

Program of the course

Principles of Mathematics

Prof. Renato Bruni

1. Sets of numbers: Natural numbers, Integer numbers, Rational and Irrational numbers, Real numbers, intervals.
2. What is a function, graph of a function, mathematical model of a real-world phenomenon.
3. Different types of functions: linear functions, piecewise functions, polynomial functions, power functions, trigonometric functions, exponential functions, logarithmic functions.
4. Limits of sequences, limits of functions: finite and infinite limits, limits from right and from left.
5. How to compute a limit, limits laws, geometric view of limits, continuity of a function, asymptotes, Intermediate Value theorem, Bolzano's theorem.
6. Derivatives: the concept of derivative, the tangent problem, derivative as a rate of change, differentiability, right and left derivatives, higher derivatives, properties of derivatives, computation of derivatives, derivative of a product, the chain rule, examples of derivative in sciences.
7. Study of functions using derivatives, minimum and maximum, Fermat Theorem on minimum and maximum, Weierstrass theorem, Rolle theorem, Mean-value theorem, first derivative test, second derivative test, indeterminate forms, l'Hôpital rule, guidelines for sketching a curve, antiderivatives.
8. Integrals: the concept of integrals, the area problem, definite integrals, properties of definite integrals, the Fundamental Theorem of Calculus, indefinite integrals. computation of integrals. Integration by substitution, Integration by parts.

Material of the course

Books for extensive study, they contain more than the program of this course:

Calculus For Biology and Medicine, author Claudia Neuhauser -Pearson 2014

Biocalculus: Calculus for Life Sciences, authors James Stewart, Troy Day – Cengage Learning 2015

Slides of the course, available from the home page of the professor
(<http://www.diag.uniroma1.it/~bruni/>)

Exam

There will be a written exam at the end of the course, with possible subsequent oral questions if needed for the evaluation.

Contact

To contact Renato Bruni, use bruni@diag.uniroma1.it and ALWAYS insert the subject Principles of Maths. Emails not using this subject may remain unseen and/or go into the spam folder.