

# Mathematics

## Essentials

### What mathematics degrees are there?

#### MMath degrees

Mathematics  
Mathematics with Computer Science  
Mathematics with Economics

#### BSc degrees

Mathematics  
Mathematics degrees (with a Foundation Year)  
Mathematics with Computer Science  
Mathematics with Economics

### What A levels/IB scores do I need?

(For other qualifications information, refer to pages 125-129)

Typical A level offer for MMath degrees: AAA, including both Mathematics and Further Mathematics

Typical A level offer range for BSc degrees: AAA-AAB, including Mathematics, grade A

Typical IB diploma offer: at least 36 points, including 6 in Higher Level Mathematics

The equivalent of A level Mathematics (with a very high grade) is required from all non-A Level applicants

### What else do I need?

Special entrance requirements apply to Mathematics degrees (with a Foundation Year), refer to page 93

### Fees

Refer to pages 125-129 for information on fees

### What scholarships are there?

Mathematics scholarships worth £1,000 are awarded to students who achieve exceptional results at A level, including Mathematics and excluding General Studies. The Department also awards prizes for the best student results each year, including £1,000 for the best final-year student

### English language requirements

IELTS 6.0, with 6.0 in each of the four components. Internet-based TOEFL with 80 overall, including at least 22 in Speaking and 24 in Writing. For alternative English language requirements, refer to page 130

### Foundation year for UK and EU students

Refer to Mathematics degrees (with a Foundation Year) on page 93

### Foundation year for non-EU students

If your qualifications (including English language) do not yet meet our entry requirements for admission direct to the first year of these degree programmes, we offer an international foundation year entry route. Refer to pages 26 and 131 for details

### How do I find out more?

For more information, contact:

E [ug.admissions@maths.sussex.ac.uk](mailto:ug.admissions@maths.sussex.ac.uk)

T +44 (0)1273 877345

F +44 (0)1273 678097

Department of Mathematics, University of Sussex, Falmer, Brighton BN1 9QH, UK

[www.sussex.ac.uk/maths](http://www.sussex.ac.uk/maths)

### When can I visit?

Our Open Day dates for 2011 are 11 June and 8 October. We also run regular campus tours.

Please book online at [www.sussex.ac.uk/visitors](http://www.sussex.ac.uk/visitors)

or call 01273 876787. All applicants who are offered a place are invited to attend one of our special Admissions Days, which will take place between November and April

### Why mathematics?

Mathematics is core to most modern-day science, technology and business. When you turn on a computer or use a mobile phone, you are using sophisticated technology that mathematics has played a fundamental role in developing. Unravelling the human genome or modelling the financial market relies on mathematics.

As well as playing a major role in the physical and life sciences, and in such disciplines as economics and psychology, mathematics has its own attraction and beauty. Mathematics is flourishing: more research has been published in the last 20 years than in the previous 200, and celebrated mathematical problems that had defeated strenuous attempts to settle them have recently been solved.

The breadth and relevance of mathematics leads to a wide choice of potential careers. Employers value the numeracy, clarity of thought and capacity for logical argument that the study of mathematics develop, so a degree in mathematics will give you great flexibility in career choice.

### Why mathematics at Sussex?

- In the 2008 Research Assessment Exercise (RAE) 90 per cent of our mathematics research and 97 per cent of our publications were rated as recognised internationally or higher, and 50 per cent of our research and 64 per cent of our publications were rated as internationally excellent or higher.
- Mathematics at Sussex is ranked in the top 20 in the UK in *The Complete University Guide 2010-11* and *The Guardian University Guide 2011*.
- In January 2009 US careers website [www.JobsRated.com](http://www.JobsRated.com) rated mathematician to be the best job out of the 200 considered.
- You will find that our Department is a warm, supportive and enjoyable place to study, with staff who have a genuine concern for their students.
- Our teaching is informed by current research and understanding and we update our programmes to reflect the latest developments in the field of mathematics.

### What sort of career could I have?

- software development
- actuarial work, financial consultancy, accountancy
- publishing and Civil Service
- scientific research, academia, teaching
- business research and development.

All of our degrees give you a high-level qualification for a career or further training involving mathematics. A recent survey showed that students with a mathematical degree had the highest employment rate of any subject apart from medicine and dentistry.

