



Universidad
Carlos III de Madrid

PROGRAMME

- 1. ELEMENTARY CALCULUS^(*).** Powers. Properties of exponents. Square roots. Fractional exponents. Identities and algebraic expressions. Factorizations. Operations with fractions. Linear equations with one unknown. Simple and double inequalities. Quadratic equations. Polynomial factorizations. Systems of two linear equations.
- 2. SUMS AND PRODUCTS^(*).** Summation operator. Properties. Formulas of interest. Newton's binomial. Double summations. Products. Induction principle.
- 3. FUNDAMENTALS^(*).** Systems of numbers. Real numbers. Intervals. Absolute value. Mathematical logic. Propositions. Implications. Negations. Necessary and sufficient conditions. Proofs. Deductive and inductive reasoning. Set theory. The Cartesian plane.
- 4. FUNCTIONS OF ONE VARIABLE.** Definition and notation. Domain and range. Graphical representations. Graphical shifts. Linear functions. Slope and its interpretation. Quadratic functions and optimization. Polynomials. Factorization. Powers. Exponent rules. Graphs. Exponential function. Inverse functions.
- 5. LIMITS AND CONTINUITY.** Definition of limit. Properties. Continuity. Properties of continuous functions. Sequences and series. Arithmetic and geometric series.
- 6. DERIVATIVES.** Tangents, slopes and derivatives. Interpretation: rates of change. Derivative rules. Chain rule. Derivatives of higher order. Derivatives of inverse functions. Linear and quadratic approximations. Taylor's formula. Mean value theorem. Exponential and logarithmic functions. Elasticities.
- 7. SINGLE VARIABLE OPTIMIZATION.** Local and global optima. Convexity and inflection points.
- 8. INTEGRATION^(**).** Area under a curve. Definite integral. Applications of the integral.
- 9. FUNCTIONS OF SEVERAL VARIABLES^(**).** Surfaces and contour levels. Continuity and partial derivatives. Optimization with restrictions.
- 10. VECTORS AND MATRICES.** Vectors. Properties and interpretation. Inner product. Euclidean distances. Circumferences. Orthogonality. Hyperplanes. Matrices. Operations with matrices. Product of matrices. Transposition. Symmetric matrices. Quadratic forms. Determinants and inverse matrices.

(*) : Introductory topic. (**) : Complementary topic.

BASIC BIBLIOGRAPHY

SYDSÆTER, K., HAMMOND, P., STRØM, A., and CARVAJAL, A. (2016). *Essential Mathematics for Economic Analysis*, 5th Edition, Pearson United Kingdom.

ADDITIONAL BIBLIOGRAPHY

CHIANG, A. C. and WAINWRIGHT, K. (2013). *Fundamental Methods of Mathematical Economics*, 4th Edition, McGraw Hill.