Advanced Mathematics Support Programme®

Why Study Maths?

A guide for Students, Parents and Carers

Post 16 Pathways

Managed by MEI Mathematics Education Innovation

Contents page 1

Why study Mathematics?

Leads to versatile qualifications
well-respected by employers and higher education

Develop key employability skills
e.g. problem-solving, communication, logical reasoning and resilience

To support the study of other A levels
E.g. Psychology, Biology, Geography (and more)

Excellent preparation
for a wide range of university courses

Increase knowledge and awareness
of mathematical techniques and their applications

Stimulating and challenging courses
evidenced positive effect on cognitive development

What is Core Maths?

Versatile qualification equal in size to an AS level

Maths of life and the workplace

Supports the maths in other courses

Excellent preparation for university

Interesting, engaging and relevant to the world we live in

A course that develops valuable mathematics skills

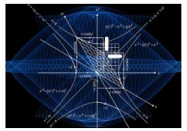
For any student with at least a GCSE Mathematics grade 4

What is in AS/A level Mathematics?

All of the content in the AS/A level Mathematics qualification is compulsory and is the same for all examination boards.

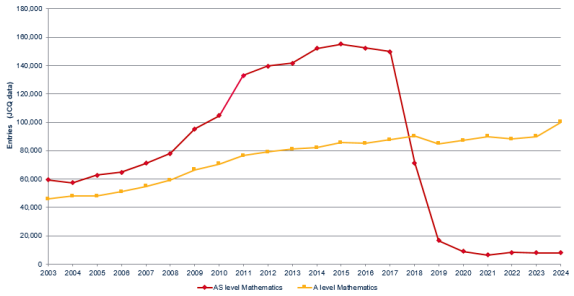
What is Further Mathematics?

Further Mathematics is an AS/A level qualification taken **in addition to** an AS/A level in Mathematics.



Great preparation for university courses in mathematics and related quantitative and scientific subjects.

A and AS level Mathematics entries in the UK 2003-2024 (JCQ data)



Contents page 2

What are the career opportunities?

What are Higher/Degree Apprenticeships?

Degree-equivalent qualifications	A levels or equivalent required for entry	The employer covers the cost.	You are paid a salary while you study
Popular alternative to a degree at university.	Mathematics is desirable for many apprenticeships	Examples include: Technology, Actuarial, Software Engineering, Data Science, Quantity Surveying	

Is A level Mathematics needed for entry to university degree courses?

It is important to have strong maths skills for progression to many degree courses at university.

A level Mathematics is also essential or desirable for a wide range of degree courses including economics, computing, social sciences and business.

Students applying to study a degree in a STEM subject should also consider taking Further Mathematics, to at least AS level, alongside A level Mathematics.

According to research by UCL, students with an A level in Mathematics are more likely to attend a Russell Group university ...

Look at the entry requirements on an individual university's website for the degree subjects that you might be interested in

Studying a Maths degree

Wide range of degrees
e.g. BSc, MSc, MMath…

Wide range of entry requirements
From grade D to A* in A level maths

Different ways to study
Lectures, assignments, projects, placements

Different content to study
Applied maths, Abstract pure maths, Coding, Vocational

Joint honours
Combine maths with other subjects

Investigate different courses
What content and direction will suit you best?

University entry requirements

Typical: Universities and colleges set their own entry requirements for higher education courses, and these vary widely depending on the subject, the specific course, and the course provider.

Contextual: This is where the university considers any barriers you may face e.g. the school you attend, where you live, if your parents went to university, if you have been in care or cared for a family member. They may reduce their grade requirements or give you extra consideration.

Alternative: In some cases, **a qualification in Core Maths or A level Mathematics/Further Mathematics will reduce the grades required for entry** to a degree course in a related subject.

Visit **www.ucas.com** for additional information

My child loves maths. Is there any more they could be doing?

Take AS or A level Further Mathematics

Subscribe to the new AMSP SUMS magazine

Study for additional qualifications in mathematics such as STEP, TMUA or the MAT, which are required for entrance to some leading universities to study mathematics.

Why study Mathematics?

Leads to versatile qualifications
well-respected by employers and higher education

Develop key employability skills
e.g. problem-solving, communication, logical reasoning and resilience

To support the study of other A levels
E.g. Psychology, Biology, Geography (and more)

Excellent preparation
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Increase knowledge and awareness
of mathematical techniques and their applications

Stimulating and challenging courses
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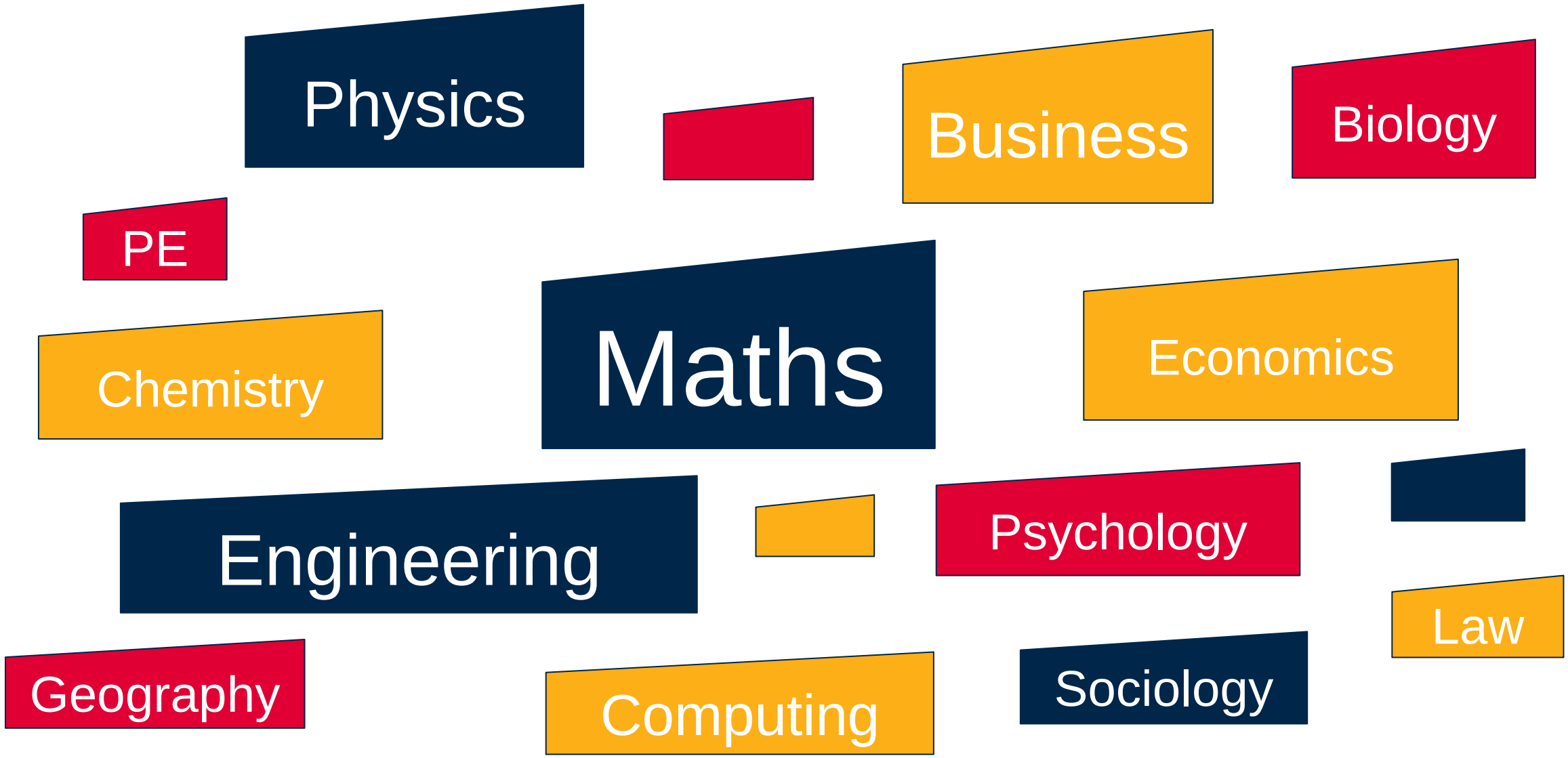
A global perspective

Many subjects use maths…



Maths content in other A levels

Geography	(no specific percentage but geographical skills include quantitative and qualitative skills equally)
Economics	(at least 20%)
Biology	(at least 10%)
Business	(at least 10%)
Psychology	(at least 10%)
PE	(at least 5%)
Sociology	(no specific percentage but you will be analysing data)

Post-16 Mathematics options

AS/A level Mathematics

AS/A level Further Mathematics

Level 3 Core Maths

A level Statistics

Which should you choose?

