UNIVERSITY OF LIVERPOOL

Mathematical Sciences

2+2

THE ORIGINAL RED BRICK

Contents

Why choose the 2+2 at the University of Liverpool?

Our story began in 1881 . . .The University of Liverpool became one of the first civic universities. **The original redbrick.**

Nearly 140 years later, we are still as original as ever - offering different viewpoints and daring ideas. Unique perspectives and a city bursting with character. We are uncovering world firsts through our pioneering research and helping you to forge your own original path. Studying in Liverpool will provide you with an amazing, life-changing university experience that will help you to achieve your ambitions.

Internationally recognised

- Ranked 165th in the Times Higher Education (THE) World University Rankings (2020)
- Ranked 164th in the QS World University Rankings (2019)
- 20th in the UK for research power with 7 subjects ranked in the top 10 in the UK's Research Excellence Framework (both Chemistry and Computer Science ranked #1 in the UK for 4* & 3* research THE 2014).

Benefits of studying in the UK

- Develop communication skills, flexibility, adaptability, empathy and a global outlook – attributes which are highly sought by employers
- No need for an IELTS when applying for postgraduate study in the UK
- Opportunity to explore the UK and Europe.

Graduate outcomes for 2+2ers

- 76% of all 2+2 graduates in Liverpool achieved a 1st or 2:1 upon graduation
- 80% of 2+2 graduates in Liverpool who were in further study after graduating from the University of Liverpool were enrolled in QS Top 100 Universities (DHLE 2020, University of Liverpool analysis of unpublished data)
- Ranked 1st in the Russell Group for graduate employability (DLHE 2016/17).

Support services

Happy students are successful students. In order to help you achieve your ambitions, the University of Liverpool has a wide range of services to support you throughout your studies, including:

- XJTLU student adviser
- Academic advisers
- International advice and guidance
- English Language Centre
- Careers Studio
- Student services (Health, Counselling, etc)
- Guild of Students
- Sports centre
- Libraries
- On-campus accommodation.

The university offers great facilities, the 24-hour library, informational Career Centre and the gym. The campus is a very friendly, passionate place with a good balance of studying and socialising.

Siqi Li
2+2 alumna in Communication and Media

Mathematical Sciences at Liverpool

Mathematics is a fascinating, beautiful and diverse subject to study. It underpins a wide range of disciplines; from physical sciences to social science, from biology to business and finance.

At Liverpool, our programmes are designed with the needs of employers in mind, to give you a solid foundation from which you may take your career in any number of directions.

Take the first steps towards a brilliant career

Employers tell us that, alongside key problem solving skills, they want strong communication skills and the ability to work in a team, so we have ensured that these are integral to our mathematics programmes. As a result, we have an excellent graduate employment record. About a third of graduates become business and finance professionals; but there is a whole host of other careers which our graduates have found success in such as management training, information technology, further education or training (including teacher training), scientific research and development, and many more.

Shape your own degree from our wide range of study options

Our modules range from financial mathematics to fluid mechanics, from chaos to combinatorics. Students have the opportunity to study a broad range of topics or specialise in areas of interest.

Fulfil your potential in a supported environment

Our students benefit from the peer-assisted study scheme, where students assist first years with maths problems, as well as small first-year tutorial groups, a Department common room and a lively maths society help to foster a friendly and supportive environment. We are also proud of our record on teaching quality, with five members of the Department having received the prestigious Sir Alastair Pilkington Award for Teaching, the University's top accolade for teaching quality.

Year Abroad

Programmes in the Mathematics departments will allow you to apply for a Year Abroad once you arrive at the University of Liverpool. The Year Abroad will allow you to spend an academic year at one of our partner universities, studying a mixture of subject-related classes and classes related to the culture and history of your host country. Find out more at: **liverpool.ac.uk/study-abroad/outbound/what-is-study-abroad/year-abroad/.**

Summer Abroad

Once you arrive at the University you'll have the opportunity to apply for one of our exciting Summer Abroad programmes. Summer Abroad allows you to visit a new country whilst undertaking worthwhile academic study. Destinations include Australia, France and Canada. Find out more at: **liverpool.ac.uk/study-abroad/outbound/what-is-study-abroad/summer/.**

Languages at Liverpool

Studying a programme within Mathematical Sciences allows you to study a language as an extracurricular course, on top of your degree. See **liverpool.ac.uk/languages** for more information.

How you learn

Your learning activities will consist of lectures, tutorials, practical classes, problem classes, private study and supervised project work. Key study skills and group work are developed in the programme. The emphasis in most modules is on the development of problem solving skills, which are regarded very highly by employers.

Most modules are assessed by examinations in January or May, but many have an element of coursework assessment. This might be through homework, class tests, mini-project work or key skills exercises.

