



A pack prepared by more maths
grads and CRAC: the Career
Development Organisation



WHY STUDY MATHS? A FEW SIMPLE REASONS . . .

1 Employability

Mathematics A level students and graduates are in high demand by employers. A qualification in maths will make your students stand out from a crowd. Employers recognise the importance of maths qualifications and reward accordingly! The CBI predicts that by 2014 the UK will need an extra 730 000 people with Science Technology Engineering and Maths (STEM) qualifications compared to 2007. Yet currently 59% of employers state they are having difficulty recruiting people with these skills. Maths is the essential transferable component across all science, engineering, technology and maths subjects.

2 Money Talks

Money will no doubt remain a great motivator for your students and, to help them to see the relevance of maths, here are a few facts that might get them thinking.

- Those with maths A level earn on average around 10% more than those without.
- The average graduate starting salary is £17 715. However, the average starting salary for a maths graduate is £19 342.
- A person with a maths degree can expect to earn £220 000 more over their lifetime than a person whose education ceased at A level.

Subject	Additional Lifetime Earnings
Maths	£220 000
Engineering	£220 000
Chemistry	£186 000
Physics	£188 000
Biological Sciences	£110 000
All Degrees	£129 000

¹CBI/Edexcel Education and Skills Survey 2008

²The economic Benefit of Higher Education Qualifications produced for the Royal Society of Chemistry and the Institute of Physics by Pricewaterhouse Coopers LLP January 2005

3 Maths Opens Doors

It is important to emphasise to students the importance of maths qualifications as a gateway to a vast array of jobs and courses, rather than just the traditional stereotypes such as accountancy. We will explore this in more detail further on in this booklet.

Don't forget many courses or jobs specify GCSE Grade C in maths as a minimum entry requirement. For example, all teachers need a grade C in maths even if they have no intention of teaching it. Remember that even jobs that don't ask for a C in maths, such as a police officer, will expect you to pass a numeracy test.

As a rule, if students are thinking of going to university to study any subject, they may be required to get at least a grade C in maths.

The actress Natalie Portman recently guest-edited Scholastic maths magazine, she wrote:
'I always found math to be such an exciting avenue to think about the world in new and different ways.'



4 Maths Develops Student Skills

In addition to developing mathematical skills studying maths also improves ...

Analytical Skills – clear thinking, attention to detail, ability to follow complex reasoning, ability to understand and construct logical arguments.

Communication skills – ability to answer questions clearly and to communicate an argument precisely and logically, both orally and in written form.

Investigative Skills – knowing where and how to find information.

Learning Skills – ability to understand difficult concepts and apply them to a problem.

Problem Solving Skills – being able to present a solution clearly, take a flexible approach, tackle a problem with confidence and appreciate when to seek help.

Self management – thorough approaches to work, time management, ability to work independently, determination.

Team Work – students often work together to solve problems.

'In terms of problem solving, it is important to be able to clarify objectives, understand a problem and model the factors involved. Equally, it is important that you are able to communicate results and make others understand the ideas.'

Aaron Sugarman, Head of Operational Research, TUI Travel

STUDYING MATHS

GCSE

If your students are taking their GCSEs at the moment, getting a good grade will keep their options open for A level and future careers, look great on their CV and equip them with some vital skills. Maths and English are the two subjects that employers regard as crucial.

It is important for everyone!

In 2007 it was widely reported that Wayne Rooney had hired a private tutor in order to retake his maths GCSE, demonstrating that however rich or successful you are, a GCSE in maths is still useful.³

In 2008 56% of students gained a minimum of a C grade in maths.

A study by the KPMG foundation in January 2009 concluded that poor maths skills cost the UK economy \$2.4bn per year.

Ask your students to look into the number of college courses and careers that request a maths GCSE. They may be surprised by just how many it is!



A-Level

When students are considering which A levels to choose, A level maths is a requirement if they want to go on to study subjects such as maths, statistics, physics, computer science, engineering or accountancy at university. It is also a useful stepping stone in enabling students to succeed in other degrees. For example, geography, psychology, medicine and sports science degrees all use advanced maths skills. A level maths is also highly respected by employers and admissions tutors at universities, making it an incredibly useful qualification.

