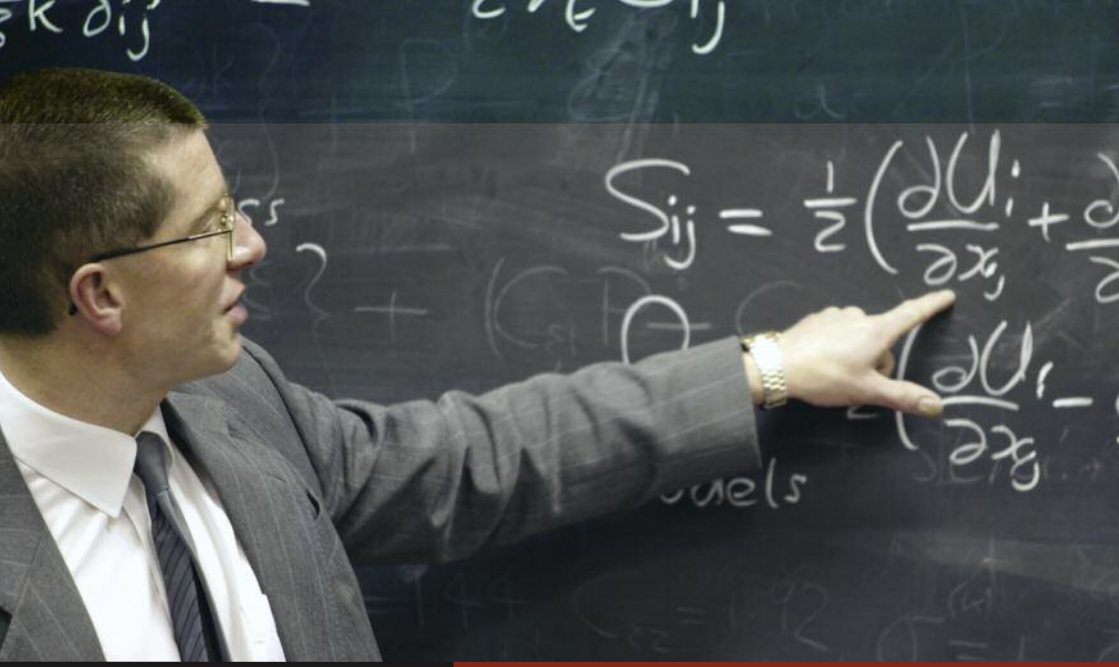
MANCHESTER 1824

The University of Manchester

Mathematics

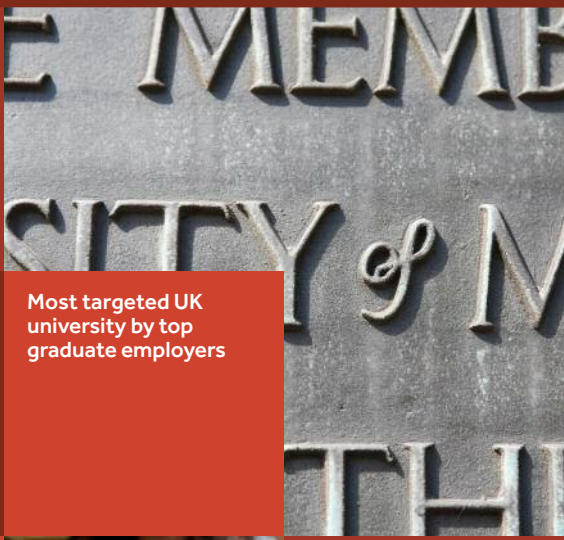
UNDERGRADUATE BROCHURE 2014

www.manchester.ac.uk/maths



The facts

State-of-the-art facilities in a purpose-built £60m building



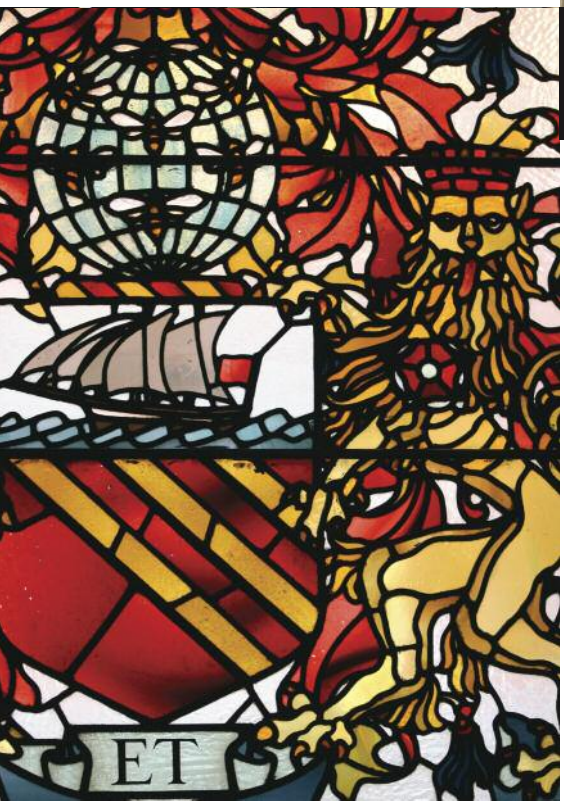
Rated "excellent" for teaching quality in mathematics in the last national assessment

Most targeted UK university by top graduate employers

Large range of lecture courses, informed by cutting-edge mathematics research

4 million books in one of the UK's best university libraries

> The staff are friendly and approachable... their passion for the subject makes the lectures engaging and interesting.
>
> **Una Gardiner**
> **MMath Mathematics**



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Our University
Making things happen

Influential, forward-thinking and down-to-earth, we'll give you an amazing university experience rooted in a rich academic heritage. We turn enthusiasm into achievement and groundbreaking theory into practice.

We accomplish feats of global significance, from splitting the atom to giving the world graphene – the two-dimensional wonder material that is one atom thick but 200 times stronger than steel. With more Nobel laureates on our staff than any other UK university, and strong links to industry and public services, we vitalise our undergraduate courses with pioneering research.

Join us at the heart of Britain's most popular student city.

Learn more about us:
www.manchester.ac.uk

Introducing Manchester

Our city
Always moving forward

Manchester lives on the edge of tomorrow, ever a step ahead in science, industry, media, sport and the arts. The Mancunian character, exemplified by the city's central role in the industrial revolution, strives for excellence in all walks of life.

This is a city of many accents, having become a cosmopolitan magnet for students and professionals eager to experience its can-do attitude, independent spirit and cultural wealth.

Never content to live on past glories, Manchester has a passion for progress.

Discover what makes Manchester unique:
www.manchester.ac.uk/cityofmanchester

Your experience
More than just a degree

From the flexible, 24/7 learning environment of the Alan Gilbert Learning Commons to the personal development opportunities and specialist support services we offer, we will empower you to be your best.

We're well underway with the biggest investment programme ever seen in UK higher education, having invested £750 million in our facilities since 2004, with another £1 billion to follow. Away from your studies you'll have access to the UK's largest student union, almost 300 student societies, and excellent sports and fitness facilities.

The only thing you won't experience is boredom.

Hear from some of our students, graduates and staff:
www.manchester.ac.uk/ug/profiles

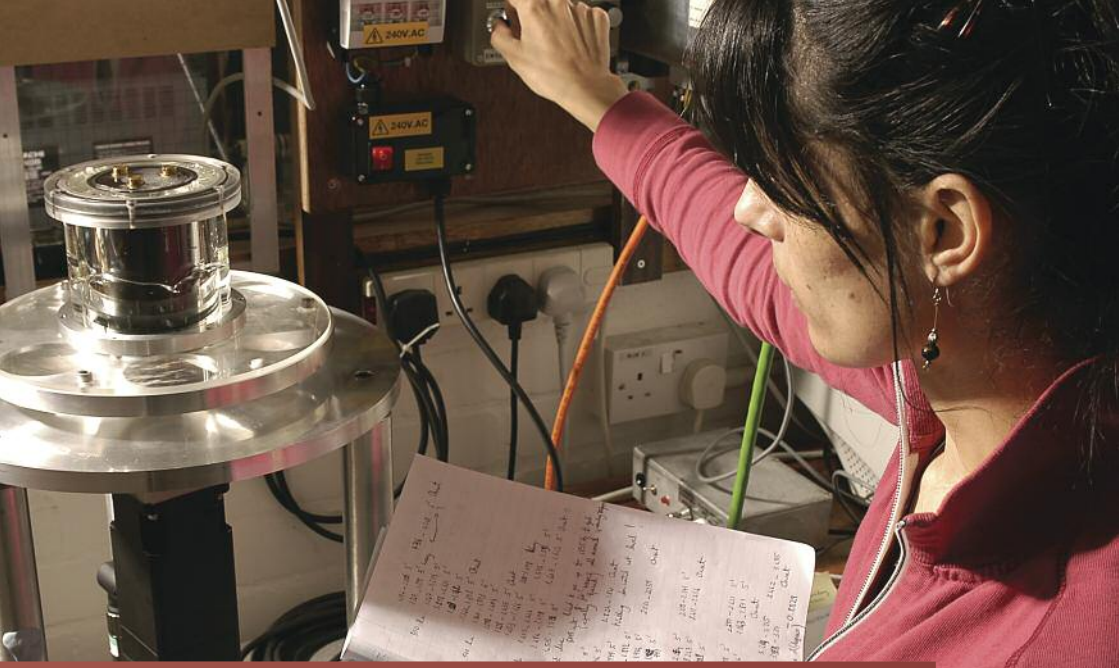
Your career
On a course to success

We are one of the UK's most targeted universities by employers – 92% of our graduates go straight into employment or further study.

We design our courses with your employability in mind. Our problem-based approach to learning inspires you to think critically, creatively, and independently. You'll also be able to learn new skills through volunteering, personal development programmes and study abroad pathways.

We have the UK's best careers service, providing advice and mentoring services, and connecting you with employers who'll put you on a path to career success.

Take control of your career:
www.manchester.ac.uk/careers



Mathematics at Manchester

With an excellent reputation for teaching and research, brand-new facilities and great staff expertise, our School of Mathematics has a great deal to offer you. We are one of the largest such academic schools in the UK, with more than 1,000 undergraduates, 200 postgraduates and 70 academic staff – all forming a welcoming, sociable and supportive community.

An outstanding reputation

From its inception, our School has always been well known for the quality of our teaching and degree programmes. Excellent resources enable us to offer considerable small-group teaching in your first year while you adjust to university life, with its more independent style of learning. In addition, the number and quality of academic staff in our School mean that you have a huge range of options in your third and fourth years, giving you the freedom to specialise in whatever area of mathematics you wish.