"The most enjoyable thing about my course and studying at UoL must be my kind teachers. The teachers of all my courses are enthusiastic about my studying and willing to respond to any of my questions no matter how busy they are in their research. Also, teachers reply to the questions on the Discussion Board on VITAL very quickly."

Baicheng Liu, 2+2 student in Mathematics with Finance BSc

Good to know

96%

are employed or in further study six months after graduation (DLHE 2016/17).

We offer accredited programmes.

We offer the chance to study a language.

Institute and Faculty of Actuaries

ROYAL STATISTICAL SOCIETY
DATA | EVIDENCE | DECISIONS

IOP Institute of Physics

Institute of mathematics & its applications

Invest in your future

A mathematically-based degree opens up a wide range of career opportunities, including some of the most lucrative professions. Typical types of work our graduates have gone onto include as an actuarial trainee analyst in the audit practice, a graduate management trainee risk analyst and as a trainee chartered accountant on a graduate business programme. Employers value mathematicians' high level of numeracy and problem solving skills. Financial rewards are impressive, as maths graduates have the third highest 'graduate premium' of all subject areas.

Recent employers of our graduates

- Aston University
- Baker Tilly
- Barclays Bank plc
- Deloitte
- EuroMoney Training
- Forrest Recruitment
- Hallidays Chartered Accountants
- Marks and Spencer
- Mercer Human Resource Consulting Ltd
- Mitchell Charlesworth
- Norwich Union
- Transmission Marketing Ltd
- Venture Marketing Group
- Wilson Henry Partnership
- Wolsley Group.

STAFF PROFILE

Professor Corina Constantinescu-Loeffen

Professor Constantinescu is a Professor of Mathematics and the Director of the Institute for Financial and Actuarial Mathematics, in the Mathematical Sciences department of the University of Liverpool.

She has recently coordinated a large European grant under the Marie Curie framework, on Risk Analysis, Ruin and Extremes (RARE), that connected 12 higher education institutions and over 60 researchers from all over the world working on extreme events and their applications to insurance modelling.

Prior to being an academic, she worked as an actuary and led the life insurance department of one of the first private Romanian insurance companies.

Articulation routes

Mathematics BSc (Hons)

Studying Mathematics provides an excellent foundation for a wide range of careers.

Programme in detail

In the first year of the programme in Liverpool, you will study a range of topics covering important areas of both pure and applied mathematics. We have accreditation from the Institute of Mathematics and its Applications and from the Royal Statistical Society.

See pages 08-10 for module descriptions.

Mathematics with Finance BSc (Hons)

This is one of our most popular degree programmes with great employment potential. The programme is designed primarily for those who wish to work in finance, insurance or banking after graduation. We have accreditation from the Institute and Faculty of Actuaries, from the Institute of Mathematics and its Applications and from the Royal Statistical Society. Currently our students can receive exemptions for CM2, CS1 and CB1 of the professional actuarial exams conducted by the Institute and Faculty of Actuaries, the professional body for actuaries in the UK.

Programme in detail

In your first year in Liverpool, you will study a range of topics covering important areas of mathematics. The main focus will be on basic financial mathematics, statistics and probability. In the final year, you will cover some specialised work in financial mathematics. Subsequently, you will begin to study more advanced ideas in probability theory and statistics as well as stochastic modelling, econometrics and finance.

This programme is designed to prepare you for a career in the banking sector, pension or investment funds, hedge funds, consultancy and auditing firms or government regulators. The course prepares students to be professionals who use mathematical models to analyse and solve financial problems under uncertainty. The programme will provide a useful perspective on how capital markets function in a modern economy.

See pages 08-10 for module descriptions.

Actuarial Mathematics BSc (Hons)

A programme aimed at those students who want to work in the world of insurance, financial or governmental services, where actuarial mathematics plays a key role.

We have accreditation from the Institute and Faculty of Actuaries, the professional body for actuaries in the UK and from the Institute of Mathematics and its Applications. Currently, our students can receive exemptions for CM1, CM2, CS1, CS2, CB1 and CB2 from IFoA of the professional actuarial exams.

Programme in detail

Actuarial mathematics prepares students to be professionals who use mathematical models to analyse and solve financial problems under uncertainty. Actuaries are experts in the design, financing and operation of insurance plans, annuities, and pension or other employee benefit plans.

In your final year, you will cover some specialised work in advanced actuarial and financial mathematics. Subsequently, you start to study more advanced ideas in both life and non-life insurance mathematics as well as stochastic modelling, econometrics and finance. This programme is designed to prepare you for a career as an actuary, combining financial and actuarial mathematics with statistical techniques and business topics.

See pages 08-10 for module descriptions.

Within our programmes, there are a wide range of modules. Each year you will take the equivalent of eight modules. Please note that we regularly review our teaching so the choice of modules may change.

