Mathematics and Statistics
Undergraduate Prospectus
Welcome to Mathematics and Statistics

I am very pleased that you are considering applying to study with us. We are a highly-ranked department for both teaching and research and a recent significant expansion of academic staffing has enabled us to broaden and strengthen our course provision.

Every student is important to us and tutors, academics and Directors of Studies will all meet you regularly to support you in your education.

Our courses will teach you about mathematics and statistics at a high level. By your final year, you will be studying topics heavily influenced by our research interests in algebra, analysis, probability and statistics. An individual dissertation in the fourth year is an opportunity to work closely with a member of academic staff on a topic of mutual interest and can lead towards study for a postgraduate research degree.

A key part of all of our courses is flexibility. In the first year, you choose an additional subject to study alongside your mathematics modules, with the option to move to a combined programme or even to the other subject at the end of the year. This flexibility and our academic support systems are important reasons why very few of our students drop out.

We are also a diverse department with many international students and staff. Among our student body, we have a nearly even male-female split and we strive to maintain a friendly and welcoming atmosphere. Our staff are accessible and happy to talk to you individually about mathematics or any other aspect of your studies.

When the time comes for you to graduate, we are confident you will be well-prepared for your next steps. We have an excellent track record in employability of our graduates - 90% of recent graduates are in work or further study six months after graduation.

As well as the numeracy and rigorous analytical skills you gain from studying mathematics and statistics, our programmes include project skills and group work too, both of which are important in the workplace or academia.

Please get in touch with us if you have any further questions about our department or our courses. Our website also has further information, including news and events, as well as links to more detailed information about the University and the City of Lancaster.

I look forward to meeting you at one of our applicant events on campus, when you will be able to talk to our staff and students, see our facilities and find out what life in our department is like.

Professor Andrey Lazarev
Head of Department
Why Lancaster?

Our courses are taught within a friendly and supportive environment which is relaxed but academically rigorous. All of our degree programmes offer a wide range of experience in pure mathematics and statistics, and produce graduates with excellent career prospects.

Expertise
The Pure Mathematics and Statistics sections work together to make up a vibrant department of enthusiastic staff, whose keen interest in their areas of expertise ensures lively and stimulating teaching. Our research is internationally recognised and informs our teaching.

Support
Support is provided by lecturers, tutors and directors of studies (academic staff from the department) and college advisors. The student-run Maths and Stats Society (MASS) is very active, hosting social events and holding a Maths Cafe on Monday lunchtimes, for students to meet and get help from one another.

Flexibility
The department offers a lot of flexibility, with three-year and four-year courses, the opportunity to study abroad and a wide range of combined honours degrees. Many of our students go on to take higher degrees at Masters and PhD level.

Employability
The study of pure mathematics provides intellectual stimulation and helps develop the ability to approach problems logically. This produces numerate graduates who are highly employable in many different areas, including finance, software development, the Civil Service and teaching. A degree in statistics equips its holder with the tools required to analyse and interpret data in real-world situations. Combining the two disciplines for a degree in mathematics and statistics gives a broad base for possible career options. 90% of our graduates are in work or further study six months after graduation.

Professional Recognition
Our Mathematics with Statistics and Statistics degrees qualify graduates for professional membership (GradStat) of the Royal Statistical Society. Sufficiency strong performance in certain second-year modules allows our students to claim exemption from the Probability and Mathematical Statistics examination of the Institute and Faculty of Actuaries.

Fulfilling Potential
The flexibility of our courses, expert teaching provision and a helpful environment combine to allow our students to perform to the best of their abilities. In 2013, around 60% of those who completed their studies with the department gained a first or upper-second degree.

Satisfaction
In the annual National Student Survey, 91% of our final-year students said they were satisfied with the quality of their course. They also recognised our staff’s enthusiasm for their teaching (91% agreeing), their ability to explain the subject (87%) and the prompt feedback on their work (91%).

League Tables
Our department’s current rankings are:
- 11th in the The Complete University Guide 2015
- 12th in the The Guardian University Guide 2015
- 16th in the The Times Good University Guide 2014

In addition, the 2014 QS World University Rankings reaffirm Lancaster’s Statistics and Operational Research in the top 100 places in the world for the subject, a position we have held since the rankings began in 2011.
How will I be taught?