The reality of A-Level maths

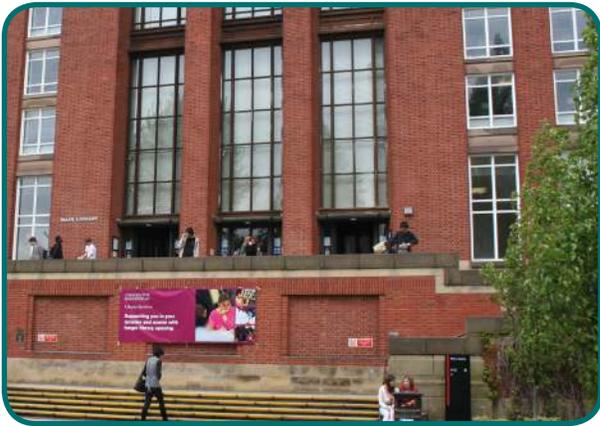
As you will no doubt appreciate, many students find A level maths more demanding than they had anticipated, both intellectually and in terms of time, organisation and application. This leads to a significant number opting not to progress from AS to A level.

In fact, for students who continue to the full A level the grades achieved are often comparable with other subjects. Any shortfall is offset by the perceived high status of mathematics amongst employers and universities. It is recognised as a respectable A level that takes both ability and steady application, and students often say how satisfying they found the subject by the time they come to the end of the course.

Thinking of going straight to employment?

For students who want to go straight to employment it can be a challenge to persuade them of the importance of AS or A level maths. A maths A level will teach them logical thinking, the ability to process information and to understand and manipulate numbers and mathematical processes. These skills will benefit them greatly in whatever occupation they choose and it is these skills which employers are looking for in their prospective employees.

4 ³<http://www.dailymail.co.uk/news/article-493539/Wayne-Rooney-hires-private-tutor-help-pass-GCSEs.html>



University

For students who are considering which degree programme to choose, a maths degree will help them to become a highly sought after graduate. Apart from the obvious sectors such as finance and IT, maths graduates go into a vast range of different careers, as highly skilled and paid employees.

University Degrees

If students do choose to study maths at university, there is a wide range of courses on offer with very different entry requirements and content. It isn't only students getting grade A or B who can study a maths degree, and institutions taking students with lower grades still have a good record of employment for their graduates.

Courses also vary considerably in content and there are lots of joint honours degrees available. Students can also choose to study more applied courses or take a degree with a year in industry.

Below are some of the topics which students may study if they pursue a maths degree. Many degrees also allow students to study outside options such as languages, education or philosophy modules.

Maths Degrees

- **Pure mathematics:** e.g. algebra, geometry, topology, analysis
- **Applied mathematics:** e.g. mechanics, differential equations, mathematical modelling
- **Financial mathematics:** e.g. probability, mathematical modelling, statistics
- **Mathematical physics:** e.g. fluid dynamics, magnetohydrodynamics, mechanics, modern physics, thermal dynamics
- **Mathematical biology:** e.g. differential equations, mathematical modelling
- **Statistics**
- **Operational research:** extension of the ideas in decision maths, very applicable in various industries
- **Computing:** e.g. computer programming, database design, courses on using packages such as MATLAB or Maple

Combined Degrees – A Few Examples

Mathematics with management

Mathematical sciences

Actuarial science and mathematics

Mathematics and philosophy

Mathematics and computing science

Mathematics and French

Mathematics and music

Mathematics and chemistry

Mathematics with physics

plus many many more ...

SO WHY DON'T MORE STUDENTS STUDY MATHS?

Obviously there is no simple answer to this but here are a few suggestions ...

I am rubbish at maths!

There seems to be a cultural acceptance that it is okay to be poor at maths, in a way that it is not okay to be unable to read or write. You will often hear people say "I can't add up" but rarely do they boast about not being able to read.

It is important to challenge students' stance on this and break this as the accepted norm, in order to emphasise just how necessary maths is.

Think of how hard the dragons are on *Dragon's Den* when they feel they are dealing with someone who doesn't know their figures!

"One of my favourite subjects was maths. I was good with numbers but I had to teach myself after I left how to evaluate cash flow or understand a sales ledger."

