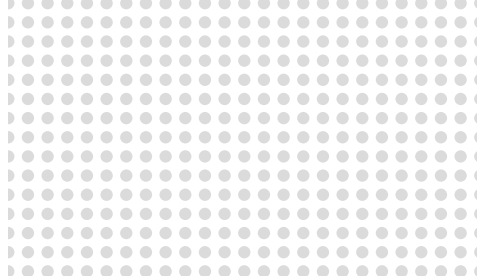




Advanced Mathematics
Support Programme®



Maths
Opening the door to your future

What does 'maths' mean to you?

Is it the study of patterns?
Or is it a way of making relationships between ideas such as graphs and algebra?

Do you see maths as a human activity that forms part of our culture?

Perhaps it is a way of illuminating the relationships we see in the world around us?

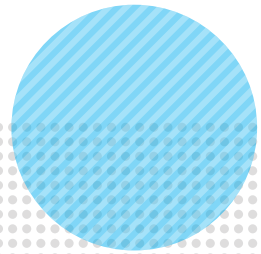
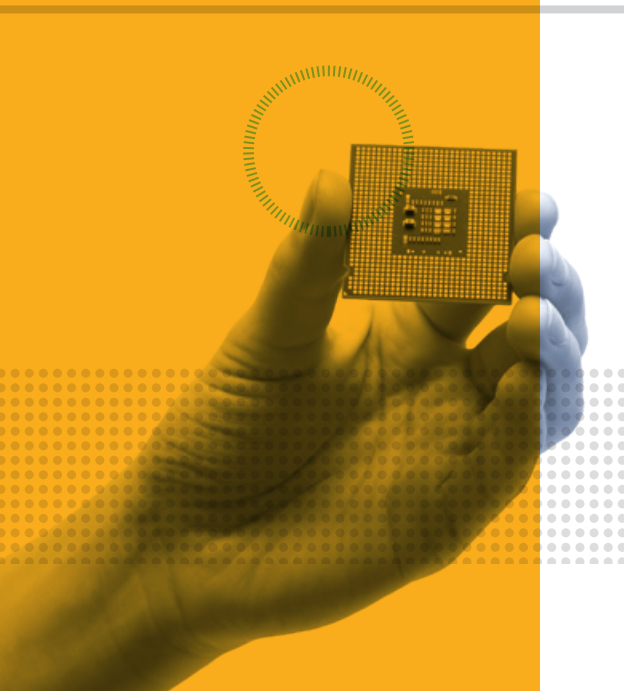


Why study maths?

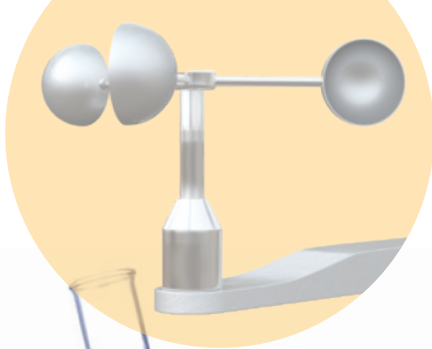
The skills developed through the study of maths are in high demand from employers and universities. In addition to developing the ability to solve problems and think logically, the study of maths provides opportunities to develop team-working skills, resilience, effective communication of complex ideas and the ability to use your own initiative.



Whatever maths means to you, the breadth of applications is immense. Maths underpins most of science, technology and engineering and is also important in areas as diverse as business, law, nutrition, sports science and psychology. There are many opportunities to use maths to make a difference in society, for example through the analysis involved in medical research, developing new technology, modelling epidemics or in the study of patterns of criminal activity to identify trends.



Which maths qualification is suitable for me?



Continuing to study maths is a fantastic choice because of the wide range of applications of the subject. If you gain a good pass in GCSE Mathematics by the end of Year 11 you should consider taking maths further.

Your options are:

- **Core Maths.**
- **AS or A level Mathematics;**
- **A level Mathematics with AS or A level Further Mathematics;**

Core Maths is a new Level 3 qualification which develops the mathematical skills gained at GCSE. It focuses on using and applying maths to solve problems drawn from other subjects, work and real life. The Core Maths course includes new content such as statistics, financial maths and using algebra. Core Maths helps with the maths needed for a broad range of other subjects.

