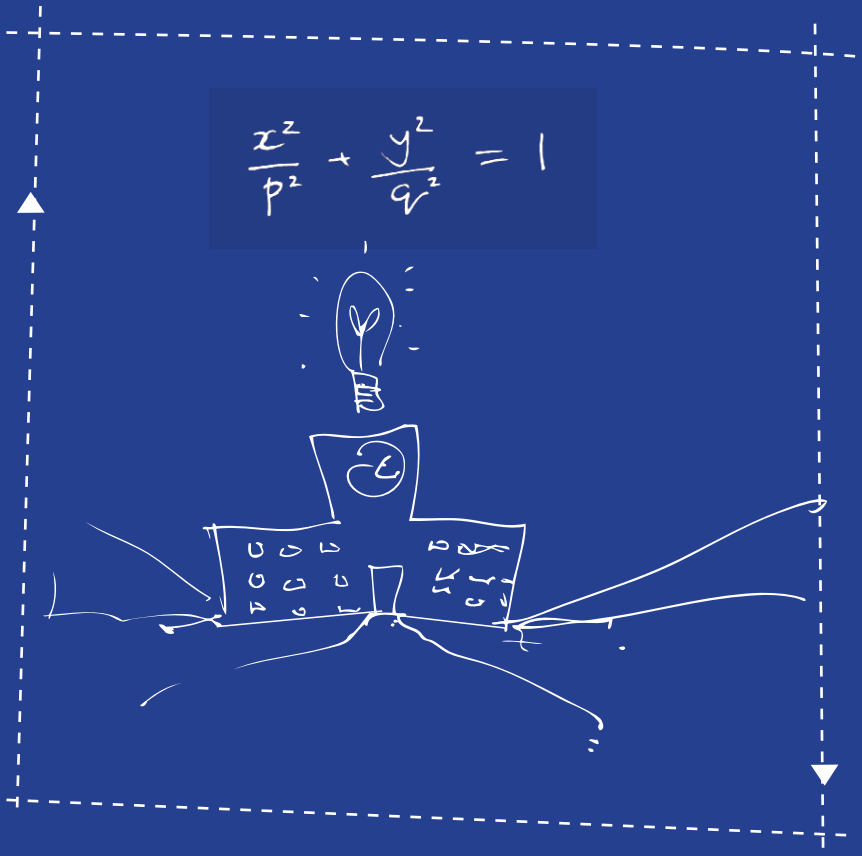
MATHS at UNIVERSITY

Start to finish – your guide to maths at university



MATHS at UNIVERSITY

So, you're thinking of studying maths at university...

What is it that attracted you?

Perhaps you've always loved maths and are eager for the chance to learn more. Perhaps you're excited every time you conquer a new mathematical puzzle. Perhaps you want to work on some of the difficult problems we currently face, using your mathematical skills to model changes in the environment, advance medical knowledge or understand just what goes on in the City. Perhaps you like the thought of having a qualification which is well-respected amongst an incredibly wide range of employers. Perhaps you want to write computer games, work in the movie industry or develop your own version of Facebook or Google.

Whatever your reason for picking up this booklet, you've made a great decision. Facing the challenges of maths requires logic, skill, creativity and imagination, and the rewards are huge and immensely satisfying. Mathematical advances can change (and have changed) the face of civilisation. What's more, the training you'll get from a maths degree will give you a head start in the world of work. Mathematicians are highly prized by employers and not only in jobs which use their maths directly. Your precise method of thinking and problem-solving skills will enable you to tackle a wide range of roles, wherever you're headed. Whatever you do, a maths degree is the perfect training for the challenges of the 21st century.

This booklet will give you a guide to how to apply to do a maths degree, what to expect when you study maths at university, the differences between courses and universities and what opportunities doing such a degree will give you.

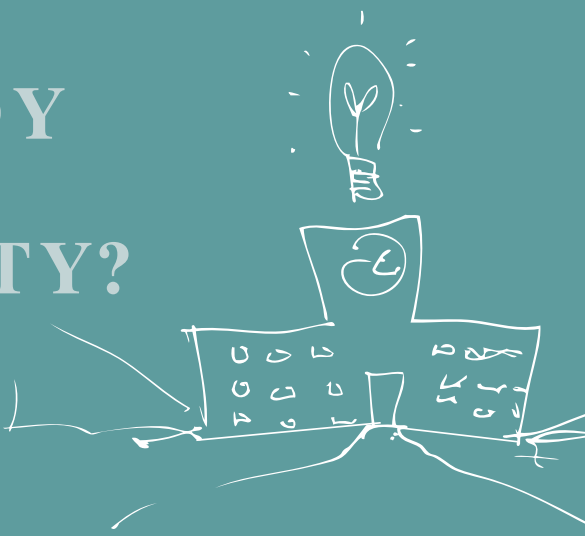
Good luck – whatever decision you make.

MATHS at UNIVERSITY

Where to get answers

- Look at the university and departmental websites. These will contain the answers to many of the questions you might have.
- Consult the online or printed prospectuses for the courses you are interested in.
- Ask questions – of staff and, where possible, students – at open days.
- If you still have unanswered questions, talk to the admissions tutor.

WHY STUDY MATHS at UNIVERSITY?



What will I get from a maths degree?

In a maths degree, obviously you learn lots of maths(!), sometimes as a continuation of your school maths and sometimes in completely new areas. Exactly what maths you meet will depend on the university you go to and what choices you make during your degree.

The mathematical topics you learn about are important for some future careers but there are other things you will learn which have a wider application and which are much sought after by a wide range of employers. These include the ability to think logically, to construct coherent arguments, to understand abstract ideas and concepts and to solve practical problems.

