# MATH0045 Calculus and Linear Algebra

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| *Year:* | 2021–2022 |
| *Code:* | MATH0045 |
| *Level:* | 4 (UG) |
| *Normal student group(s):* | UG: Students outside Mathematics |
| *Value:* | 15 credits (= 7.5 ECTS credits) |
| *Term:* | 1 |
| *Assessment:* | 85% examination, 15% coursework |
| *Normal Pre-requisites:* | An A-level in Mathematics eg Pure and Applied or Pure with Statistics |
| *Lecturer:* | Prof J-M Vanden-Broeck |

*Course Description and Objectives*

An introductory course on Mathematical Methods and their Applications for students of Economics, Statistics and related disciplines. The emphasis of the course is on technique rather than full rigour and this is developed through the use of many examples. Topics covered include differentiation, integration, infinite series, functions of several variables, and elementary matrix theory.

*Detailed Syllabus*

Functions of a real variable: limits, elementary treatment of continuity and differentiability. Differentiation: proofs of derivative formulae, critical points, linear and quadratic approximations, asymptotes.

Methods of integration: substitution, integration by parts, partial fractions, hyperbolic and trigonometric substitution. Improper integrals.

Convergence of infinite series: integral test, $p$-test, alternating series test, comparison to geometric series. Taylor series for elementary transcendental functions.

Functions of several real variables: partial derivative, gradient, chain rule, implicit function theorem, critical points, maxima, minima and saddle points.

Matrices and systems of linear equations: solution by reduction to echelon form, geometric interpretation of vectors and matrices, examples of linear dependence and independence, matrix algebra, rank, transpose, inverse, determinants.