AS or A level Mathematics supports the study of a wide range of other AS/A level subjects. Physics, Chemistry and Biology rely on good algebraic and graphical skills, statistical techniques and the use of a range of functions including logarithms and trigonometry. In addition, Economics, Psychology, Business, Computing and Geography all benefit from students having fluent and confident numerical, algebraic, graphical and statistical skills.

Many students take AS/A level Mathematics in conjunction with non-related subjects in order to maintain a broad range of subject choices until they make decisions about their future study and career plans.

Mathematics is a qualification that is highly valued by employers and universities and is one of the most popular subjects for both boys and girls. The vast range of degree courses and careers that require solid mathematical skills ensures that taking maths to AS level or beyond will open doors to a world of opportunities!

Further Mathematics provides a great opportunity for enthusiastic mathematicians to broaden and deepen their subject knowledge. If you plan to apply for a STEM (Science, Technology, Engineering and Mathematics) degree you should consider taking Further Mathematics to at least AS level. Further Mathematics is also a fantastic qualification for those students who love maths and want to devote more time to the studying wider aspects of the subject.

Sometimes AS Further Mathematics can be completed during Year 13 – ask your school or college.

If you are thinking of applying for a medical degree, consult individual university websites to check for any special rules relating to Further Mathematics.

Core Maths



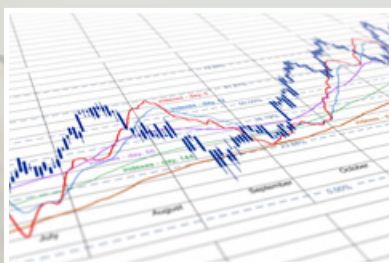
Core Maths is a level 3 qualification, equivalent in size to an AS level qualification. It is designed for students who have passed GCSE Maths at grade 4 or above and who want to keep their valuable maths skills up to date in preparation for employment or university study, but who are not planning to take AS/A level Mathematics. The skills developed in the study of mathematics are increasingly important in the workplace and in higher education; studying Core Maths will help you keep up these essential skills.

Core Maths attracts up to 20 UCAS points, the same as an AS level qualification, which can help to achieve the entry requirements required for entry to an undergraduate degree course.

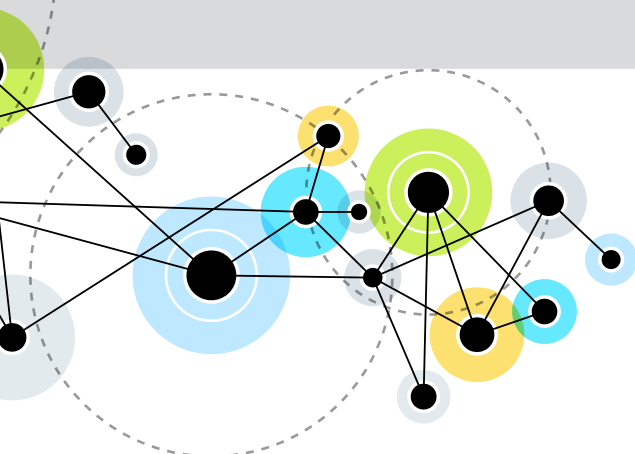
Many schools and colleges already offer Core Maths, which is taken across either one or two years alongside A levels or other post-16 studies. It is designed to develop real-life maths skills and builds on GCSE Maths content, along with some new mathematical content. It is very useful in supporting other A level subjects such as biology, geography, psychology, business, and geography. It also complements other level 3 studies, such as BTEC level 3 qualifications.

The subject content of Core Maths qualifications varies between different awarding organisations, but all include analysing data to make decisions, and using spreadsheets and percentages in real-life contexts. You might also study topics such as critical path analysis, exponential growth and the Normal distribution – each of these are used to solve problems arising from everyday life, business or scientific contexts.

Speak to your school/college to discuss the specific content of the Core Maths qualification they offer.



AS and A level Mathematics



Maths can be taken at AS level or A level.

All students study the same mathematical content, which extends techniques covered at GCSE and introduces new methods and concepts.

