Fundamentals of Algebra and Calculus 2022-23

Course Information

Topics in the course

The course will interleave the two strands, **Algebra** and **Calculus**. The topics covered will be similar to those in SQA Advanced Higher Mathematics or A-Level Further Mathematics; full details are on the next page.

Learning activities

Most of the course is delivered through **online learning materials**. Each week there are four sections of material to work through, each of which should take about 2 hours (similar to a lecture and some associated practice). The online materials include explanatory text, short videos of worked solutions, and numerous practice questions which provide you with feedback on your work.

In week 1, we will set up **autonomous learning groups**. These are groups of about 6 students, and after week 1 these groups should arrange to meet regularly to work on weekly tasks and to discuss the course.

Assessment

Unit Tests (80% of course grade)

At the end of each week, there is a **Practice Quiz** on the week's topic, which you can try as many times as you wish. You need to score at least 80% on the Practice Quiz in order to unlock the **Unit Test** for the week. Your result on the Unit Test is either Mastery (if you score 80% or more) or Distinction (if you score 95% or more). The results of all the Unit Tests are combined using the following table:

Number of units Mastered (80%+ on the unit test)	Number of Distinctions (95%+ on the unit test)	Unit Score %	Letter Grade
10	10	100%	A1
10	8 or 9	85%	A2
10	6 or 7	75%	A3
9	4 or 5	65%	B
8	2 or 3	55%	C
7	-	45%	D
Less than 7	-	0	F

Final Test (20% of course grade)

In weeks 11 and 12, you will be able to take a 2-hour **Final Test** covering topics from throughout the course. You must achieve at least 40% on this test in order to pass the course.

Summary of course content

Week	Topic	Content
1	Polynomials and rational functions	Remainder/factor theorems Partial fractions Binomial theorem
2	Principles and techniques of differentiation	Definition and standard derivs Stationary points, graphing Chain/product/quotient rules
3	Vectors	Scalar, vector, triple products in $\mathbb{R}^3$ Lines and planes (equations, distances, angles)
4	Principles of integration	Definition and standard antiderivitives Definite integrals, Fundamental Theorem of Calculus Calculating enclosed areas
5	Functions and Graphs	Graphs of standard functions and transforms Odd/even, periodic Parametric functions
6	Further techniques and applications of differentiation	Differentiating inverse and implicit functions Logarithmic and parametric differentiation Applications to graphs and optimization
7	Complex numbers	Definitions, Argand diagrams, basic algebra De Moivre's Theorem, nth roots
8	Methods of integration	Integration by substitution Integration by parts Integrating rational functions
9	Sequences and series	Arithmetic and geometric sequences and series Maclaurin series
10	Applications of integration	Areas, volumes Separable/1st order DEs
11	Revision and Final Test	

Requirements

Higher Mathematics or A-Level Mathematics at Grade A, or equivalent.

Not appropriate for those with A-Level Mathematics at Grade A*, or SQA Advanced Higher at Grade A, or equivalent.