MATHEMATICS

(Professor I. Massabò)

The course is targeted to provide advanced Mathematical tools for the analysis of Economics and Business issues. Main Course contents are:

a) One-Variable Calculus: Linear functions, the slope of a line in the plane, the slope of a non-linear function. Continuous, differentiable functions. Higher-order derivatives. Taylor formula.
b) Criteria for local Maxima and Minima: first order condition, second order conditions.
c) Applications to Economics: product, cost, revenue and profit functions; demand functions and elasticity.
d) Linear Algebra: System of linear equations. Matrix Algebra. Determinants. Uses of the determinants.
e) Euclidean Spaces: Vectors, the Algebra of vectors, linear independence, inner product, the length and the distance in R^n.
f) Lines and planes: parametric equations, Cartesian equations. Hyperplanes.
g) Calculus of Several Variables: Open sets in R^n, functions of several variables. Geometric representations of real valued functions, level curves.
h) Special kind of real valued functions: linear functions, quadratic forms –matrix representation.
i) The total derivate, tangent vector to a curve, differentiating along a curve, directional derivatives. The Gradient vector –properties. Second order derivatives and Hessian. Economics applications.
j) Implicit Functions and their Derivatives: Dini Implicit Function Theorem in R^2. Levels curves and their tangents. Applications.
k) Optimization: Quadratic forms and Definite Symmetric Matrices. Linear constraints and bordered matrices.
l) Unconstrained Optimization: First order conditions. Second order conditions. Convex functions. Economics applications.
m) Constrained Optimization -First Order Conditions: The lagrangian function. The meaning of the multiplier.
n) Constrained Optimization -Second Order Conditions: maximization/minimization problems, Border Hessian. Inequality constraints.
o) Concave and Convex Functions: Properties. Concave programming.
p) Economic Applications: Utility and demand, Pareto Optima, portfolio selection.
q) Ordinary Differential Equations: Scalar equations. Systems of equations, in continuous and discrete time. Stability of linear and non-linear Systems. Liapunov Functions.

The final assessment will be determined through several students' seminar presentations

Recommended textbook: *Mathematics for Economists* by C.P.SIMON and L.BLUME. W.W. Norton@Company