

Why study Mathematics at Plume ?

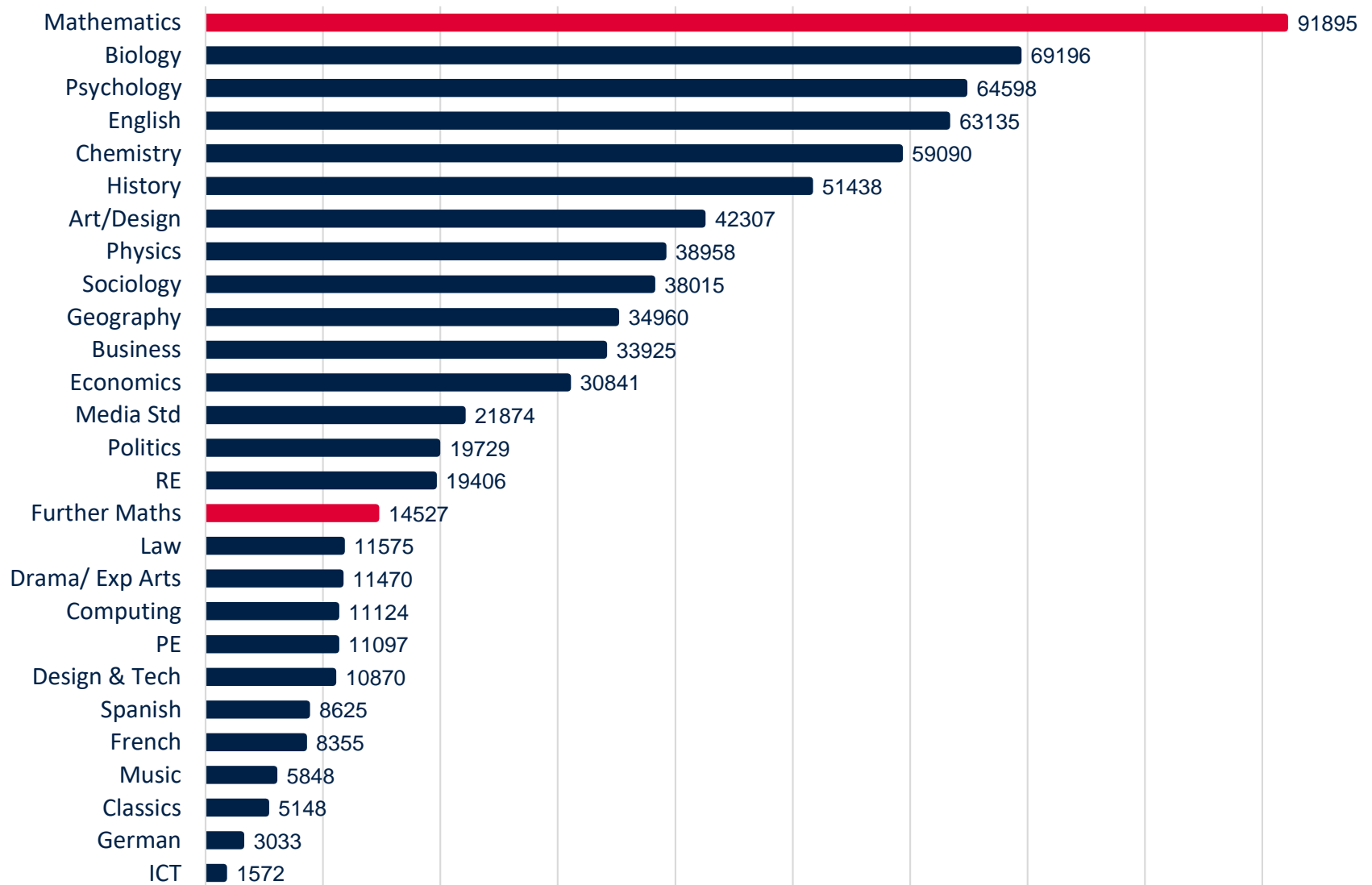
A guide for Students, Parents and Carers