We continue to maintain a truly excellent international research reputation; our staff work actively with colleagues in other Schools and universities, both in this country and abroad, and with various industrial organisations. This liveliness and breadth of research is reflected in the lecture courses on offer; indeed, many third and fourth-year options reflect the current research interests of members of our staff. In the most recent Research Assessment Exercise (2008), our School scored strongly in all three 'units of assessment', Pure Mathematics, Applied Mathematics and Statistics, which puts us firmly in the top ten places for Mathematics.

As well as carrying out research, our academic staff teach undergraduate and postgraduate courses, supervise the work of research students and research assistants, and undertake various administrative jobs, including working as admissions tutors, speaking at open days and interviewing at visiting days.

What will you gain from Manchester?

Our aim is to provide a wide variety of high-quality degree programmes for students of good mathematical ability. On completion of your degree, you will have a knowledge of such basic ideas as rigorous argument, formal proof and the power of abstract formulation of problems, together with deeper ideas in those areas of mathematics in which you have decided to specialise. You will also have been introduced to applications of mathematics, computing skills and the use of IT resources, and you will have developed your ability to work independently.

We are also in the unique position of having arranged membership of the Institute of Mathematics and its Applications for all our School's undergraduates, so you will have all the benefits of membership throughout your time as a student.

Why Manchester?

- One of the largest, most respected schools of mathematics in Britain
- A new building, purpose-built and incorporating excellent facilities
- A portfolio of high-quality flexible Single Honours and Combined Honours degrees, with a large range of lecture course options
- Strong traditions of good relations between staff and students, and a high standard of pastoral care

Mathematics

Friendly, dedicated support

We strive to provide you with a friendly working environment. As a new student, you are assigned to a particular member of the academic staff who acts as your academic advisor throughout your degree. This advisor's role includes supervising your academic progress, advising on choices of options and assisting with any problems which may arise, be they academic, financial, personal or otherwise. You meet with your advisor on a regular basis, so you can feel confident that there is a member of staff who takes a direct personal interest in your progress and to whom you can turn for help or advice at any time.

We value our students and strive to make every aspect of academic life run as smoothly as possible for you, particularly with regard to the undergraduate course units. There is strong student representation on the School staff-student liaison committee, and also on the School Board, which is the main forum for School policy discussions.

Our second- and third-year students also run a student mentoring scheme (called PASS) to help first years settle into the School and into university life and work.

The student-run Mathematics Society (Mathsoc), which is open to all our undergraduates, organises a wide variety of regular social activities. The Galois Group, which arranges a varied and stimulating series of fortnightly mathematical lectures, is also run by our undergraduates.

Study resources and facilities

During the summer of 2007, the School of Mathematics moved into a new, purpose-built home. We are very pleased to be in this £60 million building, based at the heart of the University campus. Students and staff benefit from extensive facilities for computing and study, relaxation and refreshment, in an attractive, light, comfortable environment.

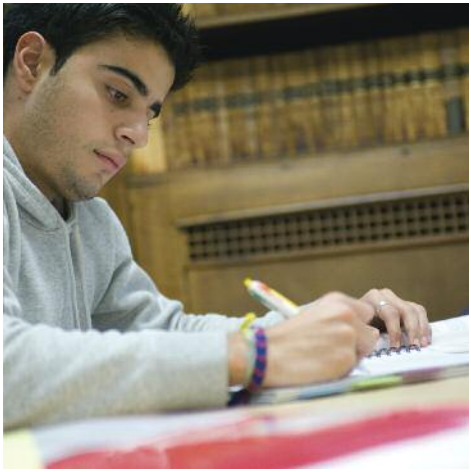
Our School has a number of computer clusters, which run the standard software, as well as powerful mathematical and statistical software packages (such as Matlab, Minitab and Mathematica). These packages are used in some lecture courses and you can use them for project work and homework assignments. All of our students have free access to email and the internet. There is also a large computer cluster in the University Library and clusters in most of the halls of residence. All student rooms also have a high-speed Ethernet connection.

You will have access to the extensive stock and state-of-the-art facilities of our University Library, which is one of the largest academic libraries in the UK. The principal working collections in mathematics, science, medicine, the humanities, social sciences and law comprise over one million books. A wide range of reader services is available, in addition to the loan of books, including extensive photocopying facilities.

You also have the opportunity to study abroad for one semester, or exceptionally a whole year, at a university in Australia, Canada, Hong Kong, Singapore, or the USA.

Several of our degree programmes (G1NH/J, G1N2 and G1N3) involve lecture courses taught by the University's internationally renowned Manchester Business School.

As you will see, in the School of Mathematics we provide a high-quality educational experience in a friendly, supportive environment.



Course details

Our undergraduate degrees

We offer a wide variety of full-time undergraduate degree programmes. These are divided into two groups: Single Honours Mathematics degrees and Other Honours Mathematics degrees.

This admissions brochure describes the degree programmes, entry requirements, scholarships and other details for students starting in September 2014. The information given here is correct to the best of our knowledge, but please note that some changes might take place before you start with us, in particular to the lists of course unit options available. Should you wish to defer your entry, you should consult the brochure for the appropriate year, when it becomes available.

Single Honours degrees

These degrees are constructed around a core of basic mathematics that provides fundamental mathematical knowledge and skills, and forms the basis for more advanced work in later years.

This compulsory material forms the Single Honours Mathematics core and is covered in the first three semesters up to the midpoint of your second year. It enables you to develop your capacity to learn and apply mathematical ideas, to understand the significance and power of mathematics, and to acquire a thorough knowledge and understanding of those mathematical topics that any employer would expect of a mathematics graduate.

After the first three semesters, a wide range of options is available, within Mathematics as well as outside the subject, allowing you to arrange as varied and broad a mathematical education as you want. The two degrees at the heart of our provision are BSc Mathematics and MMath Mathematics.

The traditional three-year BSc (Hons) Mathematics degree (UCAS code G100) is very flexible and is an excellent programme for students who wish to maintain the widest choice of career options in mathematics. MMath stands for the Master of Mathematics degree, which is an undergraduate masters degree. The four-year MMath (Hons) Mathematics degree (UCAS code G104) is also flexible, and provides in addition the experience of working to a higher level in selected areas of mathematics. It is particularly appropriate for those who wish to undertake postgraduate studies, conduct mathematical research, or work as a professional mathematician in industry, commerce, or higher education.

Single Honours degrees	Duration	UCAS Code	Page
BSc			
Mathematics	3 years	G100	18
Mathematics and Statistics	3 years	GGC3	20
Mathematics with Financial Mathematics	3 years	G1NH	21
MMath			
Mathematics	4 years	G104	18
Mathematics and Statistics	4 years	GG13	20
Mathematics with Financial Mathematics	4 years	G1NJ	21

Within the framework of these two Single Honours degrees, you can opt to construct a broad mathematical programme. Alternatively, if you so wish, you can take one of the more specialised Single Honours BSc (three years) or MMath (four years) degrees listed above (with their UCAS course codes).

For all Single Honours degrees, the BSc and corresponding MMath programmes have the first two years in common, so change between them is possible at any time during your first two years. At the end of your second year, you decide which degree to proceed to in the third year; usually, you may take the MMath only if you have done well enough in your second year.

As their titles suggest, these more specialised programmes give you the opportunity to study a particular mathematical topic to a greater depth (ie statistics or financial mathematics). They involve some extra core course units from the second year onwards (see later in this brochure for further details), so your choice of options in other areas of mathematics will be more restricted. One of these degrees would be suitable if you have a particular career in mind (eg working for a financial institution). All the Single Honours Mathematics degrees are described in detail later in this brochure.

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Joint Honours degrees	Duration	UCAS Code	Page
BSc			
Mathematics with Finance	3 years	G1N3	32
Mathematics with Business and Management	3 years	G1N2	34
Actuarial Science and Mathematics	3 years	NG31	36
Mathematics with a Modern Language	4 years	G1R9	38
Computer Science and Mathematics	3 years	GG14	40
Computer Science and Mathematics with Industrial Experience	4 years	GG41	40
Mathematics and Physics	3 years	FG31	41
Mathematics and Philosophy	3 years	GV15	42
MMath & Phys			
Mathematics and Physics	4 years	FG3C	41

Other Honours degrees

These degrees combine mathematics with another main subject. One of these may be your best choice if you are good at mathematics and wish to pursue another subject to the same level, either for career reasons, or for personal development. You should note, however, that in combined degrees there is little scope for taking course units from outside the two main subjects.

These combined degrees come in three combinations: 'and' degrees, which normally combine the two subjects on a 50-50 basis; 'with' degrees, which are normally two-thirds mathematics and one-third of something else, and the remaining two degrees G1N3 and NG31. Since much of the material you need to learn for Finance and Actuarial Science is Mathematics or Statistics, these two programmes have a rather smaller component from outside Mathematics than their names would suggest.

If you do well enough in the mathematics component of these combined programmes, you can usually, if you wish, transfer to Single Honours Mathematics at the end of your first year.

All these degrees that involve combinations of subjects are listed above (with their UCAS codes) and are described individually later.

Entry requirements

Typical requirements for entry into each degree are detailed below (see pages 11 and 12 for the UCAS codes for each degree). Even though the typical offers may be similar across our range of degrees, we emphasise that each application is considered separately on its own merits and each offer is individual. We also have separate English language requirements, listed on p13.

Typical A-level offer
A*AA - AAA

For full details of our entry requirements, visit:
www.manchester.ac.uk/ugcourses

If you are applying for the BSc Mathematics with a Modern Language (UCAS code G1R9), we will ask for a language qualification in the "required language" as part of your offer. This required language is French, if that subject is to be studied. If you wish to study German, Italian, Japanese, Russian, or Spanish, the language required for the post A-level programme (see p38) is your chosen language, or is any modern language for the beginners' version of the degree.

Note that we will never include General Studies in any offer. In place of the third A-level, we will normally accept a pass in the core of the Welsh Baccalaureate.

International Baccalaureate
Typically, we will ask for 37 points overall; of these 18 or more should be at Higher Level, including 6 in Mathematics and also including (for G1R9 only) 5 in the required language.

Scottish Highers/Advanced Highers
We will typically ask for grades AAA in Advanced Highers, or grades AAAA in four Highers, or some equivalent combination of Advanced Highers and Highers with top grades. For G1R9, you will need (as part of the above) the required language at grade A in Advanced Highers.

Other qualifications
Please enquire for details if you are taking the European or French Baccalaureates, German Abitur, Cypriot Apolytirion, BTEC, Irish Leaving Certificate, or other national examination.

Mature students
We welcome applications from mature students. We would look for evidence that you are able to achieve success on a demanding full-time programme, as well as evidence that you have the required mathematical ability and knowledge. You may find it helpful to contact an admissions tutor for advice before submitting an application through UCAS.