What are the options?

AS/A level Mathematics	Extends GCSE Maths and introduces new ideas
AS/A level Further Mathematics	An additional A level to add breadth/depth
Level 3 Core Maths	Develops maths skills and knowledge to focus on applied problem solving
A level Statistics	Focuses on data analysis and statistical techniques

What is Core Maths?

Versatile qualification equal in size to an AS level

Supports the maths in other courses

Interesting, engaging and relevant to the world we live in

Maths of life and the workplace

Excellent preparation for university

A course that develops valuable mathematics skills

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Main Content of Core Maths

- Financial Maths
- Statistics & Probability
- Critical Analysis
- Modelling (spreadsheets)
- Estimation

What is Core Maths like?

How much domestic water does the UK require every year?

A new teacher earns £23,000 per year, has no student loans, and pays 7.4% of their salary into a pension scheme. What is the teacher's net monthly salary after tax and national insurance contributions?

A genetic disease occurs in one in every 10,000 people. A test for the disease is accurate 98% of the time. If you are tested and the result is positive, what are the chances of you actually having the disease?

The speed of cars driving down a road with a speed limit of 50mph is recorded. The mean speed was 47mph and the standard deviation of the speeds 5mph. What percentage of the cars were breaking the speed limit?

What is in AS/A level Mathematics?

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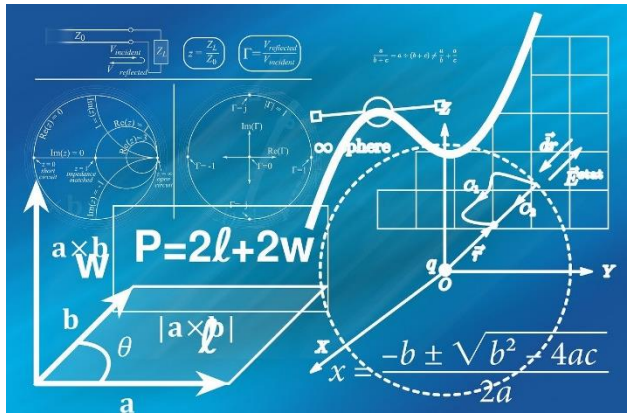
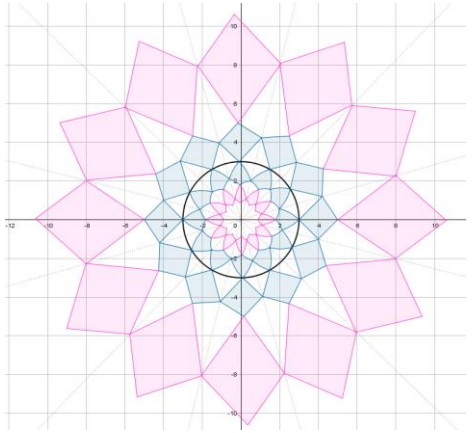
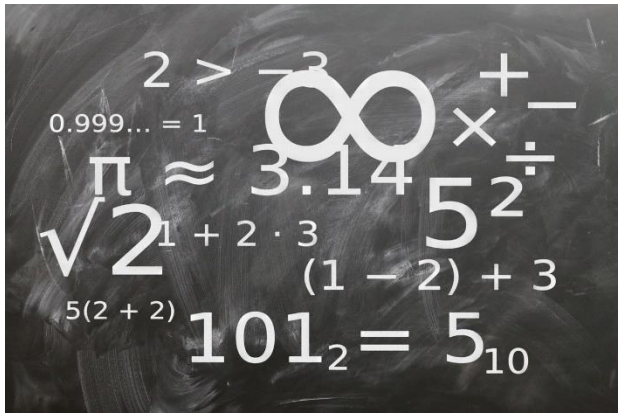
What is Pure Mathematics?

Methods and techniques which underpin the study of all other areas of mathematics, such as, proof, algebra, trigonometry, calculus, and vectors ...







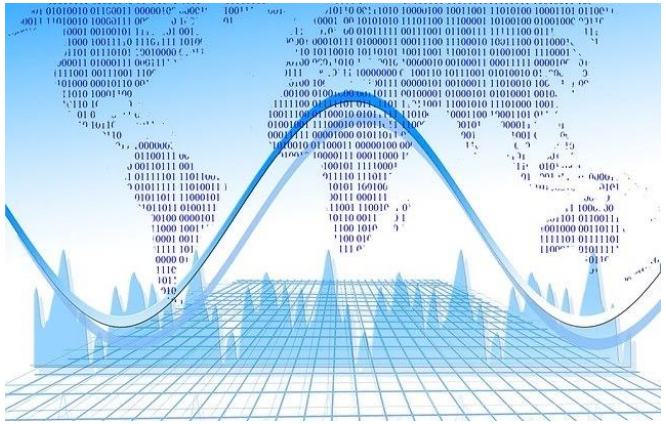
What is Pure Mathematics?

Methods and techniques which underpin the study of all other areas of mathematics, such as, proof, algebra, trigonometry, calculus, and vectors … enabling us to solve real world problems.

What is the least amount of metal you need to make a cylindrical can that holds 330ml of fizzy drink?

What is Statistics?

Reaching conclusions from data in order to make informed decisions to help plan for the future.



What is Statistics?

Reaching conclusions from data in order to make informed decisions to help plan for the future.

Professor Sir Adrian Smith

What is the probability of two '100 year floods' happening within the space of 5 years?

What assumptions have you made?

Source: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/630488/AS_review_report.pdf

What is Statistics?

"The majority of private sector organisations believe the use of data analytics will the most important factor in increasing growth in UK businesses"

Professor Sir Adrian Smith

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What is Mechanics?

The modelling of the world around us, the motion of objects and the forces acting on them.

Particularly useful for careers in physics or engineering

What is Mechanics?

The modelling of the world around us, the motion of objects and the forces acting on them.

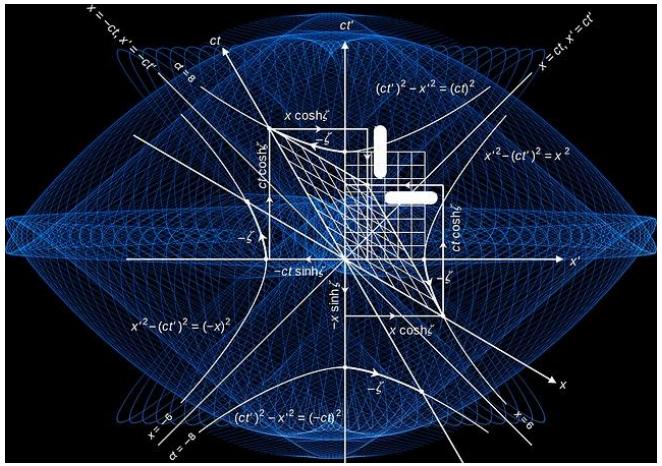
A golfer drives their ball from a tee on horizontal ground so that it has an initial velocity of 50ms^{-1} at an angle of 40 degrees above the horizontal.