Selected modules overview Year Two

Module title	Module description
Classical mechanics MATH228	Provides an understanding of the principles of classical mechanics and their application to simple dynamical systems.
Commutative algebra MATH247	Gives an introduction to abstract commutative algebra and shows how it both arises naturally, and is a useful tool, in number theory.
Complex functions MATH243	Introduces students to a surprising, very beautiful theory having intimate connections with other areas of mathematics and physical sciences, for instance ordinary and partial differential equations and potential theory.
Corporate financial management ACFI213	Introduces students to the modern theory of finance and financial management.
Differential equations MATH221	Introduces fundamental techniques for the solution of the ordinary and partial differential equations encountered in the applications of mathematics.
Financial mathematics MATH260/MATH262	Introduces the basic financial mathematics theory required in actuarial and financial processes.
Financial reporting and finance ACFI290	Develops the ability to interpret published financial statements with respect to performance, liquidity and efficiency.
Life insurance mathematics MATH273	An introduction to mathematical methods for managing the risk in life insurance.
Mathematical economics II ECON211	Deepens students' knowledge of mathematical models and techniques in the study of Economics.
Metric spaces and calculus MATH241	Introduces the basic elements of the theories of metric spaces and calculus of several variables.
Numerical methods MATH256/MATH266/ MATH226	Provides an introduction to the main topics in numerical analysis, and shows how the theory can be implemented in a computer programming language, enabling us to find approximate solutions to problems that cannot be solved exactly.
Operational research with group projects MATH261/MATH269	Introduces and develops the mathematics of optimisation and decision making in real-world contexts.
Statistics and probability I MATH263/MATH253.	This module introduces important statistical methods and tests such as simple linear regression and one-way ANOVA. It will also introduce statistical distribution theory.
Vector calculus with applications in fluids and electromagnetism MATH225	Provides an understanding of the various vector integrals, the operators div, grad and curl and the relations between them. Gives an appreciation of the many applications of vector calculus to physical situations. Provides an introduction to the subjects of fluid mechanics and electromagnetism.

STAFF PROFILE

Professor Rachel Bearon

Professor Bearon received her Master of Arts and PhD in Mathematics from the University of Cambridge. She leads the mathematical biology research group and is responsible for User Engagement at the Liverpool Centre of Mathematics for Healthcare (LCMH). She has extensive experience of developing models bridging spatial and temporal scales to make biological predictions concerning the movement of cells within complex environments. Furthermore, she has significant expertise working directly with experimental biologists to develop novel frameworks for processing and integrating imaging data.

Please note: modules are illustrative only and subject to change.

Selected modules overview Year Three

Module title	Module description
Actuarial models MATH376	Develops the understanding of differences between stochastic and determinist modelling and how to model actuarial data.
Applied probability MATH362	Introduces empirical phenomena for which stochastic processes provide suitable mathematical models.
Applied stochastic models MATH360	Continues developing the understanding of the methods of stochastic to model building for 'dynamic' events occurring over time or space.
Cartesian tensors and mathematical models of solids and viscous fluids MATH324	Provides an introduction to the mathematical theory of viscous fluid flows and solid elastic materials. Cartesian tensors are first introduced.
Combinatorics MATH344	Provides an introduction to the problems and methods of combinatorics, particularly to those areas of the subject with the widest applications such as pairings problems, the inclusion-exclusion principle, recurrence relations, partitions and the elementary theory of symmetric functions.
Complex dynamics MATH345	Provides an introduction to the rich and fascinating area of complex dynamics.
Derivative securities ACFI310	Examine derivative securities, the theory and practical applications of how to value these assets and the use of derivatives in arbitrage, hedging and speculation.
Differential geometry MATH349	An introduction to the methods of differential geometry, applied in concrete situations to the study of curves and surfaces in Euclidean 3-space.
Financial and actuarial modelling in R MATH377	Focuses on the applications of actuarial and financial mathematics using the programming language R.
Further methods of applied mathematics MATH323	Gives an insight into some specific methods for solving important types of ordinary differential equations. Provides a basic understanding of the calculus of variations and to illustrate the techniques using simple examples in a variety of areas in mathematics and physics.
Group theory MATH343	Introduces the basic techniques of finite group theory with the objective of explaining the ideas needed to solve classification results.
Life Insurance mathematics II MATH373	Examines life insurance including life contingencies for multiple life, analysis of life assurance, life annuities, pension contracts, multi-state models and profit testing.
Linear statistical models MATH363	Understand how regression methods for continuous data extend to include multiple continuous and categorical predictors, and categorical response variables.
Mathematical biology MATH335	Develops skills for the construction and analysis of models for a wide range of biological systems.
Mathematical economics MATH331	Explores, from a game-theoretic point of view, models which have been used to understand phenomena in which conflict and cooperation occur.
Mathematical risk theory MATH366	Provides an understanding of the mathematical risk theory used in the study process of actuarial interest.
Measure theory and probability MATH365	Provides a sufficiently deep introduction to the measure and probability theory and to the Lebesgue theory of integration. In particular, this module aims to provide a solid background for the modern probability theory which is essential for financial mathematics.
Medical statistics MATH364	Demonstrates the purpose of medical statistics and the role it plays in the control of disease and promotion of health.