Deferred entry
Some students benefit from a year away from academic work between school and university. Accordingly, we welcome applications from prospective students of good ability who wish to defer entry to our University for one academic year, or those who are currently on such a gap year.

English language requirements

You must have an approved English language qualification, which can be one of several possibilities. These include IELTS or TOEFL (see below), or by achieving at least a grade C in GCSE English Language, in UCLES Cambridge Advanced Certificate, or in Scottish Certificate of Education English. Contact our admissions staff for advice if you have, or are taking, an alternative qualification.

For G100, G104, G1NH, G1NJ, GG13 and the non-Finance pathway of GGC3 IELTS 6.0 overall (with at least 6.0 in writing and 5.5 in each other component)

Internet-based TOEFL 80 (with at least 20 in each component)

For G1N2, G1N3, NG31, GV15 and the Finance pathway of GGC3 IELTS 6.5 overall (with at least 6.0 in writing and 5.5 in each other component) Internet-based TOEFL 90 (with at least 22 in each component)

For G1R9
IELTS 7.0 overall (with at least 6.0 in each component) Internet-based TOEFL 100 (with at least 25 in each component)

The higher requirements for G1N2, G1N3, G1R9, NG31, GV15 and for the Finance pathway of GGC3 are necessary because of the considerable amount of reading and essay writing that lecture course units on these degrees involve.

Mathematics

Teaching and learning

This section gives a brief overview of how we teach and examine topics in our School. More detail can be found on later pages.

Your teaching year is split into two semesters, each consisting of 12 teaching weeks, followed by a period for revision and examination. The first semester starts in mid-September and the second at the end of January.

Most course units are taught by lectures (normally two, three, or four per week) with an associated support class to provide individual assistance, although there are some variations on these basic arrangements. Typically, you will have up to 12 lectures and about five support-class hours per week. Support classes are either tutorials, in which 8 to 12 students and a member of staff discuss mathematical problems in some detail, or examples classes, in which you work on a problem sheet with a group of other students and get help from staff as required. You can also consult individually with lecturers and tutors about your work. It is important to realise that each one-hour lecture normally requires at least two hours of associated work (on the lecture notes, examples sheets and textbooks and just thinking about the material!).

A ten-credit course unit normally consists of two lectures a week, plus one support class. If you pass such a course unit, you will earn ten credits. Some larger (15- or 20-credit) course units involve proportionately more work. You will normally be expected to earn 120 credits in each year of your degree, via a combination of 10-, 15- and 20-credit course units.

There are two sets of examinations in each academic year, in January and May/June. Many lecture course units, including all first-year and second-year course units, incorporate some continual assessment (usually 15-20%), which contributes to the final mark for that course unit. In order to proceed from one year to the next, you need a satisfactory result, but students who fail at their first attempt may normally re-sit examinations in August.

As well as our standard taught course units, we incorporate a number of elements aimed at extending your skills in ways that will help in your future. Of particular note is our Career Management Skills course unit, which is run in collaboration with the University's Careers Service. This will build your presentation skills, group interaction skills, and job application skills, such as CV writing, that will help you obtain and retain a job when you graduate.

We will help you with the transition to undergraduate mathematics in a number of ways. Our small group teaching, Mathematical Workshop, and student mentoring scheme run by second- and third-years, will all help you to settle in as smoothly as possible.

First-year portfolio

In this section we describe the first-year core course units in mathematics that we are offering to our students entering in September 2014.

In the first year, all Single Honours students take the Single Honours Mathematics core. This consists of two 20-credit course units and two ten-credit course units in each semester (see the information on credits above). The material covered in these units is described briefly below.

Most other Honours students will take a separate portfolio of core course units designed specially for their particular degree. These units cover the same range of basic material as the Single Honours core, but with some reduction in breadth. Which course units are taken will depend on the degree; this is described in detail, for each degree, later in the brochure.

Single Honours Mathematics core course units

Semester 1

Sets, Numbers and Functions (20 credits)
One of the main differences between mathematics at university and beforehand is the emphasis on proofs at university. This course unit explores what a proof is and how to construct proofs. Various methods of proof are considered, including proof by induction and proof by contradiction, and the language of sets and functions is introduced. The general ideas in this course unit are introduced in the context of number theory: an area of mathematics that includes some of the most famous mathematical problems (such as the recently proved Fermat's Last Theorem).

Calculus and Vectors (20 credits)
Differentiation and integration are key ideas whose influence pervades almost the whole of mathematics. This course unit builds on the pre-university study of these ideas and takes it further. This involves the study of standard functions, such as the circular functions sine and cosine, the hyperbolic functions, the exponential function and the logarithm, by means of their Taylor series. An exciting new perspective is provided when these functions are viewed in the context of complex numbers, illustrating an approach that you will use extensively in some later course units. Many of the applications of the calculus also make use of vectors and so you will acquire a good working knowledge of the geometry of three-dimensional vectors and vector calculus.

Probability 1 (10 credits)
Uncertainty and randomness are present throughout the world we live in. Probability theory provides a framework for quantifying and assessing randomness. Probability is used to gain an understanding in a wide variety of fields ranging from finance to genetics. This course unit introduces the basic ideas and techniques of probability, including the handling of random variables and standard probability distributions and the crucial notions of conditional probability and of independence.

Throughout the first semester, we offer Single-Honours students a skills course unit:

Mathematical Workshop (10 credits)
This course unit complements the material covered in the other first-year lecture courses and enables you to develop problem-solving and study skills. You work individually and in groups on mini-projects and become familiar with mathematics computer packages, as well as developing your mathematical writing skills.

Mathematics

Semester 2

Linear Algebra (20 credits)
Linear algebra is the part of algebra that builds upon the study of systems of linear equations (also called simultaneous equations). The techniques of linear algebra are fundamental in many applications of mathematics, including mechanics and statistics, and the theory also underpins much of pure mathematics. The main tool in the study of linear equations is the theory of matrices. This course unit develops the theory of matrices and their applications to linear equations.

Calculus and Applications (20 credits)
A mathematical model of a real-life problem often leads to a differential equation, that is, an equation involving the derivatives of a function. The mathematical problem is to solve this equation (ie to find from the equation what the function is), or at least to determine some properties of the function. This course unit introduces differential equations and gives a variety of applications to the physical world.

Introduction to Statistics (10 credits)
Statistics is the analysis and interpretation of data. Statistics is underpinned by probability theory and is used to understand data across the biological, social and medical sciences. In this course we develop a knowledge of basic statistical concepts and methodology which build upon the ideas in Probability. We introduce you to the basic ideas of how to summarise information in a random sample and how to use this to make reasonable inferences about the population characteristics.

Sequences and Series (10 credits)
This lecture course introduces the concept of a limit in the setting of sequences and series. It lays the foundations for the second year study of analysis, which is the rigorous treatment of calculus, one of the highlights of 19th century mathematics. Topics include tests for the convergence of sequences and series, standard series and the radius of convergence of a power series.

Core course units for other Honours

Mathematics degrees
These core course units cover the same range of basic material as the Single Honours core course units, but with the 20-credit units replaced by 15-credit units that have some reduction in breadth. See p31 for the details of which course units are required in each degree.

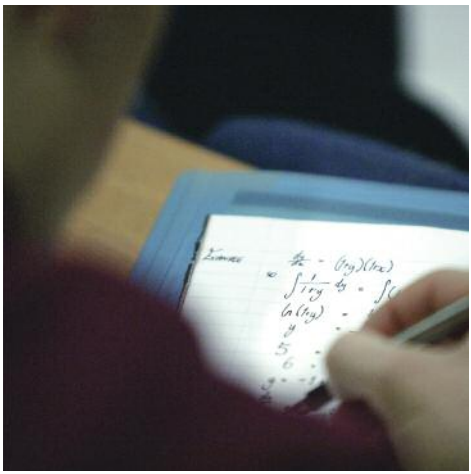
Second-year portfolio

In your second year, you begin to choose your mathematical direction, aided by the wide choice of options we have available.

Semester 1

Single Honours students take the Single Honours core, consisting of two 20-credit course units and two ten-credit units:

Real and Complex Analysis (20 credits)
This course unit builds on the first year Sequences and Series unit to develop the rigorous underpinning of the calculus already studied, essential for more advanced work. It also extends the ideas of the calculus to complex numbers that leads, surprisingly, to new techniques for evaluating real integrals. Complex analysis has applications across mathematics, from fluid mechanics to number theory.



Partial Differential Equations and Vector Calculus (20 credits)
This course unit aims to introduce you to more advanced ideas of differential and integral calculus, building on the first-year Calculus units. The methods employed in the course unit will prove essential for all the more advanced applied mathematics options. The main topics to be explored are: volume and surface integrals; Fourier series; partial differential equations; Frobenius' solution of ordinary differential equations; vector calculus; tensors; and numerical methods.

Probability II (10 credits)
This course unit continues the development of probability and statistics from the first year, so that all students on the Single Honours programme have the basic grounding in the area that would be expected of a mathematics graduate. It provides a solid basis for a wide variety of options later in the degree for students who wish to take their studies in probability and/or statistics further.

Algebraic Structures 1 (10 credits)
Algebra is the branch of mathematics that deals with general properties of numbers, and considers generalisations to other situations where ideas of addition and multiplication can be given meaning. This course unit focuses on 'groups', mathematical structures that are fundamental to the study of symmetry in a variety of contexts. There are applications across mathematics, from geometry and number theory, to particle physics.

Other Honours students take course units from a Mathematics core covering the same basic range of mathematics, as well as course units from the other discipline, the selection depending on the particular degree. Students on the "and" degree programmes (except NG31) and G1R9 (see p38) take Real and Complex Analysis as two ten-credit units instead, studying the complex analysis part in the second semester.

Semester 2

The Single Honours Mathematics degrees G100 and G104 contain no compulsory course units. You are free to take any six of the following (ten-credit) options:

- Introduction to Financial Mathematics
- Foundations of Modern Probability
- Statistical Methods
- Random Models
- Practical Statistics I
- Discrete Mathematics
- Calculus of Several Variables
- Fluid Mechanics
- Classical Mechanics
- Numerical Analysis I
- Propositional Logic
- Algebraic Structures II
- Introduction to Geometry
- Metric Spaces
- History of Mathematics
- Leadership in Action
- Career Management Skills

In this semester, the specialised Single Honours degrees and our other degree combinations normally specify some mathematics units from the above list. See the individual degree description for more details. Single Honours students may also replace up to 20 credits of mathematics course units with units from other disciplines. Thus, you can gain skills in another subject (eg accountancy, a language, a science, or music) without committing yourself to a fixed combination of two disciplines.

