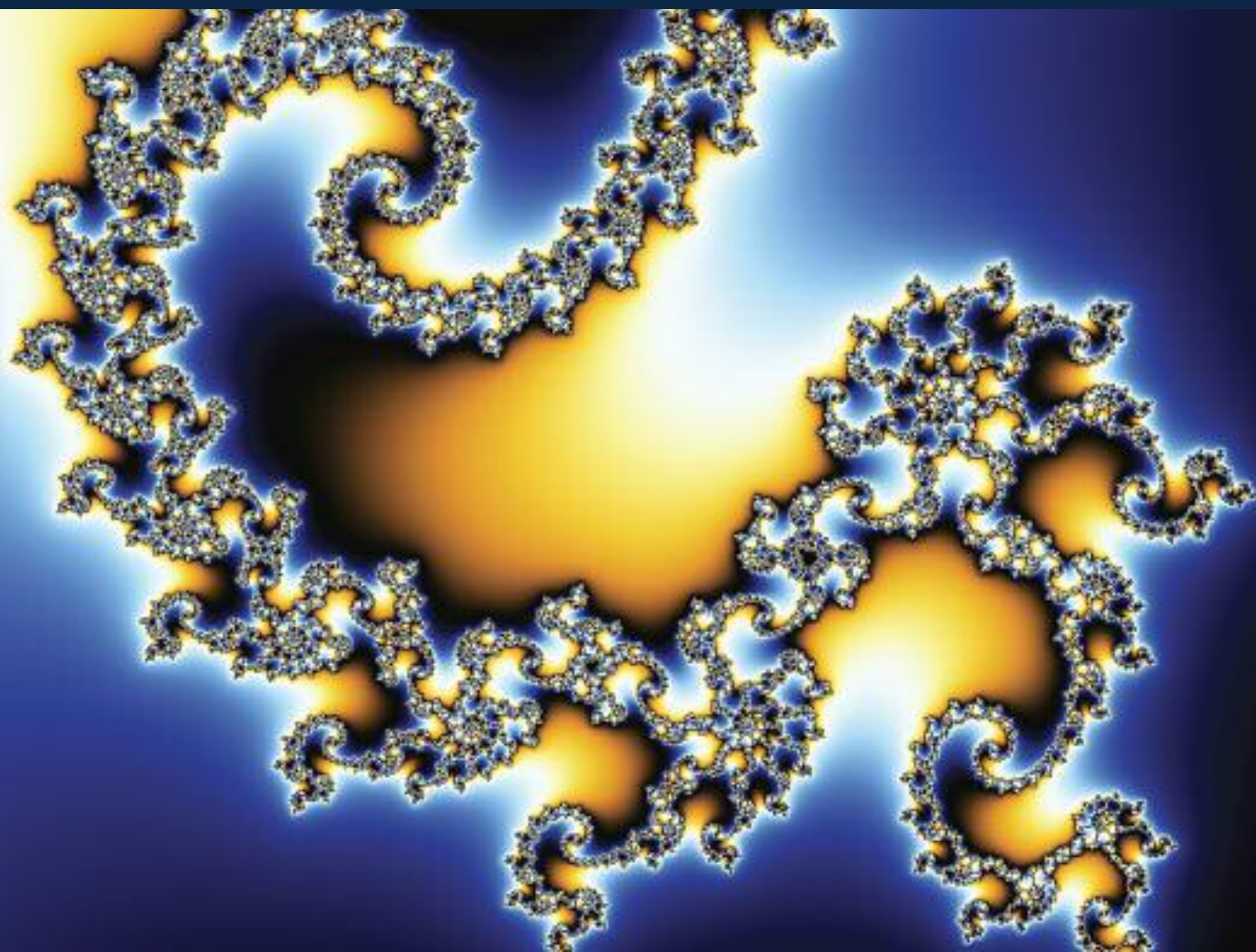


School of Mathematical Sciences

Parents' Guide to Studying Mathematics



What is Mathematics?