In many universities you will also gain experience in key skills which most employers consider important, for example making presentations, writing reports, team-work and use of computers.

$$\frac{x^2}{p^2} + \frac{y^2}{q^2} = 1$$

Questions you should ask

- **What do graduates from this course do after their degree?**
- **What proportion of graduates get jobs within six months of leaving this course? What proportion go on to further study?**
- **Does this course help me to develop skills such as team-working, IT skills, making presentations and writing reports?**

What careers are open to me with a maths degree?

Maths graduates are very popular with many employers, who value the analytical and problem-solving skills which you develop during your degree as well as the subject knowledge you can bring to a future job. In addition many maths graduates go on to further study for an MSc or PhD.

Mathematicians work in business (for example, in logistics, financial analysis, market research, management consultancy or operational research); in the finance industry (in banking, insurance, pensions, accountancy or actuarial work); in IT (in systems analysis or research); in the civil service (as scientists or statisticians); in medicine (as medical or pharmaceutical researchers or as statisticians); in the engineering industry (in aerospace, building design, transport planning or telecommunications); in scientific jobs (in biotechnology, meteorology, oceanography or research and development) and, of course, as teachers.

For much more detailed information about careers for maths graduates, visit www.mathscareers.org.uk.

Habib

Age 22, Final year, BSc Mathematics

Habib did A levels in Maths, Accountancy and Physics at college and when he started his degree, he didn't have any firm career plans.

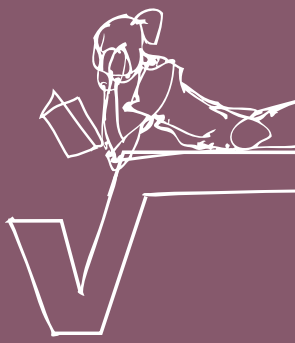
"I always liked the problem-solving aspect of doing maths at A level, which was why I choose this as a degree subject. At the start, I didn't have ideas about my future career but now that I'm graduating I'm looking for jobs in finance or as a statistician."

Habib did a sandwich year in industry as part of his degree.

"I was able to see a whole new perspective on statistics, focussing on what the stats mean and how to present them to non-statisticians."

Habib found the workload tough – "it goes up in the second year and again in the final year" – but appreciates how much he's learnt, particularly the IT skills, using general applications such as Excel as well as specialist software like SAS (a statistics package) and programming.

GETTING into UNIVERSITY to STUDY MATHS



Do I have to be a genius to study maths?

Some people believe that you have to be brilliant to study maths at university. It is certainly true that some aspects can be very abstract and some universities have high entry requirements but most mathematicians are not geniuses and there are plenty of ordinary people successfully doing maths!

What A level results do I need?

Entry requirements for any degree vary enormously from university to university. You do *not* need to get a high A level grade to study maths, although obviously a top grade will give you a wider choice of university. Most university websites will give you an idea of the offers they make.

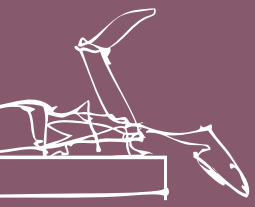
Most universities accept some other qualifications as equivalent to A level – for example the International Baccalaureate is widely respected.

I don't have an A level in maths – can I still study maths at university?

If you don't have A level maths or an equivalent qualification, most universities would require you to do some further study in maths before starting on a maths degree. Preparatory years (sometimes called foundation years) run by many universities and Access to HE courses run by FE colleges are both designed to bring your maths up to the required standard.

Some mature students may be able to get a place because of prior experience. Talk to the admissions tutor about the possibilities.

The Open University (www.open.ac.uk) has no entry requirements for its part-time degrees.



Do I need Further Maths A level to study maths at university?

No. That said, it certainly won't do any harm! At some universities, Further Maths, at least to AS level, is strongly recommended. At many others it is unusual for students to have done Further Maths.

Scottish qualifications

Much of the content of this booklet is applicable to maths courses across the UK. However some of the comments about entry qualifications or length of course apply primarily to students from England, Wales or Northern Ireland, or those students from Scotland with A levels or Scottish Advanced Highers, applying to universities in England, Wales or Northern Ireland.

Degree courses in Scotland, where Highers are the main entrance qualification, are typically a year longer than elsewhere in the UK. Students with A levels or Advanced Highers may be able to gain admission directly into the second year of Scottish courses, which are broadly equivalent to the first year of other UK courses. Consult the university websites for more information.

Questions you should ask

- **What is the typical UCAS offer for this university?**
- **Is Further Maths recommended?**
- **What percentage of students have Further Maths? If this is a substantial proportion, is there additional help for students without it? Do students without Further Maths get results comparable to those with it?**
- **Do I need to do STEP/AEA to gain a place at this university?**
- **What is the department's attitude to students taking a gap year?**
- **If you are enquiring without A level maths or equivalent, does the university run a preparatory year?**

Amanda

Age 42, Second year, BSc Mathematics

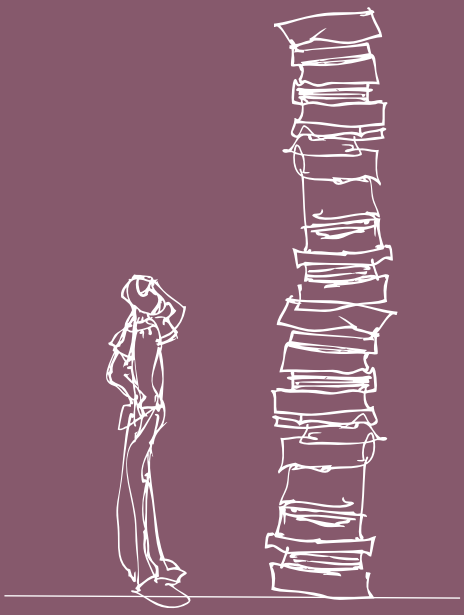
Amanda is married with three sons and a daughter.
"I studied GCSE maths as an adult to help my children with homework. Wanting to improve my career prospects, I then took an Access course at a local college followed by a preparatory year at university and am now in the second year of a maths degree course. Although at times it has been a steep learning curve, I am now completely hooked on maths – I really love it. Amongst other alternatives, I am considering going into adult education when I finish, hopefully to persuade other adults that they can still learn no matter what their age or educational background."

