

## Course content for MT1710, Calculus

### Prerequisites:

A-level Mathematics or equivalent

### Aims:

This course aims to develop the students' confidence and skill in dealing with mathematical expressions, to extend their understanding of calculus, and to introduce some topics which they may not have met at A-level. It also aims to ease the transition to university work and to encourage the student to develop good study skills. Mathematica is to be used as a calculating and graphical aid.

### Learning outcomes:

On completion of the course the student should be able to:

- factorise polynomials and separate rational functions into partial fractions;
- sketch the graphs of polynomials, rational functions and other elementary functions,
- identifying turning points and asymptotes where appropriate;
- differentiate commonly occurring functions, and find indefinite and definite integrals of a wide variety of functions, using substitution or integration by parts;
- recognise the standard forms of first-order differential equations, reduce other equations to these forms, and solve them;
- solve certain second and higher order differential equations;
- demonstrate that he or she can use Mathematica as an aid in the solution of problems or to illustrate the ideas met in the course.

### Course content:

**Polynomials and rational functions:** asymptotes, sketching, differentiation.

**Transcendental functions:** exp, ln, trigonometric and hyperbolic functions (differentiation, zeros, turning points, sketching, symmetry, periodicity).

**Calculus:** chain rule, integration by parts, substitution, use of trigonometric formulae, partial fractions.

**First-order differential equations:** separable equations, linear equations.

**Second-order differential equations:** constant coefficients, complementary function and particular integral.

**Use of the Mathematica package:** including polynomials, integrals and derivatives, plots, and general applications to many of the above topics.