



**STUDY SKILLS
IN
MATHEMATICS**

The key to success in University work is learning how to study effectively. These study notes are designed to help you to that end – to suggest some good study habits and to draw attention to some of the pitfalls. Read them carefully and keep them to read again after you have settled into the term's work. Remember that different people work best in different ways; **so try to discover what works best for you.** The staff in the Department is always willing to help and advise but the chief responsibility at University must lie with you, the student.

**FILE THESE NOTES AT THE FRONT OF YOUR RING BINDER SO
THAT YOU CAN REFER TO THEM AGAIN LATER.**

STUDY SKILLS in MATHEMATICS

INTRODUCTION

University life provides for many interests and it is good to take advantage of the various opportunities on offer. There are many ways of being a happy and successful student provided that your academic studies form the core component. With proper organisation it is possible to lead an active social life, getting involved with societies and sports, besides achieving your potential in your studies. This does however require a certain amount of self-discipline and effective time-management.

You should expect to do some work in the evenings, at weekends and during vacations, especially the two shorter vacations. Vacations are not just holidays. They provide the time needed to clarify, assimilate and revise the material covered in the previous term; the summer examination period begins almost as soon as the summer term (usually the next day)! The long vacation is the best time for gaining invaluable work experience.

Discover the study and life pattern that suits you best. This includes deciding where and how you work best. Some people prefer to work in groups, others to work alone; some prefer to work in silence, others need background noise. Yet others prefer to find a quiet backwater in a library where they will be undisturbed, especially at revision time! Whatever your preference, remember that most of us work better in a comfortable, well-ventilated, warm and well-lit environment – but not one that's too soporific! Experiment to find what suits you best. One disadvantage? In the Mathematics Department, most first-year lectures are in the morning, when your brain is supposed to be most receptive, but you do need to be awake if you are to take full advantage of them!

Try to allocate your time fairly between the different courses that you are taking. **Unless you are careful, computational work, essays and projects can take up a disproportionate amount of time.**

1. TAKING LECTURE NOTES

It is a common misconception of students that they should be able to understand everything that is presented in a lecture at the time at which it is presented. This does not always happen.

It is essential, therefore, that your record of a lecture should be full, clear and accurate.

Write down everything that the lecturer writes on the board but remember also to listen to what is being said. There may be useful “asides” that are worth adding to your notes. **Try to follow the arguments and to understand the main ideas.**

The following practical points are worth mentioning.

- Remember to download any relevant lecture material from Moodle (<http://moodle.rhul.ac.uk>) before you head for the lecture.
- Arrive for the lecture in good time. The introduction usually sets the scene, increasing understanding of the material.
- Sit where you can see the board/OHP and hear most clearly.
- Have with you something to write with and on.
- File each course separately.
- There are advantages in loose-leaf filing: extra pages can be added; example sheets and solutions can be filed at the relevant point.
- Number your pages: you can make cross-references later; you can restore the correct order, should the ordering become confused for any reason. Dating the notes can also help here.
- Leave plenty of space (for example, wide margins) so that you can add comments later; it can be helpful to add such comments in pencil or in a different colour so that you preserve a faithful copy of the lecturer’s text.
- Use headings or highlighting, to distinguish major from minor results, proofs from examples, theory from technique.
- Try for a neat original. There is no point in mechanically copying out your notes in neater handwriting and it is very time consuming.

DON’T PANIC if you don’t immediately understand something. Concentrate on making accurate notes and, if you cannot resolve the problem yourself, seek help later - from your friends, the lecturer, your workshop leader, your tutor, or from books. Don’t be afraid to ask

questions during or at the end of a lecture; usually there will be other students who do not understand as well. **Lecturers do make mistakes** - sometimes “slips of the pen”, sometimes mathematical errors. If you do spot any errors, draw the lecturer’s attention to them immediately.

2. NOTATION AND CONVENTIONS

Progress in understanding will be quicker if you are familiar with the basic notation and conventions. Get to know the Greek alphabet and the meaning of any special symbols such as $\exists, \forall, \Rightarrow$, making your own list at the front of your notes if necessary. Make sure that you understand the meaning of words such as “axiom”, “definition”, “proof”, “example”, “whenever”, “unless”, “if”, “only if”, “implies”, “hypothesis”, “conclusion”, “necessary”, “sufficient”, “for some”, “for every”, and “for each”. Be aware that many words like “bound”, “limit”, and “infinity” have technical meanings superficially similar to, but actually different from, common usage.

3. DIFFICULT SUBJECTS

Some subjects are intrinsically difficult and progress in these subjects is bound to be slower than in ‘easier’ subjects. You should be aware of this so that you are not discouraged. Remember also that the brain has an amazing ability to resolve problems for you, given time. And the harder a challenge, the greater the satisfaction gained when you are successful.

4. CONSOLIDATION OF LECTURE MATERIAL

It is not sufficient to have a copy of the lecture notes. The material must be understood and assimilated.

- **Work through** your lecture notes as soon as possible after the lecture - the same day if you can, but certainly before the next lecture in that course.
- **Check** (with the lecturer, your workshop leader or your tutor) the accuracy of statements and formulae whenever there is any doubt.
- **Learn** any new definitions straightaway.

- **Make sure you understand** the details of any worked examples.
- **Try to grasp** the important features of any new concepts and proofs.