At primary school, we are taught the number skills that we will require for everyday life. Fluency in multiplication tables and competency with arithmetic are things that are easy to see the use for. Then during secondary school, these tangible numeracy lessons gradually give way to what is called “mathematics”. While teachers still cover some topics with clear uses, such as measurements and statistics, far more abstract topics in the style of algebra and calculus are taught. By the time a student reaches the end of A-level mathematics, it takes a vivid imagination to see what the every-day uses are for differential equations and vector multiplication.

Should a student then study mathematics at university, the days of numeracy skills will not only be long-gone, they can easily be long-forgotten. Mathematics undergraduates will be taught by lecturers who have probably completely forgotten their multiplication tables, and they will cover obscure mathematical topics which may still be hundreds of years away from finding a practical application.

So where is the line between what is useful to learn and what is not?

If all you wish to equip yourself with are numeracy skills for normal life, then you will have the foundations of what you need by the end of primary school and will have safely over-shot the mark by the completion of GCSE maths. However, if you intend to function in a slightly technical area involving any aspect of science, then A-level mathematics will give you the analytical skills and logical thinking you will require. University level mathematics will likewise provide advanced thinking skills, only several times more so.

The difference between numeracy and mathematics is the difference between learning a technique and learning why that technique works. Mathematics not only equips people with the mathematical skills which all areas of engineering, science and finance depend on, but it also trains people in understanding the logic and patterns behind those subjects.



Of course, doing a mathematics degree is not the only way to learn maths at university. Everyone from engineering students to slightly-startled psychology first-years will find themselves completing mathematical subjects. It is the applied areas of mathematics and statistics which give these other subjects a firm foundation and equip students with the techniques they will need for their profession. However, only students who study mathematics itself - or embrace the mathematical elements of their degree course rather than see it as a necessary evil - will gain a deep understanding of how and why those techniques work.

This deeper understanding of mathematical techniques is evident in the range of the occupations which people who study mathematics end up in. You will find mathematics graduates happily working away in finance companies, engineering firms, IT services, medical research organisations and so on. Not to mention the countless areas such as marketing and managerial work where solid logic and creative problem solving skills are invaluable. There is not the same dispersion of students from other more vocationally-focused subjects, and where there is you can argue it is because of their mathematical basis. A mathematics student can easily work in finance or engineering, but a financial graduate cannot easily decide to work as an engineer.

So even though university mathematics may seem to be more abstract and less applied than other subjects, it is unique

in its ability to provide graduates with a wide range of transferable thinking skills which makes them employable in such a wide range of industries.

Naturally, a good maths student knows that this is just correlation and does not necessarily imply causality. It could be that people who already have good thinking skills are drawn to study mathematics. But there is no doubt that people who complete a maths degree – whether they started with them or not – seem to have brilliant thinking skills. Employers use mathematics as an indicator of proven logical thinking skills.

Finally, if you look at the bigger picture, we need people learning and researching new mathematics to support our future technologies. Our modern society is only possible because of various bits of maths which were developed by mathematicians over the past few thousand years, often out of pure curiosity. There are mathematics students in universities now working on concepts which will become the next Google search algorithm or the foundation for a new form of electronic communication, which is far more useful than just learning your multiplication tables.

Matt Parker

When Matt isn't working as an Outreach Officer for Queen Mary, he can be found writing for the Guardian or appearing on Radio 4 in his other guise as a stand-up mathematician.

www.standupmaths.com

Studying Mathematics at University

Studying mathematics at university is different to studying the subject at school or college. To begin with, the class sizes are much larger and the style of teaching is different as undergraduates are expected to be more independent. The degree programme that the student enters on will have an outline of the different subjects (called modules) required. However, there will be some options open to students. They are each assigned an academic adviser who will help them decide on which modules to take as part of their studies. They can also offer advice on many different aspects of student life. The skills developed as part of the degree are applicable to many areas - problem solving, analytical skills, communication skills, computing skills – are all developed as undergraduates progress through their degree.

