Aims

This course seeks to provide students in their first year in the university with a range of techniques in Algebra and Calculus which equip them to tackle problems in their own subject area. The course also provides a foundation in mathematics for more advanced courses in later years.

Syllabus

**Advanced Differentiation:** Revision of differentiation; Maclaurin and Taylor series. *(4 lectures)*

**Applications of Differentiation:** Optimisation, Differential equations. *(4 lectures)*

**Advanced Integration:** Revision of integration; Integration by substitution; Integration by parts; Integration using partial fractions. *(5 lectures)*

**Applications of Integration:** Area under and between curves; Average value; Curve length; Separation of variables for 1st order ODEs; Approximate integration (Trapezoidal rule). *(5 lectures)*

**Complex Numbers:** Definition; Real and imaginary parts; Arithmetic of complex numbers; Solving quadratic equations; The Argand diagram; Modulus and argument; the polar form of a complex number; The exponential form; De Moivre’s theorem. *(6 lectures)*

**Matrices:** Definition and notation for matrices; Null (zero) matrix; Identity matrix; Transpose matrix; Addition and subtraction; Multiplication by a scalar; Matrix multiplication; The 2x2 and 3x3 determinant; The inverse of a 2x2 matrix; Solving systems of linear equations; formulating problems in matrix form. *(6 lectures)*

Teaching and Assessment

**Contact Hours:** 3 lectures and 1 tutorial per week

**Assessment:** 15% by class tests or other continuous assessment

85% by end of module 2-hour exam

**Resit Type:** exam
By the end of the course, students should be able to:

- calculate Maclaurin and Taylor series in one variable
- calculate integrals by using a substitution
- calculate integrals by using integration by parts
- calculate integrals of rational functions by using partial fractions
- solve first order ODEs of variable separable type
- approximate integrals using the Trapezoidal rule
- define complex numbers
- perform addition, subtraction and multiplication of complex numbers
- perform division of complex numbers
- solve quadratic equations in terms of complex numbers
- understand the Argand diagram
- determine the modulus and argument of a complex number
- understand and compute the polar form of a complex number
- define the exponential function and know its properties
- understand Euler's formula
- find the exponential form of a complex number
- know De Moivre's Theorem
- use De Moivre's Theorem to find powers of complex numbers
- understand and use matrix notation
- add, subtract and multiply matrices
- find the transpose of a matrix
- know and use basic properties of matrix algebra
- evaluate determinants (2x2, 3x3)
- find the inverse of a 2x2 matrix
- solve systems of linear equations using row eliminations