## Charlie's career perspective

'I chose Sussex because of the warm, friendly atmosphere I experienced when I came along to an Open Day. 'Alongside my degree, I was also a student representative and president of the maths society which I set up. This involved organising many socials along the way, and I really enjoyed proving that maths isn't just for geeks! 'I'm now working in a large secondary school, earning my teaching qualification on the job as part of the Graduate Teaching Programme. The organisational and communication skills I gained at Sussex have proved really valuable. I've always wanted to teach A level Maths, and I'm looking forward to inspiring the next generation of mathematicians.'

Charlie Refoy  
Graduate Teaching  
Programme Teacher,  
Brighton & Hove



## Richard's perspective

'Maths at university is very different from A level – it's much less about "doing sums" and much more about finding out how things work. This is no bad thing – in fact, I love it. At school I always questioned the why and how of things and never had satisfactory answers. Here at Sussex, I'm constantly encouraged to address all those questions. For example, one course took simple calculus from A level and made it much more exciting, infusing with significance something that seemed deceptively trivial at A level. 'Maths at Sussex is great. The lecturers and workshop tutors really want you to do well and are always very happy to help you. I've been challenged to push myself in my quest to gain a deep understanding of mathematics, and there is no better place to learn than here at Sussex.'

Richard Roberts  
BSc in  
Mathematics





The wings of the female *Papilio dardanus* exhibit a spectacular variety of complicated patterns and it can be hard to see a logical relationship between them. The figure above shows the patterns of the butterflies *lamborni* (left) and *planemoides* (right). In both cases, the wing on the left is a photograph of an actual butterfly wing, while the wing on the right is a numerical approximation obtained from a mathematical model

#### How will I learn?

We recognise that new students have a range of mathematical backgrounds and that the transition from A level to university-level study can be challenging, so we have designed our first-term courses to ease this. Although university modes of teaching place more emphasis on independent learning, you will have access to a wide range of support from tutors.

Teaching and learning is by a combination of lectures, workshops, lab sessions and independent study. All courses are supported by small-group teaching in which you can discuss topics raised in lectures. We emphasise the 'doing' of mathematics as it cannot be passively learnt. Our workshops are designed to support the solution of exercises and problems.

Most courses consist of regular lectures, supported by classes for smaller groups. You receive regular feedback on your work from your tutor. If you need further help, all tutors and lecturers have weekly office hours when you can drop in for advice, individually or in groups. Most of the lecture notes, problem sheets and background material are available on the Department's website.

Upon arrival at Sussex you will be designated an academic advisor for the period of your study. They also operate office hours and in the first year they will see you weekly. This will help you settle in quickly and offers a great opportunity to work through any academic and personal problems.

#### What will I achieve?

- excellent training in problem-solving skills
- understanding of the structures and techniques of mathematics, including methods of proof and logical arguments
- written and oral communication skills
- organisational and time-management skills
- an ability to make effective use of information and to evaluate numerical data
- IT skills and computer literacy through computational and mathematical projects
- you will learn to manage your own personal professional career development in preparation for further study, or the world of work.

#### MMath or BSc?

The MMath programmes are aimed at students who have a strong interest in pursuing a deeper study of mathematics and who wish to use it extensively in careers where advanced mathematical skills are important, such as mathematical modelling in finance or industry, advanced-level teaching or postgraduate research.

Applicants unsure about whether to do an MMath or a BSc are strongly advised to opt initially for the MMath programme. If your eventual A level grades meet the offer level for a BSc but not an MMath we will automatically offer you a place on the BSc programme. Students on the MMath programme can opt to transfer to the BSc at the end of the second year.

#### Degrees

##### Mathematics

**MMath (Hons), 4 years UCAS Code: G103**

**BSc (Hons), 3 years UCAS Code: G100**

The single-honours degree is our most popular programme. The two variants, BSc and MMath, are identical in the first two years and it is possible to switch from one to the other up to the end of the second year.

As well as the mathematics core courses, you take additional courses that supplement them, such as Computing with MATLAB and Mathematics in Everyday Life.

You will have the opportunity to study specialised and advanced options in the third year, which currently include Functional Analysis • Financial Mathematics • Applied Mathematical Models • Groups and Rings, Probability Models • Partial Differential Equations.

MMath students have further advanced courses in the fourth year and complete a year-long project under the guidance of a lecturer.

##### Mathematics degrees (with a Foundation Year)

**BSc (Hons), 4 years UCAS Code: G140**

*The standard A level offer is CD, including A level Mathematics at grade C, but other post-GCSE qualifications may be sufficient*

This programme is ideal if you want to take a degree in mathematics, but your qualifications do not meet the entry requirements for a three-year programme. The final honours degree is entirely equivalent to a standard three-year BSc (Hons) degree.

