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?

Continuing to study maths beyond GCSE opens many doors to you.

The skills you'll develop are in high demand from employers and universities. They know that continuing to study maths develops your ability to:

- **solve problems**
- **think logically**
- **work in a team**
- **develop resilience**
- **communicate complex ideas**
- **and use your own initiative.**

Maths is needed for a wide range of future career options. It underpins science, technology, and engineering. It's also important in areas as diverse as business, law, nutrition, sports science, and psychology.

There are lots of ways in which maths can be used to make a difference in society. Medical research, epidemiology, modelling climate change, and (of course!) education, all rely on maths.

Which maths qualification is suitable for me?
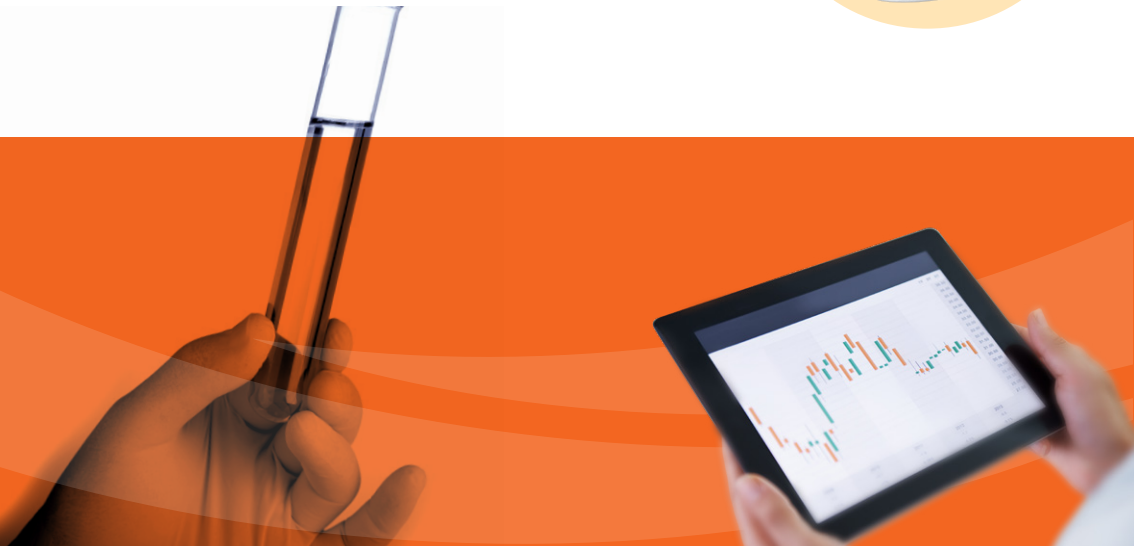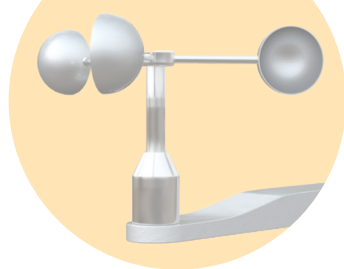
If you gain a good pass in GCSE Mathematics, consider taking one of these options:

- **Core Maths** – This qualification is equivalent in size to an AS level. It builds on topics covered in GCSE Mathematics and introduces some new content. Core Maths develops your skills in using this maths to solve real world problems – the kinds of challenges you'll meet in other subjects you're studying, your future career, and day-to-day life.

- **AS or A level Mathematics** – You can take Mathematics at AS level or A level. It extends the techniques you'll have covered at GCSE, and introduces new methods and concepts.

- **A level Mathematics with AS or A level Further Mathematics** – You can take Further Mathematics at AS level or A level, in addition to A level Mathematics. You may be able to complete AS Further Mathematics during Year 13 – ask your school or college.

Core Maths

Core Maths is designed for students who have passed GCSE Mathematics at grade 4 or above but don't intend to take AS/A level Mathematics or Further Mathematics. If that's you, it's a great choice.

