

FMSP Student Guide

1 Why study Further Mathematics?

Because mathematics is so important: it is the only subject with a second AS and A level, which extend the standard A level Mathematics in both breadth and depth.

By taking an A or AS level in Further Mathematics you will:

- deepen your knowledge and understanding of pure mathematics,
- be able to study a wider range of applied mathematics relevant to your future choice of degree/employment,
- develop your problem-solving and analytical skills, which are so valued by employers,
- increase your success at university in maths-based subjects like Engineering, Sciences, Computing, Economics, and of course Mathematics itself.

Mathematical ability is a very valuable asset: if you have some, make the most of it!

Studying Further Mathematics will:

- boost your performance in your standard A level Mathematics, making topics seem easier,
- provide a more stimulating experience than the standard A level Mathematics on its own,
- develop areas of the brain untouched by other subjects,
- give you a highly-respected qualification to add to your CV.

WHAT IS MORE

A and AS level Further Mathematics carry UCAS points in exactly the same way as other such qualifications. The government has recognised the importance of Further Mathematics and is supporting the national Further Mathematics Support Program to ensure that ALL students are able to access it. As well as being taken in year 12, as the first year of a full Further Mathematics A level, Further Mathematics AS level can be taken over two years, or in year 13. The AS supports and reinforces the standard Mathematics AS/A level and introduces new topics that are extremely useful to any student going on to study a maths-related degree.

Further Mathematics is a very prestigious qualification and taking it identifies you to universities and employers as a serious and committed student who is prepared to meet a challenge.

IN THE WORDS OF UNIVERSITY STUDENTS

“Maths has always interested me, and Further Mathematics starts you thinking about it like a mathematician. Single Maths doesn’t.”

“The people I know who didn’t do Further Mathematics found some topics difficult because they had never seen them before and, because of the schedule at university, each topic takes only one lecture.”

2 What each Further Mathematics Support Programme student should have

Tutor(s) Details	Name: _____ E-mail: _____
Integral Resources Website, accessed via http://integralmaths.org/	Username: _____ Password: _____
Textbooks for the modules you are studying	
The examinations formula book for your specification	

3 Studying through the Further Maths Support Programme

Your studies will be managed through your tutor in conjunction with your local Further Mathematics Support Programme Area Coordinator.

How will your studies be managed?

Tutors allocated by your Area Coordinator will manage your studies. You may have more than one tutor, each supporting you with different parts of the course. See “How will you work with your tutors” for details of how you and your tutors will work together. Tutors may be based in your own school or college, or in a different institution.

Why work in this way?

There are two reasons:

- The number of students wishing to study Further Mathematics from a single school or college may be small, so that classes would be too expensive for an individual school or college to run.
- Not all schools and colleges have teachers available to teach Further Mathematics.

What resources are available to support your studies?

Several different resources are integrated to support your studies effectively.

- Extensive on-line resources.
- Textbooks. See Making the most of your textbook for how to make best use of textbooks.
- You may take part in live on-line lessons with your own class, or with students from other schools or colleges
- There are revision videos for each module that you study.

What skills will you develop in addition to learning Further Mathematics?

You will develop many very useful skills through this method of study and you will find them particularly helpful in your future studies and/or career. These include:

- Self-motivation
- Independent learning
- Time management
- Working with others
- Using technology

We want to develop the Support Programme to make it as effective as possible, so please let us know what you think, either through your tutors, or by sending an email to:

studentfeedback@furthermaths.org.uk

4 How will you work with your tutors?

As a student using the Support Programme, you will have your own Support Programme tutors. The Support Programme is designed to help you to achieve a qualification in Further Mathematics. Your tutors, whether based at your school/college or at another institution, are committed to helping you manage your studies effectively to achieve that goal.

It is your tutors' job to do the following:

- Help you manage your studies
- Provide tuition
- Help you with mathematical queries
- Give regular feedback on your work
- Have regular classes with you, in which all of the above issues will be addressed
- Generally support you in your studies

You will be asked to submit homework to your tutors. It is important that your tutors know how you are progressing so that any difficulties can be identified and resolved quickly and effectively.

If you feel that you are getting behind with your work, let your tutors know immediately. Your tutor will help you to get back on target, perhaps by re-scheduling some of your work.

Classes

Come to classes well prepared so that the time is used effectively.