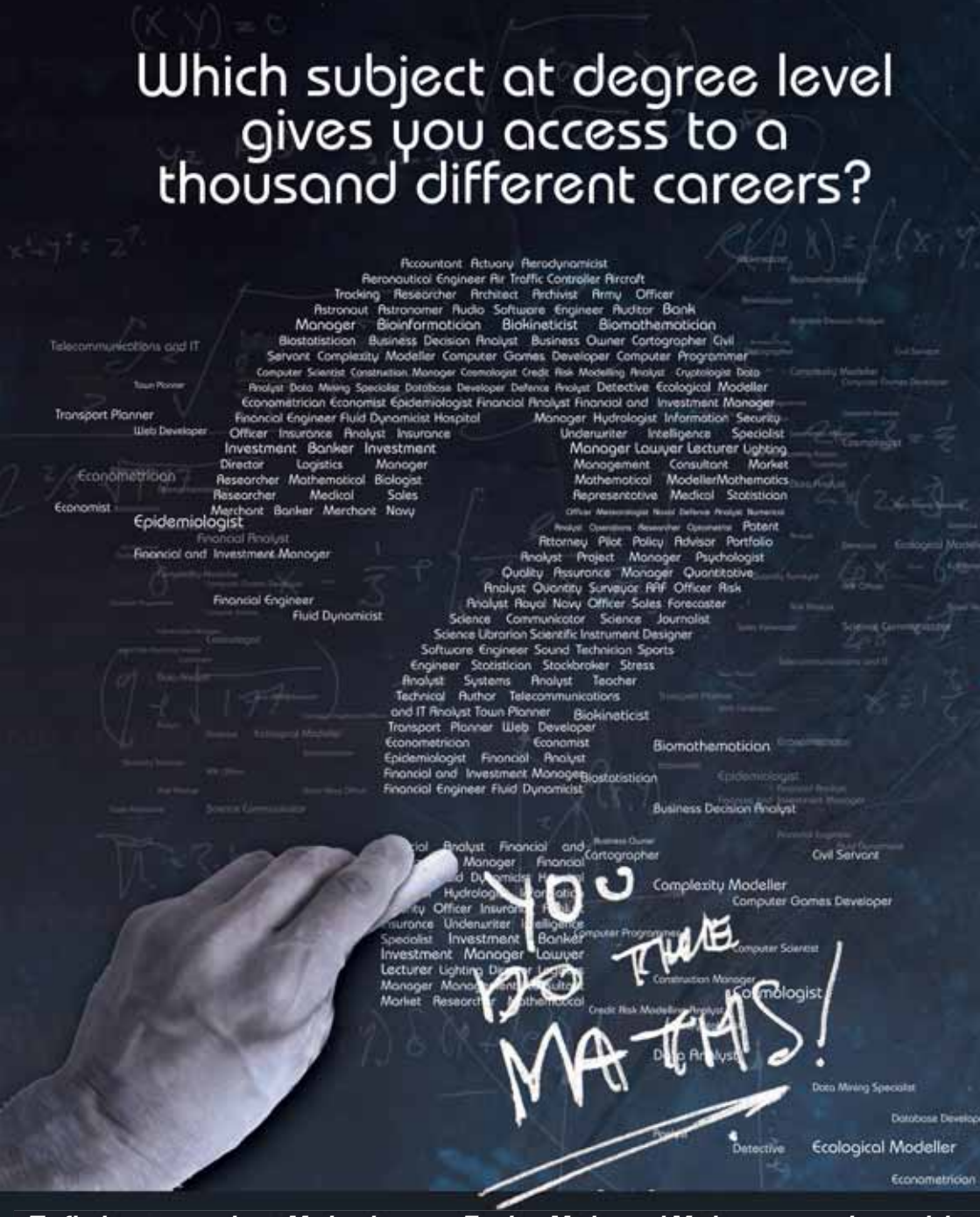
Do I need to take STEP or AEA to study maths at university?

A very small number of universities may ask you take a Sixth Term Exam Paper (STEP) or Advanced Extension Award (AEA) as part of their conditional offer. If so you will be given support in preparing for these and will find there are several helpful websites. You may find these stimulating, enjoyable and helpful for your A level study, even if you are not required to take the exam.

Can I take a gap year before studying maths?

There is an urban myth that mathematicians don't take gap years. This is not the case; many maths students take a year between sixth form and university. Although you may find you forget some of your A level maths, a little revision should quickly compensate for this.





To find out more about Maths degrees, Further Maths and Maths careers please visit:

www.moremathsgrads.org.uk, www.fmnetwork.org.uk and www.mathscareers.org.uk

ACCESS TO FURTHER mathematics the Further Mathematics network www.fmnetwork.org.uk

more maths grads
multiplying opportunities

maths careers
endless opportunities

CHOOSING a UNIVERSITY

Are all maths degrees the same?

No. There is a nationally agreed standard for maths degrees but it only specifies two topics which every course *must* contain so there is plenty of scope for universities to offer very different things. Even with the same outline syllabus, universities can approach topics in very different ways, for example by having a different balance between theoretical and practical approaches.

Which maths degree is best for me?

This depends on lots of things, including what interests you, your views on class sizes and the level of support you might get, how you feel about the use of technology in maths, whether you want a wide choice of topics, whether you want to combine studying maths with another subject and what you want to do after university. Research what is on offer carefully, using this booklet as a guide.

