up problems of evaluation and choice in the same areas.
Course prerequisites	Algebraic elementary calculus and basics of analytic geometry (equation of a straight line and related topics)
Contents	Basics on set theory: logical symbols, sets, elements and related properties. Set operations: union, intersection, difference, complement, simmetric difference. Cartesian product. The numerical sets N, Z, Q and related properties. The set R of real numbers: algebraic and order properties. Upper and lower bound of a subset of R. Bounded and unbounded sets. Maximun and minimum, supremum and infimum of a subset of R. The completeness property and equivalent versions. Some applications: n-roots, exponentials and logarithms. Absolute value, integer part and fractional part of a real number. Intervals of R. The density of Q in R. The estended real line: neighborhoods, cluster points and isolated points. Functions: domain, range and graph. Injective, surjective, bijective and invertible functions. Composition of two or more functions. Inverse function. Restrictions of a function. Real functions of one real variable: upper and lower bound, supremum and infimum, maximun and minimum. Local and global extrema. Bounded, odd, even, periodic, monotone and convex functions. Sequences of real numbers. Sequences defined by recurrence. Aritmetic and geometric progressions with applications: simple and continuous compounding in finance. The factorial of a natural number. The study of some elementary functions: constant function, identity function, affine function, piecewise affine function, absolute value function, power function, n-root function, exponential function, logarithmic function, power function with real exponent, trigonometric functions and the corresponding inverse functions. Equations and inequations. Determining the domain of a function. Limits: basic definitions and corresponding interpretation. Limit of sequences. Uniqueness of the limit. Local character of the limit. Limit of a restriction of a function. Non – regularity test. Right-hand and left-hand limit and related theorem. Comparison theorems. Squeeze theorem. Divergence criterion. Operations with the limits.

	Indeterminate forms. Limit of the composition of functions. Theorem about the limit of monotone functions/sequences. Limits of the elementary functions. Some fundamental limits. Neper's number and its financial meaning. Asimptotic analysis for computing limits in indeterminate forms and Landau's symbols. An estimate of the growth of n!: DeMoivre-Stirling's formula. Continuity: definition of the continuity of a function at a point and basic properties. Points of discontinuity and the corresponding classification. Integer part and fractional part functions and the related discontinuities. Functions everywhere continuous in their domains. Sum, product, quotient and composition of continuous functions. Continuity criterion for monotone functions. Continuity of the elementary functions. Intermediate value property and Bolzano's theorem. Existence of zeros theorem, fixed point theorem and Weierstrass's theorem. Differentiation: the concept of derivative and its meaning in different frameworks. Differentiable functions Left and right derivative. Geometric interpretation: tangent line and rate of approximation. Angular and cusp points. Continuity of the differentiable functions. Differentiation rules. Higher order derivatives and Lagrange's spaces. The chain rule and the differentiability of the inverse function Determining the derivatives of the elementary functions. Elasticity, semielasticity and applications in Economics and Finance. Applications of the differential calculus: functions which are strictly monotone at a point: necessary condition and sufficient condition. Local extrema. Stationary points. Fermat's theorem. Main theorems in differentiation: Rolle's theorem Cauchy's theorem and Lagrange's theorem. Darboux's theorem. Consequences of Lagrange's theorem. Monotonicity test for differentiable functions. Some sufficient conditions for local extrema. Convexity/concavity test through the sign of the second derivative. Inflection points: a necessary condition and some sufficient conditions. De L'Hospital's rule and applications for computing limits in indeterminate forms. Discontinuity of the first derivative. Second order Taylor's expansion and some applications. Asymptotes and graph-sketching. Basics of integration theory: antiderivatives, indefinite integral and main properties. The standard rules of integration. Integration by parts and by substitution. Riemann lower and upper integral sums. The Riemann integrability and the corresponding integral. Criterion of integrability and the integral as a limit. Properties of the definite integrals. Computing areas of normal domains. Some classes of integrable functions: the integrability of continuous functions and of monotone functions. Mean value theorem. Torricelli-Barrow's theorem. Newton-Leibnitz's theorem (or Fundamental theorem of integral calculus). Some elements of linear algebra: vectors in Rn and basic operations. Linearly independent vectors and basis in Euclidean spaces. Matrices, determinants and related properties. The rank of a matrix. Kronecker's theorem. Solving systems of linear equations: Cramer's formula and Rouchè-Capelli's theorem. Functions of two variables: graph, coordinate lines and level curves. Cobb-Douglas functions in Economics. Limits and continuity. Partial derivatives and gradient vector. Differentiability and tangent plane. The chain rule. Directional derivatives and the gradient formula. Some properties of the vector gradient. Second-order partial derivatives and Schwarz's theorem. Hessian matrix. Unconstrained optimization. Something about constrained optimization: Lagrange multipliers and their economic meaning.
Books and bibliography	L. Maddalena, Matematica, Giappichelli editore. A. Guerraggio, Matematica - Mylab, Pearson. A. Attalienti, S. Ragni, Esercitazioni di Matematica, Giappichelli, Torino. P. Marcellini, C. Sbordone, Esercitazioni di Matematica, Volume I, Parte prima e

	seconda, Liguori Editore, Napoli.
Additional materials	

Work schedule			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
Hours			
280	80	20	180
ECTS			
10			

Teaching strategy	Lectures
Expected learning outcomes	
Knowledge and understanding on:	Knowledge and understanding of the main mathematical tools frequently used in economic, business and financial disciplines.
Applying knowledge and understanding on:	Ability to apply mathematical tools in an appropriate way to define, understand and solve evaluation and optimal choice problems in the business, economic and financial spheres.
Soft skills	• *Making informed judgments and choices* ability to independently evaluate the quantitative tools to be used to solve problems in the business, economic and financial spheres. • *Communicating knowledge and understanding* ability to present and communicate economic-financial topics in a clear and effective way and with scientific language acquired during the course. • *Capacities to continue learning* ability to autonomously deepen the knowledge acquired during the course in order to tackle economic-financial problems.

Assessment and feedback	
Methods of assessment	Examination of Mathematics for Economics consists of a written test and a subsequent oral examination.
Evaluation criteria	The student will be able to expose the topics covered in the course and solve related exercises. The student will be able to apply the mathematical tools provided during the course to make economic and financial choices and evaluations.
Criteria for assessment and attribution of the final mark	The evaluation elements that contribute to the attribution of the vote are: • knowledge and understanding of the course program topics, • the ability to apply the acquired knowledge in solving problems and proposed exercises, • communication skills.
Additional information	