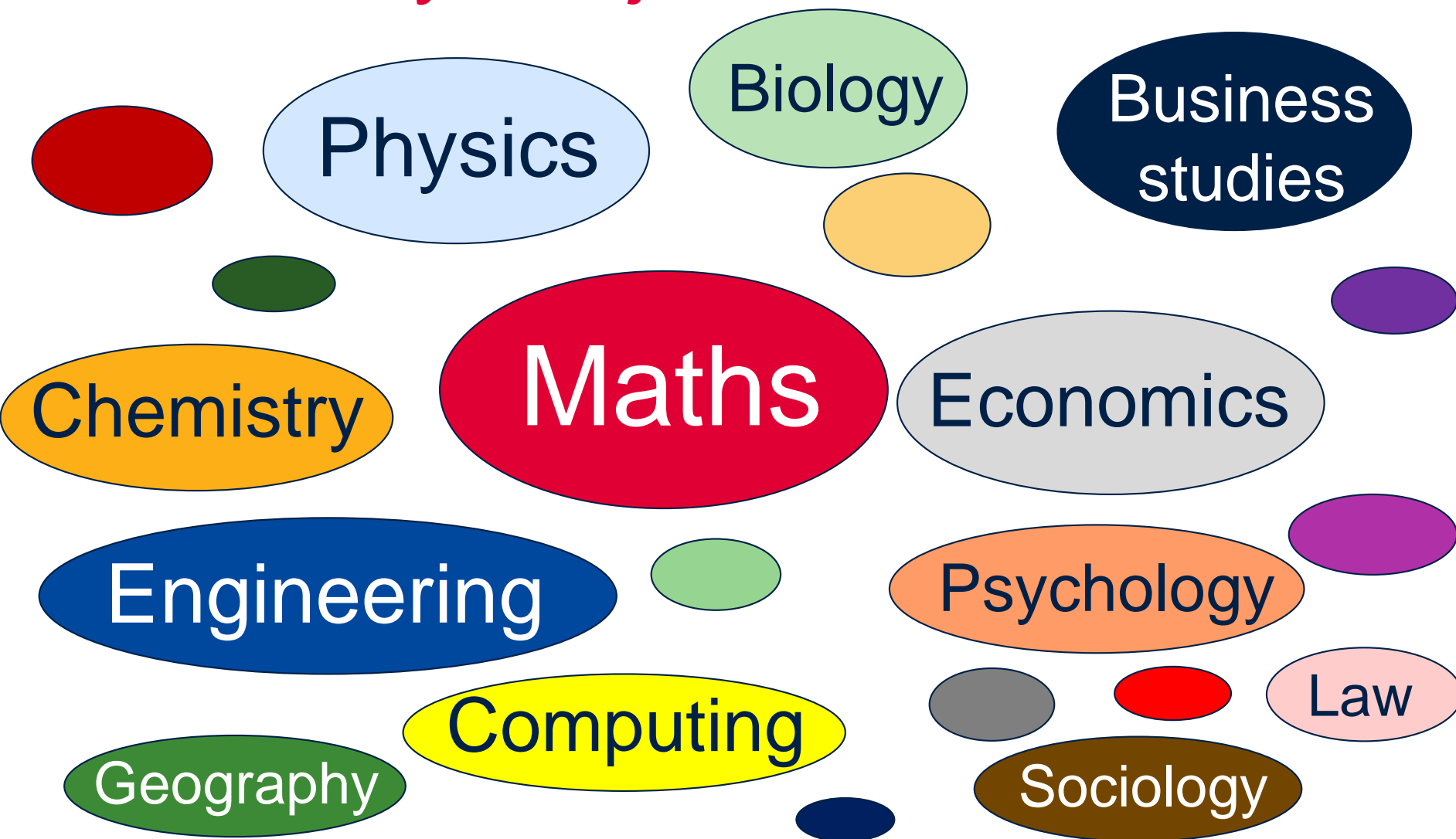
Why study Maths after GCSE?

- Stimulating and challenging courses;
- Increase knowledge and understanding of mathematical techniques and their applications;
- Support the study of other A levels;
- Develop key employability skills such as *problem-solving, logical reasoning, communication and resilience*;
- Excellent preparation for a wide range of university courses;
- Leads to *versatile qualifications* that are *well-respected* by employers and higher education.

2019 UK A level entries by subject (JCQ data)



Many subjects use maths



Post-16 Mathematics options

AS/A level
Mathematics

AS/A level Further
Mathematics

Which should you choose?

What are the options?