Ann-Marie

Age 23, Final year, BSc Mathematics

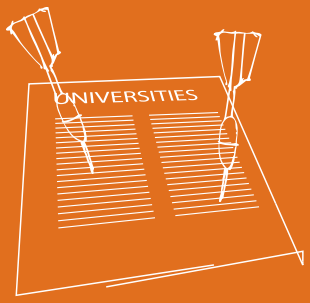
When Ann-Marie first left college, with A levels in Maths, Psychology and General Studies, she already knew that she wanted to be a maths teacher. She started maths at one university but unfortunately found at first that it wasn't for her. "So a year later I started afresh at a different university. Here we use much more technology and there are many more ways to apply your learning – not just exams. That really suited me, but I guess you have to be happy to be using computers a lot to do maths here".

"Not all maths courses are the same. I think it's about finding a teaching style that suits you personally – not everyone is the same."

Ann-Marie did a placement with Royal Mail as the third year of her degree and found it helped her in her final year.

"It's been hard work this year but going on placement helped a lot. My grades went up in the final year compared to my second year. I think my placement helped me learn how to apply myself and work regularly and gave me extra motivation."

Although Ann-Marie found her placement useful, it hasn't distracted her from her original ambition of being a maths teacher and she's looking forward to starting a PGCE course in September.



What are the different routes to a maths degree?

The majority of maths students study full time for three years and obtain a bachelor's degree (BA or BSc) but this is not the only option. Some universities offer a four-year course leading to a master's qualification (MMath or MSci). This allows you the opportunity to study to a more advanced level. Transferring from the bachelor's to the master's route or vice versa is sometimes possible, depending on the university.

Many universities offer part-time study and some, especially the Open University, specialise in this. In this case it will take more than three years to complete your course and part-time students are not eligible for the same financial support.

Some universities encourage or require students to do a 'sandwich course' where students typically spend a year gaining valuable work experience (and getting paid!) often between their second and third year of study.

In addition, at some universities it is possible to study for up to a year abroad, broadening your horizons and improving your language skills. Sometimes this is in addition to your home university studies and sometimes it is in place of part of it.

Questions you should ask

- **Is the course very theoretical and abstract or mainly practical and applied? What examples can they give you to demonstrate this?**
- **Does the degree contain a work-experience placement (sandwich degree)? Is it optional or compulsory? What do students do? What help is given to find a placement? What are the benefits of doing it?**
- **Can I combine studying maths with studying another subject?**
- **Can I transfer between different maths courses within the same university? What restrictions are there on changing courses?**
- **Is it possible to study at a university abroad for some of the time?**
- **How research-orientated is this department? What difference will this make to me?**
- **How much choice do I get about the topics I study?**
- **How many staff are there in the department and how many students?**
- **Are some classes taught by postgraduate students or postdocs?**

Danielle

Age 21, Final year, BSc Mathematics with Business Finance

Danielle had always been good at – and fond of – maths throughout school and college but she decided to combine studying maths with business management for her degree.

"I thought it would be more interesting than maths on its own and that the combination would open more employment doors for me post-gradation."

She found the variety interesting and says "it broke up my timetable". She enjoyed learning about different types of maths and exploring the diverse range of maths but was surprised to find how much computing was included in the course.

Initially she found it strange being in such big classes: "the lectures contained about 200 people which was quite daunting in comparison to a lesson in college. I felt like a little fish in a big pond" and appreciated the smaller example classes where postgraduate students were available to offer help.

She says her final year "has been the best out of the three. I felt the work was a lot easier and I had a grasp of the modules and the level of maths. I also have a lot more motivation as I look forward to graduation."

After graduation Danielle is hoping to go into teaching "as there is not only a shortage of maths teachers but also I know my job will be secure for a long while".

Can I study maths with another subject?

Many universities offer courses which combine maths with another subject, for example finance, business, physics, computing or economics. For combined honours courses (those with two or more subjects), most universities use a convention that if the degree title combines two subjects with the word 'and', each subject is given equal weight whereas if the two subjects are joined with the word 'with', you would study the first topic for two-thirds of your time and the second topic for one-third. So 'Maths and Computing' is equal amounts of each but 'Maths with Finance' is two-thirds maths and one-third finance. When maths is combined with a language, it is often required that you spend a year abroad as part of your study.

In some universities you can change your course after you arrive, although changing from combined honours to single honours maths is often not possible (without repeating the first year) because you won't have studied all the required first-year topics.

How big is the maths department?

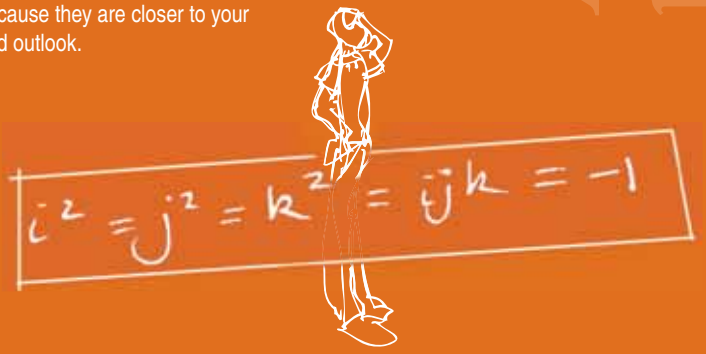
Maths departments vary in size from a handful of staff to over 100 and student numbers vary enormously too. Big departments can often offer a wider range of topics, giving you more choice particularly in your later years. Small departments may be more personal and friendly.

What difference do the university's research activities make to me?

Maths is forever changing and growing as more discoveries are made and new applications for these are found. Many universities are involved in this mathematical research. Many university lecturers combine expertise and experience in both teaching and research.