- Make sure you have done any work set in preparation for the class
- Have a clear idea of what you want to get from a class before it begins
- Remember to bring books, paper and writing equipment and be prepared to make notes (your tutors will not always prompt you to do this, so you should get into the habit of taking good notes) – for online classes, remember to bring any necessary equipment such as graphics tablets and headsets
- Sometimes a tutor may ask you to read parts of the textbook or work through things from the internet resources before a class; always note down anything you need help with, so that you can raise it with the tutor
- You may find that there is not always time to discuss all the points you would like in a class - it is important to tell the tutor if this is the case – the tutor may be able to answer your queries by email or suggest some alternative reading or activities

Make sure you make the most of classes:

- Be organised
- Don't be afraid to ask questions

5 Online support

Integral

The platform for accessing the resources is a moodle-based virtual learning environment called Integral which you may have seen before.

Your username and password are unique to you and you need to use them every time you access the resources.

There are lots and lots of resources that will be helpful to you including study plans, extra questions, worked solutions, extra notes and interactive resources.

There are also multiple choice tests and chapter assessments designed to help you with your learning. You might get set these for homework, they will help you and your tutor to judge how well you are progressing

In Integral, you can use forums to keep in touch with other students in your group and with your tutor between teaching sessions. Your tutor might use Moodle to set your homework.

Integral will keep a complete record of your progress in each module using your multiple choice test scores and assessment scores and comments which will be input by your tutor. You can see this at any time.

Detailed information on how the resources work is available on www.furthermaths.org.uk/integral, accessed from the online resources link on the Further Mathematics Support Programme homepage.

Live On-line Teaching Sessions (LIL and LOT)

We use an online platform called Blackboard Collaborate to teach live sessions in Further Mathematics over the internet. To access these sessions all you need is a computer connected to the internet. You don't need to install any software; to attend a session you just follow a link that will be provided to you by e-mail or via Integral.

If you attend live on-line sessions (LOT) you will be issued with a graphics tablet and a headset. This will mean that you can interact with your tutor by writing mathematics on the screen and by talking to them, as well as by using instant messaging.

6 Making the most of your textbook

It is possible that in most of your mathematical studies up to now you have only used your textbook as a source of questions (and probably to look at the answers in the back!). If you are to become an effective student you must also learn to use your textbook to learn new mathematical concepts and techniques. Effective use of textbooks is a vital skill for university study and for career development. Mastering it now will be of great benefit to you in the future.

Believe it or not, mathematics textbooks are designed to be read by students. The on-line resources are designed to be used alongside textbooks. The textbooks together with the on-line resources have proved a very effective resource for supporting students studying Further Mathematics.

How are your textbooks structured?

Mathematics textbooks are usually structured to a standard format.

- A chapter often begins with some background, which puts the mathematics it covers into context and perhaps gives a brief historical perspective
- The text then introduces and explains the new concepts covered in the chapter, often including concise definitions
- Next come examples, showing how you can use the new ideas that have been introduced to solve some problems
- After a few examples there is an exercise to enable you to practise the techniques that have been introduced
- Usually there are then some more notes and examples to develop the ideas further, then another exercise
- This pattern continues through the chapter until the ideas relating to the chapter topic have been developed to the extent of the module's specification – (Be aware that often A level Mathematics and Further Mathematics barely do more than scratch at the surface of an area of mathematics)

Some textbooks also contain **discussion points** and **activities**. These are designed to encourage you to think more deeply about the new ideas being introduced and to “learn by doing”. This is a far more effective way of learning mathematics than just trying to absorb information – **mathematics is much more about understanding and applying concepts than merely remembering information.**

How should you use your textbook?

A page of mathematics in a textbook can look very intimidating. If you are a reader of novels, it probably takes you between one and three minutes to read a page of typescript. Reading a mathematics textbook is not at all like this:

- The 'background' section can be read through quite quickly – it is only concerned with giving you information.
- The text introducing new concepts and definitions needs to be read much more carefully. Have a pencil and paper to hand (a pencil is better than a pen for this as you can rub out your mistakes). Read it through slowly, two or three times. Make a note of any sections you do not immediately understand. Fill in any 'gaps' in workings, to make sure you understand all of the steps. On the website you will find additional notes: read through these carefully and, if you feel it would be useful, print them out to include in your notes.
- Even if you still have unanswered questions about what you have read, don't worry. Go on and work through the examples which follow (again, there are more examples on the website which you can work through as well). To do this effectively you will need to work through them with a pencil and paper. It can be a good idea to try to work out the examples first yourself, before looking at how they are done in the textbook.
- Often you will find that working through some examples will help you to answer some of the questions which arose when you read through the theory. Re-read it again to see if you now understand it better.
- Once you feel you have a basic understanding of the ideas, make some brief notes, including key points and definitions. There is no need to copy everything out. Making some notes should help you to clarify the ideas.