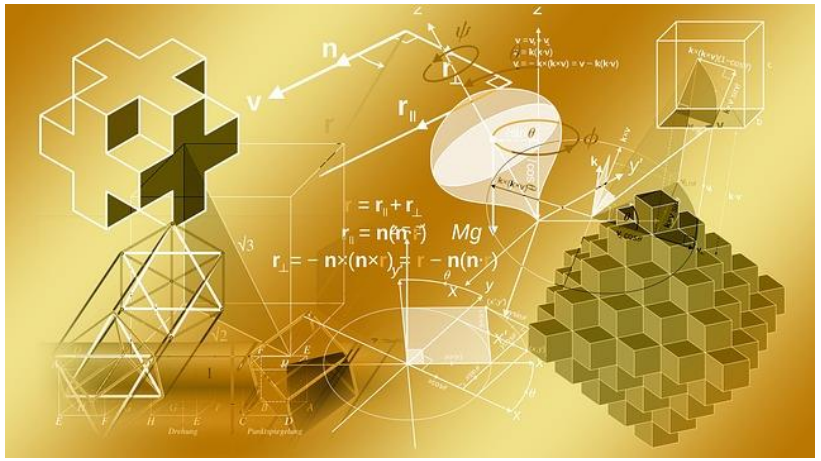
How far down the fairway will the ball land?

Particularly useful for careers in physics or engineering

What is Further Mathematics?

Further Mathematics is an AS/A level qualification taken **in addition to** an AS/A level in Mathematics.





Great preparation for university courses in mathematics and related quantitative and scientific subjects.

What is Further Mathematics?

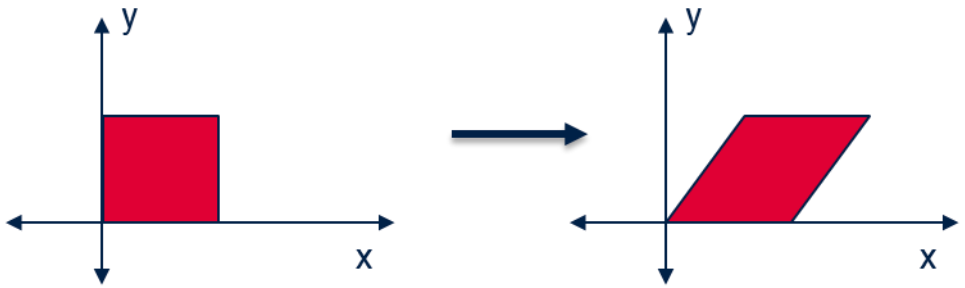
AS level

A level

Pure maths in Further Mathematics

Two examples of important Further pure topics are **complex numbers** and **matrices**.

Matrices are arrays of numbers such as $\begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$. They can be used to solve sets of simultaneous equations and to represent transformations such as the shear shown in the diagram below.



$$\sqrt{-1} = i$$

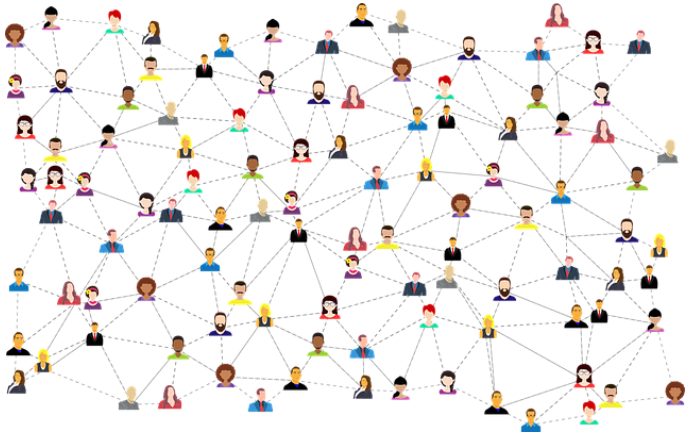
$$a + bi$$

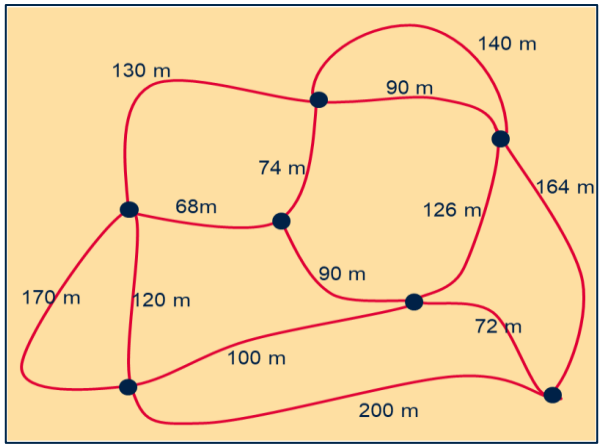
Real part Imaginary part

Complex numbers are based on the 'imaginary' number $\sqrt{-1}$. They lead to the study of lots of new areas of mathematics, including fractals like those shown in the image on the left.

What is Discrete/Decision Mathematics?

Many of the problems in Discrete maths involve Optimisation i.e. finding an efficient solution



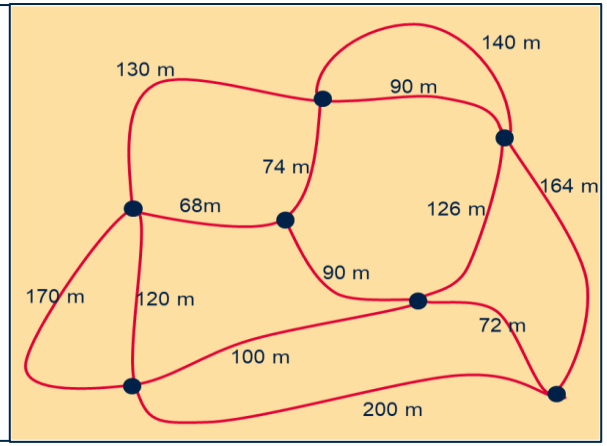


Methods are applicable to many real-world situations.

What is Discrete/Decision Mathematics?

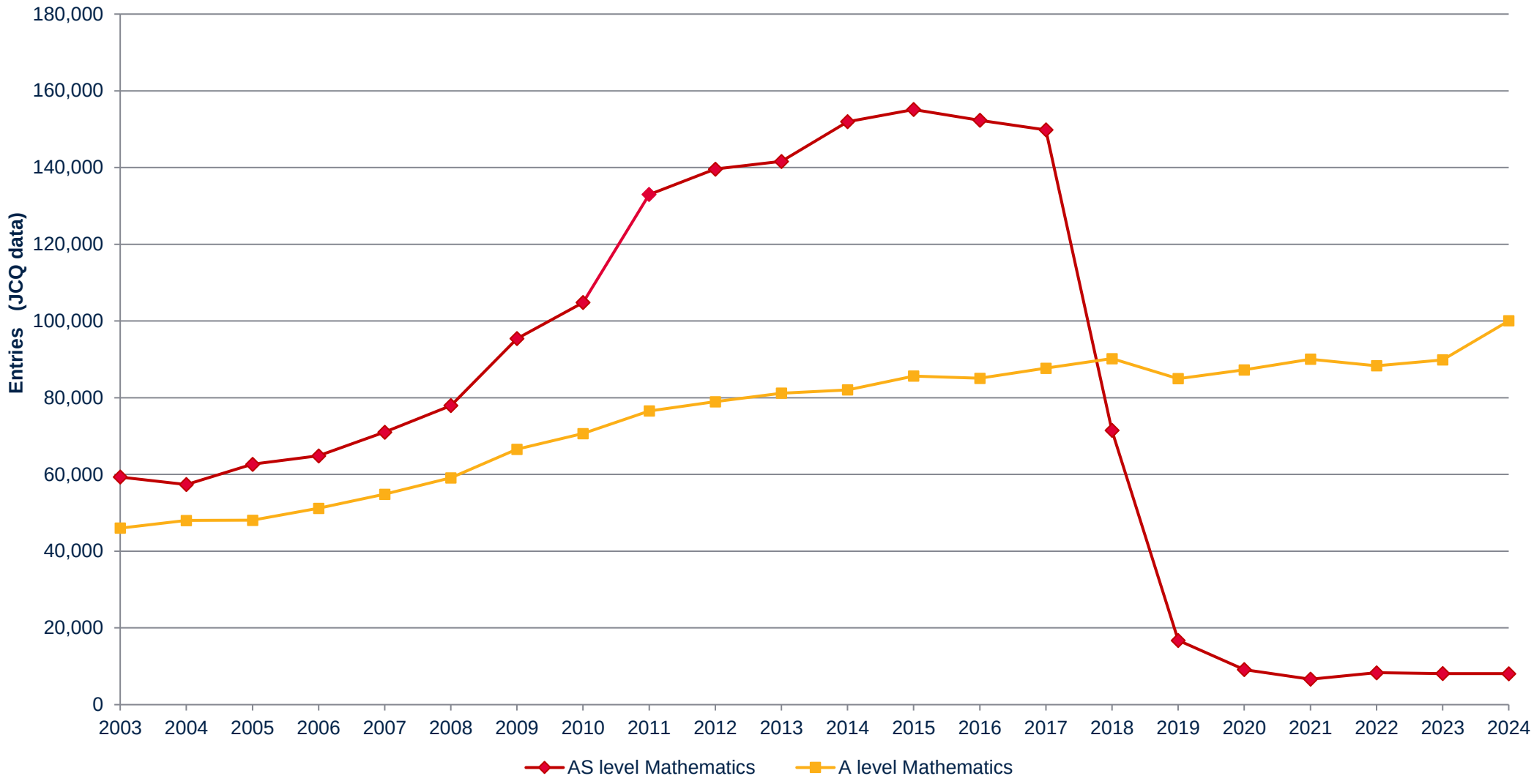
Many of the problems in Discrete maths involve Optimisation i.e. finding an efficient solution