Studying Core Maths can help you with other subjects you're taking. It keeps your maths skills up-to-date so that you're prepared for the maths you'll meet in university study and future employment. The skills you'll develop are increasingly important in the workplace and higher education.

Many schools and colleges offer Core Maths. It can usually be taken across one or two years, alongside A levels or post-16 vocational courses. A Core Maths qualification can give you up to 20 UCAS points - the same as an AS level qualification. This can help to achieve the entry requirements for a degree course. What's more, some universities reduce their entry requirements for students who've achieved good results in Core Maths.

The subject content of Core Maths qualifications varies between different specifications, but they 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.

Core Maths also features new content such as statistics, financial maths and interpreting graphs. You'll use these topics to solve problems arising from everyday life, business, or scientific contexts. Ask your school or college about the content of the Core Maths qualification they offer.

Studying Core Maths will also help you with the maths needed for a broad range of A level subjects, such as Biology, Geography, Psychology, and Business. It also complements vocational courses, such as BTEC level 3 qualifications.

AS and A level Mathematics

A level Mathematics is highly valued by employers and universities. A vast range of degree courses and careers require solid mathematical skills, so taking maths to AS level or beyond will give you a wide range of degree courses to choose from.

A level Mathematics builds on topics you'll be familiar with from GCSE, such as:

- algebra
- co-ordinate geometry
- trigonometry
- and probability.

You'll also be introduced to new topics including:

- sequences and series
- differentiation and integration – together known as calculus
- Newton's laws of motion
- and statistical hypothesis testing.

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

- **Pure Maths:** the methods and techniques which underpin the study of all areas of maths. This includes proof, algebra, trigonometry, calculus, and vectors.
- **Mechanics:** the maths used to study the physical world, modelling the motion of objects and the forces acting on them.

- **Statistics:** involves statistical sampling, data presentation and probability, leading to the study of statistical distributions with special properties, such as the Binomial Distribution.

You'll use technology such as graphical calculators, graphing software and spreadsheets throughout the course.

A level Mathematics supports a wide range of other A level subjects. Physics, Chemistry and Biology rely on good algebraic and graphical skills, statistical techniques, and a range of functions, including logarithms and trigonometry. If you're planning to study Economics, Psychology, Business, Computing and Geography, you'll benefit from being fluent and confident with numerical, algebraic, graphical, and statistical skills.

Taking A level Mathematics alongside subjects that don't involve maths, helps to keep your options open for future study and careers.

$y = 2x + 1$
$(3, 7)$
$y = x^2 - 2$
$(-1, -1)$
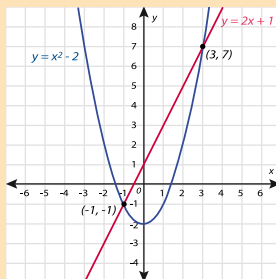
A level Further Mathematics

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

Further Mathematics is an excellent choice if you love maths and want to broaden and deepen your subject knowledge.

If you're planning to apply for a STEM (Science, Technology, Engineering and Mathematics) degree, taking Further Mathematics to at least AS level will help you with your studies.

All Further Mathematics course have the same pure maths content, which makes up 50% of the A level and 30% of the AS level. You may have some choice over the remaining content of each course. This might include further study of pure maths, statistics, mechanics, or other areas of maths, such as decision maths

or modelling with algorithms. Your school or college will be able to provide you with more information about the options available.

AS topic areas include:

- complex numbers, which allow the solution of a range of equations that would otherwise have no solutions by introducing '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 things.

A level covers further areas of pure maths, such as:

- polar co-ordinates
- differential equations
- and hyperbolic functions.

Each of these build on earlier topics and develop your understanding of the ways in which mathematical topics are interconnected.

If you are thinking of applying for a medical degree, check **amsp.org.uk/resource/ medicine-entry-summary** for any requirements relating to Further Mathematics.

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

" *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

" *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 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.

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 *nrich.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

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