Lectures
The teaching style in the department encourages and expects students to participate whenever practicable: the only way to learn mathematics is by doing it! A popular system used for many modules is the provision of course notes with gaps, which you complete and expand as the material is covered in lectures.

Workshops
Weekly workshops enable specialist tutors to work with small groups of students, with no more than fifteen in each group. These provide time to practise the mathematical and statistical skills for each module, and to get individual help and guidance. Lecturers also have office hours where they are available to assist students on a one-to-one basis.

Computing
Computing labs are used to aid mathematical learning, as well as to familiarise students with the specialist packages used by statisticians and mathematicians. Help is provided by instructors; these are usually postgraduate researchers who use the packages in their own work.

Assessment
Assessment is normally a mixture of coursework and examinations. Each week, you hand in solutions to a set of exercises, which are then marked by your tutor and returned to you with feedback in the following workshop. It is important to attempt every set of problems, not only because this forms part of your assessment, but also because this helps consolidate the learning that has taken place and prepare for the following week.

Examinations for all courses are held in May and June. Past papers are available for revision and, as always, staff are on hand if you have any questions.

In the first year, in addition to the weekly coursework, end-of-module tests help us to assess your learning every five weeks. These tests (which count towards the final grade) are rapidly marked and returned, so you have regular feedback and the chance to correct any misunderstandings that might cause problems for the next module.

Problem Solving
Alongside your lecture courses, we run classes aimed at developing your problem-solving skills. In small groups, you will look at the set problems and try to find ways to solve them, using all the tools you can think of.

First Year Timetable
A sample timetable for first-year Mathematics students

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888x647 www.lancaster.ac.uk/maths
Our Courses

We offer nine degree programmes in Mathematics and Statistics, with choices of three or four years of study and the option to study abroad.

Flexibility
Students may transfer between these programmes up to the end of their second year. Those wishing to study abroad must have strong academic performance in their second year examinations.

Entry Requirements
All the above programmes have typical A-level entry requirements of AAA including Mathematics or AAB including Mathematics and Further Mathematics.

Combined Programmes
Details of our programmes offered jointly with other departments may be found on page 13.
Your First Year

In the first year (Part I) you will take three subjects concurrently, of which two will be taught by this department and one, your minor subject, by another.

The two mathematics subjects are each composed of five modules, with each module lasting five weeks. They are assessed through weekly work and end-of-module tests (50%) and exams in June (50%).

The first subject is MATH100 Core Mathematics

• MATH101 Calculus
  This module studies functions of a single real variable, beginning with topics that are familiar from A-level. It leads on to calculus, which is concerned with derivatives (which measure rates of change) and integrals (which measure area). A second topic is the study of complex numbers, which are important in themselves and also have practical uses (in electrical engineering, for example).

• MATH102 Integration
  The graphs of functions of two real variables look like surfaces, with hills, valleys and other features. This module extends calculus to deal with these, introducing partial derivatives, and explains how repeated integration may be used to calculate volume.

The second subject is MATH110 Advanced Mathematics

• MATH111 Numbers and Relations
  Is it possible to write 84503 as a sum of the squares of two whole numbers? What is the largest whole number that exactly divides both 99457 and 75067? This module will show you how to answer these and similar questions, and explain why it is useful to do so. You will also encounter formal logic and learn about mathematical proof.

• MATH112 Discrete Mathematics
  Many mathematical questions involve counting. For example, if you dine with four friends around a circular table, how many meals can you have before you must repeat the seating arrangement? For finite sets, we can say that one is bigger than another if it contains more elements. What about infinite sets: are some infinite sets “bigger” than others?

• MATH113 Geometry and Calculus
  How would you find the length along the curve y=x^2 between two points, or the closest point to the origin on a particular curve? What is the tangent plane to a smooth surface and how do we find it? This module begins the study of geometric objects through the use of calculus.

• MATH114 Series and Functions
  No one can perform infinitely many additions, but once we are clear about the meaning of a limit, we can also be clear about the sum of an infinite series - provided that it converges. Many of the most important functions, such as exponentials, logarithms, sines and cosines, can be expressed (or even defined) as the sum of an infinite series, giving a way to compute them (and also π) to any desired degree of accuracy. Also, how many different solutions does the equation 2x^3-3x^2-12x=1 have between -2 and 4, and how would you set about calculating them?