What would be the most efficient route for delivering post around this network of streets?

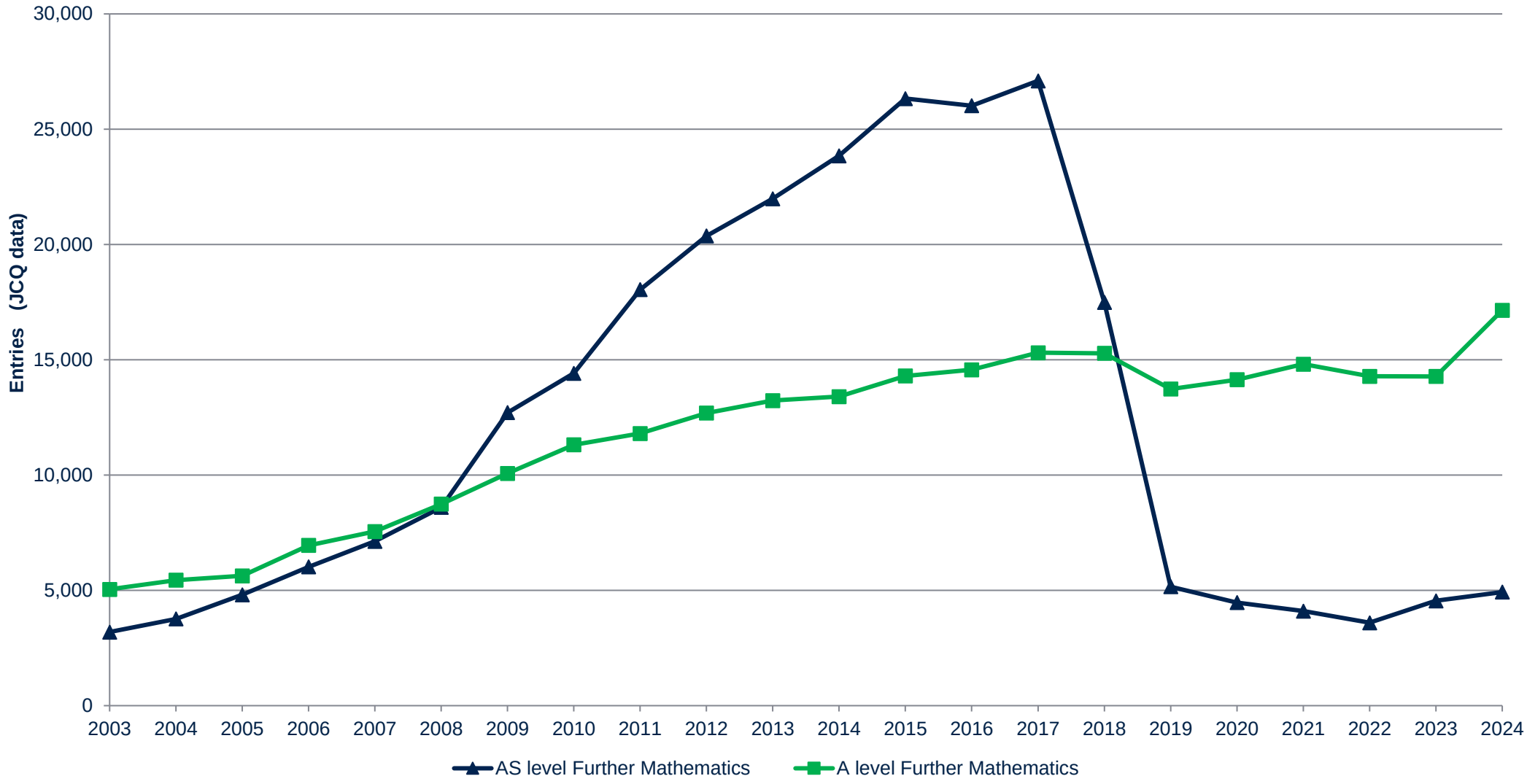


Methods are applicable to many real-world situations.

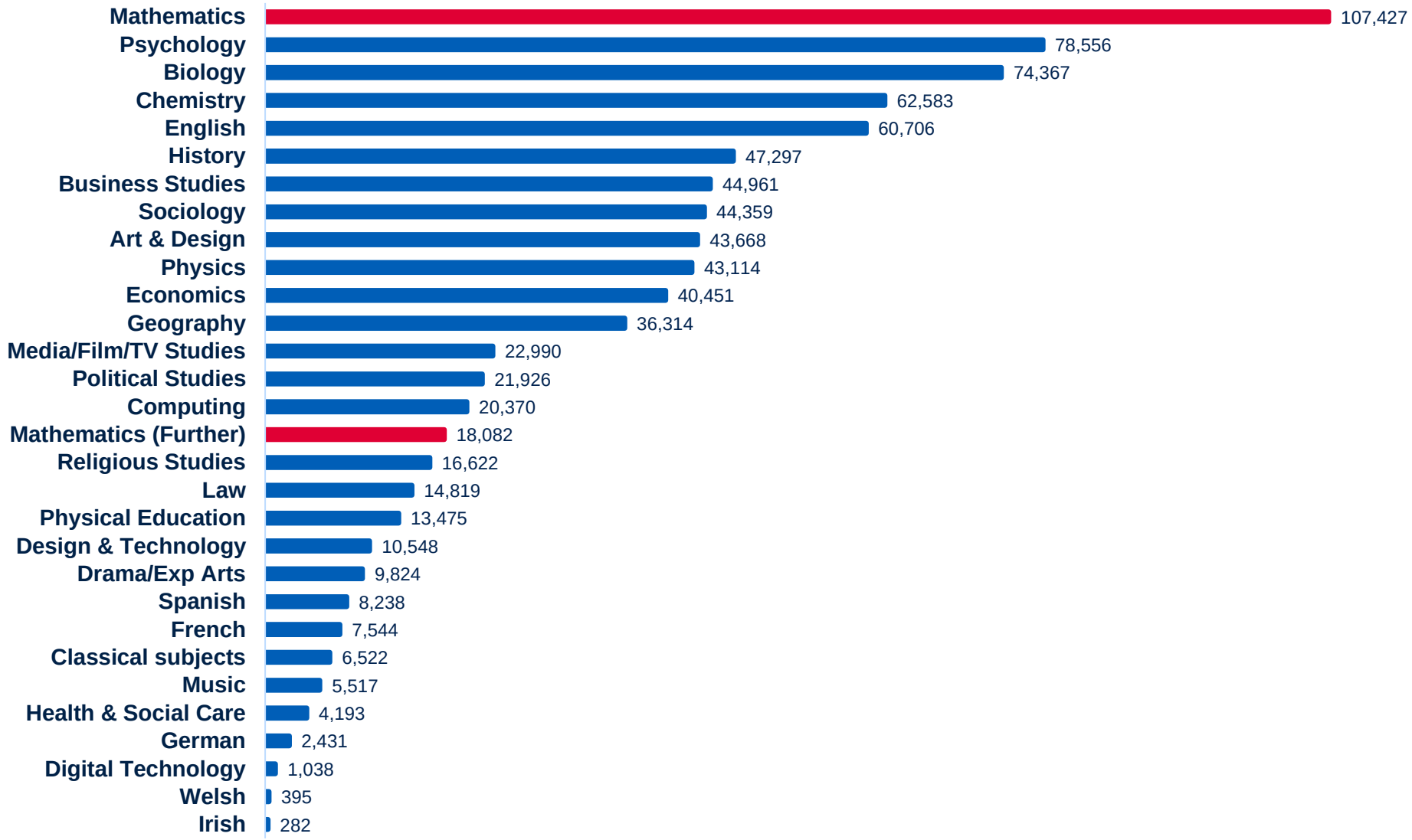
A and AS level Mathematics entries in the UK 2003-2024 (JCQ data)