Peter Jones, Dragons Den⁴

Maths is an essential life skill and if a young person is able to understand how to make the most of their financial opportunities they are bound to be more successful than others.

Maths is perceived to be more difficult than other subjects

Students often believe that maths is a more difficult subject than others to study. As already stated, students who continue to full A level achieve results that are comparable with other A level subjects. There is also evidence that, because students are told that maths is difficult, it becomes a self-fulfilling prophecy. Nearly everyone who has studied maths has found it difficult at times, but it is necessary to work hard at it just like any other subject.

"Do not worry about your difficulties in maths. I can assure you mine are greater."

Albert Einstein



Maths is uncool

Maths has something of an image problem. As we have already stated, it is seen to be acceptable to be poor at maths and it is often perceived to be a slightly 'geeky' subject.

A recently funded study by the Economic and Social Research Council found that many students perceive mathematicians as old, white, middle-class men who are obsessed with their subject, lack social skills and have no personal life outside maths.⁵

This narrow view of maths is also exacerbated by popular culture in which there are few positive depictions of maths and many examples which reinforce the stereotype of the maths geek. The maths student is nearly always depicted as a quiet nerd. For example in the ever popular High School Musical, the story of an unlikely couple involves a popular



student who is good at basketball and his unlikely attraction to a quiet maths student. The implication is clear.

It is important to think about how we might change students' misguided perception of maths, educating them in the reality of the possibilities of maths today rather than outdated misconceptions.

⁴<http://www.timesonline.co.uk/tol/news/uk/education/article3558651.ece>

⁵<http://www.guardian.co.uk/education/2008/may/12/schools.highereducation>

WHAT CAREERS CAN MATHS LEAD TO?

It will come as no surprise to learn that there are very few jobs entitled 'Mathematician'. A maths degree is, however, a route to a fantastic range of careers, not just in the obvious such as teaching and accountancy, but in a vast array of fields including music and the environment.

Maths can lead to some of the most exciting and well-paid careers available. From designing games to modelling cancer treatments, from planning multi-million pound budgets to putting satellites into space, the possibilities are extremely wide. It is important that students understand the opportunities available to them and that there really is no typical job.⁶

"Many who have had an opportunity of knowing any more about mathematics confuse it with arithmetic and consider it an arid science. In reality, however, it is a science which requires a great amount of imagination."

Sofia Kovalevskaya



Finance and Banking

Finance is the most obvious use for mathematics and usually the first one that people think of when they consider maths careers.

In modern finance maths is of paramount importance. The financial world relies heavily on accurate forecasts of the future and these are based on rigorous mathematical models. Finding the optimal way for a company or individual to organise assets requires a keen analytical mind and very good problem-solving skills, something that maths graduates have in abundance.

The industry covers personal and private banking, insurance protection and pensions, investments, the financial markets, accountancy and financial advice and management.

Students that go into finance can expect the chance to work in a challenging and high achieving climate, travel to and work in the most exciting financial capitals ... and, of course, earn quite a bit of money.

Some examples of roles in this sector:

- Accountant
- Auditor
- Credit manager
- Investment banker
- Stock broker

The Natural and Life Sciences

Try describing the world around you in an accurate and coherent way and you'll soon find that the language of maths is indispensable. There are opportunities to work throughout the world in a wide variety of environments. The range of careers in this area is immense and expanding at a rapid rate.

The population is changing and it is estimated that by 2050, 15 million people in the UK will be over 65; in 2008 it was just 8.5 million. This means that the need for medical developments will be greater than ever and mathematicians will be essential. Some of the opportunities in this field include bioinformatics, e.g. examining mutations of cancer, biomedical engineering, e.g. replacement hip and knee joints and genome research, e.g. examining how genes interact and their impact on diseases like Parkinson's and cancer.

Another expanding field relates to climate change. The UK government has a target of reducing carbon emissions by 60% by 2050. Mathematicians will be integral in helping them achieve this. This may be through monitoring statistical data or assisting with the developments of replacement energy sources such as renewable or nuclear power.

There are, of course, many other aspects of the natural and life sciences. A common way of accessing careers in this area is by doing a masters course in a more specialised area such as mathematical medicine. These are frequently fully funded, unlike masters courses in many other subjects.