• MATH115 Differential Equations
  The Nobel-prize winner Eugene Wigner described mathematics as “unreasonably effective” in describing the real world. This module introduces techniques for solving elementary differential equations and will help you understand models for bacterial growth, tumour expansion and wildly oscillating systems.
Your Second Year and Onwards

Having successfully completed the first year, students proceed to Part II.

To gain a three-year BSc, students take modules totalling 240 credits, with 120 credits in each of the second and third years. For the four years of an MSci, students take 360 credits, with 120 credits in each of the second, third and fourth years. The final degree classification is based on a student’s performance in Part II, with each year making an equal contribution to the result.

Second Year

The second year consists of six 20-credit modules, each containing 30 lectures and 10 workshops. These are compulsory for all single honours students:
- Real Analysis
- Linear Algebra
- Probability
- Complex Analysis
- Groups & Rings
- Statistics

The first group of three topics is taught in the autumn term and the second in the spring term, with examinations taking place early in May. The Project Skills module is studied for the remainder of the summer term, in preparation for work undertaken at the beginning of the third year.

Third Year

Modules worth a total of 120 credits must be studied during the third year; up to 30 credits may be taken from other departments if timetabling and prerequisites allow. We offer a wide range of topics in pure mathematics and statistics; each module is worth 15 credits and typically involves 20 lectures and 5 workshops. The Project Skills module is compulsory, so up to seven others may be selected.

Pure Mathematics
- Probability & Measure*
- Integration*
- Metric Spaces*
- Hilbert Space
- Differential Equations
- Groups & Symmetry
- Rings, Fields & Polynomials
- Elliptic Curves*
- Representation Theory of Finite Groups*
- Number Theory
- Combinatorics
- Geometry of Curves & Surfaces

Statistics
- Likelihood Inference*
- Bayesian Inference*
- Stochastic Processes*
- Statistical Models
- Topics in Modern Statistics
- Medical Statistics

Other courses
- Mathematical Education
- Mathematical Education Placement
- Project Skills (compulsory)

Courses marked * are also available in the fourth year.

Fourth Year

In the fourth year of an MSci degree, students produce an individual dissertation (worth 30 credits). You then choose six 15-credit modules, with the possibility of specialising in pure mathematics or statistics. The choices available reflect the research interests of members of the department, and the following is a small sample of what is likely to be on offer.
- Operator Theory
- Topology & Fractals
- Galois Theory
- Generalised Linear Models
- Computationally Intensive Methods
- Longitudinal Data Analysis
- Financial Risk (Extreme Value Theory)
- Clinical Trials
- Principles of Epidemiology

Having successfully completed the first year, students proceed to Part II.
Combined Programmes

We offer fourteen degrees in partnership with other departments.

The descriptions below indicate the modules taken in our department. Further information on modules from the partner department may be found on the website. Entry requirements are listed on page 23.

• GG14/GG1K Computer Science and Mathematics (BSc Hons/MSci Hons)
  The computer-science component of this degree covers languages and logic, software engineering, communications and systems. The course contains a careful balance of theory and practice which can lead to jobs in all areas of ICT, industry, business, government, health, education and many other sectors.
  Year 2: Linear Algebra and two further modules (50%)
  Year 3: Modules worth 60 credits (50%)
  Year 4: Modules worth 90 credits, split between the two departments, together with an individual dissertation (30 credits) in one or other department. The Computer Science dissertation includes the option of an industrial placement during the spring term

• F3GC/F3G1/F3G5 Theoretical Physics with Mathematics (BSc Hons/MSci Hons/MSci Hons with Study Abroad)
  Physics and mathematics enjoy a symbiotic relationship. If you would like to study the elegant formal description of the fundamental laws of nature, where mathematical models are used both to describe known facts and to predict new phenomena, then you should consider this course. It combines core physics and specialized theoretical physics modules with modules in pure mathematics
  Year 2: Complex Analysis; Linear Algebra; Introductory Real Analysis; Groups (50%)
  Year 3: (F3GC & F3G1) Groups & Symmetry; either Differential Equations, Hilbert Space or Representation Theory of Finite Groups (25%). (F3G5) Study Abroad
  Year 4: (F3G1 & F3G5) Topology & Fractals and one further module (25%)

• GN13/GN1H Financial Mathematics (BSc Hons/MSci Hons)
  This course is aimed at students interested in employment opportunities in the finance sector. Core modules provide a thorough grounding in finance, computing, quantitative methods and economics. In the third year the emphasis is on the mathematics which underpins the operation of financial markets.
  Year 2: Real Analysis; Probability; Statistics (50%)
  Year 3: Modules worth 60 credits, including Probability & Measure, Stochastic Processes and two further Statistics modules (50%)
  Year 4: Modules worth 90 credits, split between the two departments, including modules on Optimisation, Spreadsheet Modelling and Derivatives Pricing, together with an individual dissertation (30 credits).

