| General Information | |
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| Academic subject | Mathematics for Economics |
| Degree course | Economics and business administration |
| Curriculum | |
| ECTS credits | 8 |
| Compulsory attendance | No |
| Language | Italian |

| Subject teacher | Name Surname | Mail address | SSD |
|---|---|---|---|
| | Marta Elena Biancardi | marta.biancardi@uniba.it | SECS-S/06 |

| ECTS credits details | Area | | CFU/ETCS |
|---|---|---|---|
| Basic teaching activities | 13/D4 | | 8 |

| Class schedule | |
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| Period | I semester |
| Year | I |
| Type of class | Lectures in attendance |

| Time management | |
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| Hours | 64 |
| In-class study hours | 64 |
| Out-of-class study hours | |

| Academic calendar | |
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| Class begins | September |
| Class ends | December |

| Syllabus | |
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| Prerequisites/requirements | Basic knowledge of algebra and analytical geometry |
| Expected learning outcomes | *1. Knowledge and understanding. At the end of the teaching activities, the student must know and understand the mathematical tools illustrated during the course. In particular, the concepts of differential and integral calculus and linear algebra.*<br><br>*2. Ability to apply knowledge and understanding. At the end of the teaching activities, the student must be able to apply the quantitative techniques learned to the solution of economic and financial problems.*<br><br>*3. Making assessments. At the end of the teaching activities, the student must be able to acquire independent assessments in the formulation and modeling of economic and financial problems.*<br><br>*4. Communication skills. At the end of the teaching activities, the student must acquire and use the technical language typical of mathematics.*<br><br>*5. Learning skills. At the end of the teaching activities, the student must be able to continue the study of the discipline and must be able to apply the tools learned to the study of the economic, mathematical and statistical subjects present in the course of study.* |

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| Contents | **Elements of set theory**. Logical symbols. Notion of equality and inclusion. Set of parts of a set. Union, intersection, difference and complement operation. De Morgan formulas. Covering and partitioning of a whole. Cartesian product. Functions. Direct image. Reciprocal image. Injective, surjective, invertible functions. Restriction and extension of a function. Compound functions.<br><br>**Numeric sets**. The set of natural, rational and real numbers. Intervals. Absolute value. Minor and major, upper and lower extremity, maximum and minimum of a subset of R. Characteristic property of the upper/lower extremity. Separate sets. Separator element. Contiguous sets. Countable sets. Completeness properties of R. Power of a number. Root nth. Logarithms and their properties. Open and closed sets. Accumulation points.<br><br>**The space R^n**. Concept of distance on R^n. Scalar product. Standard of a carrier. Around a point. Open and closed sets. Accumulation points.<br><br>**Elements of linear algebra**. Fundamental definitions on matrices and vectors. Operations between matrices. Inverse matrix. Determinants and related properties. Laplace's theorem. Rule of Sarrus. Linearly independent vectors. Rank of a matrix. Kronecker's theorem. Systems of n equations in n unknowns. Cramer's rule. Systems of m equations in n unknowns. RouchéCapelli's theorem. Eigenvalues and eigenvectors. Characteristic polynomial. Positive, negative and undefined definite matrices. Quadratic forms. Economic applications.<br><br>**Real functions of real variable**. Cartesian representation. Symmetries (parity, disparity, periodicity). Monotony. Global and local maxima and minima of a function. Convexity and inflection points. Elementary functions.<br><br>**The notion of limit for functions**. The notion of limit. Uniqueness of the limit. Limit from right and left. Operations with limits. Indeterminate forms. Theorem on the permanence of the sign. Forced convergence theorem. Remarkable limits. Theorem on the limit of monotone functions.<br><br>**Succession**. Limit of successions. Nepero's number.<br><br>**Continuous functions**. The notion of continuity. Operations with continuous functions. Continuity of elementary functions. Discontinuity points. Zero theorem. Bolzano theorem. Compact sets. Weierstrass theorem.<br><br>**Differential calculus**. Concept of derivative. Geometric meaning of the derivative. "Economic" meanings of the derivative. Angular and cuspidal points. Operations with derivable functions. Higher order derivatives. Derivatives of |

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| | elementary functions. Elasticity of a function. Taylor formula and applications. Necessary conditions for the existence of relative maxima and minima (Fermat's theorem). Sufficient conditions for the existence of relative extremes. Convex functions.<br><br>**Real functions of several real variables**. Partial derivability. Partial derivatives of higher order. Schwarz's theorem. Differentiability and differential. Directional derivatives. Gradient. Hessian matrix. Taylor formula. Necessary conditions for the existence of relative maxima and minima (Fermat's theorem). Sufficient conditions for the existence of relative maximums and minimums. Northwest minors rule (Sylvester criterion). Functions implicitly defined. Dini's theorem. Maximum and minimum constraints. The Lagrange multiplier method.<br><br>**Applications to the economy**. Unconstrained optimization in economics. Cobb-Douglas production functions. Homogeneous functions. Returns to scale. Marginal replacement rate. Constrained optimization in economics. The consumer problem.<br><br>**The indefinite integration**. Primitive and indefinite integral. Integration by parts. Integration by replacement.<br><br>**Integration according to Riemann**. Integral defined according to Riemann. Geometric interpretation of the integral. Existence theorem of primitives. Fundamental theorem of integral calculus. Average theorem. Calculation of areas. |
| Course program | |
| Bibliography | Bertsch M., Dal Passo R., Giacomelli L., Analisi matematica 2/ed, McGraw Hill<br><br>Torriero A., Scovenna M.,Scaglianti L. Manuale di Matematica. Metodi e Applicazioni - CEDAM – Padova<br><br>Sydsaeter K., Hammond P., Strom A., Metodi matematici per l'analisi economica e finanziaria, Pearson ed. |
| Notes | None |
| Teaching methods | Frontal lessons. Exercises. |
| Assessment methods | written test - oral test |
| Evaluation criteria | The written test, consisting of open-ended questions and the oral test, are designed to identify the knowledge acquired in the resolution of exercises and knowledge of abstract theoretical notions and applied to economics and finance. In addition, the examination test ascertains the ability to acquire the specific language of the discipline, the ability to synthesize and communicate. |
| Further information | |