In the foundation year, you develop your basic mathematical skills and understanding. You take courses on calculus, geometry and algebra, including concepts of proof and logical argument. Throughout the year you will be introduced to many mathematical applications from statistics, mechanics and computer science.

On satisfactory completion of the foundation year, you may transfer to any BSc mathematics degree.

#### Core courses

You will study fundamental topics such as analysis, algebra, differential equations, calculus of several variables, probability, statistics, applied mathematics and mechanics, computation and numerical mathematics

#### Courses currently include:

##### Year 1

In the first term, the core major courses have been designed to reflect the recent changes in A and AS levels, and provide an essential foundation in the skills required for studying university mathematics. These include the development of analytical skills in calculus, logical thinking and rigorous pure mathematical arguments. This naturally leads, in the second and third terms, to the study of the fundamental areas of linear algebra (dealing with matrices and systems of linear algebraic equations) and analysis (dealing with sequences and convergence, continuous and differentiable functions)

You will also be introduced to applications of mathematics that rely on mathematical models based on differential equations. You will begin to solve advanced mathematical problems by identifying and implementing the necessary tools

##### Year 2

You will expand and deepen your mathematical knowledge, with new, interesting fields in pure and applied mathematics, as well as statistics, probability and numerical analysis

##### Year 3

You will focus on the particular fields of mathematics that interest you. Options are available in pure mathematics, applications, statistics and mathematical computation. It is possible to carry out a project working under the close supervision of a member of faculty

##### Year 4

If you are an MMath student, in your final year you will have many options that build towards a career using advanced mathematics. These include courses on algebraic topology, data compression, and financial portfolio analysis. You will also produce a dissertation, working with a faculty member. The dissertation allows you to investigate in great detail a field of mathematics that interests you. It also provides an excellent foundation for mathematical research, as well as showing future employers that you have the ability to present researched material clearly



**Mathematics with Computer Science**  
**MMath (Hons), 4 years UCAS Code: G1GK**  
**BSc (Hons), 3 years UCAS Code: G1G4**

The emphasis on logical and rigorous thought, together with the use of computers in mathematical research, means that mathematics and computer science combine well. Your study of computer science includes work in Years 1 and 2 on software, the structure of programs and operating systems, and the manipulation of databases.

The hardware side of computers is not covered and previous computing experience is not essential. The popular language Java is used for an introduction to programming. As well as the core mathematics courses in Years 1 and 2, you will spend 25 per cent of your time studying computer science courses. In the third year you take a combination of mathematics and computer science options.

If you are taking the MMath programme, you carry out a project in the fourth year and choose from a range of more advanced mathematical courses.

Refer to the core courses list on page 93 for details of mathematics courses; refer to the computing subject entry on page 48 for more information on these courses.



Figure 1

**Mathematics with Economics**  
**MMath (Hons), 4 years UCAS Code: G1LC**  
**BSc (Hons), 3 years UCAS Code: G1L1**

This degree exploits the strong relationship between mathematical modelling and economics. Alongside the mathematics core courses, you study the principles of economic analysis and its policy applications at both the macro (economy-wide) and the micro (individual/company) levels. The economics element provides an opportunity to acquire practical skills and to apply mathematical methods.

As well as the core mathematics courses in Years 1 and 2, you will spend 25 per cent of your time studying economics courses. In the third year, you take a combination of mathematics and economics options.

If you are taking the MMath programme, you carry out a project in the fourth year and choose from a range of more advanced mathematical courses.

Refer to the core courses list on page 93 for details of mathematics courses; refer to the economics subject entry on page 60 for more information on these courses.



Figure 2

A laser scan of a three-dimensional elephant sculpture gives rise to a set of points, refer to Figure 1. The reconstructed surface in Figure 2 is obtained from an implicit surface representation

The Golden Ratio, known as  $\phi$ , can be described in the following way: given a straight line, we can divide it into two segments A and B, in such a way that

$$\frac{A+B}{A} = \frac{A}{B} = \text{Golden Ratio } \phi$$

The Golden Rectangle has sides in proportion to  $\phi$   
 $AD = \phi AB$   
 supposedly the most pleasing rectangle to see

Take a Golden Rectangle and split it into a square and new Golden Rectangle

$AB = \phi AC$   
 then join diagonal corners of the squares with an arc. Repeating this pattern produces the swirling pattern associated with a nautilus sea shell