Continued over...

Selected modules overview Year Three (continued)

Module title	Module description
Methods of economic investigation: time series econometrics ECON311	Develop econometric theories for time series analysis building upon the materials learnt in **ECON212**.
Networks for mathematical biology MATH338	Provides a discussion of networks as they occur in the real world and develops mathematical techniques to analyse them.
Networks in theory and practice MATH367	Develops an appreciation of network models for real world problems.
Number theory MATH342	Gives an account of elementary number theory with use of certain algebraic methods and to apply the concepts to problem solving.
Numerical analysis for financial mathematics MATH371	Numerically solve general optimisation and root finding problems and run simulations for pricing (ODE's and SDE's).
Numerical methods for PDEs MATH336	Introduces techniques for finding approximate solutions to differential equations that cannot be solved exactly, which can be used for modelling many phenomena in physics and engineering. Short computer programs will be developed to solve a range of practical problems.
Operational research MATH357	Introduces the theory of multi-objective and constrained optimisation as well as the elementary optimal control theory.
Professional projects and employability in mathematics MATH390	The aim of this module is to further develop students' problem solving abilities and their ability to select techniques and apply mathematical knowledge to authentic work-style situations. You will develop your ability to communicate mathematical results to audiences of differing technical ability, including other mathematicians, business clients and the general public.
Quantum mechanics MATH325	Develops an understanding of the way that relatively simple mathematics (in modern terms) led Bohr, Einstein, Heisenberg and others to a radical change and improvement in our understanding of the microscopic world.
Relativity MATH326	Explores the physical principles behind special and general relativity and their main consequence.
Statistical methods in actuarial science MATH374	Covers the application of statistical methodologies and technique into actuarial sets of data.
Statistical physics MATH327	Introduces the foundations of statistical physics and develops an understanding of the stochastic roots of thermodynamics and the sometimes illusive properties of matter.
Stochastic modelling in insurance and finance MATH375	Explores stochastic modelling and its applications in different actuarial/ financial problems.
Stochastic theory and methods in data science MATH368	Use of probability theory and stochastic methods in two ways: by studying models and by using data.
Summer industrial research project MATH391	Provides an opportunity to carry out a mathematical investigation of problems in communication with an industrial partner.
Topology MATH346	Introduces topological spaces through a wide range of examples and explores their basic properties, cumulating in a discussion of the fundamental group of a space.

Please note: modules are illustrative only and subject to change.

Support in the School of Physical Sciences and next steps

As a Mathematics student, you will be a part of the School of Physical Sciences. Within the School of Physical Sciences, you will find a dedicated student support team, offering guidance and advice all the way from enrolment through to your graduation.

As a mathematics student, your first point of contact within the department is your Academic Adviser, who is supported by the student experience team. Programme Directors provide support in your choice of modules, and oversee your programme of study, whilst the Chair of the Board of Studies, Senior Tutor and Disability Support Coordinator can provide additional advice and signpost further support in complex academic or challenging personal situations.

The Mathematics Student Support Office houses a dedicated student experience team who offer a point of contact, support and general advice to all Mathematical Sciences students.

Lecturers run a range of teaching activities for each module, supported by graduate student Teaching Assistants. Your peers will also provide valuable support throughout your study, and we run a Learning Assistant scheme across several second-year modules whereby third year students support the delivery of interactive learning and teaching sessions.

Extra-curricular activities are arranged by academic staff and students, including prestigious lectures (e.g. 2019 Barkla lecture featured Nobel Prize winner Didier Queloz), employability & careers events, and internship opportunities.

Steps for registration

You will be able to register for optional modules prior to your arrival in Liverpool. You will receive instructions by email in late August or early September on how to register via the Liverpool Life portal.

I've really experienced critical thinking and creativity thinking. I found this education system is based on understanding, deriving and performing rather than just memorizing. In order to get even closer to this sense of thinking, I decided to take part in the 2+2 program. The University of Liverpool can help me in developing my logical mind and make me a sensational person instead of a 'memorizing master'.

Jinyang Wang, 2+2 student in Mathematics with Finance BSc

Find out more

liverpool.ac.uk/study

Accommodation: **liverpool.ac.uk/accommodation**
Fees and student finance: **liverpool.ac.uk/money**
Life in Liverpool: **liverpool.ac.uk/study/undergraduate/welcome-to-liverpool**
Student Welfare Advice and Guidance: **liverpool.ac.uk/studentsupport**
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