Lectures

In first year, the number of students in lectures could be as many as two or three hundred. This is because everyone will be taking similar courses to give them the broad grounding they need in mathematics before they can go on in second or third year to specialise. This specialism means that class sizes do get smaller in second and third year and depending on which modules are chosen, there could be as little as five students in the class. At Queen Mary we have over seventy undergraduate modules available for selection, but this will vary from university to university.

In lectures themselves, it is generally expected that students will take their own notes. Lecturers often provide basic notes

before or after a lecture, but students find it most helpful if they make their own record or supplement the one supplied. There will be a webpage for each module containing supporting information and further reading. Around twelve hours per week are taken up with lectures: usually three hours per each of the four modules.

Exercise and Practical Classes

To support learning in lectures, exercise classes are available for students to attend to work on problems relating to material covered that week. They are led by the lecturer and supported by post-graduate students. With regards to size, the maximum number attending these classes would be thirty to forty, so it is an opportunity for students to raise any problems they have. At Queen Mary students normally attend one hour of exercise classes per module, meaning that there is a total of sixteen hours of contact time in a mathematics degree. There are some modules which make use of specialist computing packages or techniques. This means that instead of attending lectures or exercise classes, the module is taught in a computer lab, with students learning practical skills which can be directly applied in many careers today. It is possible for undergraduates to complete a final-year research project but it is not compulsory. This could be a good option if they are thinking about continuing their studies with a Masters degree or a PhD, or if they intend on using mathematics at a high level every day in their job.

Peer study-support

In addition to the formal, timetabled classes, there are other study support options available to students. For example, at Queen Mary we have a Peer Assisted Study Support (PASS) scheme where students in their second or third year mentor first year students and help them with their studies. This allows first years to benefit not only from their subject knowledge, but their practical experience of studying mathematics at university and they often give advice on student life and information on what certain modules are like in later years, helping with future decisions the first year students will have to make.

Assessment

Unlike school or college, there is not a large coursework component in the final mark for modules. At Queen Mary, a combination of coursework and mid-term tests accounts for 10% of the module mark with the remaining 90% coming from an end of year exam (lasting 1.5-2 hours). For the computing-based modules, assessment is made via project work. Coursework is regularly set by lecturers and is marked with feedback supplied, but the mark isn't always put towards the final result; rather it is an opportunity for the student to understand how they are progressing in a subject and to find out what they can do to improve their performance.

Student Support, Careers and Learning Resources

There are many different central services available to mathematics undergraduates. These range from accommodation to advice and counselling. One of the most important services they will work with is the Careers Service. This is something they should engage with from their first day. Advice and support is available on writing a CV, attending interviews, gaining work experience all the way through to finding a graduate job.

The Library will contain a number of relevant textbooks for the use of mathematics undergraduates, but there are usually books that are recommended for purchase by lecturers.

Laura Thomas
Outreach Manager



Student finance explained for 2012 entry

Roisin Hurst from the Education Liaison Office at Queen Mary explains the finance arrangements for 2012 entry.

Yes, fees are rising, but students will have access to an excellent financial support package – and they will only repay their student loans in manageable amounts after graduation.

With the new finance arrangements for going to university from 2012 splashed all over the media it is understandable that there may be some confusion. In fact, students will be able to borrow the cost of tuition fees and money to cover living expenses – and repay them after graduation, in manageable amounts related to their graduate income. So don't let these concerns put you off university. Additionally, there will be lots of 'free' money available if you are a low or even middle income household.

Tuition fees: how much – and how do I pay?