AS and A level Mathematics courses build on familiar mathematical topics learned at GCSE such as **algebra, co-ordinate geometry, trigonometry** and **probability**. New topics introduced at A level include: **sequences and series; differentiation and integration**, together known as calculus; **Newton's laws of motion**; and **statistical hypothesis testing**.

Students are expected to use technology such as graphical calculators, graphing software and spreadsheets throughout the course.

Students starting AS and A level Mathematics courses in September 2017 or later will take all examinations at the end of the course. AS examinations may be taken at

the end of the first year (Year 12). The marks awarded for AS do not count towards the A level qualification taken at the end of the second year (Year 13).

All qualifications include the same content, covering three broad areas:

Pure maths

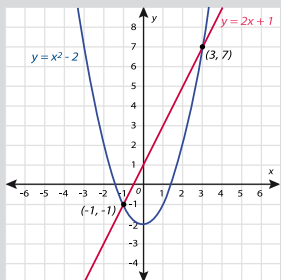
is the methods and techniques which underpin the study of all other areas of maths. This includes **proof, algebra, trigonometry, calculus**, and **vectors**.

Mechanics

is the maths used to study the physical world, modelling the **motion** of objects and the **forces** acting on them. This includes **moments**, where the turning effect of a force is considered.

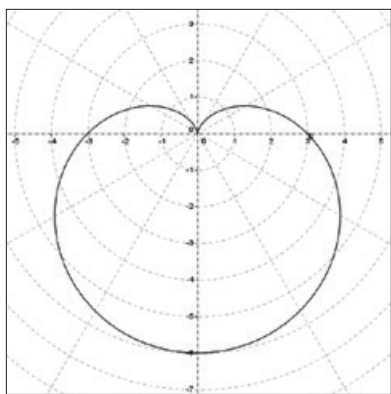
Statistics

involves **statistical sampling, data presentation** and **probability**, all of which follow on from topics met at GCSE, leading to the study of statistical distributions with special properties, such as the **Binomial Distribution**.



AS and A level Further Mathematics

Further Mathematics can be taken at AS level or A level. It is a second qualification that can be taken in addition to A level Mathematics.

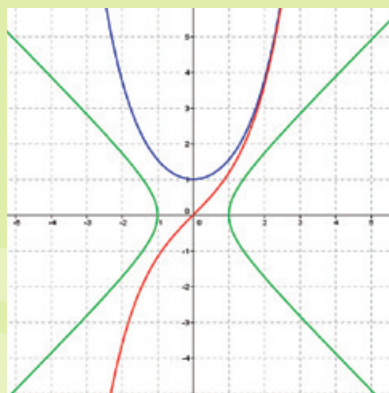


$$\begin{pmatrix} 2 & 3 & -1 \\ 0 & 1 & 1 \\ 3 & -2 & 0 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} 2 \\ 5 \\ 9 \end{pmatrix}$$

All students study the same pure maths content for Further Mathematics, which makes up 50% of the content for A level and 30% for AS level. There is some choice over the remaining content of each course which might include further study of pure maths, statistics, mechanics or other areas of maths. Individual schools and colleges will be able to provide you with more information about the structure and options available for the Further Mathematics course offered.

At AS, topic areas studied include **complex numbers**, which allow the solution of a range of equations that would otherwise have no solutions, through the introduction of 'imaginary' numbers, and **matrices** which consist of grids of numbers that can be used to represent transformations and are used to solve simultaneous equations amongst many other uses.

At A level, other areas of pure maths are covered such as **polar co-ordinates**, **differential equations** and **hyperbolic functions**. Each of these builds on earlier topics and encourages the development of a wider understanding of the ways in which mathematical topics are interconnected.



A world of opportunities



Tomasz Szyrowski

Project Manager, Marine Engineer

“ Three years of undergraduate study gave me a solid foundation not only in terms of knowledge but also allowed me to build a great academic network. After I finished the course I applied for a research based PhD position. I now work on developing mathematical and statistical tools for data acquisition, processing and interpretation in simulation and real time. The project focuses not only on the sensors used on marine applications but mainly on innovative mathematical and statistical methods for data analysis.