"If there is a god he is a great mathematician"

Paul Dirac

Some examples of roles in this sector:

- Bioinformatician
- Climatologist
- Geophysicist
- Meteorologist
- Oceanographer
- Uncertainty analyst
- Pharmacologist
- Geneticist

"Maths equations are used to find hydrocarbons like oil and gas. You see formulas and equations on exam papers and here you are actually applying them to real life."

Brian O'Connell TGS NOPEC

Art, Design and Music

Art is not the first thing that springs to mind when you think about career paths for mathematicians but increasingly powerful computers have opened up breathtaking new possibilities both for visual artists and musicians. The people who design computer graphics and the software used by artists have to be mathematically minded and this has enabled many people to combine their passion for art with their love of maths.

In particular there is a shortage of computer scientists and computer games designers. Many of the techniques which are used by computer games designers come from A level maths such as using vectors and matrices to help model a realistic 3D world.

The computer games industry was worth £9 billion in 2008 and was forecast to triple in the next five years. With half of all people in the UK regularly playing computer games this trend is likely to continue. The UK is the second largest developer of computer games in the world after the US. In addition to this there are a growing number of computer animated movies such as *Ice Age* and *Shrek*.

There are a number of opportunities in this field including testers, creatives and programmers, and a growing number of computer gaming degrees available, all of which use maths. Many computer games designers have a maths, physics or computer science degree.

Ever wondered why some songs are so catchy? The theory of tuning and scales can be traced back to Pythagoras who first noticed the ratios of frequency intervals between notes. Symmetries and pattern in the structure of a song also play a role in ensuring that it hits number one, each of which has a firm theoretical grounding in maths!

Some examples of roles in this sector:

- Multimedia specialist
- Computer game designer
- Musician
- Designer

Business Consultancy and Operational Research

How do you best organise your workforce to maximise productivity? What's the best design for a factory to run as efficiently as possible? Is the market ready for new ideas?

You need people who can solve complex problems, assess risk, predict the behaviour of markets and make sense of vast amounts of data. Many large organisations employ mathematicians and statisticians to help them with these tasks. Others seek outside help from business consultancies and market researchers, or consult experts in operational research, a part of maths concerned with finding optimal solutions to complex problems.

Working in this field you experience all kinds of businesses first-hand and there is a great opportunity to branch out and develop your career. The analytical skills of a maths or stats graduate are welcome almost everywhere!

Maths is used in all customer based industries to formulate trends and review how effective policies are."

Heather Wright, Hartley McMaster

Some examples of roles in this sector

- Data analyst
- Business development manager
- Operational researcher
- Actuary
- Management consultant

Engineering

The term 'engineering' covers an incredibly wide range of things: there's engineering in building and construction, engineering to do with anything that flies, swims or moves on the roads, engineering in the electronics and communications sector, engineering in the utilities sector – you name the area, there'll be an engineer in there somewhere. Engineers are responsible for the Olympic park, space satellites and exploring the bottom of the ocean.

Engineering is based heavily on maths and many engineers come from a maths background. There remains a crippling shortage of engineers and only a small percentage of engineers are female.

"Engineers and scientists are the people who will slow down global warming."

Philip Greenish, Chief Executive Officer, Royal Academy of engineering⁷

"I found that there was a lot of maths involved and discovered that a number of topics from mechanics are very important in designing and building structures."

James Connell, Civil Engineer, Morgan Professional Services

Did you know that on 15th October 1997 a mathematician, Andy Green, set a new world land speed record and was the first person to break the sound barrier on land? He reached a speed of 763.035 mph.

Some examples of roles in this sector

- Aerospace engineer
- Civil engineer
- Design engineer
- Medical engineer
- Sports engineer
- Mechanical engineer
- Electrical engineer
- Marine engineer
- Structural engineer
- Technical brewer
- Physicist
- Naval engineer
- Building technician

Actuary and Insurance

Life is a risky business. Insurance companies and the actuarial profession make a living by protecting individuals and companies from the consequences of these risks.