- A level Mathematics
 - Extends GCSE Maths and introduces new ideas
- A level Further Mathematics
 - An additional A level to add breadth/depth.
 - This is an *on-line course provided by AMSP*, Advanced Mathematics Support Programme.

What is covered 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*.

Pure Mathematics

(66%)

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

Statistics

(17%)

working with data from a sample to *make inferences* about a population, probability calculations, modelling real life data using statistical distributions and hypothesis testing.

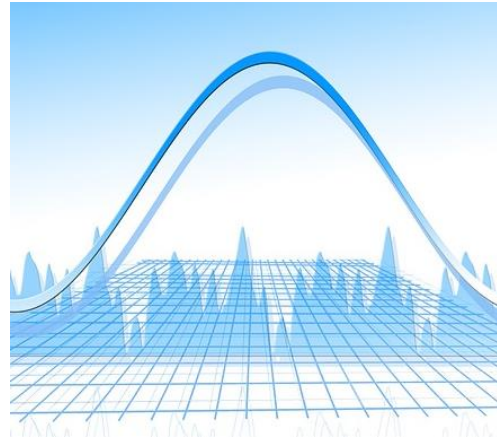
Mechanics

(17%)

the *study of the physical world*, modelling the *motion* of objects and the *forces* acting on them.

What is Statistics?

Reaching conclusions from data and calculating the likelihood of an event occurring.



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

Professor Sir Adrian Smith

What is Mechanics?

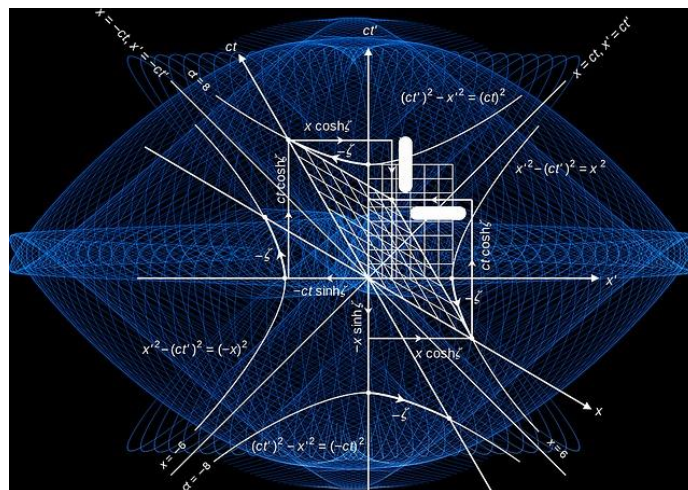
The modelling of the world around us, the motion of objects and the forces acting on them.



Students planning careers in physics or engineering would find mechanics particularly useful.

What is Further Mathematics?

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



It is designed to *stretch and challenge* able mathematicians and prepare them for university courses in mathematics and related *quantitative and scientific subjects*.

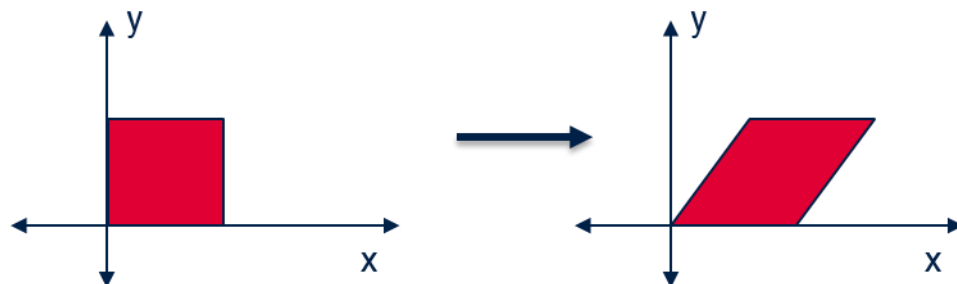
What is covered in Further Mathematics?