Third- and fourth-year portfolio

You choose course units from a huge range of options, and can also undertake projects.

The wide range of options available allows Single Honours students the opportunity to construct final-year programmes that are as broad or as specialised as they require.

In the final year of the BSc Mathematics degree, you may also take up to 20 credits of second-year or 40 credits of outside course units, provided there are at least 100 credits of course units at third-year level. Those doing the MMath can normally take at most ten credits outside Mathematics in each of the last four semesters.

In Mathematics, some of the level three course units are complete in themselves, while others find their culmination in subsequent level four course units. Thus, some units are suitable for students on both degrees, while others are more appropriate to those on one or other degree. The level four course units usually involve a study of material in greater depth and with a greater degree of mathematical sophistication; however, some level four course units are suitable for third-year BSc students.

For 2013-2014, we offer more than 40 options at level three and another 35 options at level four. Although this range of choice may seem overwhelming, your academic advisor will always be willing to discuss your options with you.

Examples of course units available at this level are:

- Coding Theory
- Hyperbolic Geometry
- Mathematical Modelling in Finance
- Mathematical Biology
- Wave Motion
- Martingales with Applications to Finance
- Medical Statistics
- Gödel's Theorems
- Predicate Logic
- Galois Theory

SINGLE HONOURS MATHEMATICS DEGREES

Our traditional Mathematics degrees are still the most popular, and most flexible, of our BSc and MMath degrees.

We offer two traditional Single Honours degrees in Mathematics: a **three-year BSc (Honours) degree programme** (UCAS code G100) and a **four-year MMath (Honours) degree programme** (UCAS code G104).

The first two years of study are common to both degree programmes, but they diverge thereafter. Change between them is therefore possible at any time during the first two years. You will need a good examination performance in your second year in order to continue with the MMath.

In general, the BSc degree gives you a good all-round knowledge of a wide range of mathematical topics, and is the most flexible programme in terms of options. The four-year degree retains most of the flexibility, but also gives you the experience of working to a higher level in selected areas of mathematics, and is particularly appropriate for those who wish to work as professional mathematicians in industry, commerce, or higher education.

Within the general framework of these programmes it is possible, with an appropriate choice of options, for you to construct a more specialised degree. Some more specialised pre-defined pathways can lead to a degree with a different title. You may transfer onto these more specialised degrees at the end of your first year – or, indeed, at any stage, so long as you have selected the appropriate course unit options.

Degree structure

In each year you must earn 120 credits by taking a combination of ten and 20-credit course units. In the first year, and in the first semester of your second year, the programme consists of the Single Honours Mathematics core (see p15-16) for both the BSc and MMath degrees. In exceptional cases, you may seek exemption from a first-level course unit if you can demonstrate a sufficiently high level of competence; and, if appropriate, you may take one or more second-level course units instead.

After the first semester in year two, you have a wide choice of course units from both within and outside our School, which makes for considerable flexibility. It is normally possible to take up to 20 credits of outside course units. A wide range of disciplines is available, either building on previous study, or starting something new. Popular choices in recent years have included course units in accountancy, computer science, economics, education, various languages, music, physics, psychology and sociology. The possibilities are almost endless; often the only constraint is fitting the course unit into your timetable.

In the third year of the BSc Mathematics degree, all units are optional and your programme may include up to 40 credits of second-year or outside course units. Your choice of course units must include 100 credits at level three, but some of these can be outside mathematics. Some, but not all, of the level four course units will be available to third-year BSc students.

In the third and fourth years of the MMath Mathematics degree, all course units are optional, except that the fourth year must include 30 credits of project work (the most rewarding part of the programme for many students). Over the two years, you must include at least 90 credits of level four Mathematics course units, in addition to your project work.

You have some flexibility about when you may take Mathematics course units: some level four units may be taken in the third year, allowing you to specialise rapidly in an area where you have a particular interest and ability. If you do this, it is then possible to take level three units in your fourth year, allowing you to broaden your programme of study. You may take up to 20 credits of outside course units in each year.

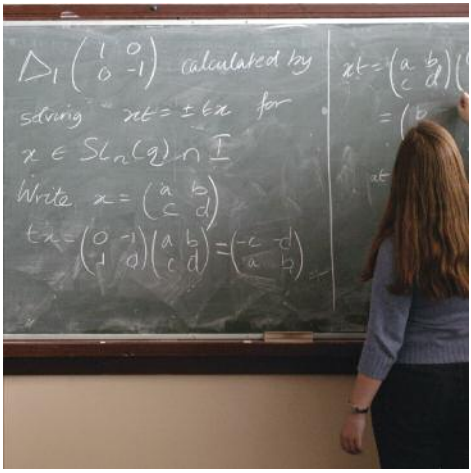
Mathematics

MATHEMATICS AND STATISTICS

Our Mathematics and Statistics degrees have been designed to meet the growing demand in business, medicine and government for Mathematics graduates with a substantial knowledge of statistics. We now include an optional pathway in Finance, which is detailed below.

We offer two Single Honours degrees in Mathematics and Statistics: a **three-year programme leading to the BSc (Honours) degree** (UCAS code GGC3), and a **four-year MMath (Honours) degree programme** (UCAS code GG13).

These degrees are accredited by the Royal Statistical Society, so that graduates qualify automatically for the Society's Graduate Statistician status, which can then lead to the Chartered Statistician status. In addition, our BSc degree has an optional 'Finance' pathway, which includes specific course units on Financial Mathematics and Financial Statistics, as well as options in Business and Management. (Note that this pathway therefore has an English Language requirement which is the same as the Mathematics with Business and Management degree – see p13.)



Degree structure

These two Mathematics and Statistics degrees are identical in structure for the first three semesters to the Mathematics degrees described on p18-19. After that, your Mathematics options must include an appropriate number of course units in probability and statistics, and in finance. You will also take Statistical Methods and Random Models in semester four.

- Semester four options must also include Practical Statistics I on the non-Finance pathway, and Introduction to Financial Mathematics on the Finance pathway
- On the Finance pathway, 20 of the remaining 30 credits in the second year can be level one course units in business and management, such as Fundamentals of Financial Reporting and Fundamentals of Management Accounting
- The third year of the non-Finance BSc must include at least 60 credits of probability and statistics at level three or four
- On the Finance pathway, the third year must include 20 credits of core Financial Mathematics and Financial Statistics, and at least 30 credits more in probability and statistics. It is also possible to take a level two 20-credit course unit in Business and Management
- The third and fourth years of the MMath degree must include at least 80 credits of probability and statistics at levels three and four; in addition, the fourth-year project must be in this area

MATHEMATICS WITH FINANCIAL MATHEMATICS

Our Mathematics with Financial Mathematics degrees are intended for students who are interested in learning about some of the recent applications of mathematics to the financial sector, with a view to pursuing a career in this area.

We offer two Single Honours degrees in Mathematics with Financial Mathematics: a **three-year programme leading to the BSc (Honours) degree** (UCAS code G1NH) and a **four-year MMath (Honours) degree programme** (UCAS code G1NJ).

Students on these degrees acquire a working knowledge of modern financial mathematics as it is applied in banks, broker companies and insurance companies, as well as in the financial departments of national and international companies. These degrees include some course units given by the Manchester Business School. However, there are not as many course units outside Mathematics as there are in the Mathematics with Finance degree (see p32).

The MMath degree is particularly well suited to students who wish to undertake postgraduate work in financial mathematics, or to move into mathematical research in the financial sector.

Degree structure

These two degrees are identical in structure to the Mathematics degrees described on p18-19, except that the Mathematics options must include an appropriate number of course units in financial mathematics:

- Second-year options must include the ten-credit course units in Fundamentals of Financial Reporting (which, in the first semester, replaces the Algebraic Structures I unit), Fundamentals of Management Accounting and Introduction to Financial Mathematics
- The third year of the BSc degree must include at least 60 credits of financial mathematics or accountancy and finance
- The third and fourth years of the MMath degree must include at least 80 credits of financial mathematics or accountancy and finance; in addition, the fourth-year project must be in this area

Student profiles

Muhammad, usually known by his middle name Irfaan, is from Mauritius. He took A-levels in Maths, Further Maths, Accounting and Economics, and is currently in the first year of the BSc (Hons) degree in Actuarial Science and Mathematics.

"I chose this course because actuaries are experts in risk who work in an ever- changing environment, so an actuarial career is one of the most diverse, exciting and rewarding in the world.

"As an international student, choosing a university in the UK was a difficult decision. I based my decision on the University's high ranking and the diversity of the course content. I have found the lecturers to be very welcoming, friendly and easily approachable. The whole learning atmosphere was highly conducive and made it easier for me to adapt to a new culture.

"What I particularly like about the teaching staff is that they are all experts in their respective fields. There is a good mix of theory and practical content throughout the course and the School makes sure that they take account of students' opinions through the student reps.

"All in all, coming to study Actuarial Science and Mathematics at The University of Manchester has been one of my best decisions and it is just getting better with time."

Muhammad Bhankarally

Alice is from Nottingham, and she studied Maths, German, Physics and Art at A-level. She is in the second year of the four-year BSc (Hons) degree in Mathematics with a Modern Language.

"I wanted a degree which allowed me to be flexible with the subject areas studied and I have found that Maths with a Modern Language allows me to do just that. Whilst studying Mathematics I have learnt more about the applications of the material that I studied at A-level, and combining my degree with German has allowed me to continue studying two subject areas that I am passionate about. The opportunity of spending my third year in Germany is also an added bonus!

"Manchester is one of the few universities who offer this degree and, as soon as I attended the visiting day, I knew it was where I wanted to be. The facilities in the Alan Turing Mathematics Building were the best I had seen and I was impressed by the overall atmosphere. I also fell in love with the city when I visited; what with the Curry Mile and Chinatown, the mixture of culture in Manchester is brilliant.

"Manchester has a great reputation and, from my experience here thus far, it is very well deserved. The teaching has been fantastic and the support within the Mathematics Department from academic advisors has been brilliant."

Alice Oatway

Student profiles

Joe is from Watford, where he studied Maths, Further Maths, Physics and Music at A-level. He is currently in the third year of the four-year MMath in Mathematics.

"I chose to study at The University of Manchester because of the quality of the School of Mathematics, combined with the scope and diverse range of course unit choices in the second, third and fourth years, as well as the opportunity to study in one of the most incredible cities on the planet!

"For me, the best thing about this University is that I just feel at home here; there's a very strong sense of community, which is unusual for such a large university, especially since Manchester has the largest student body in the UK.