• NG41 Accounting, Finance and Mathematics (BSc Hons)

• GL11 Economics and Mathematics (BSc Hons)

• NG21 Management Mathematics (BSc Hons)

• GV15 Mathematics and Philosophy (BA Hons)
  The study of philosophy develops skills in reasoning, discussion, the interpretation of texts and the analysis of problems. When coupled with mathematics, the combination produces numerate graduates who are well qualified for careers involving enquiry, assessment and analysis, such as law, finance, computing and local government.
  Year 2: Real Analysis; Linear Algebra; Complex Analysis or Groups & Rings (50%)
  Year 3: Modules worth 60 credits (50%)
  Year 4: Modules worth 90 credits (50%)

• GR11 French Studies and Mathematics (BA Hons)

• GR12 German Studies and Mathematics (BA Hons)

• GR14 Spanish Studies and Mathematics (BA Hons)
  These three four-year degree schemes are taught jointly with the Department of European Languages and Cultures. Based at Lancaster for the first two years, students spend their third year in an appropriate country before returning to Lancaster for their final year. With the ever growing importance of international markets, fluency in another European language, together with the analytical skills gained from studying mathematics, gives access to many career opportunities, such as the Diplomatic and Civil Services, business and teaching.
  Year 2: Modules worth 60 credits (50%)
  Year 3: Year abroad (0%)
  Year 4: Modules worth 60 credits (50%)

We offer fourteen degrees in partnership with other departments.

The descriptions below indicate the modules taken in our department. Further information on modules from the partner department may be found on the website. Entry requirements are listed on page 23.
Part I Options

Students choose their optional (Minor) subject during enrolment at the start of their studies, with guidance from staff.

The Minor subject gives breadth and flexibility to your course and popular choices include:

- Physics
- Economics
- Management Science
- Computer Science
- Geography
- Philosophy
- Chemistry
- Creative Writing
- Sociology

Subject to satisfactory progress, it is possible to transfer into the Minor subject at the end of the first year, or to a programme combining the Major and Minor subjects.

Combined students take one or two courses in each of the relevant Major subjects for their programme. More details may be found on the department and university websites.

Study Abroad

Studying abroad can be a life-changing experience. You will grow in confidence and become more mature and independent;

Employers are looking for graduates who have knowledge and experience of other cultures, can demonstrate flexibility and who have a global outlook. An overseas experience adds a distinctive element to your CV, helping you to stand out from other candidates.

We have been successfully sending students to study abroad for over 40 years. As well as long-established exchange programmes with US universities, we also have agreements with universities in France, Canada, Australia and New Zealand.

Recent destinations for our students have included:

- Australian National University, Canberra
- Queensland University of Technology, Brisbane
- University of Victoria, Wellington
- Université de Franche-Comté, Besançon
- University of Waterloo, Ontario
- Western University, Ontario
- Purdue University, Indiana
- Texas A&M University
- University of Maryland

Studying, working or volunteering abroad is one of the richest ways to add an international element to your Lancaster experience.
Student profiles

What our students think about their course is important to us. As well as the annual National Student Survey, we regularly ask graduating students about their time with us.

Faye Williamson  
Mathematics

What advice would you give to anyone thinking about coming to Lancaster to study mathematics?  
My advice would be, if you ever have a problem – maths related or not – do not be afraid to ask the lecturers and tutors for help because they are all very approachable and friendly. Also, I would say get involved in any internship opportunities available over summer because they really help give you an idea of what you want to do next and where your interests lie.

Evripidis Stefanou  
Mathematics with Statistics

What has been the best thing about studying at Lancaster?  
I enjoyed the most its multinational environment and the quality of resources available for students.

What are you hoping to do next?  
I have already applied for a Masters degree at Lancaster University, so hopefully I will continue my studies here.

What advice would you give to anyone thinking about coming to Lancaster to study mathematics and statistics?  
Be prepared for hard work and at the same time an amazing university life experience.