In a research-orientated department, the lecturers may be more up-to-date with the latest developments in their particular subject and might be world-renowned experts in the field. In a teaching-focussed department, you may find a higher proportion of staff whose main interest is in the best ways of teaching and learning and who may have more time available to help students. But *all* lecturing staff should have adequate subject knowledge *and* commitment to teaching to be able to teach you effectively and to make courses interesting and relevant.

Research-led universities often use postgraduate students ('postgrads') and postdoctoral research fellows ('postdocs') to help with tutorial teaching and marking. This may result in smaller class sizes. Whilst postgrad and postdoc tutors are less experienced, they are often very popular with students because they are closer to your own age and outlook.



MATHS at UNIVERSITY

...at a glance

YOU are HERE

Scottish highers

Scottish degrees first year

Scottish highers lead to four-year degree courses (five years for MMath) in Scotland. Years 2 to 4 are equivalent to first, second and final years on this map.

maths A level or maths and further maths A level or Scottish advanced highers or equivalent

COMBINED HONOURS

first year

Transfer fro
to combined
is somet
possible. Th
way is much

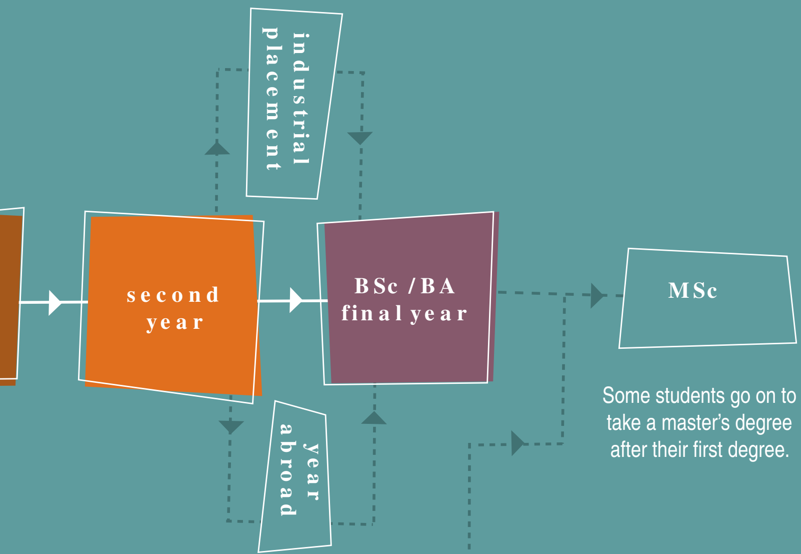
If you don't have A level maths, talk to the admissions tutor. You may need to get an A level first or there might be a preparatory or foundation year or an access course that gets you on to a degree. Some mature students can gain direct entry because of previous work experience. The Open University has no entry requirements for its part-time degrees.

no A level or Scottish highers

preparatory year or approved HE access course

SINGLE HONOURS

first year



Some students go on to take a master's degree after their first degree.

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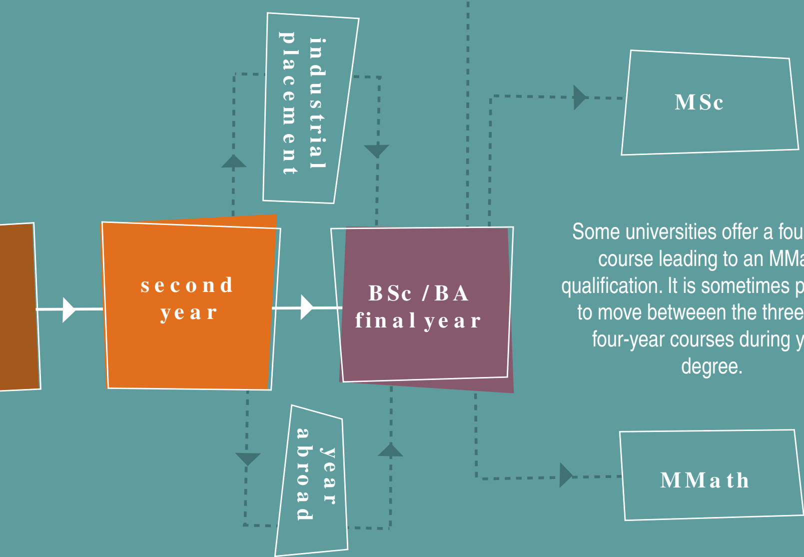
Some universities allow you to do a year in industry or a year abroad



Some universities offer a four-year course leading to an MMath qualification. It is sometimes possible to move betweeen the three- and four-year courses during your degree.

CAREERS

For a list of careers please see back page

...Actuary Aerodynamicist Aeronautical Engineer Air Traffic Controller Aircraft Tracking Researcher Architect Archivist Army Officer Astronaut Astronomer Audio Software
...or Bank Manager Bioinformatician Biokineticist Biomathematician Biostatistician Business Analyst Business Decision Analyst Business Owner Cartographer Civil Servant Complexity Modeller
...ames Developer Computer Programmer Computer Scientist Construction Manager Cosmologist Credit Risk Modelling Analyst Cryptologist Data Analyst Data Mining Specialist
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Hospital Manager Hydrologist Information Security Officer Insurance Analyst Insurance Underwriter Intelligence Specialist Investment Banker Investment Manager Lawyer
...Director Logistics Manager Management Consultant Market Researcher Mathematical Biologist Mathematical Editor Mathematical Modeller Mathematics Researcher Medica...

MATHS at UNIVERSITY

What is meant by 'pure' and 'applied' at university? How theoretical or practical is a maths degree?