From 2012, universities will be able to charge between £6,000 and £9,000 per year, as long as they meet strict criteria to ensure that all students can access their courses, regardless of family income. The majority of universities have announced that they will charge £9,000, but check their websites for full details. The good news is that fees do not need to be paid upfront. Instead, the student can take out a Tuition Fee Loan from Student Finance England, who pay the fees direct to the university. The loan is available to all eligible home students, on part- and full-time degree programmes, irrespective of their family's income.

Living costs

Obviously money is needed for accommodation, food, books, socialising, communications (smartphone, plus apps), and so on. Where will this money come from? Your lottery-win dreams are unlikely to come true, so for most this will mean taking out a Student Loan for Maintenance, again from Student Finance England, to cover living costs. Eligible students are

entitled to at least 65 per cent of the maximum amounts available; the other 35 per cent depends on household income.

The maximum loan available will vary depending on where the student lives and studies. If living away from home to study in London, the maximum will be £7,675. For a student living away from home outside London it will be £5,500, and for students living at home it will be £4,375. The loan will be paid into their bank account in instalments each term to help them budget: so that means they won't spend it all in freshers' week on clothes/socialising/a car!

How are the loans repaid?

Fee and maintenance loans will be combined and students will start paying them back through the tax system from the April after they graduate, BUT, only if they are earning over £21,000 (gross). However, interest will begin to accrue from the time they receive their loan. The most important point is that the monthly repayments will be linked to how much they earn, not the amount they actually owe: they'll repay at a rate of 9 per cent of their income above £21,000 (gross). For example, if they are earning £25,000 they will pay back approximately £30 a month. If for any reason their income drops below £21,000, their repayments will stop. Any debt left after 30 years will be written off. The interest rate is linked to the Retail Price Index (RPI), plus extra depending on their graduate income. The maximum interest rate, which will apply once you are earning over £41,000 a year, will be RPI plus 3 per cent.

Maintenance Grant (non-repayable)

If your family's household income is £25,000 or less, the student will be entitled to a non-repayable Maintenance Grant of up to £3,250; students from households with incomes of up to £42,600 will be entitled to a partial Maintenance Grant. Your family income will be assessed before they go to university. Like the maintenance loan, any grant awarded will be paid termly. (However, the maintenance loan will be reduced by 50p for every £1 of grant you receive.)

Bursaries (non-repayable)

A bursary is provided by the university and is not something that is repaid. From 2012 onwards, universities charging between £6,000 and £9,000 have to agree to provide financial support to help students from low income backgrounds. You need to check universities' websites to find out what they are offering; but, as an illustration, Queen Mary plans to offer a generous bursary package: £1,500 a year for students in receipt of the full Maintenance Grant and £1,200 for students who get a partial Maintenance Grant.

Scholarships (non-repayable)

Scholarships are awarded by universities and are non-repayable. The criteria for awarding them can be based on academic achievement, for example, excellent results in year 13 exams, or, once at university, first year exam results. Many universities offer scholarships, although information on these can be hard to find. To find out more, contact university finance advisers, usually located in welfare or student support offices. They can advise on all aspects of financial support to study, including how to actually obtain what students are entitled to.

National Scholarship Programme (non-repayable)

The Government has announced a £150m National Scholarships Programme for students from lower income families. Again, check with individual universities to see how they will administer this. For example, Queen Mary plans to offer 266 students from low income families a £3,000 benefit in their first year: a £1,500 fee reduction plus £1,500 made up of a cash bursary and 'in-kind' support. In their second and third years, they'll receive the Queen Mary Bursary.

Important note 1: these arrangements refer to students living in England and studying for an eligible course at an English university, and who qualify as home students.

Important note 2: some of this information might change before you start university so keep up to date at:
www.direct.gov.uk/studentfinance and/or
www.bis.gov/studentfinance

Career Opportunities for Mathematics Graduates

Mathematics is at the heart of innovation and growth in the UK economy. The roles undertaken by mathematics graduates are diverse, highly skilled and central to many businesses. The combination of knowledge and skills gained from a mathematics degree offers graduates opportunities in many different fields. Therefore undergraduates just starting their degree course do not need to have mapped out their career down to the smallest detail, as they will have support to explore their options whilst at university.