Once you have worked through the notes and examples you are ready to tackle questions from the exercise which follows. The initial questions in an exercise tend to be quite straightforward. As you work through they get progressively more difficult. The initial questions are usually planned to help you grasp the basics of the mathematics you have been learning. The later questions may require you to use the new ideas you have learned with fluency.

7 Managing your studies

It is likely that you are used to having the structure of your studies determined largely by the school or college where you study. You attend classes or lectures at pre-set times, several times each week, and have frequent face-to-face contact with your teachers. Studying through the Further Mathematics Support Programme is less closely-managed than this and more responsibility is placed upon you to manage your own studies. This may take some getting used to, but it is excellent preparation for the type of studying you will need to do at university and/or in your future career.

When filling out your UCAS application, or applying for a job, be sure to mention that you have developed your independent learning skills by studying through the Further Mathematics Support Programme. It will impress!

Q How much work do I need to do?

One of the most common student questions is: 'How much studying do I need to do?' Students usually expect an answer in terms of time, but that is not really very useful. Different people learn different things at different rates. The crucial thing is how much you need to learn each week, not how long you should spend doing it.

The website resources have been structured into study sections. Your tutors will agree a schedule with you that will ensure your studies meet the necessary timetable for module exams.

As a rough guide you should usually expect to do between 2 and 4 hours of Further Mathematics study each week, in addition to the time you spend in class.

Q How do I know if I am doing enough?

Your tutors will help you to manage your studies in more detail and will agree an individual work plan with you. You should agree a date to submit each assessment. Work submitted to your tutors will normally be marked and returned within a week.

For each section of work there is a list of textbook questions on the website, together with hints and worked solutions. Your tutors will tell you which of these questions you should do. It is important that you work on the questions properly, rather than just looking at the hints and worked solutions. Always attempt a question without using any hints or solutions initially and only look at the hints if you get stuck.

If you are not honest with yourself about whether or not you have done enough work, the section test and assessment will find you out!

Your tutors will constantly monitor your progress and will quickly intervene to help if you seem to be getting behind. It is essential that you communicate with your tutors regularly – at least once each week – to discuss your progress and address any problems.

Q When should I do my work?

It is a very good idea to set aside specific periods of time each week when you will do your Further Mathematics study. Treat it as if it were part of your timetable. Different people work most effectively at different times. Some work early in the mornings, some burn the midnight oil, some structure their working days very strictly and get everything done between 9am and 5pm. You must do what suits you best, but you must discipline yourself to work consistently each week. If you have the opportunity, it is a very good idea to meet regularly with other students studying the same modules. If you cannot do this physically because you have no direct access to other Further Mathematics students, try contacting other students via e-mail. Your tutors can help with this.

Q What study techniques are most effective?

This is likely to depend on you as an individual. See Study skills for more detailed information about study skills. However, the next question is important.

Q Should I concentrate on learning techniques from my notes and textbook, or on doing questions?

It is a common mistake to think you can learn mathematics just by reading through notes or textbook many times and committing large amounts of information to memory. This is not an effective study technique for learning mathematics.

The best way to get better at solving mathematics problems is by doing them. In this sense mathematics is a practical subject. Mathematics exams don't ask you to write down everything you know about a particular topic, they ask you to solve problems. Once you have learned a new technique it is vital that you practise applying it by doing textbook questions and the multiple-choice questions in the section tests. The assessments will provide you and your tutors with clear evidence of how effectively you have learned each topic.

Q What should I do if I get stuck?

Learning mathematics is not a linear process. Sometimes you will feel you have not made much progress, at other times ideas will 'click' rapidly and you will cover large amounts of material in a short time. 'Steps to help you to solve a maths problem' (see Study skills) can often help to overcome a problem and form a good general strategy for solving mathematics problems.

Staying power is very important when studying mathematics. Don't become discouraged and give up. If you are stuck, you will often need someone to help you. Contact other students on the same course or your tutors.

