

ADVANCED CALCULUS

MA1132

HILARY TERM 2019

KIRK M. SOODHALTER

Learning Outcomes

On successful completion of this module, students will be able to:

- Analyse the behaviour of functions of several variables, present the result graphically and efficiently calculate partial derivatives of functions of several variables (also for functions given implicitly);
- Obtain equations for tangent lines to plane curves and tangent planes to space surfaces;
- Apply derivative tests and the method of Lagrange multipliers to find maxima and minima of functions of several variables, local and global;
- Effectively calculate multiple integrals, in Cartesian and polar coordinates, in particular, to find areas, volumes and centres of mass.

Lecture notes

Lecture notes, homework problems, tutorial worksheets, assignments and solutions will be available to download as the course progresses from Blackboard.

Textbooks

This course is based on Chapters 12-14 of the book ‘Calculus, Late Transcendentals’ by Howard Anton, Irl C. Bivens and Stephen Davis, 9th Edition.

There are course notes created by a previous instructor, Dr. Anthony Brown. They will also be made available as a supplement to the official text.

For a book at a slightly higher level, there is ‘Multivariate Calculus and Geometry’ by Seán Dineen.

Lectures

There will be three lectures each week at the following times and places:

- Wednesday 12:00pm Joly Theatre, Hamilton Building
- Thursday 10:00am LB01 Lloyd Building.
- Thursday 15:00am EELT3 East End Building Lecture Theatre 3

You should attend all of these.

Tutorials

There will be three tutorials each week starting in Week 2, given by your assigned tutors:

- Friday 10:00am Museum Building M17, Tutor: Marlon Navarro
- Friday 12:00pm Maxwell Theatre, Hamilton Building, Tutor: Marlon Navarro
- Friday 2:00pm Synge Theatre, Hamilton Building, Tutor: Katarzyna Siewerska

You should attend your assigned tutorial. In extraordinary circumstances, you may make arrangements to visit a different tutorial for a particular week, but you may not permanently switch tutorials without prior authorization.

Continuous Assessment

There will be an assignment every week throughout the semester, starting in week 2. They will be posted on blackboard such that you may begin to consider them prior to the meeting of your tutorial. They must be completed and handed-in by the end of your tutorial on Friday. In addition, there will be four homework assignments throughout the semester to be handed in at beginning of certain tutorial sessions.

Exam

There will be a two hour exam during the Hillary term examination period.

Grading Policy

The continuous assessment will count for 20% of the final mark and the exam will count for the other 80%.

Contact details

If you wish to contact me outside lecture or tutorial times then my contact details are as follows.

- My e-mail address is ksoodha@maths.tcd.ie
- My office is Room 1.8 in the Hamilton Building, one floor above the School of Mathematics office. There are no fixed office hours; so you should email me to make an appointment if you would like to see me.

Syllabus

(1) Vector-Valued Functions.

- Introduction to Vector-Valued Functions,
- Calculus of Vector-Valued Functions,
- Change of Parameter; Arc Length,
- Unit Tangent, Normal and Binormal Vectors,
- Curvature,
- Motion Along a Curve.

(2) Partial Derivatives.

- Functions of Two or More Variables,
- Limits and Continuity,
- Partial Derivatives,
- Differentiability, Differentials, and Local Linearity,
- The Chain Rule,
- Directional Derivatives and Gradients,
- Tangent Planes and Normal Vectors,
- Maxima and Minima of Functions of Two Variables,
- Lagrange Multipliers.

(3) Multiple Integrals.

- Double Integrals,
- Double Integrals over Nonrectangular Regions,
- Double Integrals in Polar Coordinates,
- Surface Areas; Parametric Surfaces,
- Triple Integrals,
- Triple Integrals in Cylindrical and Spherical Coordinates,
- Change of Variables in Multiple Integrals; Jacobians.