Amanda Kaminski

Research Manager, BBC

“ I am responsible for radio and music reporting for the BBC and am the company's expert in both radio data and statistics. Part of my role includes providing reports on the performance of the BBC's summer music festivals including Glastonbury and the BBC Proms. I have also provided important figures for key publications such as the BBC's Annual report.



Coralie Colmez

Author, tutor, speaker & businesswoman

“ I co-wrote a popular maths book, *Math on Trial*, about real-life criminal trials where there was an attempt to use a mathematical argument as evidence, and where a mistake was made. I use mathematics when I am tutoring and giving talks, and in business when I have to deal with big databases and make sense of them. Mostly, I use my capacity for clear and logical thinking, which was certainly developed through studying maths.





Stevie Gosling Project Manager



I completed an undergraduate MEng in Automotive Engineering. Doing Further Mathematics really benefited me in my degree especially in the first year as it meant I was ahead of most of my peers who were only being introduced to some topics for the first time. Probably the most interesting element of my degree was a competition called 'Formula Student', which pretty much took over my life for two years! As a University team we built a single seat race car from scratch that was raced around Silverstone. Within the team I designed, stress tested on computer systems, mathematically modelled and built the car's steering system – which I then spray painted with glitter!

Jennifer Lannon

Principal Statistician NHS Blood & Transplant

I My aim has always been to enjoy what I do for a living and to make a difference. I can't imagine a better place to do this than at NHS Blood and Transplant (NHSBT). It is important to me to be genuinely interested in the data I am analysing and in my job as Principal Statistician I analyse transplantation data. The results of the analyses performed at NHSBT can really make a difference. There is a great deal of job satisfaction because through our work we are helping to save and improve lives. The range of work is great and you learn something new every day – 'Understanding the data' for us means working closely with transplant surgeons and meeting patients which is a huge privilege.



James Bennett Actuary

I Mathematics is appreciated massively in the business world. Even very simple things can be considered complex to those who haven't got a mathematical background. In addition, it is the interpretation of mathematics and statistics that is incredibly useful in a business environment.



David Lee Mathematics Teacher



I I enjoy working with students and building relationships with them, but most of all I enjoy helping students with mathematics. Every year I teach, I see links between topics that I have not seen before. Part of me wishes I could do my whole degree again, because I would see so many things I missed the first time round! The logical skills I've acquired mean I am quite adept programming in software like Excel and Geogebra to do fancy mathematical things. I also use a lot of statistics: to analyse and interpret student data and to look critically at the wealth of data that is available in schools and the conclusions drawn from it.



Want to know more?

If you are unsure about whether Core Maths, AS/A level Mathematics or AS/A level Further Mathematics are suitable for you, talk to your maths teacher and find out more at sixth-form open events. If you have a career in mind, research the entry requirements to ensure you are choosing the best subject combinations. Some degrees require or prefer A level Mathematics and/or Further Mathematics.



Advanced Mathematics
Support Programme

The **Advanced Mathematics Support Programme (AMSP)** provides a range of support for students including:

- mathematical articles, challenges and puzzles
- Information about university courses
- enrichment and revision materials

The AMSP can also help provide tuition support for Further Mathematics if your school or college does not offer it.

See amsp.org.uk for more information.

Other websites where you will find useful information are:



- **Mathscareers** – detailed information about careers that are available for students who have taken A level Mathematics and Further Mathematics and Mathematics degrees mathscareers.org.uk



- **NRICH** – interesting resources to help you develop your problem solving skills, and information on preparing for university rich.maths.org/secondary-upper



- **+ plus magazine** – articles, podcasts and puzzles designed to introduce readers to the beauty and applications of mathematics plus.maths.org



- **Future Morph** – outlines career opportunities from science and mathematics for 14–16 and 16+ age groups futuremorph.org



- **STEM Learning** – information about STEM (Science, Technology, Engineering and Mathematics) Ambassadors and STEM Clubs stem.org.uk

What excited me the most was the wide range of subjects you could learn about and contribute to using statistics; anything from sport to environmental issues and from medicine to finance.

Jennifer Lannon Principal Statistician, NHSBT



The Advanced Mathematics Support Programme

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