Actuaries use financial and statistical skills to solve business problems, although the day to day depends on what sector they actually work in. For example they may help an insurance company measure whether they have enough money to cover potential claims or a pension fund to estimate levels of contribution. Trainees earn approximately £30 000 a year and senior actuaries can earn in excess of £100 000. Recruits are nearly always graduates usually from a numeracy-based degree. Once a trainee, an actuary will be required to take professional qualifications which can be expected to take between three and six years.

“Actually seeing the application of the maths which I learned in my degree has been great. There is a lot of flexibility with my job too. I can choose to switch office location if I want to.”

Fayezah Sayed, Trainee Actuary, KPMG

Some examples of roles in this sector

- Actuary
- Risk manager
- Loss adjuster
- Insurance broker
- Insurance claims settler
- Pensions manager

IT and Computers

Computers are the ultimate maths machines. In the seventeenth century the mathematician Gottfried von Leibniz realised that you can calculate anything you want only using zeros and ones and he presented the first ever calculating machine to the Royal Society in London.

Today, a world without computers is hard to imagine. IT permeates every aspect of our lives and this is set only to increase. Maths is essential to their design and to the development of their software. Scientists, engineers, architects and medical professionals all rely on computer simulations in their work. The people who put these simulations together have to be experts not only in computer science but also in maths. Many university computing courses are actually taught by mathematicians.

Every second an enormous amount of information is transmitted via email, the internet and other telecommunication devices. For example think about the number of credit and debit card transactions happening throughout the world every day. It's ultimately maths that makes them work efficiently and in most cases keeps them safe.

What's more, the amount of data that is collected doubles every three years, providing a real need for statisticians who can spot patterns in and make sense of the data. Uses range from combating terrorism to studying consumer spending.

Some examples of roles in this sector

- IT product developer
- Technical support technician
- Computer games tester
- Forensic computer analyst
- Software developer
- Web designer

Medicine and Health

The National Health Service and the pharmaceutical industry rely heavily on maths and stats. It's vitally important that clinical trials are set up safely and accurately and that new treatments are safe for general release. Medical statisticians play a vital role in this process and currently there is a big shortage of suitable people. After doing a maths or statistics degree you can access this career by doing a masters degree or by on the job training.

Mathematical modelling techniques are also important in modelling the growth of cancer or the spread of a drug through the body. Many people access this route by doing a PhD or masters course after a maths degree.

“Here at the centre we make sure that all the radiation machines for treating cancer operate efficiently. One of the main attractions of my area is that the maths involved is very applicable to real scenarios and extremely important for the care of patients.”

Kevin Young, Arden Cancer Centre, Walsgrave Hospital, Coventry

Some roles in this sector include

- Medical statistician
- Medical laboratory assistant
- Medical physicist

Education

There are a wide range of opportunities in the teaching profession from teaching maths itself to primary and special needs. It is an extremely creative and rewarding profession

Maths teachers are in great demand in schools. The UK, in common with many other countries in the Western world, has a shortage of maths teachers and employment prospects are therefore excellent. A qualified maths teacher will be in extremely high demand, with good training opportunities and competitive salaries.

In addition to this, there are many other roles in teaching that use maths. Primary teachers, special needs teachers and a variety of senior management roles all require at the very least GCSE maths.

Maths teachers may be eligible for a golden hello on completion of training. This is a cash amount of up to £5000 on getting their first job. They may also be eligible for a training bursary of up to £9000.

Some examples of roles in this sector

- Maths teacher
- Primary school teacher
- Numeracy co-ordinator
- Special needs teacher
- Deputy head teacher
- Head teacher
- Research mathematician

Other Sectors

Defence and the Military

The defence sector is an important and exciting employer of mathematicians. There are a wide range of roles available in this sector using anything from basic to advanced maths. To enter the army, navy or air force you will be asked to complete a series of tests including one in numeracy. Although a GCSE is not required for the lowest level, it is for all officer and more senior level roles.

The defence sector is wide ranging and includes the army, navy and air force, MI5, MI6 and GCHQ (Government Communications Headquarters). It needs people who can design, build and operate planes, ships and other advanced defence equipment and it needs experts in a variety of fields. Many of the jobs covered in other fields will also be needed here, including IT experts and programmers, engineers and statisticians.