"Student life in Manchester is out of this world! Due to the size of the university and the city, there really is everything you could imagine on offer, not only in terms of extra-curricular opportunities from the university itself, but also due to the nature of the city as a cultural centre in all respects. The nightlife is incredible and Manchester boasts some of the top clubs in the UK. All I'll say is that it is impossible to get bored!"

Joe Bronstein

Nicki is from Sheffield, and she studied Maths, Further Maths, Physics and German at A-level, as well as AS Physical Education. She has just completed the BSc (Hons) degree in Actuarial Science and Mathematics.

"I have had a strong interest in maths from a young age and it has always been my strongest subject. I came across actuarial work as a career prospect, and so decided to study it along with maths at university in order to learn more about it.

"I really enjoy being in Manchester; there are so many clubs and bars and, since I live at the start of the curry mile, plenty of takeaways too! The University is also very close to several cinemas and the city centre has every shop imaginable. Everyone's really friendly, and it's a really diverse community. I've met people on my course and in my halls from all over the world.

"There are also societies for just about anything, which means there's something to suit everyone. I am a member of the University Badminton team, and have met a lot of my closest friends through the university training and matches. The club is really sociable and supportive, and organises socials outside of training to give everyone the opportunity to get to know each other better."

Nicki Chan-Lam

"Weijian Zhang, who likes to be called Bill, is from Liaoning in China, and studied Maths, Further Maths, Physics and English on the NCUK Foundation Year. He is currently in the second year of the BSc (Hons) degree in Mathematics with Finance.

"I've always loved mathematics and really want to learn more about it. The reason why I chose this combined programme is that I believe learning some finance courses will make me more employable.

"I chose The University of Manchester for its good reputation and because Manchester is a lovely city for students to study in. It is actually rather wonderful that students come from all over the world to this university, and you can make friends from different countries. I've met people on my course and in my halls from all over the world.

"Students can find everything they need in Manchester, and the University Library is wonderful. Also, Manchester is an open city, which offers a large number of part- time jobs and volunteering opportunities.

"As an overseas student, I find the people in UK are very friendly and you feel very safe in UK. My advice to someone thinking of applying to The University of Manchester is that this is a great University and it is well worth an application.

Weijian Zhang (Bill)

"Orla is from Belfast, where she studied A-levels in Maths, Further Maths, English Literature and Spanish. She is currently in the first year of the four-year MMath in Mathematics.

"I think a degree in mathematics is indispensable because it teaches so many transferrable skills. Thus I chose Single Honours Mathematics partly to keep my options open in terms of a career, but also because it will always challenge me; once one problem is solved, there's always a further, more difficult question to be answered.

"Manchester was my choice because the School of Mathematics is accredited for its excellence, so I knew I was going to be offered a high standard of teaching accompanied by a wide range of course units. Furthermore, I was excited to live in such a diverse city; you get to meet people from all over the globe.

"I live in Fallowfield and I'm really enjoying student life. I've met so many new people and there is always something going on making it impossible to get bored or lonely! The nightlife is so varied that there's something for everyone. With the biggest student body in the UK, it sometimes feels as if Manchester is designed for students. Also, there's such a wide scope of clubs and societies that it's easy to find something that you'll love to get involved with.

Orla Weir

Graduate profiles

Pete, who comes from Coventry, graduated with a First class BSc (Hons) degree in Mathematics and Statistics in July 2009. He is currently working in London as a Marketing Science Executive for Millward Brown, one of the world's leading market research companies.

"I chose to study BSc Mathematics in order to develop my problem-solving skills and initially kept my degree subject broad in order to find a field in which to specialise. I switched to BSc Maths and Stats because it's the main area of my interests, and also to try and show future employers my dedication to statistics.

"I loved the vibe of the city from my very first visit, especially its 24-hour student life! The best thing about this University is the atmosphere; there's a fantastic sense of togetherness amongst the students, and it's always easy to find some help with any situation. It was so easy to make friends on my degree, and find people with like-minded musical interests. You're never short of a night out in Manchester. All-in-all, fantastic!

"I was the Secretary of Manchester's Rock and Alternative Music Society during my final year. The rock scene in Manchester is really thriving and our society had great fun in putting on a host of events for our members."

Peter Green

Caroline is from Manchester, and took A-levels in Maths, Further Maths, Physics, Chemistry and General Studies before coming to university. She studied on the BSc (Hons) in Mathematics, and graduated with a First class degree in July 2009.

"I chose my degree because I enjoyed A-level Maths and wanted to study it in greater detail. I wasn't sure what I wanted to do after university and I thought that maths would be useful in many different career areas.

"It was a really enjoyable course with plenty of flexibility to decide what you study from the second year onwards. The department is very supportive, with help always available if you need it.

"I chose to study in Manchester because I was looking for a balance between high quality teaching and a vibrant social scene. Student life in Manchester is fantastic; you have the chance to try new things and meet hundreds of new people. The nightlife is great, there's music to suit every taste. Also, the accommodation is in great locations, especially the halls in Fallowfield, which have everything a student could want."

Caroline Warrillow

Graduate profiles

Yu Zheng, who likes to be known as Joy, is from Beijing in China, where she took the NCUK Foundation Year after finishing High School. She studied on the BSc (Hons) degree in Mathematics with Business and Management, and graduated in July 2009 with an Upper Second class degree. She has gone to take an MSc in Mathematics and Finance at Imperial College.

"The University of Manchester was my first choice because it is well known for its excellence in mathematics and in business, and it also has a fantastic Careers Service, which can help students get part-time jobs and internships. In addition, the University has an outstanding record in both teaching and research.

"I chose my degree because it involves both mathematical knowledge and ideas from business. My country is involved in rapid development with respect to the global economy, and I felt I must get some business and management skills in order to be a success.

"Student life in Manchester is exciting and colourful, and very different from life in China. I really enjoyed the social aspects of being a student in Manchester; there are so many diverse things to do. I was particularly involved in the Table Tennis Club, making many friends and taking part in the BUSA event at Nottingham in February."

Yu Zheng (Joy)

Matthew, who is from Knutsford, studied Maths, Further Maths, English and Psychology at A-level before coming to university to study on the BSc (Hons) degree in Mathematics. He graduated with a First class degree in 2007.

"I love mathematics, so my degree programme was an easy choice. I made my choice of university because The University of Manchester has a good reputation, with excellent all-round facilities (such as for computing and for sports, as well as libraries) and Manchester is a great city. Student life in Manchester was great fun, and there was always something going on.

"Studying mathematics in Manchester is a great option. The size of the department allows a wide range of course units to be offered, which gives more flexibility over the type of mathematics you want to study. The Alan Turing Building and its location are also great selling points.

"My degree programme has helped me to pursue my love for the subject and get onto great postgraduate courses. I took an MSc in Oxford, and I am now finishing a PhD in Pure Mathematics in Cambridge."

Matthew Clark

"Anastasia is from Cyprus, and took A-levels in Maths, Statistics, Accounting and Economics before she came to Manchester to study on the BSc (Hons) degree in Mathematics and Management. She graduated in 2007 with a First class degree.

"I chose my degree programme because I wanted a wider understanding in both mathematics and in management, so that the skills and techniques that I gained would help me in my future career. I chose Manchester because it was a well-known university, and because the city and the university campus were great for students.

"As I come from abroad and do not have family or friends in the UK, it was important that the teaching staff and the other students were very helpful and made me feel at home so that I enjoyed my time at university.

"My degree from Manchester has helped me to get a job with PwC (Pricewaterhouse Coopers, which is one of the 'Big Four') to work towards chartered accountancy. If I hadn't graduated from such a good university with a good class of degree, I think that the competition nowadays would have meant I wouldn't have stood a chance of such a career."

Anastasia Stylianou

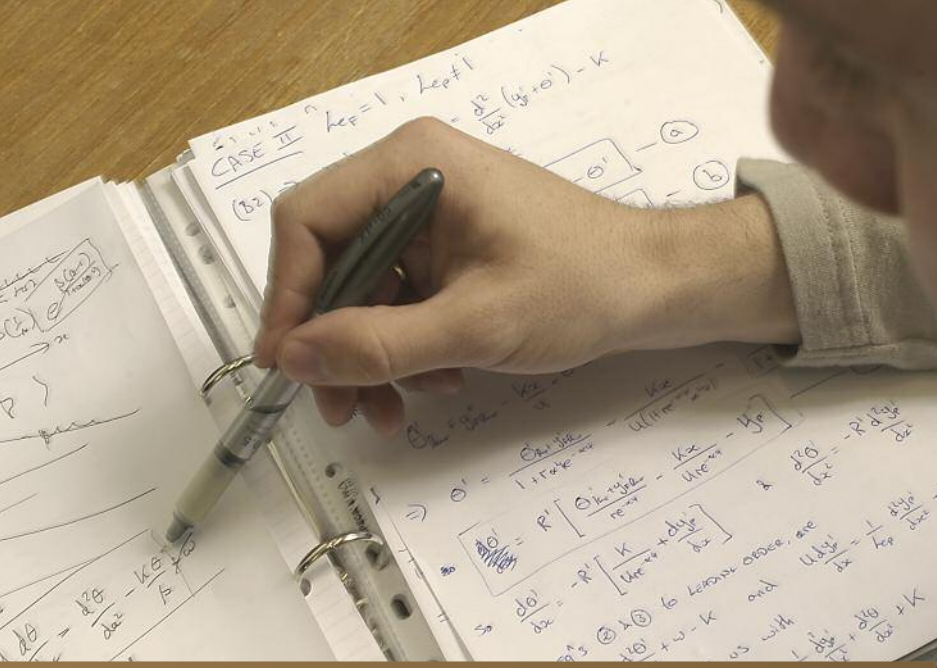
"Bronwyn is from Kent, and took A-levels in Maths, Biology and Geography before coming to Manchester to study on the MMath degree; she graduated with First class Honours in July 2008. She now works for the Royal Bank of Scotland, and is a middleware developer in the GBM Technology department.

"I chose to study in Manchester having visited the city and found it to be vibrant and lively. I also knew that the University has a very good reputation. My choice of degree programme was based on what I was best at in school, coupled with the fact that a mathematics degree would prove a very worthwhile qualification.

"My degree has been pivotal because I joined a graduate scheme for which a good class of degree was essential. I also took two Italian courses and the Manchester Leadership Programme alongside my studies.

"Being a student in The University of Manchester is hard work, but great; there was lots of affordable and nice accommodation in the student areas, along with a fantastic student life, with so many opportunities, lots of great bars, things to join in with and places to go."

Bronwyn Morcom



Other Honours

Mathematics Degrees

These Honours degrees, including Mathematics with another main subject, study the two disciplines in different proportions. As a result, there are two different patterns for the first-year Mathematics core, as described here.