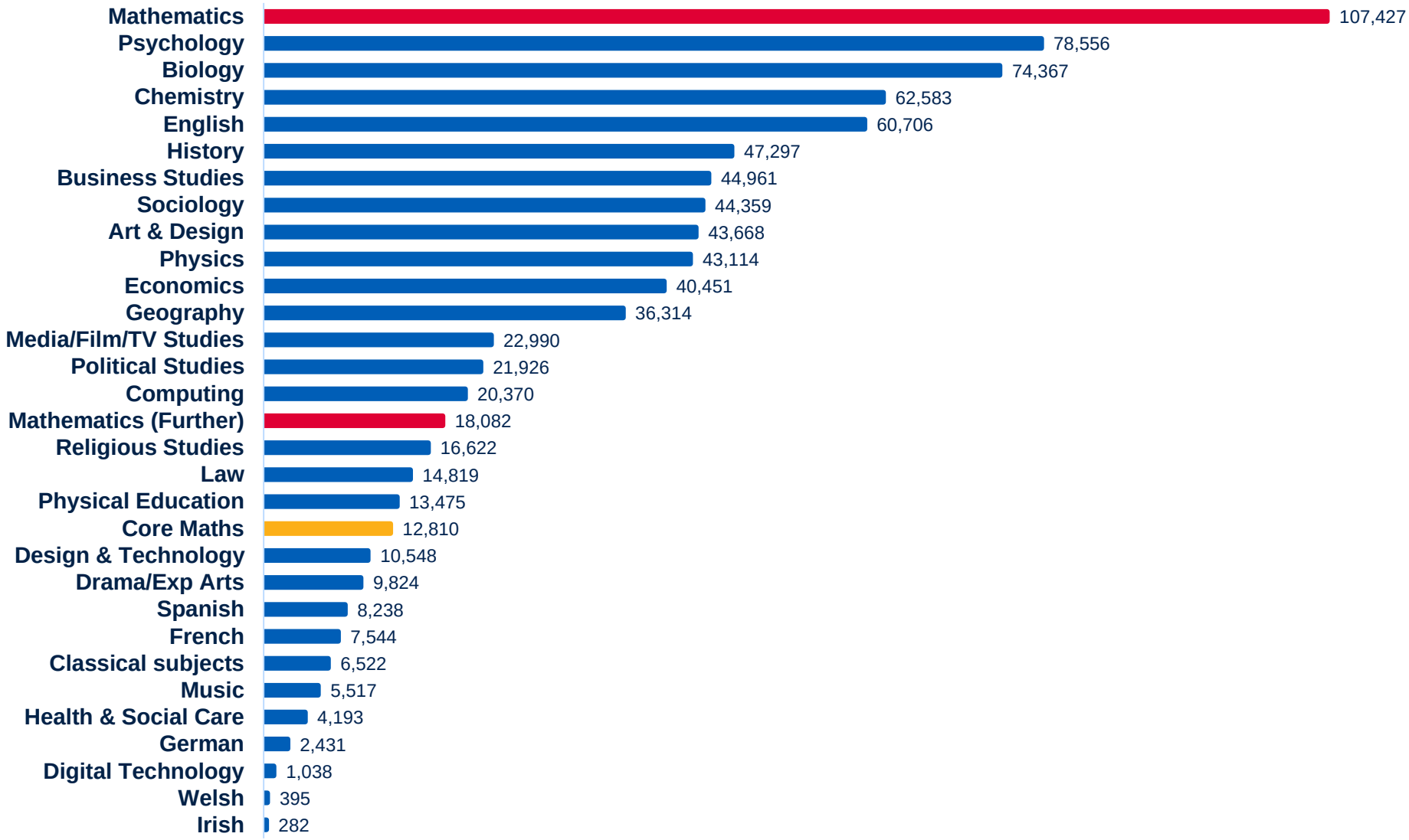
A and AS level Further Mathematics entries in the UK 2003-2024 (JCQ data)