Lecture notes should be amplified through reading, thought and observation, furnished with illustration, critical comments, references and extracts from other relevant sources. The final record should be an expansion of the initial lecture notes, but with the original record preserved.

If there is a section of your notes that you do not understand, make a note to **ask about it in your next workshop/tutorial** and mark the relevant section so that you can find it again easily. Discussion with fellow students can sometimes benefit all concerned.

Work through your notes again in the following vacation. This will help clarify the basic structure of the course and the inter-relation of different ideas.

5. PROBLEM SHEETS

One learns and even enjoys mathematics by doing it, not just by reading it. The tackling of problems is, therefore, an essential part of learning. It will give you practice in using new techniques and help you to understand new concepts.

Before you tackle a problem sheet, **read the relevant sections** of your lecture notes. Then, if you have difficulty in starting a problem, you may recall similar ones in your notes or you may need to consult a textbook. Sometimes words like “deduce” and “hence” indicate a method of solution. In other cases, it may be possible to work backwards from the answer, or the form of the solution may suggest the techniques to be used. Discussions with fellow students can be helpful but make sure that the work you hand in is your own work.

It is most important to hand in your work for marking regularly and on time. Only in this way will you find out whether your ideas are right and your solutions correct. If you cannot solve a question completely, hand in your attempt up to the point at which you get stuck.

Set out your work clearly and logically, leaving plenty of room for the marker's comments. When your work is returned, study the comments and file it with the problem sheets and solutions at the appropriate place in your notes. Use the solution sheets/hints to solutions to see if you can improve/complete your solution to a question. This will help when you come to revise.

6. WORKSHOPS AND TUTORIALS

The philosophy underlying workshops and tutorials is given on page 10 of the Undergraduate Handbook.

The weekly workshop/tutorial groups provide you with an opportunity of sorting out any difficulties with a course. **Make the most of this.** Problems should ideally be cleared up as quickly as possible otherwise you may not understand the next piece of new material.

Always take your notes with you, with markers inserted at the place of any difficulties.

It is **not** intended that your workshop leader/tutor should do your week's problem sheets for you. This does not benefit anyone! But your workshop leader or your tutor should give help when asked.

7. TEXTBOOKS

These are often recommended by your lecturer, tutor, advisor, etc. to supplement lecture notes. You may like to buy your own copy, but this is not usually essential. Whether or not you understand the presentation of an idea in a lecture, another point of view will often help or enrich your understanding. Working through additional textbook examples on topics you have found difficult can also be very beneficial.

Make use of the library. You may find books, other than the recommended texts, which can help resolve difficulties.

Most textbooks are best treated as books of reference. Learn how to use the list of contents and the index to find particular topics.

In reading a chapter, do not expect to understand everything at a first reading. Go through it once then back over the more difficult sections, using pencil and paper to work through examples and to make any necessary notes.

Definitions and notation may differ from one book to another and from the lecture notes. Sometimes these differences matter, sometimes they do not – check, and then consult your lecturer/tutor if in any doubt.

8. PREPARATION FOR EXAMINATIONS

The longer you spend getting to know a subject, the easier it is in the weeks before examinations. You should not expect to learn painlessly or expect your knowledge to be absolutely permanent. A certain amount of rote learning may be necessary but this is much reduced if you can develop a feel for the logic and structure of the subject.

- **Basic definitions** should be learnt during the year, as they arise.
- **Formulae** become familiar through regular use – decide which ones you need to memorise and which you can derive from more basic principles; **formulae sheets are not provided in examinations.**
- **In learning bookwork**, learn the statement of a theorem, the main steps in the proof and, finally, the details of the proof.
- **Only college calculators** are allowed in the examination room; familiarise yourself with one of these and make sure that you understand the logic that these calculators use.

Make good use of the Christmas and Easter vacations to go through the previous term's work. Obtain copies of previous years' examination papers, work through these and practise doing questions under self-imposed examination conditions. Speed of writing is not so important in mathematics as in essay-based subjects. Clarity of thought and economy of expression are what matters.

It is not a good idea to work long hours in the days immediately before an examination. There is a limit to what one can absorb and, beyond this limit, the rest of the time is wasted – you will simply make yourself tired. This is even more the case if you overwork on a “spare day” between examinations, or on the night before an examination – there are no prizes for falling asleep during the exam!

Get used to working in sessions of two hours, the length of a mathematics examination and, if you are preparing for a morning examination, get used to working at 9.30 a.m.!

9. EXAMINATION TECHNIQUES

- Do not be in a hurry to start writing.
- Read the instructions carefully.
- Then read **all** the questions through, marking those you think you may be able to answer fairly completely; there is no point in spending time on a question that you find difficult and then running out of time before you can answer the questions about which you are more confident. You are also giving your brain the maximum amount of time to recall the relevant material.
- Select the question you feel most sure of and start with that; once you feel you have earned some marks, you gain in confidence and are more ready to tackle the “harder” questions.
- Read the question carefully, answering only what the question asks.
- Be careful of the accuracy of any calculations and if there is a simple way of checking your result, do so. For most exams, you may use the calculator provided by the college – but no other one.
- If you get stuck, **DO NOT PANIC**. You may find that one part of a question escapes you, but that by assuming an intermediate result you can continue. Sometimes there are hints at the end of a section or a question: use them.

After an examination – forget it – and focus on your preparations for coming examinations, or breathe a sign of relief that they are all over!

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