For the "and" degree programmes (GG14, GG41, GV15, FG31 and FG3C, but not NG31) first-year students study Mathematics Core A, which is composed of the following course units:

Semester 1

- Sets, Numbers and Functions
- Calculus and Vectors

Semester 2

- Linear Algebra
- Calculus and Applications

These four course units are generally slightly reduced (15-credit) versions of those described on p14-15, the exception being that, for students combining Mathematics and Physics (on FG31 and FG3C), the two calculus course units are the 20-credit, Single Honours ones.

For details of the other first-year course units you must study, see the descriptions of the individual degrees below.

Mathematics Core A is also taken by those on the "beginners' level" version of G1R9 in their first year (see p38).

In the first year of the Actuarial Science and Mathematics degree (NG31), on the 'post A-level' version of G1R9 and on the 'with' programmes G1N2 and G1N3, students take the following course units, which together form Mathematics Core B:

Semester 1

- Sets, Numbers and Functions (15credits)
- Calculus and Vectors (15credits)
- Probability1 (10credits)

Semester 2

- Linear Algebra (15 credits)
- Calculus and Applications (15 credits)
- Introduction to Statistics (10 credits)
- Sequences and Series (10 credits) (except G1R9)

As with Core A, these 15-credit core course units cover the same material as the Single Honours core units described on p15-16, but in a slightly reduced form. Some degree programmes may include one or more additional first-year core course units in Mathematics; they may also involve some core course units during the second year. These details are given in the relevant degree information later in this brochure.

Students on G1N3 take the 10-credit Mathematical Workshop in semester 1, along with all the Single-Honours students.

Other Honours Mathematics Degrees

MATHEMATICS WITH FINANCE

This degree is intended for students who are good at Mathematics and would like to take financial options that are biased towards accounting applications.

The well-established, three-year programme leads to the degree of **BSc (Honours) in Mathematics with Finance** (UCAS code G1N3). The staff of the world-renowned Manchester Business School provide a coherent set of course units related to Finance to go with the mathematical part of the degree.

Note that there are some important differences between this programme and the Single Honours 'Mathematics with Financial Mathematics' programmes (G1NH and G1NJ):

- G1N3 has more course units outside Mathematics than G1NH
- On G1NJ, it is possible to take significantly more course units outside Mathematics, or in Financial Mathematics, than on G1N3
- G1NH and G1NJ have considerably more flexibility than G1N3

Degree structure

Year 1

In the first year, all course units are core. You study the10-credit Mathematical Workshop and Core B (see p15 and p31). You also take the 10-credit course units Fundamentals of Financial Reporting and Financial Decision Making, described briefly here:

Fundamentals of Financial Reporting
Introduces non-specialist accounting and finance students to the fundamental concepts and techniques of accounting. We emphasise general principles, which you should be able to apply to specific problems in accounting, as well as the wider business/social environment.

Financial Decision Making
Introduces you to finance, giving a foundation for subsequent finance course units in the second and third years. We introduce some of the basic techniques of finance: calculating the time value of money; valuing bonds and shares, techniques for appraising capital investments; characterising share price behaviour; and the role of risk in security valuation.

Year 2

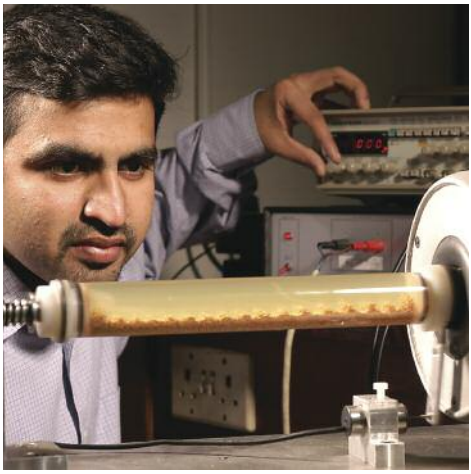
In Mathematics, you take the first semester core course units as described on p16, except that you take a special ten-credit version of the PDEs and Vector Calculus course unit. In the second semester, you take ten-credit units in Statistics, Probability and Financial Mathematics. In Finance, the core course units are Foundations of Finance (20 credits) and Investment Analysis (ten credits), described briefly here. You can choose the remaining ten credits in semester two from the list of Mathematics options on p17.

Foundations of Finance
The first semester of this course unit includes study of the valuation of assets, portfolio analysis, the capital asset pricing model and option pricing. The second semester covers the Net Present Value criterion for investment decision-making, the capital structure decision and the dividend decision.

Investment Analysis
Introduces you to the objectives and techniques of investment management at the individual security and portfolio levels. Topics we cover include security analysis, asset selection, equity portfolio management and investor psychology.

Year 3

You have two core ten-credit units in Mathematics: Martingales with Applications to Finance, and Mathematical Modelling in Finance. In Finance, you have two core ten-credit units: Advanced Corporate Finance and Financial Derivatives. The remaining 80 credits come from taking options at level three or level four, which must include at least ten credits of finance- related units. It is also possible to take some level two course units in Mathematics to improve flexibility.



Other Honours Mathematics Degrees

MATHEMATICS WITH BUSINESS AND MANAGEMENT

This degree is intended for students who are interested in gaining exposure to the modern theory and practice of business and management, at the same time as developing their mathematical skills.

This long-established and popular three-year programme leads to **the degree of BSc (Honours) in Mathematics with Business and Management** (UCAS code G1N2). Staff of our world-renowned Manchester Business School provide a coherent set of course units in business and management to go with the mathematical part of the degree.

This degree offers you very good career prospects in mathematics, management and a wide variety of openings in the business world. Many of our graduates find careers in the financial sector – ie banking and insurance, and in accountancy or actuarial work in particular.

We will not assume any prior knowledge of business studies, but this degree is equally designed to be suitable for those with good grades at A-level in that or a related subject.

Degree structure
Overall, you will spend roughly two-thirds of your time studying Mathematics and one-third studying Business and Management, although the ratio between the two components is 3:1 in years one and two, and 1:1 in the final year.

Please note that the current structure, which is what is described here, is currently under review in order to allow you more choice of course units, particularly in your second year.

Year 1

You study Mathematics Core B (see p31) and a first semester ten-credit 'skills' course unit: Transferable Management and Study Skills. You also study Fundamentals of Management (ten credits – semester one) and Fundamentals of Finance (ten credits – semester two). The Business and Management course units are described here:

Transferable Management and Study Skills
Aims to give you the generic skills you will need as students of management. This includes how to write reports and give presentations on management topics, and will also look at the psychology of study, communication and creative problem solving.

Fundamentals of Management
Lays the foundations for subsequent management course units. Topics include the nature, role and ethics of management, history of management, management processes (planning, organising, communicating, etc) and management functions (such as production, marketing, human resources and finance).

Fundamentals of Finance
Introduces you to the main foundations of finance within organisations. We offer general introductory coverage of a number of topic areas, but also provide the basis for more specialist course units later.

Year 2

In Mathematics, you take the first-semester core course units as described on p16, except that you take a special ten-credit version of the course unit on Linear PDEs and Vector Calculus. In the second semester, you take the ten-credit course unit on Discrete Mathematics and select three more ten-credit options from the list on p17. You also choose 30 credits of Business and Management course units from a list of nine options available; examples are Fundamentals of Financial Reporting and Global Contexts of Business and Management, both worth ten credits, which are described briefly here:

Fundamentals of Financial Reporting
Covers a basic knowledge of the principles and concepts underpinning financial accounting, and an appreciation of the main techniques used, to non-specialist accounting and finance students. It also aims to give you a conceptual understanding of the significance of accounting techniques in the making of corporate decisions and in reporting the results of corporate activity.

Global Contexts of Business and Management
Explores two of the broad contexts in which firms operate: the changing social, economic and political environments in which business evolves; and the labour markets, procedures and institutions used to regulate the employment relationship.

Year 3

You select your 60 credits of third-year or fourth-year Mathematics options from an extensive list of course units. (It is also possible to take up to 20 credits of level two Mathematics options not already studied.)

You also select 60 credits of Business and Management course units; there is one 20-credit all- year option and 12 ten-credit options available, such as Marketing, Financial Derivatives, Financial Engineering, Strategy, Organisational Analysis, and Human Resource Management.

Other Honours Mathematics Degrees

ACTUARIAL SCIENCE AND MATHEMATICS

Our Actuarial Science and Mathematics degree focuses on developing a unique combination of strong mathematical skills, real world business understanding, communication, interpersonal and leadership skills, all of which have been identified by the actuarial profession as core skills required by graduates and trainee actuaries.

This recently established and very popular three-year programme leads to **the degree of BSc (Honours) in Actuarial Science and Mathematics** (UCAS code NG31). The degree, which has been set up in close consultation with the Institute of Actuaries and actuarial firms, is intended for students who would like to put their mathematical skills to good effect and who see actuarial work as their possible career path.

This degree has elements specific to our University, including the exemplary Manchester Leadership Programme, which will give you the opportunity to develop your team-working and leadership skills, alongside your understanding of the specialist actuarial and mathematical subject areas. We also use the expertise of staff from the Economics group of the School of Social Sciences, and from our renowned Careers Service, giving you a unique, interdisciplinary learning experience.

This degree is now accredited by the Institute and Faculty of Actuaries, so when you graduate you will be eligible for up to seven exemptions from the Core Technical stage of the professional examinations, subject to your performance.

The University of Manchester is renowned for our strong links with industry, and strong industrial involvement in this degree ensures that the content of the programme reflects the needs of graduate employers.

Please note that, unlike all our other degrees, NG31 has a strict limit on the number of places available.

Degree structure

Year 1

All course units are core. You study Core B (see p31) and a ten-credit Mathematical Workshop. In addition, you take Microeconomic Principles, Financial Mathematics for Actuarial Science (each ten credits – semester one) and Macroeconomic Principles (ten credits – semester two), which are described briefly here:

Microeconomic Principles
Aims to provide you with self-contained introduction to microeconomics. Topics covered include studying how markets clear through the interaction of supply and demand and the consequences of government intervention.

Financial Mathematics for Actuarial Science 1
Provides you with an introduction, from a mathematical point of view, to simple financial transactions as used in actuarial science, such as interest and discount and the time value of money.

Macroeconomic Principles
Explains some of the most important concepts in macroeconomics, such as Gross Domestic Product, the Consumer Price Index, the Exchange Rate and the Balance of Payments.

Year 2

In Mathematics, you take the first semester core course units as described on p16, except that the ten- credit Financial Mathematics for Actuarial Science 2 replaces Algebraic Structures 1, which becomes an option. In the second semester, you take Statistical Methods, as well as Actuarial Insurance and Contingencies 1 (ten credits each). The remaining 30 credits are options; your choice can include up to 20 credits outside Mathematics, the ten-credit Leadership in Action course unit, and any Mathematics or Statistics units listed on p17.