Q Isn't it cheating to ask other students?

Just copying the work of other students is cheating and will not help you in the long term. However, learning from other students is certainly not cheating; it is a very effective way to learn. Other students can learn from you too. Many people have the idea that mathematics is a solitary subject. It really isn't. Professional mathematicians and other academics and professionals spend a lot of time discussing problems with other people in the same field.

If you help another student, or another student helps you, both of you benefit. By explaining something to someone else you can really help to clarify your own understanding.

Learning how to work with other people in this way will also be of great help to you at university and/or in employment.

However, assessments and tests should be done without help from others, to enable you and your tutors to assess your progress reliably.

8 Coursework

You may take modules that require compulsory coursework, which makes up 20% of the assessment marks.

The main modules supported by the FMSP which have such a coursework requirement are:

- Numerical Methods
- Differential Equations

Your tutors will explain exactly what is required for the coursework, maybe by enabling you to attend an online session, and will agree deadlines with you for submission of:

- an initial plan
- an overall outline
- your completed project

Provided that you stick to the deadlines your tutors give you and consider the mark scheme carefully (your tutors will ensure that you understand what the markscheme means), you should find the coursework a useful experience.

- Coursework should help you to understand the module thoroughly.
- Coursework is an excellent opportunity to earn marks without the pressure of an exam situation.

9 Study skills

General mathematics study strategies

Here are the main points you need to follow when studying through your Further Mathematics Centre:

- Try to do some studying for Further Mathematics every day. Frequent study is far more effective than trying to cram in large chunks of work at the last minute. New ideas need frequent practice for them to 'sink in' properly.
- Draw up a study timetable and stick to it. You will need to integrate your Further Mathematics study into your weekly schedule alongside your other subjects and commitments.
- Practising questions is a far more effective technique for learning mathematics than just reading through textbooks and notes.
- If you can't understand something even after working through the textbook and web materials, ASK. Use Ask NRICH and/or talk to other students. If you need to, contact your tutors, who are there to help you.

Steps to help you to solve a mathematics problem

1 Understand the problem

What is it about?

What topic of mathematics is involved?

Describe the problem to yourself verbally. What information are you given?

What are you asked to do?

What is the unknown?

Write down the information.

If appropriate, draw a diagram.

If necessary, introduce suitable notation.

Ensure that you fully understand the problem and the given information before you proceed.

2 Devise a plan

Do you need to introduce notation?

What can you deduce from the given information?

Can you see a connection between the given information and what you are trying to find?

What do you need to get the unknown?

Have you solved a similar problem to this one?

Can you simplify it and solve an easier problem, then adapt to the original problem?

Have you used all the given information?

Write down an outline of your plan before you proceed

3 Carry out the plan

Check each step.

If you come across a difficulty, go back to your plan and revise it.

4 Look Back

Reflect on the method; you may be faced with a similar problem in the future.

Can you check the result?

Can you check the argument?

Having found one way of solving the problem, can you now see a better way?

Can you use the result, or the method, for some other problem?

10 Revision

From when you have finished a module, leading up to the exam, your tutors can provide about your revision. The points below will help you to do this effectively:

- Practising questions is the best way to revise mathematics.
- Look through all of your work at regular intervals throughout the course. This does not take as much time as you might think and can really help you to retain the mathematics you have learned.
- It is a good idea to re-do the chapter assessments and multiple choice tests from the resources website as you proceed through your revision.
- Watch FMSP revision videos for the modules you are studying.
- Make sure you are familiar with the formula book you will be given in the exams and can find any information you need quickly.

Once you have revised the content of a complete module, you need to get as much practice as possible on past papers.

- Try to do complete past papers under examination conditions. Check your answers using the solutions from the resources website.
- Save the most recent past paper to use as a mock exam, about a week before the real exam date.
- Spend the last few days up to the exam going back over questions from past papers .

11 And finally ...

Learning to study more independently is not easy and you may find adapting to the style of teaching and learning demanded by the Further Mathematics Support Programme difficult, especially at first. However, please stick with it and never be afraid to ask for help, either from your tutors or via studentfeedback@furthermaths.org.uk. The vast majority of Further Mathematics Support Programme students are successful and they report that both the mathematics they learn, and the study skills they develop by studying through the Further Mathematics Support Programme, are extremely useful to them at university and beyond.

GOOD LUCK!