Analysis in Many Variables II.
Pre-requisites

Pre-requisite Modules

Analysis in Many Variables II (AMV II) builds on concepts first learned in Calculus I, as well as in Analysis I, and Linear Algebra I. These modules are all pre-requisites for this module (though Analysis I may be taken as a co-requisite in some instances), and so this module will assume you are familiar with the material in these courses. You may therefore want to spend some time refreshing yourself with some of the material from these modules. This document aims to highlight some of the most important things from these modules that you are expected to know, though the remainder of the material from these courses is still expected to be known.

Key sections of pre-requisite courses for AMV II Michaelmas

In the Michaelmas term of AMV II, we will be largely focussed on discussing differentiation and integration for functions of multiple variables. You have already discussed some of these ideas for functions of two variables in Calculus I, and so it is material from Calculus I that will be used most in AMV II Michaelmas. A small optional e-assessment revision exercise, covering some relevant questions from Calculus I, can be found on the quiz server, linked from the "Assignments" section of the course.

The following is a list of the most important sections of the pre-requisite courses, roughly in the order that we will need them for AMV II.

- The functions we will be studying are functions of multiple real variables, that is functions on $\mathbb{R}^n$ (either to $\mathbb{R}^n$ or to $\mathbb{R}$). We will be using the scalar product on $\mathbb{R}^n$, and the vector product of vectors in $\mathbb{R}^3$. We will also meet lines in $\mathbb{R}^n$ and planes in $\mathbb{R}^3$. All of these are introduced in Section 1 of the Michaelmas Linear Algebra I notes.

- With regards to differentiation for functions of multiple variables, you will find it helpful to re-familiarise yourself with Section 1 of the Epiphany Calculus I notes. In particular, we will use most of the ideas introduced in sections 1.1 – 1.6, with the definition of differentiability, the partial derivatives, the directional derivative and the gradient being particularly important.

- In order to discuss differentiability, we will want to discuss open sets in $\mathbb{R}^n$, limits of functions in $\mathbb{R}^n$ and continuity of functions in $\mathbb{R}^n$. You discussed these notions in Section 2 of the Michaelmas notes for Calculus I for functions of a single variable, briefly for functions of two variables in Section 1.2 of the Epiphany notes of Calculus I, and more rigorously (for functions of one variable) in Section 4 of the Epiphany notes for Analysis I.

- With regards to integrating functions of multiple variables, you will find it helpful to re-familiarise yourself with double integrals for functions of two variables, covered in Section 5 of the Michaelmas Calculus 1 notes.

- In the final chapter of the Michaelmas term of AMV II, we meet three big important theorems which generalise the Fundamental Theorem of Calculus for functions of one variable to functions of multiple variables. You should therefore remind yourself of the Fundamental Theorem of Calculus, which can be found in Section 4.2 of the Michaelmas Notes of Calculus I.

- We will discuss the role of the Jacobian in changing integration variables, and so you should be familiar with the determinant of a matrix, and its relation to the area/volume of a parallelepiped. This material is covered in Section 4 of the Michaelmas Notes for Linear Algebra I.