Year 3

You have 50 credits of options; these are chosen from the huge list of third-year course units in Mathematics and Statistics, together with a Sustainable Development course and Tools and Techniques for Enterprise. The core course units you study are:

Applied Time Series Analysis

Generalised Linear Models

Linear Statistical Models

Statistical Inference

Models 1: Survival Models

Contingencies 2

Models 2: Actuarial Models

> I am delighted that The University of Manchester, with its strong reputation in Mathematics, is introducing an undergraduate course in Actuarial Science and Mathematics.
>
> **Nick Dumbreck**
> **President, Institute of Actuaries**

Other Honours Mathematics Degrees

MATHEMATICS WITH A MODERN LANGUAGE

This is the degree for you if you want to study Mathematics at the same time as enhancing your language skills, particularly as you are able to spend your third year abroad.

This well-established, four-year degree programme leads to **the degree of BSc (Honours) in Mathematics with a Modern Language** (UCAS code G1R9), and the language studied can be French, German, Italian, Japanese, Russian, or Spanish.

You study in Manchester in your first, second and fourth years; you spend your third year in a country appropriate to the language you are studying. With the growth of the European Union, leading to increased commercial and industrial trade, graduates in mathematics with language skills and cultural experience will be in demand. Students on the Mathematics with a Modern Language degree therefore have good career prospects.

Degree structure

The language part of the programme has two slightly different versions, classified as "post A-level" and "beginners' level". You follow the post A-level programme if you have achieved A-level grade A or B (or equivalent) in your chosen language, and the beginners' programme otherwise. Please note: there is no beginners' programme in French.

In the first, second and fourth years of the post A-level programme, you will spend roughly two-thirds of your time studying Mathematics and one-third studying your chosen language. In the third year, you fulfil the requirements by satisfactorily completing the year abroad. The beginners' programme requires you to divide your time equally between the two subjects in the first year (thus providing more language tuition), but otherwise has the same structure.

Year 1

Post A-level: In Mathematics you study Core B (see p31), except that Sequences and Series is replaced by a ten-credit Mathematical Workshop. In each semester you also study ten-credit course units in your chosen language and in a language option, chosen from a list offered by the School of Languages, Linguistics and Culture.

Beginners: In Mathematics you study Core A (see p30). You also study 40 credits in your chosen language plus 20 credits of language options.

Year 2

You study two ten-credit core course units in Real Analysis and Complex Analysis, and 20 credits of core language study. You also study 20 credits of options in the language, and 60 credits of options in Mathematics from the list on p16; those on the beginners' programme should include the first-year Probability and Statistics 1 course unit.

Year 4

You take a core 20-credit course unit in the language and a 20-credit language unit chosen from a list of options. In Mathematics, you choose 80 credits from the extensive list of course units available at levels three and four.

Year abroad

Third-year arrangements are extremely flexible, but most students studying Mathematics with French, German, Italian, or Spanish choose one of the following options:

a) to take Mathematics and Language course units in a foreign university sponsored by the European Community's ERASMUS/SOCRATES programme

b) to undertake paid work abroad as a language assistant, sponsored by the Central Bureau for Educational Visits and Exchanges

You choose which option you prefer at the beginning of your second year, with the help of your academic advisor.

Under option (a) you take an approved combination of Mathematics and Language course units, determined after consultation with your advisor. Lectures and examinations will normally be given in the foreign language, though the number of your course units will be fewer than that taken by the local students. Our School of Mathematics has ERASMUS links with universities at Bordeaux, Madrid, Rome and Tubingen. The language departments have their own links, which may sometimes be used for this purpose – although, of course, there is more competition for some places than others.

Under option (b), you spend the year working at a school under a scheme sponsored by the Central Bureau for Educational Visits and Exchanges. Applications for this scheme (administered by your language department) must be submitted by November in the second year. You are expected to teach English to small groups for 12 hours a week, and will be paid; no previous teaching experience is necessary, though obviously an interest in teaching is desirable. You should also be fully conversant with British culture, current affairs, social issues and institutions. Students studying Mathematics with Russian will normally study the language at a university abroad in their third year. Our School has close links with the Russian Department in Manchester and with the University of St Petersburg. Those studying Mathematics with Japanese will normally study Japanese at a language school in Japan during their third year, and this will be arranged through the University's Japan Centre.

Financial arrangements for the year abroad
Students who choose to study at a university abroad for a full year will pay a maximum of £1350 in tuition fees to The University of Manchester for that year. Students participating in the ERASMUS programme will be eligible for a grant of around €200 per month for the duration of their time abroad (the grant amount is set on a yearly basis by the European Commission and hence is not guaranteed).

The tuition fees payable by students who undertake paid work abroad for a full year are unconfirmed at the time of publication but will be no more than £1800. If the work placement is undertaken in an EU country students may be eligible for the Erasmus funding outlined above.

UK students studying abroad or working abroad through Erasmus are still eligible for a full student maintenance loan for the time abroad, and may be eligible for the slightly higher 'overseas' rate.

Students working abroad at a non-Erasmus placement (be that paid or unpaid) will find that the loan is likely to be reduced.

Other Honours Mathematics Degrees

COMPUTER SCIENCE AND MATHEMATICS

These are the degrees for you if you wish to study both Mathematics and Computer Science to degree level. Our School of Mathematics and School of Computer Science jointly run two degree programmes for students who are interested in both subjects. You may study either on the three-year programme (UCAS code GG14), or on the four-year programme (UCAS code GG41) in which the third year is spent in industry; in all other respects, the three and four-year programmes are the same, and each programme leads to a **BSc (Honours) degree with Joint Honours in Computer Science and Mathematics**.

These degrees offer you an ideal opportunity to develop mathematical and computer science expertise that bridges the increasingly important interface between the subjects – eg in modelling, simulation and logic for information technology.

In addition, students on the four-year "with Industrial Experience" programme have the opportunity to gain practical experience in an industrial or business environment. It is your responsibility to obtain the industrial placement, but the School of Computer Science will give you advice.

The content of this joint degree is closely linked with that of the two individual Single Honours degrees, and so transfer into either of these Schools is possible at the end of the first year, provided a sufficient standard has been achieved in the relevant side of the programme.

Degree structure

The general aim of the first two years is to provide you with a firm foundation in the most fundamental aspects of degree-level mathematics and computer science. This foundation permits you to choose from a wide range of high-level options in your third or fourth year, as appropriate. Your workload is divided approximately equally between the two subjects.

Because the first two years of these programmes are common, your decision on whether to spend your third year in industry does not have to be made until the end of the second year. You will need a good performance in both the first and second-year examinations in order to be accepted on the four-year BSc programme.

The admissions procedure for this degree is administered by the School of Computer Science, so please enquire there for any further details you need:

tel **+44 (0)161 275 6124**
email **ug-compsci@manchester.ac.uk**
www.manchester.ac.uk/cs

MATHEMATICS AND PHYSICS

These are the degrees for you if you wish to study both Mathematics and Physics to degree level.

Our School of Mathematics and School of Physics and Astronomy jointly run two degree programmes for students who wish to study both mathematics and physics to degree level.

You may study for three years, leading to the BSc (Honours) degree (UCAS code FG31), or for four years to graduate with the MMath and Phys degree (UCAS code FG3C), each degree being with Joint Honours in Mathematics and Physics. You attend lectures, tutorials, examples classes and laboratory sessions, covering a broad range of topics in mathematics and physics.

Teaching in both mathematics and physics is greatly strengthened by the wide variety of research fields that are pursued by the staff. There are large and lively groups active in both applied mathematics and theoretical physics. These disciplines frequently overlap and research on theoretical astronomy and on chaos and fractals is carried out in both subjects. Other research topics in applied mathematics include hydrodynamics, waves, elasticity, boundary layer theory, and modelling of industrial processes. The theoretical physics group is actively engaged in high-energy particle physics, nuclear physics and quark matter, condensed matter physics, high temperature superconductivity, phase transitions and disordered systems.

Degree structure

The general aim of the first two years is to provide you with a firm foundation in the most fundamental aspects of degree-level Mathematics and Physics. This foundation permits you to choose from a wide range of high-level options in your third and, if appropriate, fourth years. The workload of the degree is divided approximately equally between the two subjects.

The content of this joint degree is closely linked with the contents of the two individual Single Honours degrees, so transfer to either of these Schools is possible at the end of the first year, provided a sufficient standard has been achieved in the relevant side of the programme.

The admissions procedure for this degree is administered by the School of Physics and Astronomy, so please enquire there for any further details you need:

tel **+44 (0)161 275 4210**
email **ug-physics@manchester.ac.uk**
www.manchester.ac.uk/physics

Other Honours Mathematics Degrees

MATHEMATICS AND PHILOSOPHY

Since the time of ancient Greece there has been a close and fruitful connection between mathematics (especially logic and the foundations of mathematics) and philosophy. Indeed, many of the world's greatest mathematicians have also made valuable contributions to philosophy, and vice versa.

This long-established, three-year programme leads to the degree of BSc (Honours) in Mathematics and Philosophy (UCAS code GV15).

While our primary aim is that you reach an advanced level of understanding in both subjects separately, the programme also provides you with an excellent opportunity to explore the fascinating interplay between the subjects, aided by the strengths of our School of Mathematics in logic and foundational studies.

The degree content is closely linked with the contents of the two individual Single Honours degrees, so transfer to either of these Schools is possible at the end of your first year, provided a sufficient standard has been achieved in the relevant side of the programme.

Degree structure

In all three years, your study time is split equally between the two components.

Year1

In Mathematics you study Core A (see p31). The 20-credit Philosophy course units you study are listed here:

Values We Live By

Mind and World

Discovering Reality

Year 2

In Mathematics, you have a core of 20 credits on Real and Complex Analysis and ten credits on Propositional Logic. In Philosophy, you have a 20-credit core course unit on Philosophy of Science. You choose three (ten-credit) course units from a list of Mathematics options (see p17). Of your two optional 20-credit course units in Philosophy, one is a completely free choice and one is chosen from Philosophy of Mind, 20th Century Analytic Philosophy, and Locke, Berkeley, Hume.

Year 3

In Philosophy, you have a core 20-credit dissertation; a further 40 credits consist of one completely free choice and one course unit chosen from Metaphysics, Philosophy of Language, and Issues in Epistemology. We offer a huge list of options at levels three and four, from which you select your third-year Mathematics course units.

Your future prospects

Careers for mathematics graduates

A wide range of career options is open to you as a Mathematics graduate.