Did you know? GCHQ is home to Britain's highest concentration of mathematicians and they work hard to keep Britain safe. In the Second World War, code breakers worked at Bletchley Park to crack the Enigma code and mathematicians are still work today on the latest encryption techniques. It was here that RSA was invented, a method used to keep data safe when transmitting information over the internet.

Space and Astronomy

Space science involves a whole range of activities. It is a fast-growing sector and it is forecast that it will exceed 1 trillion pounds globally within 12 years. The UK space industry is extremely diverse and includes university-based groups as well as companies supplying information such as Infoterra and Google Earth.

Aside from astronauts, space has a number of relevancies in our daily life. Orbiting the earth is a ring system of 300 active telecommunications satellites ensuring the TV coverage that is beamed into our homes. Increasingly the internet is using this network and some commentators have calculated that if the satellites were all switched off the global economy would grind to a halt in less than a day.

Meteorological satellites are vital in earth observation, spotting key environmental trends and monitoring climate change, and where would we be without satnav?

Opportunities for today's students in this sector are both exciting and growing⁸

Science Communication and the Media

Maths, like all the sciences, has become a highly-specialised field. It is next to impossible for a lay person to understand all its uses and the latest advances. Science communicators, writers and journalists are here to make maths and science accessible to the general public. They work for broadsheet newspapers and popular science magazines such as New Scientist, help to put together and host TV programmes, write popular science books and help put on science exhibitions. There are also jobs available in scientific publishing.

Konnie Huq has an A level in maths and an economics degree. She presented Blue Peter for eleven years.

Sport

Maths is used in a number of ways in sport, for example, an athlete will tell you it's all about pace and timing. In training, the difference between decreasing your lap time by 0.1 or 0.2 of a second can make the difference between a gold medal and silver medal. A footballer uses instant calculations of angles, speed and distance before scoring, even using quadratic equations to score the perfect goal.

In reality though most footballers are not using quadratic equations when trying to score that perfect goal. There are however a number of roles for mathematicians in the sports world. For example, much of the design and construction for the 2012 Olympics is reliant on maths. Think about the design of equipment such as bikes and javelins or the material used for athletes' clothing. Statistics can be used in planning and estimation in sport and also in practice, e.g. drugs testing. If a maths student has a passion for sport there will no doubt be a career for them.

"If someone said to me they lived at number 16 I would think double 8"

Phil Taylor

⁸Summarised from STEM choices – A resource pack for Careers Education and Information, Advice and Guidance practitioners.

⁹Taken from the MMG postcard – See the Maths in Sport

USEFUL RESOURCES

Maths careers

The most useful site for information relating to maths careers is www.mathscareers.org.uk. This has a large number of career profiles of people working in many different sectors.

Many of the *more maths grads* career resources can also be used in your school to illustrate the versatility and possibilities enabled by the study of maths. They are detailed below, but can be requested or downloaded from the website.

- **Posters:** A series of posters drawing young people's attention to the range of careers available with maths.
- **See the maths in ...** postcards: Postcards asking young people to see the maths in the world around them.
- **What's the point of ...** leaflets: A series of leaflets answering the question 'What's the point of ...' different elements of maths. These leaflets can be really useful for focussing students in a lesson and demonstrating the relevance of certain areas of maths, e.g. trigonometry or algebra.
- **Maths in work:** A series of two-minute clips showing people using particular GCSE topics in the workplace. Jointly developed with NCETM, these are hosted on the Maths Careers website, as well as the NCETM site.

www.mathscareers.org.uk

Millennium Mathematics Project

The Millennium Mathematics Project (MMP) is a maths education initiative for ages 5 to 19 and the general public. It is based at the University of Cambridge but is active nationally and internationally. MMP operates a number of exciting initiatives including NRICH, Plus and Motivate.

<http://mmp.maths.org/>

NRICH

The NRICH project aims to enrich the mathematical experiences of all learners. To support this aim, members of the NRICH team work in a wide range of capacities, including providing professional development for teachers wishing to embed rich mathematical tasks into everyday classroom practice.

