

Università degli Studi di Foggia - Facoltà di Economia

Course of

Mathematics (8 Credits)

Prof. Luca Grilli

<http://www.dsems.unifg.it/personale/grilli.html>

I mod. 4 cfu

0. Elements of Linear Algebra:

Vectors: definition, graphical representation for $n=1,2,3$. The operations of vectors: addition and subtraction of two vectors, multiply a vector by a scalar. Vector multiplication. Linear combination among vectors. Matrices: definition, special matrices. Matrix transposition. The operations of matrices: addition and subtraction of two matrices, multiply a matrix by a scalar. Matrix multiplication. Trace. Inverse of a matrix. Determinant of a square matrix, definition and properties. Rank of a matrix. Kronecker's theorem. Parametric matrices. The equation $\det(A-\lambda I)=0$. Solving linear equation systems. Cramer's rule. Rouché-Capelli's theorem.

1. Functions.

Functions: main definition, domain. Inverse of a function. Composition. Sequences. \mathbb{N} , \mathbb{Z} , \mathbb{Q} , \mathbb{R} . Intervals in \mathbb{R} . Absolute value. Bounded sets in \mathbb{R} . Sup and Inf: definition and properties. Unbounded sets. Induction principle. The sum of n integers. Cartesian product. The graph of a function. Linear functions and main properties. Distance between two points. Equation of a circumference. Monotone functions. Concave functions. Special functions. Power function with exponent n , $-n$, $1/n$. Exponential function, logarithmic. Trigonometric functions $\sin(x)$ and $\cos(x)$, main properties. Functions $\tan(x)$, $\cotan(x)$. Inverse of trigonometric functions. Operations with functions.

2. Limits of sequences and functions.

Neighbourhood of a point. Accumulation points. Definition of limit. Theorem of uniqueness of the limit. Limit for sequences. Theorems of comparison. The "Pinching" or "Sandwich" Theorem. Operations with limits. Limit of the sum, of the product. Limits and infinity. Indeterminate forms. Theorem for the limit of the composition. Theorem for the limit of monotone functions. Fundamental theorem for the limits.

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3. Continuous functions.

Continuity and discontinuity. Weierstrass's theorem. Theorem of zeroes, the bisection method. Bolzano's theorem.

4. Differential calculus.

Derivative. Geometric meaning of derivative. Points of non derivability. Derivatives of higher order. Continuity and derivability. Rules for computing derivatives. Derivative of composition, and inverse of a function. De L'Hopital's theorem. Local and global maxim and minima. Fermat's theorem. Rollé's theorem. Lagrange's theorem. Conditions for monotony. Functions differing from a constant. Taylor's formula. Convex functions and minimum points. Applications to the graph of a function.

5. Series.

Definitions and examples. Geometric series. Operation with series. Necessary condition for convergence. Series with positive terms. Theorem of basic comparison. Harmonic series and

harmonic generalized. The root and the ratio tests. The alternating series. Leibnitz's theorem. Series absolutely convergents.

6. Integrals.

Primitive. Indefinite integral. Linearity of integrals. Integration by parts. Integral of rational functions. Integral by substitution. Riemann integral. Theorem of the mean value. Theorem for existence primitives. Fundamental theorem for integral calculus. Improper integrals.

References:

Appunti delle lezioni <http://www.dsems.unifg.it/newsmat/>

L. Albano, **Lezioni di Matematica Generale**, Cacucci Editore, Bari, 1998.

G.C. Barozzi e C. Corradi, **Matematica Generale per le Scienze Economiche**, Il Mulino, Bologna, 1999.

G.C. Barozzi e C. Corradi, **Esercizi per il corso di Matematica Generale per le Scienze Economiche**, Il Mulino, Bologna, 1999.

L. De Cesare e L. Maddalena, **Esercizi di Matematica Generale**, Cacucci Editore, Bari, 1997.

L. De Cesare e L. Maddalena, **Prove Scritte di Matematica Generale**, Grenzi Editore, Foggia, 2000.

E. Giusti, **Analisi Matematica 1**, Bollati Boringhieri, Torino, 2002.