2024 UK A level entries by subject (JCQ data)

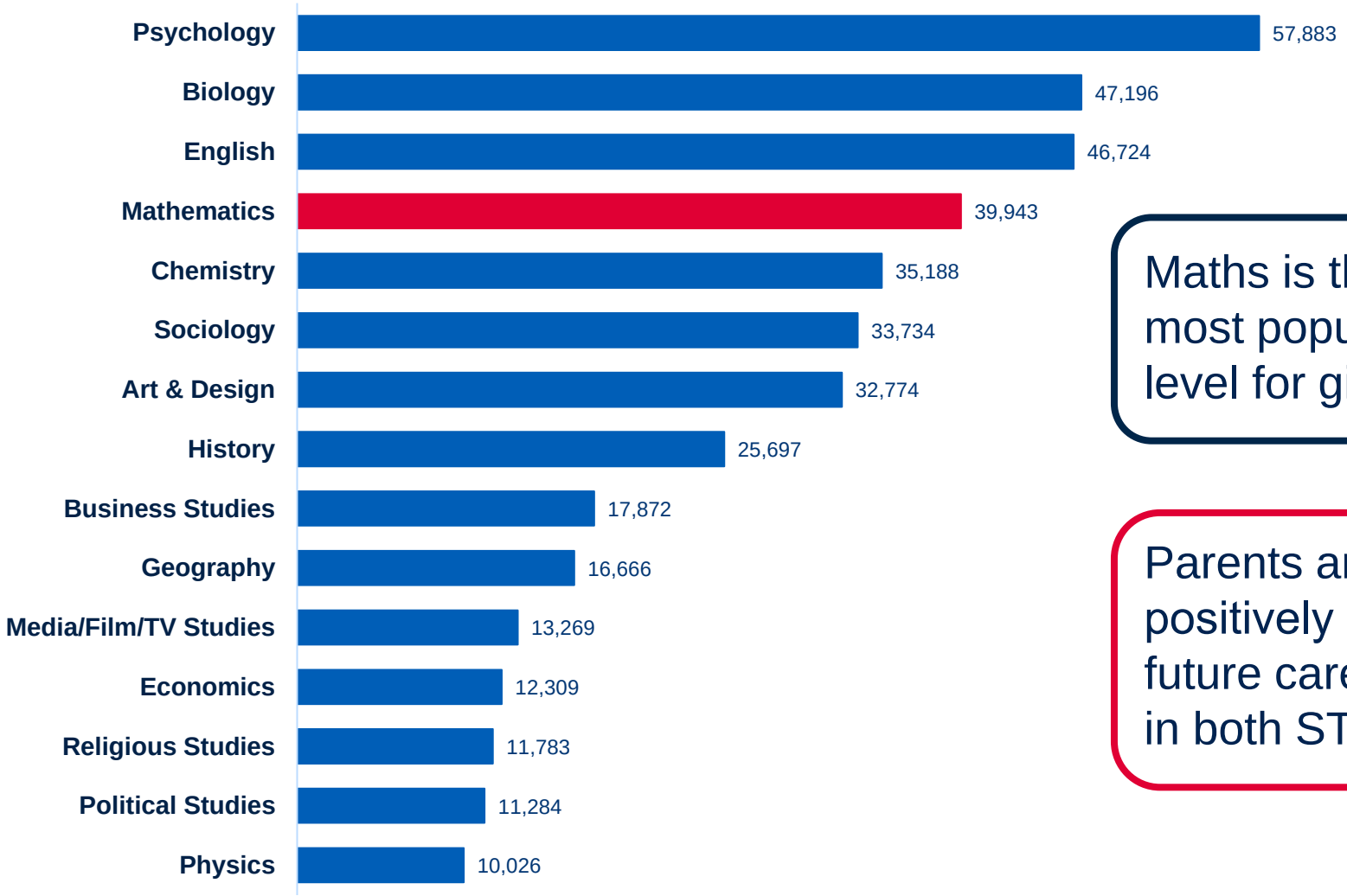


2024 UK A level entries by subject (JCQ data) plus Core Maths



Girls' participation in Mathematics

Top 15 A level subjects for females in the UK in 2024



Maths is the fourth most popular A level for girls.

48% of the Level 3 Core Maths cohort are female

Parents and carers play a **key** role in positively influencing girls' A level and future career choices towards mathematics in both STEM and non-STEM disciplines

What are the career opportunities?

Career myths

Unless you plan to do a STEM (Science, Technology, Engineering, Mathematics) degree, you don't need to study mathematics post-GCSE.

You're either a maths person or an arts person. Not both.

You only do a mathematics degree to become a mathematics teacher.

Most careers that require A level Mathematics are male-dominated.

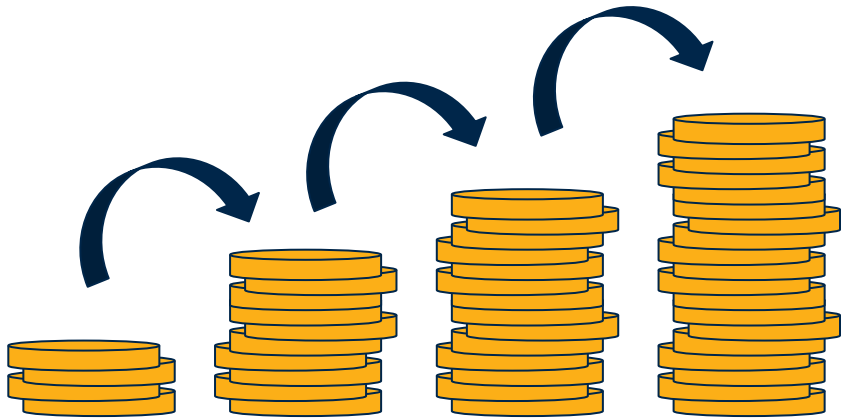
Further Mathematics is an A level just for students who want to become engineers or physicists

“Quantitative skills are required in a wide range of occupations and activities, embracing not only the mathematical and physical sciences but also the social sciences, the humanities and the creative arts. Mathematics is now intrinsic to some aspects of the creative arts… and learned societies argue that students across the sciences, social sciences and humanities need significant quantitative skills, and these should be a central component of their education.”

Professor Sir Adrian Smith

Source: Review of Post-16 Mathematics

What are the career opportunities?

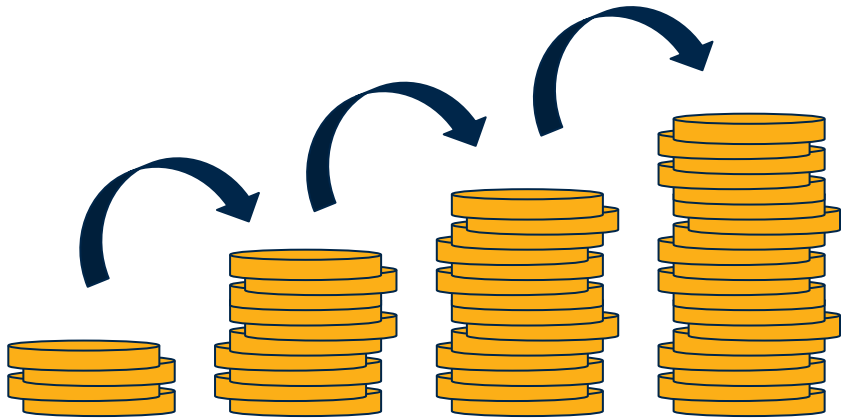


"…analysis highlights the economic value of good mathematical skills and of higher level qualifications… There is compelling evidence of continued wage returns of up to 11% to A level Mathematics."

Rethinking the Value of Advanced Mathematics Participation
http://www.nottingham.ac.uk/education/documents/research/revamp-final-report-3.1.17.pdf

What are the career opportunities?

Average earnings five years after achieving level 3 qualifications (by subject).



Further maths	£25,500
Maths	**£22,500**
Physics	£23,700
Computing	**£22,500**
Business Studies	£21,000
Geography	**£20,900**
Biology	£20,600

Chemistry	**£21,600**
P.E.	£20,400
French	**£19,900**
History	£19,400
English Literature	**£19,200**
Sociology	£18,300
Art and Design	**£16,800**

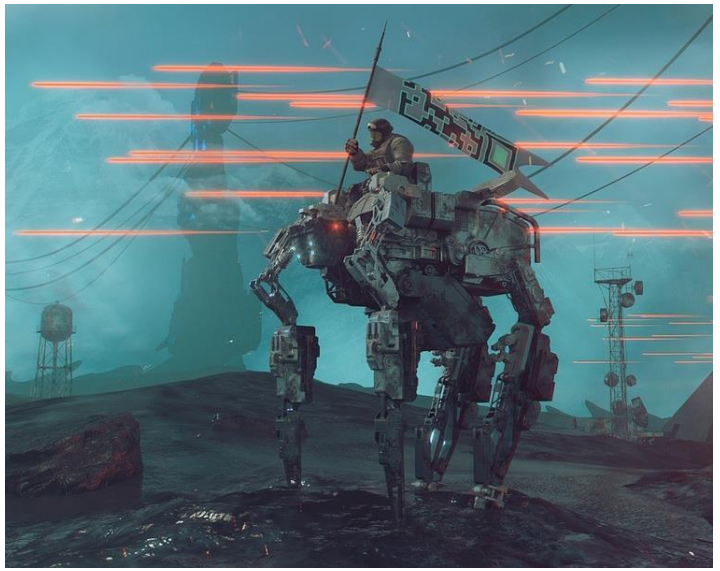
Published 2019: Average earnings in the 2016/17 Tax year for learners that achieved level 3 qualifications in 2011

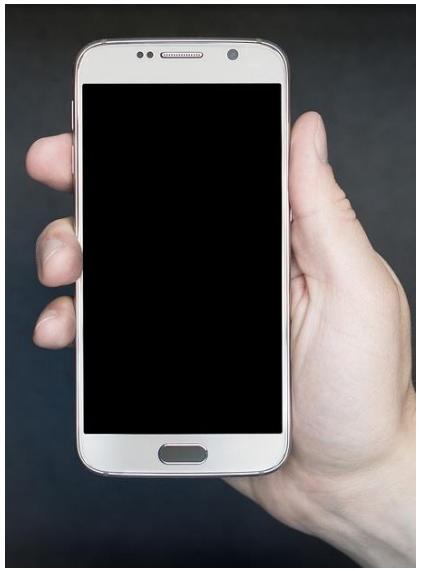
https://www.gov.uk/government/publications/post-16-education-earnings-outcomes-for-level-3-achievements

Careers using maths

Applications of mathematics in technology:

- Medical
- Game Design
- Internet Security
- Financial Cryptography
- Computing
- Communications
- Artificial Intelligence

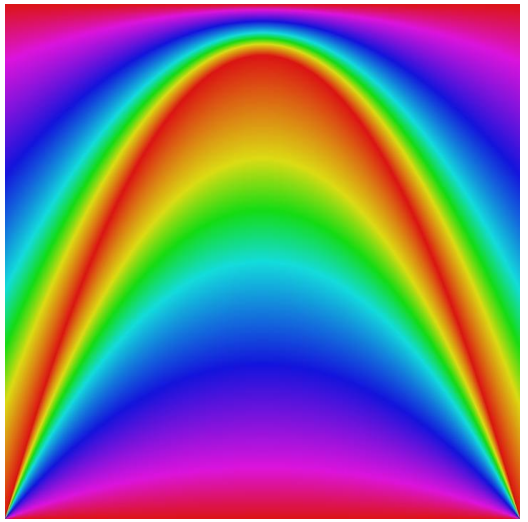




Careers using maths

On-going applications in engineering, such as:

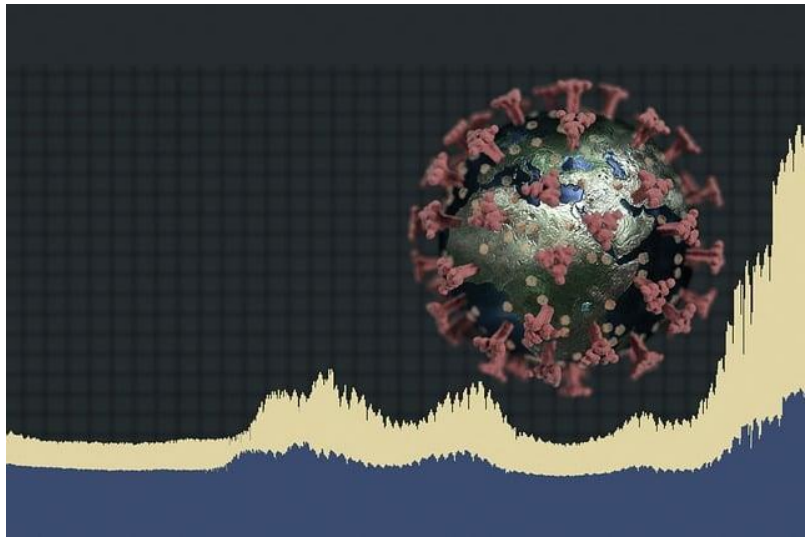
- Aircraft Modelling
- Fluid Flows
- Acoustic
- Software Development
- Electronics
- Civil Engineering.



Careers using maths

New scientific processes such as:

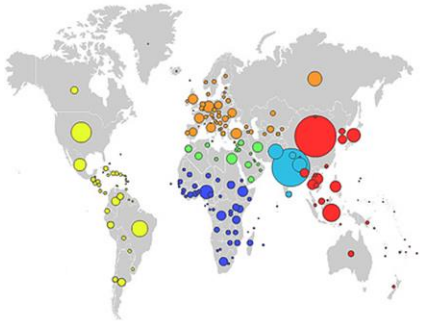
- Modelling populations
- Modelling diseases
- Quantum Physics
- Astronomy
- Forensics
- DNA sequencing



Careers using maths

Applications relating to human behaviours and interactions:

- Data Science
- Psychology
- Law
- Economics
- Climate Change
- Environmental Modelling
- Political Science
- International Development



What are Higher/Degree Apprenticeships?

Degree-equivalent qualifications

A levels or equivalent required for entry

The employer covers the cost.

You are paid a salary while you study

Popular alternative to a degree at university.

Mathematics is desirable for many apprenticeships

Examples include:

Technology

Actuarial

Software Engineering

Data Science

Quantity Surveying

Exemplar Entry Requirements

Apprenticeships

Diagnostic Radiographer Degree Apprenticeship

A levels: BBC with a grade B in Science/Maths

Portsmouth NHS, September 2024

Digital and Technology Solutions Degree Apprenticeship

112 UCAS points, grade C/B Mathematics and a STEM subject

WMG, University of Warwick, September 2024

Aerospace Engineering Degree Apprenticeship

A levels: BBC to include Mathematics

GE - Dowty, September 2024

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According to research by UCL, students with an A level in Mathematics are more likely to attend a Russell Group university **...**

Look at the entry requirements on an individual university's website for the degree subjects that you might be interested in

A level Maths opens doors to leading universities

Taking maths at A-level is more helpful for landing a place at a Russell Group university than studying at a grammar or private school, research from University College London's Institute of Education suggests.

There is even a maths premium for degree subjects that are not directly related to maths or which require a different skillset, such as languages and humanities.

Source: https://schoolsweek.co.uk/a-level-maths-is-more-useful-for-top-university-places-than-private-school

A level Maths and degree courses

Degree subject category	% of students on the course who have A level Maths
Mathematics (G1)	100%
Physics (F3)	99%
Chemical, Process and Energy Engineering (H8)	98%
Mechanical Engineering (H3)	93%
Pre-clinical medicine (A1)	75%
Economics (L1)	70%
Computer Science (I1)	57%
Chemistry (F1)	34%

A level Further Maths and degrees

Degree subject category	% of students on the course who have A level Further Maths
Mathematics (G1)	65%
Physics (F3)	38%
General Engineering (H1)	28%
Mechanical Engineering (H3)	26%
Chemical, Process and Energy Engineering (H8)	17%
Computer Science (I1)	16%
Economics (L1)	11%
Chemistry (F1)	8%

Exemplar Entry Requirements

Maths

ABB (including Maths at A) **or** ABC if taking both A level Mathematics and Further Mathematics (Maths at A and Further Maths at B)

University of Kent 2024 entry

A*A*A - Mathematics, Further Mathematics and one other subject + STEP

Cambridge University 2024 entry

CCE - 3 A levels or BB - 2 A levels (72 UCAS points) including Mathematics

London Metropolitan University 2024 entry

Exemplar Entry Requirements

Engineering

ABB-BBB including Maths (Further Maths recommended)

Swansea University ***(Chemical Engineering degree),*** *2024 entry*

128 UCAS points (typical offer) to include Maths grade B or above

Hull University ***(Biomedical Engineering degree),*** *2024 entry*

112 UCAS points (typical offer) including Mathematics and one other relevant subject at grade C or above.

Plymouth University ***(Mechanical Engineering degree),*** *2024 entry*

Exemplar Entry Requirements

Science

AAB - ABB to include Chemistry and one further science subject (from Biology, Human Biology, Physics, Maths, Further Maths, Psychology, Geography or Geology).

*Southampton University **(Chemistry degree),** 2024 entry*

ABB including grade B in Maths.

*Reading University **(Meteorology and Climate degree),** 2024 entry*

104-112 UCAS points including Maths and Physics

University of Saltford **(Physics degree)** 2024 entry

Exemplar Entry Requirements

Other subjects

AAB to include one Science subject (list of sciences includes Mathematics and Further Mathematics)

Liverpool University ***(Psychology degree),*** *2024 entry*

128 UCAS points (ABB-BBB) to include Mathematics

University of Portsmouth ***(Economics degree),*** *2024 entry*

104 UCAS points to include Geography or one related subject (includes Mathematics)

University of Lincoln ***(Geography degree),*** *2024 entry*

Studying a Maths degree

Wide range of degrees
e.g. BSc, MSc, MMath…

Different ways to study
Lectures, assignments, projects, placements

Joint honours
Combine maths with other subjects

Wide range of entry requirements
From grade D to A* in A level maths

Different content to study
Applied maths, Abstract pure maths, Coding, Vocational

Investigate different courses
What content and direction will suit you best?

Maths degree courses

This map shows Maths degree courses by minimum A level Maths entry requirement.