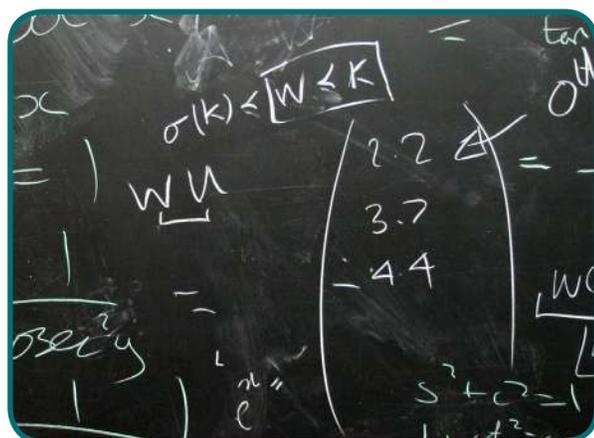
On this website you will find thousands of free mathematics enrichment materials (problems, articles and games) for teachers and learners from ages 5 to 19 years. All the resources are designed to develop subject knowledge, problem solving and mathematical thinking skills.

<http://nrich.maths.org/public/>

Plus magazine

Plus magazine opens a door to the world of maths, with all its beauty and applications, by providing articles from top mathematicians and science writers on topics as diverse as art, medicine, cosmology and sport. There is a huge range of relevant and exciting articles as well as a library of career interviews.

<http://plus.maths.org/index.html>



iSquared magazine

iSquared is a quarterly magazine which sheds light on the growing number of real-world applications of mathematics. The magazine contains a wide variety of articles about how maths is used in the modern world. Previous articles have covered topics as diverse as neuroscience, climatology, string theory, malaria modelling, aerodynamics, cryptography and even mathematical poetry. iSquared also features articles on mathematics-related news, reviews of recently released books on mathematical topics, biographies of mathematicians from the past and interviews with mathematicians from the present, as well as a variety of puzzles. For more information about iSquared magazine and to subscribe online, visit the website.

www.isquaredmagazine.co.uk

Future morph

Developed by the Science Council with backing from government and industry, this is a national website of careers information to engage young people and encourage them to appreciate why they study science and maths in school and to understand the breadth of opportunities that are available from studying STEM subjects. It aims to illustrate the career possibilities arising from the study of STEM subjects rather than the careers within those subject fields.

www.futuremorph.org

Motivate

A programme of mathematically based video conferences for schools.

<http://motivate.maths.org/>

UK Mathematics Trust

The UKMT was founded in 1996 as a registered charity to advance the education of children and young people in mathematics. The UKMT organises national mathematics competitions and other mathematical enrichment activities for 11- to 18-year-old UK students. These range from popular 'mass' maths challenges to team competitions, forums for teachers and the selection and training of the UK team for the International Mathematical Olympiad (IMO). Through the maths challenges and team competitions, UKMT aims to stimulate greater interest in mathematics across the 11 to 18 age group, encouraging participation and rewarding enthusiasm and achievement. Last year over 600 000 students from 4500 schools took part in the three challenges, the UK's biggest national maths competition.

www.mathcomp.leeds.ac.uk

The Institute of Mathematics

The Institute of Mathematics and its Applications exists to support the advancement of mathematical knowledge and its applications and to promote and enhance mathematical culture in the UK and elsewhere, for the public good.

It runs a scheme where volunteers from industry will come and speak in your school.

http://www.ima.org.uk/Education/school_speaker_scheme.html

NCETM

The National Centre for Excellence in the Teaching of Mathematics provides effective strategic leadership for mathematics-specific CPD. It aims to raise the professional status of all those engaged in the teaching of mathematics so that the mathematical potential of learners will be fully realised. This is a really useful support for maths teachers and the bank of resources should help students to see the wider relevance of many aspects of maths.

www.ncetm.org.uk/home

The STEM directories

Following the success of the engineering sector's publication 'Shape the Future' which catalogued some of the best and most widely available activities and resources, new STEM directories have been published. The STEM Directory Mathematics 2008/9 provides a concise catalogue of activities, mostly extension and enrichment across the STEM subjects. It is available in printed form or as a download from the website. It is a really essential resource for every mathematics teacher in the UK.

www.stemdirectories.org.uk

STEMNET (Science, Technology, Engineering and Mathematics Network)

STEMPOINTS are local groups hosted by various organisations across the UK. They are skilled in facilitating links between education and the wider STEM community. STEMPOINTS can provide high-quality meaningful extension and enrichment activities and other schemes for schools. In particular they host the Science and Engineering Ambassador Scheme whereby representatives from industry can visit your school.

www.stemnet.org.uk

Generic career databases

www.connexions-direct.com/Jobs4u/ is a national website of job descriptions across all job and career sectors provided by the Connexions service.

