

Why study Mathematics?

Notes to accompany the PowerPoint presentation

These slides form an approximately 30 minute presentation for parents/carers about the importance of studying mathematics post-GCSE. Please note that the presentation is for students starting A level Mathematics from September 2017 onwards.

These notes below provide additional information, advice and guidance for teachers, heads of mathematics departments, careers advisors and senior leaders to help support them in presenting the 'Why study Mathematics?' PowerPoint.

Please add or remove slides to suit your talk/event. The presentation could also be used as a slideshow running on a loop during an opening evening event.

For more details about the work of the FMSP visit www.furthermaths.org.uk.

Slide numbers	Notes
1	FMSP logo www.furthermaths.org.uk
2	Information slide – to be deleted before using the powerpoint
3	Title slide
4	<p>A key message to students should be that if they achieved a good pass at GCSE in Mathematics then they should not be asking “shall I take mathematics in the sixth form?”, rather the question should be “which mathematics course shall I take?”</p> <p>The Wolf Report (2011) recommended that students who have not yet achieved grade A*-C in GCSE Mathematics by the age of 16 should continue to study it as part of their 16-19 education. This became part of the post-16 full time funding arrangements from August 2015. In March 2017 it was announced that students attaining grade 4 or above would not be required to resit GCSE Mathematics; grade 4 would be considered a ‘standard pass’ and grade 5 a ‘good pass’.</p> <p>The Smith Review (2017) has advised the government to ensure that the profile of Core Maths is raised and that the qualification is made available to all students at level 3. The main focus of this presentation will be information relating to AS and A level qualifications in Mathematics and Further Mathematics, however slides 5-7 have brief information about Core Maths which can be removed if it is not being offered.</p>
5	<p>Key questions that form the structure of the presentation.</p> <p>(Edit if you are not offering Core Maths.)</p>
6-7	A recommendation of the report Towards Universal Participation in Post-16 Mathematics (2013) was that all students in England should be enabled to study mathematics in upper secondary at an appropriate level. The report

	<p>recommended the introduction of one new advanced mathematics pathway aimed at those who have achieved a grade C/4 or above at GCSE but are not currently studying advanced mathematics. This led to the development of six new qualifications, collectively known as Core Mathematics qualifications, which were first examined in 2016. For more information see the list of Core Maths Specifications.</p> <p>Guidance and resources can be found on the STEM Learning website and also through MEI, which has developed a full set of resources through its interactive online Integral platform.</p> <p>A video and report, <i>Count Us In: Quantitative skills for a new generation</i>, by the British Academy provides a vision for a more numerate society.</p> <p>Tailor slide 6 to incorporate the entry requirement for Core Maths in own school/college.</p>
8	<p>This slide provides an overview for AS and A level Mathematics. At this stage, depending on the audience, it may be beneficial to explain what is meant by an AS qualification and how it relates to the A level qualification. Also, state that from 2017 onwards AS Mathematics will be decoupled from A level mathematics. This means that marks from an AS qualification will no longer count towards the A level qualification.</p> <p>The rules for the number of subjects taken in the particular school/college could be outlined here, as could the school/college policy relating to whether or not AS levels will be entered at the end of the first year of the A level course of study.</p>
9-10	<p>These slides briefly explain the nature of the two types of application contained in AS / A level qualifications –Mechanics and Statistics.</p> <p>Note that decision mathematics is no longer an element of the AS/A level Mathematics qualification but it is an optional aspect of Further Mathematics courses, sometimes under the heading ‘discrete mathematics’.</p>
11-14	<p>Slide 11 explains what Further Mathematics is and the differences from A level Mathematics. This slide could be adapted to indicate whether students will or will not take AS qualifications in Year 12.</p> <p>Slide 12 gives a very brief overview of the content of the Further Mathematics qualification. The list of possible options could be adapted to reflect those offered in the school/college.</p> <p>Slide 13 gives a brief insight into the new areas of pure mathematics that students would meet in Further Mathematics.</p> <p>Slide 14 is optional – it gives an insight into one topic that might be covered in a decision/discrete mathematics unit. This could be removed if the school/college is not offering options in this area.</p>
15	<p>An overview of the reasons why students would benefit from studying A levels in Mathematics and Further Mathematics.</p> <p>Stress the skill development that comes from studying A level Mathematics – students would benefit from studying the course in conjunction with many other</p>