- A* (11 Unis)
- A (19 Unis)
- B (19 Unis)
- C (15 Unis)
- D (1 Uni)

Correct as of 23/24

Example of course content

Maths

Sheffield Hallam University – Min Entry BBC. *BSc Mathematics*

- Course specialises in supporting students to thrive
- Student-centred curriculum through active, collaborative learning
- Live projects with industry partners from year 1 – become a professional mathematician
- Coursework-driven assessment methods, allowing skills development alongside maths
- Use of appropriate technology to support professional learning

- 1st year:
  - Gently consolidate and extend A Level knowledge and methods
  - Strong focus on applied learning – realistic scenarios and datasets
  - Problem solving and thinking skills
- 2nd year:
  - Continuing and extending topics
  - Introducing analysis and other advanced topics
- Placement year (optional)
- Final year:
  - Advanced topics build on learning
  - Individual, in-depth project

Example of course content

Maths

University of Manchester - Min entry A*A*A

BSc or MMath Mathematics (joint honours courses with other subjects also available.

- 1st year: modules in pure, applied maths, probability and statistics, group problem solving
- 2nd year: choose two streams from pure, applied or P&S, programming with Python, Group project, mathematical modelling, optional modules in other areas, UCIL
- 3rd and 4th year: wide range of options to choose from, optional project in 3rd year, compulsory project in 4th year.

University entry requirements

Typical:

Universities and colleges set their own entry requirements for higher education courses, and these vary widely depending on the subject, the specific course, and the course provider.

Contextual:

This is where the university considers any barriers you may face e.g. the school you attend, where you live, if your parents went to university, if you have been in care or cared for a family member. They may reduce their grade requirements or give you extra consideration.

Alternative:

In some cases, **a qualification in Core Maths or A level Mathematics/Further Mathematics will reduce the grades required for entry** to a degree course in a related subject.

Visit **www.ucas.com** for additional information

Exemplar University Alternative Offers

University of Bath

Typical offer A level	Alternative offer A level
A*AA	AAA
AAA or A*AB	AAB
AAB	ABB

- Applies to all degrees that **do not require** A level Maths
- For students achieving a **grade B** in **Core Maths**
- Or grade B in AS or A level Maths or AS or A level Statistics if studied in addition to 3 subjects.

Courses: Architecture, Business Courses, Biosciences, Chemistry, Pharmacy, Education, Health and Sport degrees Languages, Politics, Psychology, and Social Sciences

Exemplar University Alternative Offers

University of Bath

Typical offer A level	Alternative offer A level
A*AA	AAA
AAA or A*AB	AAB
AAB	ABB

- Applies to degrees that **require** A level Maths
- For students achieving a **grade B** in **AS or A level Further Maths**

Courses: Civil, Chemical, Mechanical and Electrical Engineering, Computer Science, Physics, Economics and Accounting & Finance

The University of Sheffield

If we offer you a place on certain courses with a GCSE Maths requirement, and you're taking a Core Maths qualifications, we'll make you an alternative offer equivalent to one A Level grade below the standard entry requirements for your course, subject to you achieving a specific grade in Core Maths.

Taken from https://www.sheffield.ac.uk/study/policies/access-sheffield

The University of Sheffield

Core Maths

BSc Psychology: AAB including 1 specified science, or ABB, including 1 specified science + A in Core Maths

BA Architecture: AAA or AAB + B in Core Maths

BSc Biomedical Science: AAB, including two science subjects, or ABB, including two science subjects + B in Core Maths

The University of Sheffield

If we offer you a place on certain courses with an A Level Maths requirement and you're taking AS or A Level Further Maths, we'll make you an alternative offer equivalent to one A Level grade below the standard entry requirements, subject to you achieving a specific grade in Further Maths.

Taken from https://www.sheffield.ac.uk/study/policies/access-sheffield

The University of Sheffield

Further Maths

BSc Chemistry: AAB including Chemistry, or BBB, including Chemistry + B in a EPQ, or ABB, including A in Chemistry + A in Further Maths

BEng Aerospace Engineering: AAB, including Maths and a science, or ABB, including Maths and a science + B in a relevant EPQ, or ABB, including Maths and a science + A in AS or B in A Level Further Maths

The University of York

If you achieve B or higher in Core Maths, you may be eligible for an alternative offer up to one A level grade (or equivalent) below our typical offer.

This applies to a wide range of courses including

Biology, Business and Management, History of Art, Midwifery Practice, Music, Philosophy, Social Work

My child loves maths. Is there any more they could be doing?

Take AS or A level Further Mathematics

Subscribe to the new AMSP SUMS magazine

Study for additional qualifications in mathematics such as STEP, TMUA or the MAT, which are required for entrance to some leading universities to study mathematics.

Other sources of information

AMSP website www.amsp.org.uk/students

Maths Careers website www.mathscareers.org.uk

Apprenticeship websites e.g.

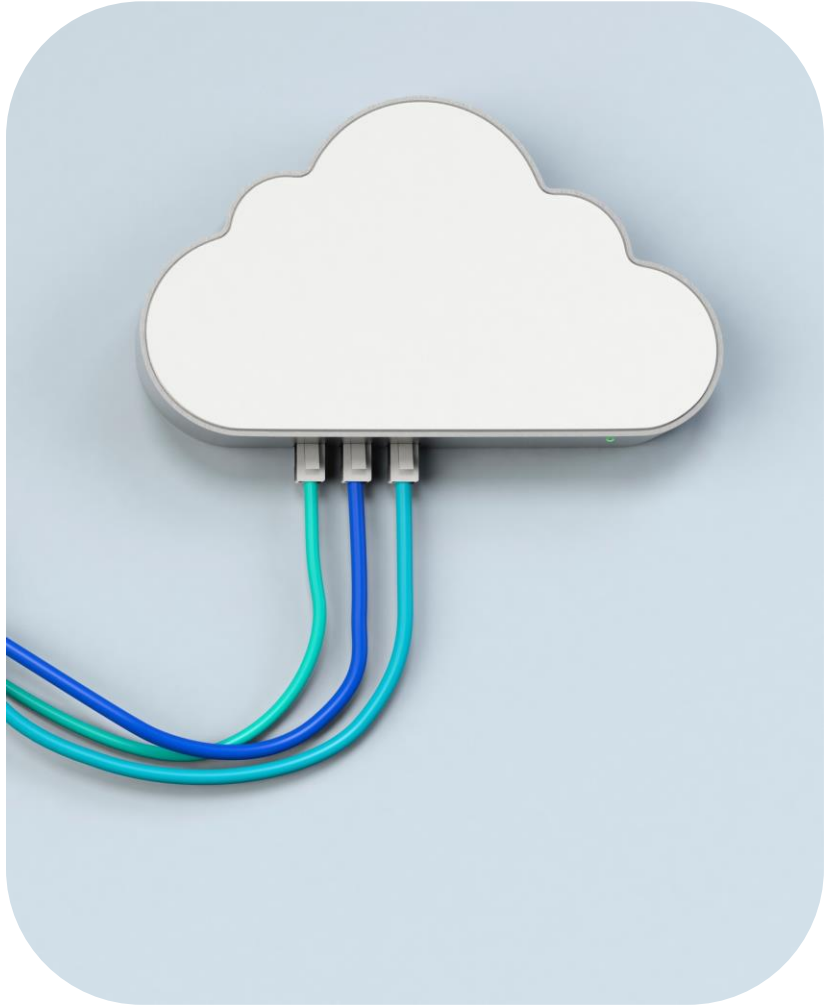
www.amazingapprenticeships.com

Universities and Colleges Admissions Service (UCAS)

www.ucas.com

Russell Group Universities www.informedchoices.ac.uk

Nrich www.nrich.org.uk



About the AMSP

- A government-funded initiative, managed by MEI, providing national support for teachers and students in all state-funded schools and colleges in England.
- It aims to increase participation in AS/A level Mathematics and Further Mathematics, and Core Maths, and improve the teaching of these qualifications.
- Additional support is given to those in priority areas to boost social mobility so that, whatever their gender, background or location, students can choose their best maths pathway post-16, and have access to high quality maths teaching.

Contact the AMSP

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Advanced_Maths