It is hard to define 'pure' and 'applied' because it changes over time and with the level of study. For example, many of the topics you call 'pure' at A level are treated as applied maths at university. Prime numbers used to be considered very pure but now form the basis for much of the cryptography used, for example, in online banking. Pure maths involves an attempt to understand precisely why and when methods or ideas are valid and inherent elegance and interest play a big role. Applied maths looks at ways of using mathematical ideas and methods in real life; here practicality and usefulness are desired.

Do I have to decide whether I'm a pure or applied mathematician or a statistician before I apply?

No. Most universities offer a general maths degree (UCAS code: G100) which will usually include pure and applied maths and statistics in the first year, so you don't need to decide which branch interests you now. A few institutions do offer courses which specialise from the start – refer to UCAS or the university prospectus.

Most university courses are modular and you will build up credits towards your degree by passing individual modules. In most universities, the majority of your first-year modules will be compulsory. By the time you reach your final year some universities offer you an enormous choice of modules, allowing you to specialise. Others have a much smaller choice. If you have specific future interests in mind – for example if you want to study mathematical physics or financial maths or statistics to a high level, then you need to ensure that there are suitable options in the course you choose. A course with lots of options will also give you the flexibility to follow your main interests if these change (as they often do) during your time at university.

What does a maths degree contain?

Only calculus and linear algebra are required subjects in every maths degree. You need to look at university websites and prospectuses or talk to staff to find out what the course contains but you may find the names given to subject areas hard to understand at first. At the end of this booklet we give a brief explanation of some of the subjects you might meet in your first year at university.

How is technology used in university maths?

In any degree you will be expected to develop your general IT skills, for example researching online and word processing. In addition, on a maths course you might be expected to develop specialist skills, for example programming, using statistics software, computer algebra systems or powerful graphics packages. Attitudes to the use of technology in maths vary; for example there are universities where only basic calculators (or none) are allowed in exams and others where very powerful programmable calculators or computers can be used.

Victoria

Age 22, Graduate, MMath

Victoria decided to study maths at university because she always appreciated the problem solving and use of logic it required. She likes the fact that the subject allowed her to learn techniques that had many applications in everyday life and in other fields. She noticed some difference between how the subject is approached at university and how it is approached at A level, with greater emphasis on understanding where concepts have come from and in learning how to justify your own work, and says the course allowed her to study topics in greater depth and to feel even more confident when applying her knowledge in abstract settings. The course also enabled her to develop computer programming skills, which are invaluable in many maths-related careers.

By studying on a Masters in Mathematics (MMath) course she was able to study a wider range of both pure and applied modules, with the opportunity to specialise later in the course.

She says “the problem solving, logic and computing skills developed while studying maths at university are highly sought after by many employers and, as a result, studying maths opens up a wide variety of career opportunities. I am now applying the knowledge I have gained by studying for an MPhil in maths and electrical engineering.”

What are maths classes like? How big are the classes?

The style of classes you will encounter depends on the university and the individual members of staff but it's usually very different from what you are used to at school or sixth form college.

Traditionally, most maths lectures consist of the lecturer introducing the material, working through and explaining both the theory and examples, with the important details written on the board, and students taking notes.

These days, this is just one approach; notes are sometimes given online or in printed handouts and the lectures are often much more interactive (meaning you'll be expected to get involved!). Depending on the size of the department and the particular module, classes might have anything from 10 to 300 students in them; bigger classes are less likely to be interactive.

Lectures are usually supported by small-group teaching, often called tutorials which, depending on the university, could be anything from 2 to 30 students. Smaller groups can be taught by postgraduate students, postdocs or lecturers, again depending on the university. The format can vary but might include individual work, group work, working through exercises at the front of the class or asking for individual help from the tutor.

You may also find classes where you work on set exercises with a tutor available to help – similar to many maths classes at school. These might be in a traditional classroom or, where appropriate, a computer room. Some universities call these tutorials and some call them exercise or example classes.

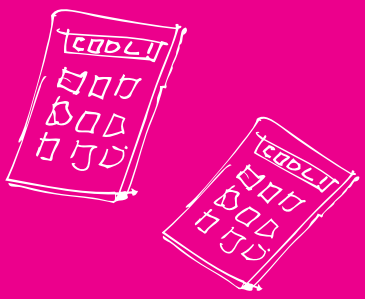
In departments with fewer students, the distinction between lectures, tutorials and example classes may be blurred, with each class containing elements of all of them. In this way the teaching might be similar to many maths classes in school.

Questions you should ask

- **What are the compulsory topics and what are the optional topics? If there are particular topics or applications which you are interested in, does this university offer modules in these subjects?**
- **What is the course attitude to the use of technology within maths? Is the use of technology encouraged throughout the course or only in specific modules?**
- **How big are the classes?**
- **How many hours a week of teaching will I get?**
- **What are 'typical' lectures and tutorials like?**
- **What support is available?**
- **How much is assessed through exams and how much through coursework?**
- **Will I get the opportunity to do a personal project in the final year?**

What support is there when I get stuck?

Everyone gets stuck sometimes so it's worth asking what help is available when you do. Some universities encourage you to work with your fellow students and usually this is the first place students go for help. Some places organise special sessions with students from higher years. Some have small tutorial groups with members of staff or with postgraduate students. Some have drop-in sessions where you can go with any maths problems. Some lecturers have 'office hours' when you can call in and ask for help and some have an open-door policy so you can call round at any time. Some universities have an online forum where students – and sometimes staff – help with questions. Many lecturers will also offer support via email.



How will I be assessed?

Again, there are different approaches to assessing you. Formal examinations are as unavoidable as death and taxes wherever you study, but at some universities almost all your assessment will be through examinations whereas, at others, there can be substantial credit given to coursework.