	<p>subjects for this reason. Mathematics can support Biology, Chemistry, Business Studies, Economics, Computing, Physics and Psychology in particular.</p> <p>Note that girls are more likely than boys to take A level Mathematics in conjunction with non-STEM subjects, so it is important to draw out links with non-STEM subjects as well as STEM subjects.</p> <p>(See slide 27 for more information about girls' participation in A level Mathematics and Further Mathematics).</p>
16-18	<p>These slides give an overview of the pattern of entry for A level Mathematics and Further Mathematics over time and how the 2017 entries for these qualifications compare to those in other subjects.</p> <p>Slide 16: there has been a general increase over the last 10-15 years in the number of students studying AS and A level Mathematics. Since 2003 UK entries in A level Mathematics have increased by 88% and AS level by 151%. The decoupling of AS and A level qualifications is likely to have an impact on numbers of students taking AS qualification generally over the coming years.</p> <p>Slide 17: The number of students taking AS and A level Further Maths has also increased dramatically. Since 2003 in the UK there has been an increase of over 200% in A level Further Mathematics entries and of 730% in AS Further Mathematics entries!</p> <p>Slide 18: In 2017 Mathematics was the most popular A level subject and Further Maths was the 16th most popular, with more entries than PE, Law, ICT or Languages.</p>
19-26	<p>This series of slides provide some introductory information about the importance of mathematics for a range of careers.</p> <p>Slide 19: As an introduction to mathematics in careers this slide lists some possible misconceptions about who might take Mathematics and Further Mathematics at A level. Take the opportunity here to stress that mathematics is a subject that is relevant to many careers and is not solely associated with physics/engineering type careers. Whilst it is important to dispel the myth that studying mathematics would <u>only</u> lead to a career as a mathematics teacher, it is important also to indicate the range of opportunities the teaching profession offers and that there is a shortage of well-qualified specialist mathematics teachers. Stress that parents and carers can play a key role in positively influencing girls' A level choices towards mathematics in particular.</p> <p>Slide 20: Mathematics and Further Mathematics are versatile qualifications, well-respected by employers and both are facilitating subjects for entry to higher education. Facilitating subjects are listed in the Informed Choices guide produced by the Russell group. Careers for men and women with good mathematics skills and qualifications are not only well paid, but they are also often interesting and rewarding. People who have studied mathematics are in the fortunate position of having an excellent choice of career, as illustrated in the wide range of career titles shown in the slide.</p> <p>Slide 21: The quote is taken from the speech by former Education Secretary Nicky Morgan at the launch of the YourLife Campaign. Your Life is a three-</p>

	<p>year campaign to helping young people in UK build the skills needed to succeed in the current competitive global economy. The campaign aims to inspire young people to study Maths and Physics as a gateway into wide-ranging careers - taking Maths and Science at school does not only lead to a career in a lab coat or hard hat, having mathematical skills will help students succeed in all sectors.</p> <p>Slide 22: The quotes are taken from the Rethinking the Value of Advanced Mathematics Participation (REVAMP) by Professor Andrew Noyes and Dr Mike Adkins, 2016 http://www.nottingham.ac.uk/education/documents/research/revamp-final-report-3.1.17.pdf which indicates that there are wage returns of around 11% of taking A level Mathematics.</p> <p>Slides 23 – 26 outline a range of careers in STEM and non-STEM disciplines. Of course there are a huge number of careers in which mathematics is essential or beneficial – the Mathscareers website is a good starting point to provide guidance for students and their parents. They could also look at the FMSP's careers pages for more information.</p>
27	<p>A key national priority is to increase the proportion of girls studying A level Mathematics and Further Mathematics. Data about the participation rates of girls in these, and other science qualifications, has been published in recent years. This data is available at school, regional and national level. It shows that of all students taking at least one A level, boys are almost twice as likely to choose A level Mathematics and over 3 times more likely to choose A level Further Mathematics than girls. There are also regional variations with the lowest participation rates by girls occurring in the North East and Yorkshire and Humber regions.</p> <p>The FMSP is working to support an increase in the proportion of girls participating in A level Mathematics and Further Mathematics nationally. In conjunction with the UCL IOE we have published a gender literature review and the interim report of a series of gender case studies, both of which provide a series of recommendations for schools and colleges in how they can encourage girls to aspire to study advanced mathematics. It should be noted that one of the findings of this research is that discussion of low uptake can be a self-fulfilling prophecy, with girls less likely to opt for Mathematics if they perceive it as being a 'boy's subject'. It is therefore important to stress that numbers of girls taking the subject is growing at a faster rate than that of boys. Boys are more likely to combine A level Mathematics with other STEM A levels, whereas girls are more likely to include it within a broader range of subjects. It is therefore worth stressing the value of A level Mathematics as a facilitating subject beyond its traditional STEM base.</p> <p>Briefing documents summarising the research projects and other work of the FMSP in relation to gender can be found at www.furthermaths.org.uk/encouraging-girls-maths. Information for students can be obtained from www.furthermaths.org.uk/girls-maths - this page includes</p>