- Pure mathematics content, making up at least 30% of the AS level and at least 50% of the A level. This is *compulsory*.
- The remainder of the content is made up of options which will include some of:
 - ❖ Additional pure mathematics
 - ❖ Additional statistics and/or mechanics
 - ❖ Discrete / Decision mathematics

Pure maths in Further Mathematics

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

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



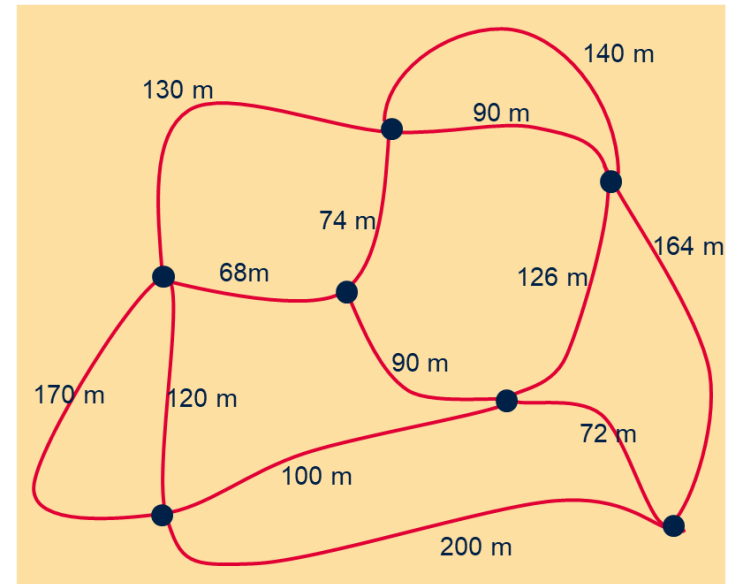
Complex numbers are based on the 'imaginary' number $\sqrt{-1}$. They lead to the study of lots of new areas of mathematics, including fractals like those shown in the image above.

What is Discrete/Decision Maths?

One area of discrete mathematics is graph theory, which includes solving problems such as:

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

This topic uses **algorithms** vital in **computer science**.



What are the career opportunities?

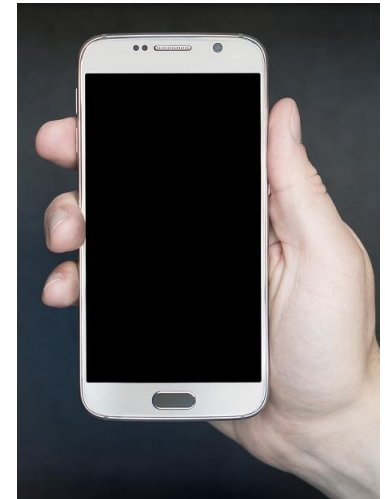
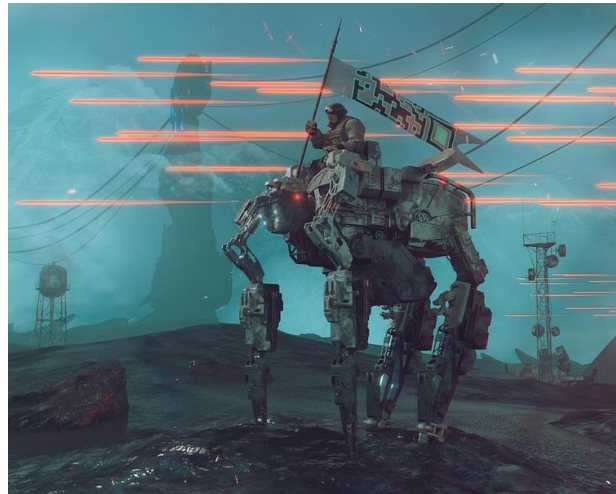


Careers using Maths

There is a huge shortage of people with STEM skills needed to enter the workforce.

Applications of mathematics in technology:

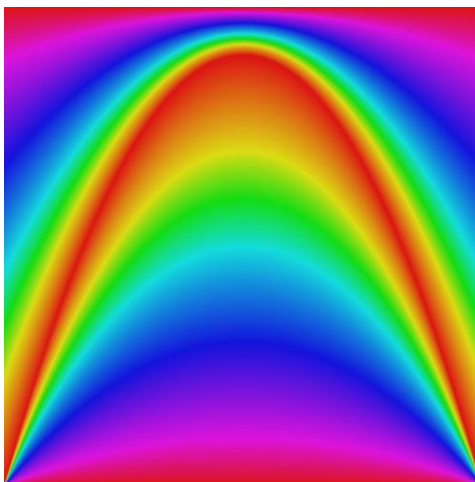
- Medical
- Games Design
- Internet Security
- Financial Cryptography
- Programming
- Communications



