

MATH3711: Higher Algebra (2007, S1)**Lecturer/Tutor:** Daniel Chan**E-Mail:** *danielc@unsw.edu.au***Webpage:** web.maths.unsw.edu.au/~danielch**Office:** Red Centre (East Wing) Room 4104**Office Phone No.:** 9385 7084**Consultation Hours:** TBA (see webpage)

Most of the information you need to know about the course can be gotten from the webpage above, including a copy of this handout. There is a tentative syllabus there as well.

Lectures/Tutorials

In general, there will be 3 lectures and one tutorial a week. Unfortunately, there will definitely be exceptions to this rule.

What you need to know to do this course

You need to know some linear algebra, up to the level of MATH1241 or MATH1251 and some basic naive set theory as you might pick up in those courses and, ideally a discrete maths course. If you haven't done discrete maths, don't worry, the only "non-trivial" bits of set theory you really need are the notions of products of sets and equivalence relations. I will talk about both in the first tutorial. Lastly, and most importantly, you need a certain amount of mathematical maturity which the handbook attempts to define as 12 units of credit in level 2 maths courses with distinction average. Certainly, if your average is 70 or lower, you should come and see me. Most of you will have done the 2nd year linear algebra course MATH2601 and already seen ϵ group theory. I will go over all this material, but only lightly. More precisely, the theory will be covered, but there will be few examples so you should check out the relevant tutorial questions etc carefully if this material is unfamiliar to you.

About this course

This is one of three core third year pure maths courses (the others being MATH3611 and MATH3701). These three courses should give you a reasonable introduction to modern (i.e. 20th century) maths.

This course introduces the basic language and ideas of modern algebra, the two main concepts being that of a group and that of a ring. Groups are the vehicle through which mathematicians study symmetry. The data used to define them involves one algebraic operation, group multiplication. Rings on the other hand have two algebraic operations, addition and multiplication, much as you find with numbers. Indeed historically, number theory was a major driving force for the development of ring theory and in particular, we will look at the role rings played in 19th century attempts to prove Fermat's last theorem. Unfortunately, we will not be able to delve into the role ring theory has played in geometry or in the study of operators. Ring theory provides a common language between geometry and number theory and so underpins bizarre and striking parallels between the two disciplines. To learn about this, you will need to do an honours course on commutative algebra or algebraic geometry or do an honours thesis with me. Rings of operators are studied in the honours course MATH5735.

Assessment

The grade for this course will be determined from 2 short assignments (worth 15% each), a quick quiz (tentatively in week 6, worth 20%) and a final exam (worth 50%). Check the webpage for when the assignments are due (as well as for hints and typos!).

The assignments are meant to be extremely easy, once you have understood the material. The hard part is of course understanding the material. Similarly, the quiz will be relatively straightforward. It is expected that most of you will be getting close to full marks in the assignments and quiz. That way, a “pass” in the final exam should get you close to a distinction. If you are having trouble with the assignments, you should talk to other students or to me about it. The most important thing is that you learn the material. The final exam will be hard and is designed to distinguish the best students in the class. If Gauss has reincarnated amongst you, this exam will find him (or her).

A portion of your assignment marks will be devoted to mathematical writing. See separate handout for details.

Studying for this course

This course is as hard as it is interesting. It is very demanding conceptually and indeed, the lectures will introduce lots of new ideas and modes of thinking that will take some time to get used to. Most likely you will have to expand and develop your learning patterns to cope. I have written on a separate handout some tips to help you out. Your first and foremost goal will be to understand the material. Make sure you try to fill in gaps in your understanding after each lecture. I expect this will take up a sizable chunk of your study for this course. The tutorials are designed to reinforce your understanding of the material and also to develop your problem solving skills.

References

The lectures, tutorials and problem sheets will cover all the material that you need to know, but nevertheless, you will probably find it handy to supplement your studies by looking at texts such as those below. Some of them only cover the group theory portion of the course. There are lots of texts designed for a first course in algebra. They vary a lot so you should scout around for what’s suitable for you.

- Artin, “Algebra”
- Armstrong, “Groups and Symmetry”
- Fraleigh, “A first course in abstract algebra”
- Herstein, “Abstract Algebra”
- Jacobson, “Basic Algebra I” P512 94
- Stillwell, “Elements of Algebra” P512.812 9
- Lang, “Algebra”
- Lederman, Weir (Jeffrey) “An Introduction to Group Theory”

Continual Course Improvement

The School of Mathematics evaluates each course each time it is run. Feedback on the course is gathered, using among other means, UNSW’s Course and Teaching Evaluation and

Improvement Process. Student feedback is taken seriously, and continual improvements are made to the course based in part on such feedback.

Already, tutorials were recently introduced into this course, in direct response to student feedback, so I encourage you wholeheartedly, to let me know what parts of the course you find conducive to learning, and any suggestions for improvement you have.

School of Mathematics Student Policies

School of Mathematics policy regarding tests, assignments additional assessment etc can be found at

<http://www.maths.unsw.edu.au/students/current/policies/studentpolicy.html>

You should at the very least make sure you are familiar with the “Important Information for Mathematics Students” that is linked there. The Plagiarism Policy is on the other side of this page.

Final Remarks

Best of luck, I hope you have as much fun as I did when I first learnt this stuff!

Daniel Chan