A new addition to generic careers websites is icould (www.icould.com) produced by CRAC, the Career Development Organisation. This contains video career stories of people across the entire spectrum of jobs in the UK, providing real human stories of people working in jobs and how they achieved them.

Both these generic resources contain a variety of examples of jobs for which maths is a particularly useful qualification.

Education Business Partnerships (EBPs)

In England and Wales, EBPs provide, amongst other things, work experience and enterprise activities for students as well as professional development for teachers, including placements with employers. In England EBPs are autonomous organisations but in Wales they are managed by Careers Wales.

http://www.nebpn.org/folders/nebpn_membership/

Trident

Trident is now owned by Edexcel and offers a range of services to EBPs, but especially focussing on work experience. The relationship between EBP and Trident activities and services will vary from area to area. Contact either body in your locality to find out who is responsible for what.

www.trident-edexcel.co.uk

The Engineering Education Alliance

The EEA has published guidelines aimed particularly at those within the STEM community who 'are considering developing, or assessing for continuation, any activity that falls under any heading (including schemes, programmes, initiatives, resources, materials and competitions) which seeks to involve schools, teachers or students.' These guidelines can be found at their website.

http://www.the-eea.org.uk/_db/_documents/EEA_Resource_Guidelines.pdf

The Industrial Trust

The Industrial Trust provides structured experiences to students in England to help them understand business and enterprise. Four programmes are offered for students up to Key Stage 4.

- **Open apprenticeships:** Takes Key Stage 3 students out of school to find out about what an apprenticeship involves.
- **Open horizons:** Students at Key Stages 3, 4 and 5 are taken to an employer and/or HE institution to help them understand the benefits of further study.
- **Open industry:** Comprises visits to companies for students up to Key Stage 3 to look at a curriculum topic in a business setting. The scheme specifically addresses STEM subjects.
- **Open enterprise:** For Key Stage 3 and 4 students, this is designed to develop economic and business capability, financial literacy and/or enterprise capability.

Teachers' professional development is also catered for through in-company programmes.

The Trust has regional teams in seven of the nine English regions. Information is available on the Trust's website.

<http://www.industrialtrust.org.uk/>

Researchers in Residence

Researchers in Residence facilitates a mutually beneficial relationship between researchers and secondary school students by placing PhD and post doctoral researchers in secondary schools across the UK. The programme has funding from the Research Councils UK and the Wellcome Trust. This scheme is delivered by a consortium of regional partners led by the University of Edinburgh.

<http://www.researchersinresidence.ac.uk/rir/>

Nuffield Bursary Scheme

The Nuffield Bursary Scheme is sponsored by the Nuffield Foundation. The Nuffield Foundation is a charitable trust that supports different areas of research and development. They offer bursaries to year 12 students (aged 16 to 17) and give them the opportunity to spend four to six weeks in a science-, technology-, engineering- or maths-based company working on mainly field-based projects.

www.nuffieldfoundation.org

Insight at Headstart

This is a well-established programme developed by Women into Science, Engineering and Construction (WISE) for young women interested in maths and/or science. It designed to help them consider their options from the hundreds of technology-based courses and career opportunities that are available to them. It provides an opportunity for 16/17-year-olds to spend a week in the engineering department of a university prior to making their UCAS application. The course examines several different aspects of science and engineering including problem solving, teamwork exercises, practical activities and a company visit. It is an introduction to university life as well as an aid to making informed decisions. Participants meet women who are undergraduates at the university or beginning their career. Information is provided regarding work experience, industrial placement and company bursary schemes.

<http://www.headstartcourses.org.uk/courses.php>

American GEMS (Girls Excelling in Math and Science)

This site supports GEMS clubs run by teachers. The site has resources for parents and teachers.

<http://www.gemsclub.org/GEMSACT1.html>

