



Dipartimento di Scienze e Tecnologie

ACADEMIC YEAR 2017/2018

BIOTECHNOLOGY DEGREE COURSE
TEACHING DENOMINATION:
MATHEMATICS AND STATISTICS – MATHEMATICS MODULE

TEACHER Giuliano Gargiulo

Prerequisites: Elements of Set Theory and basic logic. Numerical sets: N , Z , Q . The real number system. Maximum and minimum; infimum and supremum. Axiom of completeness. The real line. Operations with real numbers: powers and roots; exponential and logarithm; trigonometric functions. Basic equations and inequalities.

Function of a real variable. Numeric functions, injective, surjective and bijective functions. Restrictions and extensions. Monotonicity and extrema. Inverse and composition of functions. Function graphs. Symmetry of graphs and functions. Elementary functions and their properties.

Sequences. Limits. *Limit uniqueness theorem*. Limit and comparison. "carabinieri" (squeeze) theorem. Sign Permanence Theorem. Limits and operations: indeterminate forms. Some remarkable limits. Monotone sequences and their properties. Euler's number E . Subsequences and *Bolzano-Weierstrass theorem*.

Function Limits. Limits and asymptotes. Accumulation (limit) points. Left- and Right-hand Limits. *Limit uniqueness theorem*. Limits of elementary functions. Function limits and comparison. Sign Permanence Theorem, "carabinieri" (squeeze) theorem. Limits and operations: indeterminate forms. Notable special limits. *Fundamental limit of the sine function*.

Continuous functions. *Weierstrass's Theorem*. *Bolzano's (zero) Theorem*. *Intermediate value theorem*.

Differential Calculus. Geometrical meaning of derivative. *Differentiability and continuity*. Derivatives of elementary functions. Differentiation rules. *Theorems of Rolle, Lagrange (mean value), Cauchy* and their consequences. *L'Hospital's rule (outline)*. Characterization of monotone functions over intervals. Local (relative) extrema: *Fermat's theorem; sufficient conditions*. Concavity and convexity. Function graphs. Elementary differential equations and their solutions (outline).

Integral Calculus. Indefinite integrals: primitive functions; *characterization of indefinite integrals*. Integrals of elementary functions; integration schemes ("almost immediate" integrals). Partial fraction decomposition algorithms. Integration by parts and by substitution. Area bounded by a positive continuous function over an interval; definite (Riemann) integral and its properties. *Mean value theorem for definite integrals and fundamental theorems of calculus*

N.B.: Proofs are required for topics written in *italics*.

Textbooks

P. Marcellini – C. Sbordone, Elementi di Analisi Matematica Uno, Liguori ed.

F. Casolaro, Integrali, Zanichelli ed.