Some of these careers require subject specific knowledge and skills that are part of the Mathematics degree; others may depend mainly on 'higher-order' skills, such as numeracy, the ability to think logically and quantitatively, and the ability to analyse and solve complicated problems. Our Mathematics degrees are designed both to give you a good mathematical education and to develop these higher order skills.

The wide variety of Mathematics options we have available, together with the opportunity to take course units in other subjects, allows you to tailor your degree to suit your requirements and interests. A student aiming for actuarial work might, on the BSc degree, include an emphasis on statistics and take some accountancy and economics course units. Another, hoping to work for a PhD, might take the MMath degree, with its opportunity for specialisation. Yet another might take a language, with a view to working abroad. Of course, options may also be chosen purely for their inherent interest.

The most popular areas of employment are financial work and management services, but postgraduate work and teaching are also popular choices. Mathematics graduates are much in demand and are less likely to be unemployed than the graduate population as a whole, with most finding permanent employment in due course.

Further information about graduate careers can be found online: **www.manchester.ac.uk/careers**

You may have a definite career in mind when you come to the University; however, most students are unsure of the eventual career that they will follow. Studying for a mathematics degree allows you to keep many options open while you discover your strengths and find out more about specific careers.

Our School works closely with the University's Careers Service, which provides valuable assistance to our students in exploring the jobs market. This close relationship includes a special careers talk to our second-year students, and active collaboration on our second-year course unit on Career Management Skills.

It is worthy of note that more employers visit the Manchester campus than any other university; indeed, the recent Signposts to Employability report identifies graduates from The University of Manchester as the most sought-after in the country!

Postgraduate study opportunities

As well as the first-degree programmes described in this booklet, our School of Mathematics offers a variety of opportunities for postgraduate study.

About 18% of our graduates go on to take higher degrees, either in this University, or elsewhere. In 2012, we had about 180 postgraduate students (including many from overseas) working for the Master of Science (MSc), Doctor of Philosophy (PhD), or other degrees. Postgraduate students play a vital role in the life of our School, and you will certainly meet some of them as demonstrators in examples classes.

You may wish to consider postgraduate study for a variety of reasons. For some, there is the satisfaction of doing 'leading-edge' mathematics by working on a research problem, under the personal supervision of a member of staff who is an active researcher in your chosen area. Others choose to do a second degree in order to broaden or deepen their mathematical knowledge in a specific area, often one that is directly related to their future career.

Whatever the motive, postgraduate students acquire a number of skills of direct relevance to employers: for example in technical writing, extracting information from library resources, and mathematical word processing. These skills, combined with those of formulating and criticising arguments, make mathematicians very employable – doing a PhD does not mean that you have to become a university lecturer.

Our postgraduate degrees are of two main types. MSc programmes normally take one year; they consist of taught lecture course units, with exams in January and April, followed by a project, which is written up as a dissertation. Completing a PhD normally takes three years; you will attend some lecture courses and research seminars, but the emphasis is on making an original contribution to mathematical knowledge in the written thesis. In this way, a PhD student becomes a member of the world mathematics community.

We offer MSc and PhD programmes in Applied Mathematics, Numerical Analysis, Logic, Pure Mathematics and Statistics. For UK-based students, funding for postgraduate study in Mathematics comes mainly from central government through the Engineering and Physical Sciences Research Council (EPSRC), and is competitive.

For further information about postgraduate degrees, including contact details and information on sources of funding, see our School website: **www.manchester.ac.uk/maths**

Funding

Scholarships for UK students

School Entrance Scholarship

All new UK undergraduates admitted by our School of Mathematics, who achieve A* in Mathematics A-level plus grade A in two more A-levels (not counting General Studies), will be awarded a School Entrance Scholarship of £1000.

Fourth-year scholarship

Our School has up to 15 generous scholarships for students on a Single-Honours degree programme in their fourth year. These competitive awards, decided on the basis of earlier years' exam results, take the form of a complete fee waiver so that you would not need to pay any tuition fees for that year.

Other scholarships and bursaries

As well as our School scholarships, the University has a wide range of other awards designed to provide financial help for those who might otherwise find it difficult to proceed to university.

Worthy of mention among these awards are:

- Opportunity Manchester Scholarships worth £1,000 per year for any UK student who either:
- has gained a place at the University after having completed the Manchester Access Programme (MAP), or
- is under 25 years old and is currently, or has been, in public care for at least three months
- The Manchester Bursaries, which are additional to the government package of maintenance grants, are worth up to £3,000 in Year 1 and up to £2,500 per year after that, for any student from a household with income below a certain threshold
- Foundation Year Bursaries are worth up to £5,000 for students from low-income families who enrol on a 'Year 0' Foundation Year in Science and Engineering

Scholarships for international students

For those paying fees at the international rate, the following generous scholarships are available:

International Mathematics Scholarship
Our School has a large number of these scholarships, each of which is worth £1,000 per year of study. All new international students who satisfy the mathematical component of their entrance requirement will be awarded this scholarship against their tuition fees. The award, which lasts as long as your undergraduate degree, whether that is three or four years, is paid automatically in the first year; after that payment is subject to you maintaining at least a 50% exam average.

These awards are for international students on any degree programme.

School International Excellence Scholarships
In addition to the International Mathematics Scholarships just mentioned, and the Faculty Scholarships mentioned below, our School of Mathematics will award up to fifteen School International Excellence Scholarships.

These competitive awards are for the successful international applicants who have demonstrated the highest overall academic excellence. The awards are worth £2,000 per year of study on top of the International Mathematics Scholarship (making a total award of £3,000 per year). These excellence scholarships are for one academic year and are awarded to the best students each year, the decision being based on the previous year's exam results.

Eight of these awards are specifically for students from Africa, China, India, Pakistan and Malaysia, and seven more will be open to any international student.

International Excellence Undergraduate Scholarships
The Faculty of Engineering and Physical Sciences offers up to ten scholarships worth £2,000 per year for very well qualified international undergraduate students in the Faculty. The awards will take the form of a scholarship against your tuition fees, and are in addition to any scholarship awarded by our School of Mathematics.

All international students who have firmly accepted the offer of a place within the Faculty by 30 June will be automatically considered for a scholarship, based on academic merit. For details of eligibility, see: **www.manchester.ac.uk/undergraduate/faculty-scholarships**

Applying

Application procedure

Applications for all our first degree programmes should be made through the Universities and Colleges Admissions Service (UCAS). In most cases, a conditional offer is made on the basis of the information supplied in the UCAS application together with the result of an interview.

The most common route into our degree programmes is through A-levels, but we welcome students holding any equivalent qualifications. Details of our typical requirements for entry in 2014 are given on p11-12 for a number of qualifications, but we emphasise that each application is considered separately on its own merits and each offer is individual.

Making your choice

Once you have received all the decisions from the universities to which you have applied, UCAS will ask you to decide which will be your first choice offer. You will also be able to make a second (insurance) choice. UCAS will ask you to respond by a certain deadline, and it is important that you do communicate your choice in good time, otherwise all your offers will automatically be declined once the deadline has passed (and neither Manchester nor any other university will be able to re-instate them).

It is important that you make your choice armed with all the necessary information, in order to choose the university and the degree that is best for you. For this reason, please do not hesitate to contact our admissions staff if there is any further information you require.

Visiting days

Once we receive your UCAS application, it will be considered on merit by our admissions staff. Many of our applicants are then invited to attend one of our visiting days, which are held regularly between October and April. These give you the opportunity to see our School at first hand, to ask questions, and to meet members of staff and current students. They start with registration and a welcoming buffet lunch. Your parents can also attend the visiting day, and we arrange a separate programme for them.

It is important that you visit our School, if at all possible, because of the interview you will have with a member of staff, which helps to determine what conditional offer we make you. Our visiting days also enable you to get some insight into what it is like to be a Mathematics student at Manchester; as well as having the interview, you will be shown around the campus by some of our current students and attend a mathematical talk.

Our entrance requirements, and the offer we make to you, are designed to ensure that you have the necessary background knowledge, together with the ability and commitment, to do well on the course.

Confirmation

Most of the applicants who accept our conditional offers are taking A-levels, so most of our decisions about whether or not you have a place happen in August, when we receive the A-level results. If you achieve the required A-level grades, you will be able to check that we have confirmed your place on the UCAS website on the day you get your results. If you have missed your required grades by a very small margin, we may be able to offer you a place, but it may take us until the following week to decide this.

If your results become available earlier than mid-August, it is most important that you contact us with the details at the first opportunity. The earlier your place is confirmed, the better, both for you and for the University – particularly if you need to obtain a visa.

English language

If part of your offer concerns an English Language qualification other than a GCSE, we must receive your English result no later than we know your other results, or we may not be able to hold your University place. In particular, if you are taking an IELTS or TOEFL test, you need to arrange to take the test early enough so that you can give us the result by the end of July, at the very latest.

Also note that GCSE results come out at least ten days after we receive your A-level results, thereby delaying our decision, so you might for instance not get your choice of accommodation and have difficulty getting the required visa in time; you are therefore strongly advised to do an early IELTS test as well.

Find out more online

Accommodation
Discover your new home:
www.manchester.ac.uk/accommodation

Admissions and applications
Everything you need to apply:
www.manchester.ac.uk/ug/howtoapply

Alan Gilbert Learning Commons
Take a look around our 24/7, independent learning space
www.manchester.ac.uk/library/learningcommons

Careers
Take control of your career:
www.manchester.ac.uk/careers

Childcare
Balancing your studies with your caring responsibilities:
www.manchester.ac.uk/childcare

Disability support
Talk to us about any support you need:
www.manchester.ac.uk/dso

Funding and finance
Get to grips with fees, loans, scholarships and more:
www.manchester.ac.uk/studentfinance

International students
Let us help you prepare for your time here:
www.manchester.ac.uk/international

IT Services
Online learning, computer access, IT support and more:
www.manchester.ac.uk/itservices

Library
We have one of the UK's largest and best-resourced university libraries:
www.manchester.ac.uk/library

Maps
Find your way around our campus, city and accommodation:
www.manchester.ac.uk/aboutus/travel/maps

Prospectus
Download or order a copy of our prospectus:
www.manchester.ac.uk/ug/courses/prospectus

Sport
Get active with our clubs, leagues, classes and facilities:
www.manchester.ac.uk/sport

Support
Let us help with any academic, personal, financial and administrative issues:
my.manchester.ac.uk/guest

Students' Union
Immerse yourself in societies, events, campaigns and more:
manchesterstudentsunion.com

Videos
Learn more about us on our YouTube channel:
www.youtube.com/user/universitymanchester

Contact details

For further information about the courses, or about qualifications, please contact:

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(Head of Admissions, Recruitment and External Affairs)

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Royal Charter Number RC000797
M651 05.13