Emily Granger  
Mathematics with Statistics

What has been the best thing about studying at Lancaster?  
The opportunities it has given me. I was quite shy before coming here, but by coming to Lancaster I have been given opportunities such as being part of an executive for a society, completing an internship at the Uni and even living in Canada for a year! All these have not only been a lot of fun to experience, but have filled me with confidence and I feel much more prepared for what comes next after university.

Glen Martin  
Mathematics

Why did you choose Lancaster?  
I chose Lancaster for a number of reasons. After visiting the campus on open days and department visit days, I loved the welcoming and friendly atmosphere of the campus. The course structure and content was highly appealing. The use of end-of-term tests in first year was a great way to make sure you fully understood the material. Then in final year you get the opportunity to choose modules from a wide selection, meaning that you can really focus on what area of maths you want to study.

Helen Barnett  
Mathematics

Why did you choose Lancaster?  
The department of Mathematics and Statistics here has a really good reputation, and the University is consistently high in league tables. I came for an open day, and even though it was rainy and miserable weather, everyone was so happy and helpful. It was a really lovely atmosphere and they made me feel so at home, I loved it.

What has been the best thing about studying at Lancaster?  
The support from the department and colleges. You have tutors within your college and also within your department, so if you have a problem with anything, there is always someone to turn to for help. This was especially reassuring in first year, as it was a big step moving away from home.
A mathematician’s ability to describe a complex problem or situation in a suitable form for modelling is required in more technically-oriented disciplines such as statistics, credit scoring, meteorology, cryptography, environmental modelling and trading.

The training provided during a mathematics degree also produces many other transferable skills. The logical and analytical abilities of graduates are valued by businesses, who employ graduates in business analysis and management-consultancy roles.

The numerical abilities of mathematics graduates are required in many areas including accountancy and finance. There is continued demand for maths graduates within the education sector, for example, as mathematics teachers at secondary level.

Data from our recent graduates show that 90% are in work or further study six months after their course.

Source: Destination of Leavers from Higher Education survey, via Unistats

Relevant work experience while you are at university is crucial to achieving a good graduate job. Internships offer you the opportunity to apply your academic knowledge in real world situations - and get paid for it!

Case Study
As part of her degree, Junhan Lei strengthened her skills set and employability through an internship at Simplifi-Solutions Limited. This company provides a range of tools to help businesses monitor and manage their compliance with relevant energy, environmental and health-and-safety legislation.

Lei researched how to improve customer support for a compliance software tool and how to source and contact potential new clients. This informed the development of new tools and helped the company expand its client base.

Following her graduation, Lei now works for Citibank in China.
There are nearly fifty academic staff in our department, as well as postdoctoral researchers and administrative support staff. Here is a short guide to some of those you will meet during the application process and in your first year.
Entry Requirements

Our typical offers are made in terms of three A-level subjects and these are listed below. For details of entry requirements for qualifications other than A-levels, please see our website.

With Lancaster University Management School

- NG41 Accounting, Finance and Mathematics BSc (Hons)
  - AAB including Mathematics or Further Mathematics
- GL11 Economics and Mathematics BSc (Hons)
- NG21 Management Mathematics BSc (Hons)
- GN13 Financial Mathematics BSc (Hons)
- GN1H Financial Mathematics MSci (Hons)

With the Faculty of Arts and Social Sciences

- GR11 French Studies and Mathematics BA (Hons)
  - AAB including Mathematics (at grade A) or Further Mathematics
- GR12 German Studies and Mathematics BA (Hons)
- GR14 Spanish Studies and Mathematics BA (Hons)
- GV15 Mathematics and Philosophy BA (Hons)
  - AAB including Mathematics (at grade A) or Further Mathematics

With the Faculty of Science and Technology

- GG14 Computer Science and Mathematics BSc (Hons)
  - AAB including Mathematics (at grade A) or Further Mathematics (one of these to be at grade A)
- GG1K Computer Science and Mathematics MSci (Hons)
- F3GC Theoretical Physics with Mathematics BSc (Hons)
  - AAA including Mathematics and Physics
- F3G1 Theoretical Physics with Mathematics MSci (Hons)
- F3G5 Theoretical Physics with Mathematics (Study Abroad) MSci (Hons)
  - A*AA including Mathematics and Physics