

Exam format

The exam is closed book, but is designed to evaluate understanding of the unit, rather than memorization ability. Past papers are a good indication as to how this understanding will be tested, with a couple of caveats.

1. The exam papers in 2020–21 and 2021–22 were open book, hence do not ask for statements of definitions or other such bookwork. The exam paper this year will do so.
2. The older past papers have some differences in notation (for example, the notation for alternation) and in some of the proofs (but any correct proof is admissible!). Also a couple of proofs, namely the existence of partitions of unity and the change of variables formula, are no longer examinable. (But the statements and applications are examinable!)
3. The inclusion or exclusion of material in past papers does not indicate whether it will or will not appear this year!

The exam will have an essay question and at least one proof sketch (either as part of the essay or as a separate question). These are described below, and will be discussed further in seminars.

Sketch proofs

There are often one or two questions which ask you to provide a sketch proof of a result from the course. Your answer to such a question should provide an overview of the key steps or ideas in the proof, in about half a dozen sentences or bullet points. Here are some tips on writing good sketch proofs:

- “Sketch” does not mean “vague” or “imprecise”. For example, if a mathematical formula is an important idea in the proof, you should include it.
- A sketch should enable someone familiar with the ideas and techniques of the course to expand it into complete proof. For example, you should not introduce unexplained quantities.
- The logical flow of the argument should be clear in the sketch. For example, a list of ingredients with no connections between them is likely to be insufficient.

A good preparation is to practice writing sketch proofs and critique each others’ sketch proofs. This is a useful activity in its own right, as it is likely to improve your understanding of the results you sketch. You may find it a useful revision aid in other units as well.

Mathematical essays

There will be a question of the form “Write an essay about X”, worth 12 marks. The essay is not meant to be a piece of creative writing, and it does not need to have an introduction or conclusion. The aim is to overview some material from the course that is relevant to topic X. Judging what material is relevant is part of the task. A good answer should:

- cover the main relevant points, stating any key definitions and results;
- include at least one proof or sketch proof (as above—you should do this if the topic involves a long proof);
- illustrate the ideas by at least one example;
- have a clear logical flow of ideas.

As a rough guide, an answer of 1–2 pages should be sufficient.

The essay question will be preceded by short questions related to the topic, worth 8 marks in total. These are intended to help you determine a suitable starting point and scope for the essay.