

## ISTITUZIONI DI MATEMATICHE I

Laurea triennale in CHIMICA

A.A. 2017-2018

Prof.ssa A. SALVATORE

### **Basics**

Elements of set theory. Numerical sets. Real numbers and the extended real number system. Bounded sets. Upper and lower bound, least upper bound and greatest lower bound, maximum and minimum of subsets of real numbers. The completeness property. Radicals. Powers. Logarithms. Function, domain, codomain, image, graphic. Composition of functions. Injective and surjective functions. Inverse function. Principle of mathematical induction.

### **Real functions of one real variable**

Basic Concepts. Monotonic functions. Elementary real functions of one real variable: absolute value function, sign function, linear function, function power and root function, exponential and logarithm function, power function with real exponent, trigonometric functions, trigonometric inverse functions. Composition of functions. Inequalities.

### **Limits**

Elements of topology in  $\mathbb{R}$ . Bounded functions. The limit of a function. Left and right limit. Uniqueness, comparison limits theorems. Elementary properties of limits. Limits of chain functions. Limits of monotonic functions. Limits of elementary functions. Infinity and infinitesimal functions. Limits of sequences and main theorems. Subsequences. Cauchy sequences. Cauchy principle.

### **Continuity**

Continuous functions from  $\mathbb{R}$  into  $\mathbb{R}$ : definition and properties. Operations with continuous functions. Discontinuities. Zero's theorem. Bolzano theorem. Continuity of inverse function. Weierstrass theorem.

### **Differentiation**

The derivative of a real function. Elementary properties of the derivative. Continuity and derivability. Rules of differentiation. Derivative of the inverse function. Derivatives of elementary functions. Derivatives of higher order. Relative minima and maxima and derivative: Fermat theorem. Rolle, Cauchy and Lagrange theorems. Consequences of the Lagrange theorem. Relative and absolute minima and maxima of a real function. L'Hopital's theorems. Taylor's theorem. Applications. Concavity and convexity. Graphic of a real function.

### **The Riemann integral**

Definition of Riemann integral. Integration of continuous or monotonic functions. Properties of the integral. The mean value integral theorem. Existence of primitives of a continuous function. Indefinite integrals. Improper integrals. Criteria of convergence of improper integrals. Integration of rational functions. Hermite formula. Method of integration by parts and by substitution. Integration of trigonometric functions. Integration of irrational functions.

## **Complex numbers**

Definition. Algebraic and trigonometric form of complex numbers. Powers and roots of complex numbers.

## **Bibliography**

M. Bertsch, R. Dal Passo, L. Giacomelli, Elementi di Analisi Matematica, Ed. Mc Graw Hill, Milano.

P. Marcellini, C. Sbordone, Esercitazioni di Matematiche, vol. I, Parte I e II, Ed. Liguori, Napoli.