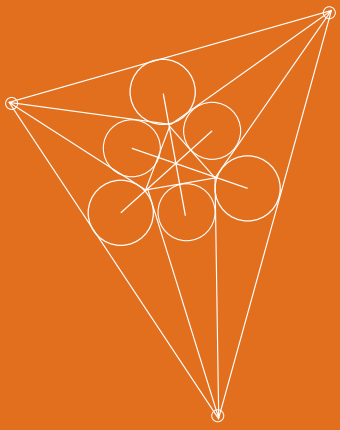
Coursework includes a wide variety of tasks: written solutions to mathematical exercises are probably the most common but you may also be expected to write reports, do group work, make presentations or write computer programs. In many universities a substantial proportion of your final year might be spent on an individual project, allowing you the opportunity to work on something that particularly interests you at the same time as developing valuable skills for the future.

MATHEMATICAL TOPICS at UNIVERSITY

Understanding the syllabus for a maths degree can be tricky because it includes words and ideas which may be unfamiliar to you.

Here we try to give you a flavour of what your first year might involve and explain some of the terms you will meet.

Some of the maths you meet at university is an extension of ideas you have already met during your previous study. For example, many courses have a first-year module – perhaps called ***Mathematical Methods*** or ***Techniques*** or ***Calculus*** – designed to consolidate and build upon topics which, at A level, you treated as pure maths but at university are considered basic tools for other subjects. At A level you have probably already met ***Statistics*** as a means of finding the trends in, and drawing conclusions from, data; at university you will extend these ideas and learn how to design experiments effectively so that the data you gather is genuinely useful.

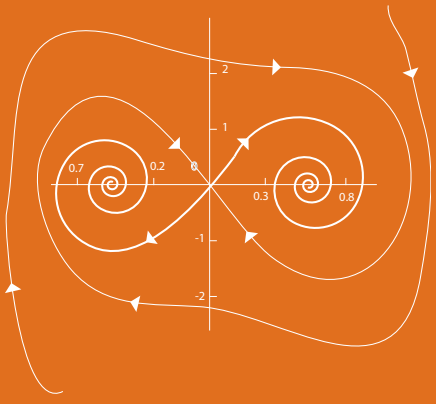


Sometimes the meaning of words you are familiar with changes as your study advances. For example, you have met algebra, but at university you will study ***Linear Algebra***, which is the maths of matrices and vectors, how to manipulate them and use them. One important mathematical application is the solution of large sets of simultaneous equations and some of the ideas in this area have unexpected practical applications, such as the technology behind internet search engines.

You may also meet ***Abstract Algebra***; for example group theory and ring theory which look at combinations of sets (for example, the set of all integers) and operations (for example, addition and multiplication) that satisfy certain conditions.

At school, ***Geometry*** is the study of size and shape in two or three dimensions but at university similar ideas can be extended, for example imagining relationships between 'shapes' in more than three dimensions.

In addition there are some topics which will be new to you. For example, ***Analysis*** is about what happens when something becomes infinitely large or infinitesimally small. It underpins and extends calculus and also includes the study of infinite series and sequences.