This article outlines the different areas open to graduates and the types of salaries they can expect. These are not the only areas available and links to further information and detail are listed at the end. The essential part to remember, is that they have the prospect of high potential earnings due to the high-skilled nature of the jobs. By taking mathematics at university, they will add a potential £200,000 to their earnings over the course of their career when compared with someone who didn't go to university. This can also be put into context alongside other subjects: history graduates can expect to add £30,000 to their career earnings by taking the subject at university. Therefore there are many benefits to taking mathematics at university.

Business and Management

This is a broad area where mathematics is a useful tool to make business more efficient and more profitable. Roles can be technical, where mathematics is used daily, or more project management related where the skills developed as part of the degree come to the fore.

Management Consultancy

There are a number of different roles and functions within a business suitable for a mathematics graduate, but one example is the role of a Management Consultant. This role requires excellent problem solving and communication skills. It involves working with a variety of clients on issues within their business or operation. One week they could be carrying out a review of the way in which a department runs in order to make recommendations on how to make it more efficient, the next they could be recommending changes to the NHS in

order to save money. It is a very project-based role which means that each week can be different to the one before.

Typical starting salary: £25,000 - £35,000+

Senior salary range: £50,000 - £120,000

Finance and Economics

Mathematical theories can be applied to many situations, but the most commonly talked about area relates to finance and economics. The influence that mathematics has on this field is substantial. Companies and governments are always looking for new developments in mathematics to apply to this area to help them understand the behaviour of the markets and analyse growth, for example.

Actuary

Actuaries can be found working in many different areas, including banking, insurance and pensions. This is an important role, as they advise on how to minimise risk based on an analysis of data using statistics and probability. Initial positions are as trainees, meaning that as well as working, exams need to be completed. Day to day, actuaries will be advising on investment decisions, carrying out calculations and monitoring risk – amongst others.

Typical starting salary: £25,000 - £35,000

Senior salary range: £60,000 - £100,000+

Economist

This role requires a good understanding of statistics combined with analytical skills and utilisation of specialist software to identify trends and make recommendations to clients. They also need to be able to communicate their ideas effectively. Examples of the type of work undertaken include making an estimate of the economic impact made by the London 2012 Olympic games or advising government on the impact policies will have on the economy.

Typical starting salary: £25,000 - £35,000

Senior salary range: £50,000 +

Communications and Security

As we are becoming more and more connected, we need to be cautious about how we share information and carry out

transactions online. Mathematics helps to safeguard bank and credit card details and protects us from fraud. There are many companies and government institutions who look for ways to protect our data.

Government Communications

Headquarters (GCHQ) Mathematician

This role requires someone who is good at problem solving and enjoys a challenge. For this type of role, it is useful to continue on to complete a further qualification on graduation: either a Masters degree or PhD in mathematics. Work can be project-based and there is a lot of work that relies on new technology and new developments in mathematics.

Typical starting salary: £25,000

Senior salary range: £40,000+

Energy and the Environment

There are many developments in the energy and climate change field. From companies who are looking at new ways to generate electricity in a clean way, to institutions who are trying to gain a greater understanding of how the climate behaves.

Meteorologist

It is important to improve our understanding of the atmosphere and therefore attempt to make better predictions and forecasts of what weather we can expect in the medium to long term. This is done by creating mathematical models and using large amounts of computing power to do calculations. There are many organisations who rely on these forecasts, for example, airlines, shipping companies and the National Health Service. Typical activities for this role include gathering information, analysing it and presenting results to clients.

Typical starting salary: £25,000

Senior salary range: £38,000 - £60,000+

Useful websites:

www.prospects.ac.uk
www.mathscareers.org.uk
www.futuremorph.org

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