	<p>profiles of female A level students and of females who work in a diverse range of mathematics related careers.</p>
<p>28-37</p>	<p>This series of slides relates to university entry requirements and we suggest choosing a selection of these slides for your presentation. Students may not be yet thinking about university applications but their choice of A level subjects may limit the range of courses they can apply for in 2 years' time.</p> <p>Slides 28, 29 and 30 – provide an overview to the type of subjects for which A level Mathematics and Further Mathematics are useful preparation. Students should be made aware that even when AS or A level Mathematics is not a specific requirement of a course, many degree courses have a significant quantitative component. Studying mathematics in the sixth form helps develop these important quantitative skills and helps with the transition to learning new mathematical concepts at university. .</p> <p>The report Popularity of A level subjects among UK university students published in 2013 (relating to academic year 2010-11) shows that 30% of all accepted university applicants had A level Mathematics – this was the highest of all A level subjects (the second subject being A level Biology with 21.3% of all accepted applicants having this qualification). The same study showed 27% of students accepted to business and administrative degrees had A level Mathematics; 29% for social studies, 69% for medicine and dentistry; 43% for architecture, building and planning; and even 18% of students entering European languages degrees had studied A level Mathematics. 60% of the top ten subject combinations for students entering degree courses at Russell Group universities included A level Mathematics.</p> <p>The table in slide 29 shows data from the Mathematical Transitions report, published by the Higher Education Academy, 2014. In most subjects there has been a steady increase in the proportion of students entering university having taken A level Mathematics, which reflects the increased numbers taking A level Mathematics (see below). The proportions are likely to be higher for Russell Group and other leading universities. These data are for full A level Mathematics and the proportions are higher for AS level Mathematics. The key message being that even though A level Mathematics is not a specific requirement, students should be advised to consider taking Mathematics at least to AS level.</p> <p>The table in slide 30 shows similar data for A level Further Mathematics. For Mathematics, Physics and Engineering courses A level Mathematics is usually a requirement and AS/A level Further Mathematics is required or preferred by many leading universities. For further reading see the article Transition to STEM Degrees – Further Maths A-level.</p> <p>Slide 31 references the recent report by Catherine Dilnot of the UCL Institute of Education http://www.ucl.ac.uk/ioe/news-events/news-pub/aug-2017/poorer-students-subject-choices-disadvantage in which she explains that students may be held back by their A level subject choices when applying for courses at prestigious universities. Students taking academic subjects were more likely to go on to study at such universities, and the report suggests schools and colleges should be clear on this when advising students on A level subject</p>

	<p>choices. Facilitating subjects, in particular mathematics, are advised as sensible choices.</p> <p>Slides 32 – 36 show some exemplar entry requirements for a range of degree courses – these slides illustrate how universities might require or encourage students to take A levels in Mathematics and Further Mathematics.</p> <ul style="list-style-type: none"> • Slide 32 shows a differentiated offer which emphasizes the way that FM is considered important in preparation for a mathematics degree. Taking AS FM or A level FM reduces the offer. • Slide 33 shows that Further Mathematics is often indicated as a preferential qualification for engineering in addition to required subjects. • Slide 34 is a differentiated offer which shows the importance of maths (as well as other sciences) as the optimal subject combination for entry to a Chemistry degree. • Slide 35 demonstrates that the generality of A level Mathematics is often preferred to specific subjects more closely related to the degree course being offered. Students may be surprised to see that A levels in Psychology and Economics are not necessarily essential for taking the subject on to degree level, underlining the flexibility and currency of A level Mathematics. In addition to investigating formal entry requirements, students should also be encouraged to consider the profile of undergraduates on courses. For example, around 25% of Economics students at Bath University have studied Further Mathematics, despite it not being a necessary part of their offer. The second example also highlights the fact that many courses require a particular grade in GCSE Mathematics. • Slide 36 shows that Mathematics underpins many scientific pathways. At GCSE level many students may identify geography as being the most relevant course to studying subjects such as earth science and meteorology, without realising how mathematical these topics become at undergraduate level. The second example shows that a failure to take A level Further Mathematics can limit access to the most prestigious STEM course. <p>Competition for places on some degree courses is high and students should consider taking A level Mathematics and Further Mathematics in order to distinguish their application, secure a place, and help them succeed once they start the course.</p> <p>Slide 37 provides a general summary of how to apply to university. Students and their parents might also be made aware of the website www.bestcourseforme.com which allows a search by subject area, university and guidance by chosen career.</p>
38	<p>This slide highlights information about how to stretch the most able mathematicians at A level in relation to the additional qualifications:</p> <ul style="list-style-type: none"> • AEA - Advanced Extension Award (AEA).

	<ul style="list-style-type: none"> • STEP - Sixth Term Examination Papers ((required for entry to Cambridge and also used by other universities such as Warwick to provide reduced offers). • MAT - Mathematics Admissions Test (required for entrance to Oxford University and Imperial, and encouraged by Warwick). • TMUA – Test of Mathematics for University Admission (encouraged for applicants for Mathematics degrees by the Universities of Durham, Lancaster, Sheffield and Warwick, as well as for certain courses at The London School of Economics). <p>These qualifications are required for admission to some degree courses in mathematics and closely related subjects. The FMSP offers a range of support, for both students and teachers, in preparing for these examinations. This takes the form of enrichment and CPD events, problem solving materials and problem solving conferences. The FMSP also offers an online MAT preparation course.</p>
39	Links to other relevant websites which students and their parents might find interesting.
40	<p>Information about the content of the FMSP website, which contains a wide range of information including:</p> <ul style="list-style-type: none"> • exemplar materials which illustrate how mathematics is used in a range of degrees; • details of enrichment and CPD events • a page specifically to encourage girls to continue to participate in mathematics post-16.