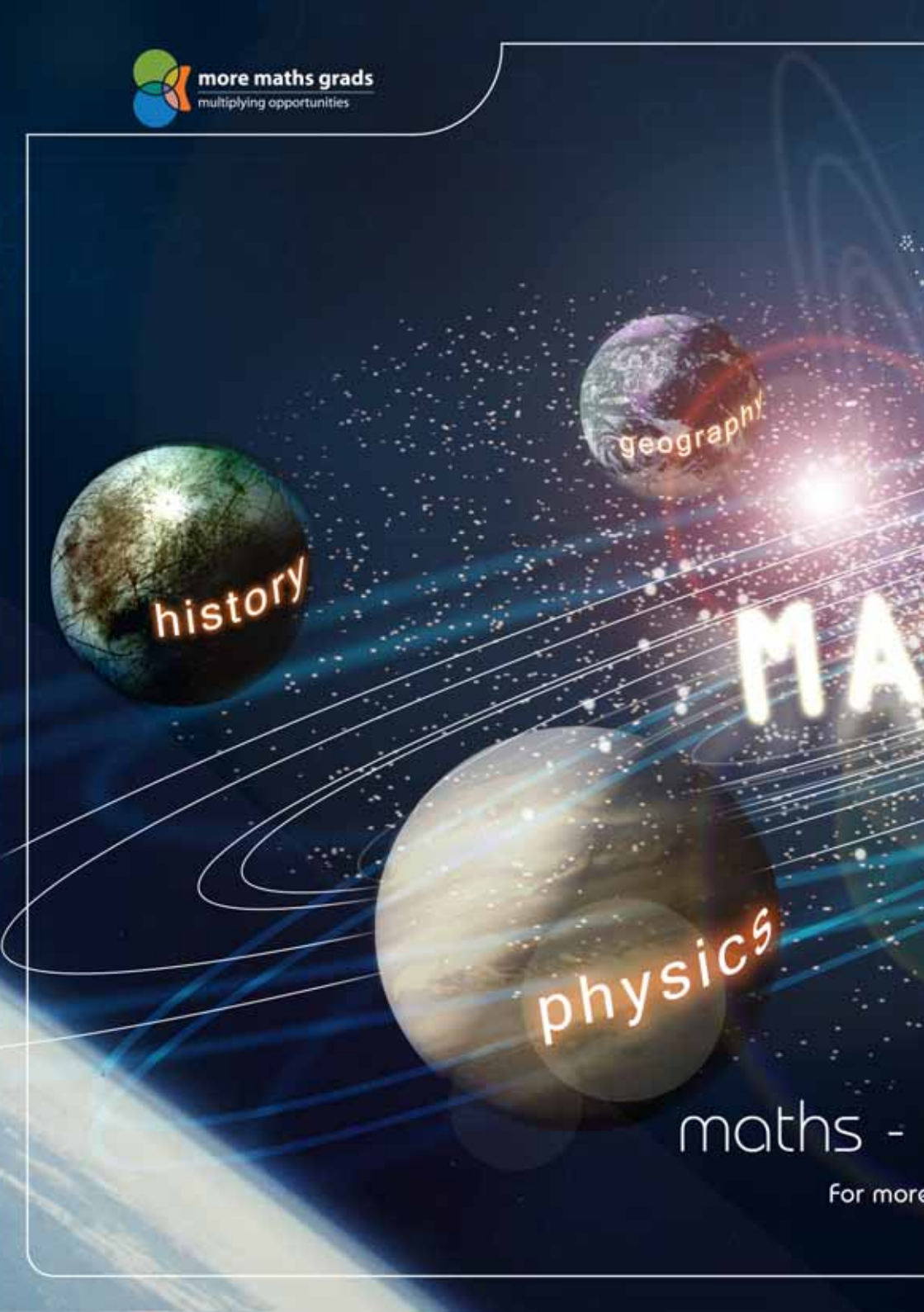


Differential equations are equations which contain derivatives and they are useful to describe many situations where something changes. These include predicting the spread of a disease, designing aerodynamic shapes for cars or turbines and studying aspects of the human body.

Intriguingly, many differential equations (and other mathematical problems) can't be solved exactly so you may learn about ***Numerical Methods*** which are ways to find approximate solutions to problems, usually using computers, along with finding out how accurate the resulting answer is.

Most courses include ***Modelling***, which is the art of using maths to represent a real-world problem. This involves deciding what 'sums' to do and, crucially, analysing and communicating the results.

Across all your modules, you are likely to find that ***Proof*** plays a much bigger role than at school; in other words, how can we be 100% certain that something is true? By understanding the rules of ***Logic*** and deductive reasoning, mathematicians take pride in understanding exactly what we do – and don't – know.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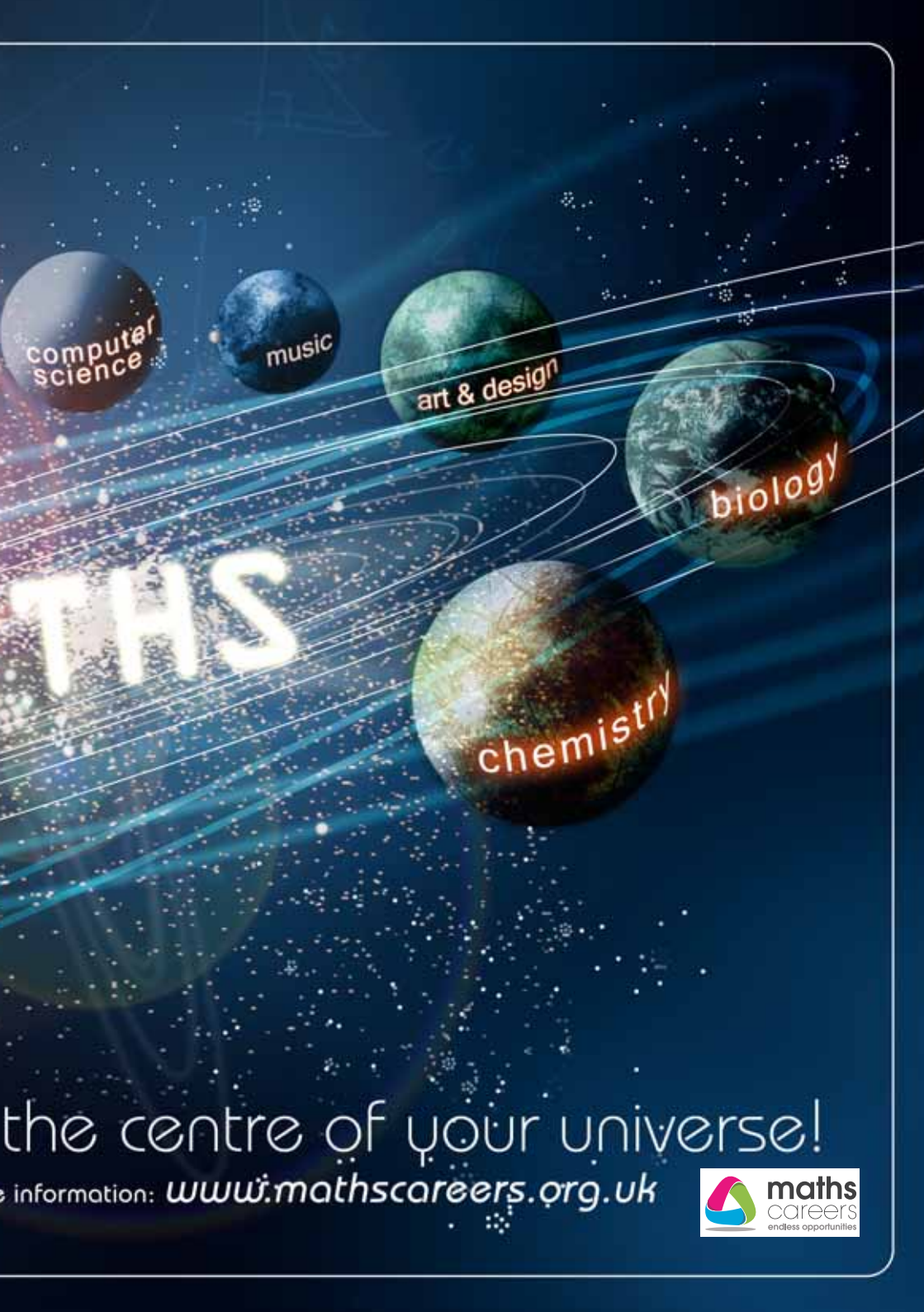
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