Organisation

The MA12001 module contains components of Algebra and then Calculus which run consecutively for 11 teaching weeks. This module is worth 20 SCQF credits (10 ECTS points). All organisation and teaching will be carried out by

**Calculus:** Dr Hiroko Kamei  
Mathematics Division  
Room Fulton G6  
Tel: 01382 – 384476  
email: hiroko@maths.dundee.ac.uk

**Algebra:** Dr Philip Murray  
Mathematics Division  
Room Fulton G11  
Tel: 01382 – 384462  
email: pmurray@maths.dundee.ac.uk

The Module Leader is Dr Kamei. You may bring matters of concern about the course to the attention of the Mathematics Division Staff/Student Committee, which meets once each semester. A volunteer from MA11001 and MA12001 will act as class representative to sit on the Staff–Student Committee; their name will be posted on BlackBoard.

The class meets six times a week, typically for 4 lectures and 2 workshops.

Assessment

You will be asked to do homework exercises and there will be four class tests in total. There will be two algebra class tests (at the middle and end of the algebra class hours), and two calculus tests (at the middle and end of the calculus class hours). You will be required to undertake and report on a small project. The investigations for the project may be carried out in groups but the reports will be written individually. There will be a 2 hour examination.

The assessment weightings are shown in the table below:

<table>
<thead>
<tr>
<th>Assessment Component</th>
<th>Weighting</th>
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</thead>
<tbody>
<tr>
<td>MapleTA Homeworks</td>
<td>20%</td>
</tr>
<tr>
<td>4 Tests: Weeks 3 (Algebra), 6 (Algebra), 8 (Calculus), 11 (Calculus)</td>
<td>20%</td>
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<tr>
<td>Project: Issued week 8, Due week 15</td>
<td>10%</td>
</tr>
<tr>
<td>2 Hour Exam during April/May Examination diet</td>
<td>50%</td>
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</table>

To pass this module in May it is necessary to gain at least 40% in the overall assessment and obtain an average of at least 30% in the homeworks and obtain an average of at least 30% in the class tests and obtain a mark of at least 30% for the exam.

For those who fail the module in May there will be a two-hour examination paper at the August Examination diet. The overall assessment will be based on 100% of the mark gained at the resit examination.

If you are unable to attend an element of assessment because of illness, you must supply a medical certificate covering the relevant period to your School Office.
Syllabus

In order to take this course you should have performed satisfactorily at MA11001 or some equivalent qualification. You will be introduced to further ideas of Calculus, Algebra and Geometry. The mathematics covered in secondary school and MA11001 will be consolidated and extended to provide a secure base on which to develop later mathematics modules.

Calculus component

Integral Calculus (14)

Idea of integral, including elementary treatment of the definite integral as a limit using rectangles.
Fundamental theorem of calculus.
Methods of integration including integration by substitution, by parts and with partial fractions.
Relation of integrals with areas.
Trapezium and Simpson’s rules for numerical integration.

Differential Equations (8)

First order ordinary differential equations by (a) separation and (b) integrating factor.
Second order ordinary differential equations with constant coefficients and simple right-hand sides. (Complex roots included, but no resonance problems.)

Algebra and Geometry component

Vectors (6)

Vector geometry in \( \mathbb{R}^2 \) and \( \mathbb{R}^3 \); vector properties and manipulation.
Unit vectors, position vectors, Cartesian coordinates.
Scalar product and vector product.

Matrices and linear equations (7)

Matrix properties, addition, multiplication.
Inverse matrices, determinants.
Linear mappings in \( \mathbb{R}^2 \) (rotation, reflection).
Systems of linear equations, Gaussian elimination and row operations.

(Further) complex numbers (3)

Polar form, exponential notation.
Multiplication, de Moivre’s Theorem, powers and roots.

Lines, planes and spheres (6)

Implicit and parametric equations of lines.
Implicit equations of planes.
Intersections, distances between points, lines and planes.
Equations of spheres, tangent planes.
Linear dependence and independence, colinear and coplanar vectors.
Recommended Books

There are many Calculus textbooks available (including several free books online) that cover the course material. One example of a suitable book is

*Calculus: Early Transcendentals (Brief), 7th Edition*
by Howard A. Anton, Irl Bivens, Stephen Davis
Publisher: John Wiley & Sons, New York.

For the Algebra and Geometry component, the majority of the material is covered in the following book, which is also the recommended textbook for Algebra at Level 2:

*Linear Algebra: A Modern Introduction*, by David Poole
Publisher: Brooks/Cole

Many similar textbooks may be found in the University Library.

Web Resources

*Advance@Dundee* [http://www.dundee.ac.uk/advancedundee/]

This is the University of Dundee Transferable Skills Website and is divided into eight key skill areas and over 60 specific topics giving access to hundreds of interlinked articles about personal transferable skills. The eight skill areas include pages on Basic Maths & Stats.

There are many other resources available on the web that are relevant to these modules. We suggest you use Google or some other search engine.

Your Commitment

You should attend all lectures and workshops except on medical grounds or with the special permission of the lecturer concerned. About 13 hours per week of your study time, including timetabled hours, should be devoted to this module. If illness or other circumstances prevent you from attending lectures, please keep your School Office informed of the reasons for your absence.

Awards

A medal may be awarded to the best student in the class.

Study Support

If you are having difficulty with the course work you are encouraged to seek help at an early stage at the workshops. You may also obtain help from your lecturers or your Personal Tutor.

Feedback

At the end of each section of the module you will be asked to complete a confidential questionnaire regarding the content and presentation of the module. This is an important element in the University’s Academic Standards procedures.