Careers using Maths

On-going applications in engineering, such as:

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



New scientific processes such as:

- Modelling populations and Diseases
- Quantum Physics
- Astronomy
- Forensics
- DNA sequencing



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. ”



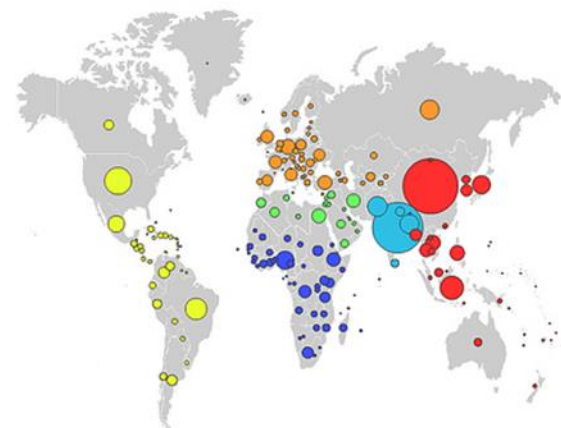
(Source: Rethinking the Value of Advanced Mathematics Participation, 2016

<http://www.nottingham.ac.uk/education/documents/research/revamp-final-report-3.1.17.pdf>)

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?

- Designed to offer *degree-equivalent qualifications*.
- A popular alternative to obtaining a degree directly from a university.
- The employer will cover the cost.
- Paid a salary while you study.
- A levels or equivalent qualifications required for entry.
- Mathematics is also essential or desirable for a wide range of apprenticeships.
- Examples include.
 - 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.
- According to research by UCL, students with an A level in Mathematics are *more likely to attend a Russell Group* university.
- Any student applying to study a degree in a STEM subject should also consider taking *Further Mathematics to at least AS level* alongside A level Mathematics.

A level Maths and degree courses

Degree subject category	% of accepted students with A levels who have studied A level Maths (entry 2016)
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 Maths opens the door 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>

I am sold – What do I do now?

- *Transition Task* (Y-11-to-Yr-12–transition-task-maths-2020 on the website)
- The transition task have been designed to *close any gaps* that you may have, as well as *prepare you* for A Level Mathematics.
 - a. Grade 7-9 Catch-up – complete the exercise booklets. All booklets contain an explanation of the topic, worked examples, practice questions and worked solutions.
 - b. Use the material to produce revision notes, spider diagrams and/or summary sheets.
- *Try the questions on the next page.*

First column				Second column			
1	\sqrt{x}	11	$\frac{1}{x^2} \times \frac{1}{x^3}$	A	$x^{-\frac{3}{2}}$	K	$x^{-\frac{1}{2}}$
2	$\frac{1}{x}$	12	$(\sqrt[3]{x})^2$	B	$\frac{1}{2}x^{-3}$	L	$x^{\frac{9}{2}}$
3	$\frac{1}{\sqrt{x}}$	13	$\sqrt{x^7}$	C	$\frac{1}{2}x^{-1}$	M	x^{-2}
4	$\sqrt[3]{x}$	14	$\sqrt{\left(\frac{1}{x^8}\right)}$	D	x^{-4}	N	$x^{\frac{3}{2}}$
5	$\frac{1}{x^2}$	15	$\frac{1}{\sqrt{x^{-8}}}$	E	x^{-1}	O	$2x^{-1}$
6	$\frac{1}{2x^3}$	16	$x \times \sqrt{x \times x^6}$	F	$\frac{1}{2}x$	P	$x^{\frac{1}{2}}$
7	$\frac{2}{x^3}$	17	$\sqrt{\left(\frac{4}{x^2}\right)}$	G	x^4	Q	x^{-5}
8	$x\sqrt{x}$	18	$\sqrt{\left(\frac{1}{4x^2}\right)}$	H	x^2	R	$x^{\frac{2}{3}}$
9	$\frac{\sqrt{x}}{x^2}$	19	$\sqrt{\left(\frac{x^2}{4}\right)}$	I	$2x$	S	$2x^{-3}$
10	$\frac{1}{x^{-2}}$	20	$\sqrt{4x^2}$	J	$x^{\frac{1}{3}}$	T	$x^{\frac{7}{2}}$

Thank you

- Look forward to seeing you in September.