

# ENRICHMENT IDEAS AND RESOURCES FOR PRIMARY AND SECONDARY MATHEMATICS

PRODUCED BY

THE PRIMARY ATM/MA AND 11-16 MA SUB-COMMITTEES



**The Mathematical Association**  
Supporting Mathematics in Education



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On the subject of **Enrichment** we say ...

**The Mathematical Association believes that mathematics teaching should focus on the needs of the individual. Every student should have an enriched mathematical experience, with that enrichment pervading curricula rather than being bolted on. Accelerating students should occur sparingly and judiciously.**

The characteristics of good learning and teaching in mathematics include pacing appropriate to the development of the individual learner and embedded opportunities for enrichment. Through enrichment, the relevance of mathematics to the modern world is revealed, breadth of experience and depth of understanding are provided, and enthusiasm, or even wonder, is engendered. Some students will be able to engage in enrichment at a deeper level, and a larger group should be challenged to do so, so that unexpected and previously unidentified abilities may emerge. Enrichment is appropriate for all mathematics learners.

**What is Enrichment?** Enrichment is the enhancement of mathematical experiences and may feature:

- the study of mathematics beyond the standard curriculum as defined by the requirements of any external examinations
- alternative and creative approaches to topics, including open-ended investigations
- accessible aspects of mathematics lying outside the curriculum
- connections between aspects of mathematics usually met separately
- the mathematics of other subjects or found in other subjects
- the history and development of some of the deepest ideas of mathematics
- mathematics of particular relevance to the students, e.g. related to their locale or to the school's specialism
- visits out of school by the students or visits to the school by outside speakers.

### **Why Enrichment?**

Enrichment provides greater freedom for exploring mathematics and by increasing intellectual satisfaction contributes to a student's well-being.



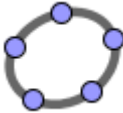





When central to curriculum planning, enrichment helps to ensure that the learning experience is not fragmented because there are clear links between such activities and the general classroom activities and topics of study.

Enrichment reduces the need to assess for giftedness and without the gifted label students tend to be treated with respect by their peers and to be fully included.





Enrichment engages students in mathematics and its popularisation and therefore is as essential for the education of disaffected or under-achieving students as it is for the mathematically gifted. It includes all whilst meeting the needs of the individual.

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### Investigations and alternative approaches to topics

	<p>The NRICH team have identified some "rich tasks" from the NRICH collection. These resources have been chosen because they are ideal for developing subject content knowledge as well as mathematical thinking and problem-solving (process) skills. Documents giving links to the curriculum are provided. <a href="http://nrich.maths.org/5665">http://nrich.maths.org/5665</a></p>	
	<p>Bowland Maths makes maths fun and absorbing for pupils. The aim is to increase motivation and enjoyment, which should help increase confidence and competence. A second aim is to help teach maths in a different way. The website provides:</p> <ul style="list-style-type: none"> <li>teaching materials that help teachers understand and implement the intended classroom learning;</li> <li>professional development support that helps teachers with the new pedagogical challenges involved.</li> </ul> <p><a href="http://www.bowlandmaths.org.uk/index.htm">http://www.bowlandmaths.org.uk/index.htm</a></p>	
	<p>GeoGebra is free dynamic mathematics software that joins geometry, algebra and calculus. It is an interactive geometry system with which you can do a wide range of constructions. It can also be used to draw graphs of functions. <a href="http://www.geogebra.org/cms/en/download">http://www.geogebra.org/cms/en/download</a> GeoGebra Primary <a href="http://www.geogebra.org/webstart/4.0/GeoGebraPrim.inlp">http://www.geogebra.org/webstart/4.0/GeoGebraPrim.inlp</a></p>	
	<p>This easy-to-use software allows you to create puzzles based on jigsaws and dominoes. These can be printed and laminated for repeated use or stuck into books or on posters. Students can also use Tarsia to produce their own activities. Click on the icon for a free software download. <a href="http://www.mmlsoft.com/index.php?option=com_content&amp;task=view&amp;id=11&amp;Itemid=12">http://www.mmlsoft.com/index.php?option=com_content&amp;task=view&amp;id=11&amp;Itemid=12</a></p>	
	<p>The mathematics on SMILE cards is presented in the form of practical activities, games and investigations. They encourage an independent approach and are suitable for students from Key Stage 2 to 4. The cards originally formed a complete individualised mathematics scheme. The cards were organised so that each student followed their own path through the work which was recorded on a network. Now available to download from the National STEM centre. <a href="http://www.nationalstemcentre.org.uk/elibrary/resource/621/smile-activity-list-cards-0001-2403">http://www.nationalstemcentre.org.uk/elibrary/resource/621/smile-activity-list-cards-0001-2403</a></p>	
<p><a href="#"><u>17 Times Table</u></a></p>	<p>Jill Mansergh uses a number stick to teach the 17 times table in less than ten minutes. A powerful piece of mathematics teaching that can be adapted to any times table teaching, understanding of the number system. It show how pace and images can be used to teach effectively, well worth adapting for other tables! <a href="http://www.youtube.com/watch?v=vXdHGBfoqfw">http://www.youtube.com/watch?v=vXdHGBfoqfw</a></p>	
<p>The websites below have an extensive selection of ready made Tarsia activities.</p>		
		




## Accessible aspect of mathematics lying outside the curriculum

	<p>Further Mathematics Support provides GCSE Mathematics extension materials aimed at students who are working towards GCSE Mathematics and would benefit from exposure to mathematics beyond the GCSE specifications. Events are also organised for KS4 students.</p> <p><a href="http://www.fmnetwork.org.uk/supporting_maths.php">http://www.fmnetwork.org.uk/supporting_maths.php</a></p>
	<p>A mathematical miscellany to encourage students to start wondering. Full of simple to more complicated curiosities related to mathematics. A wonderful resource to investigate.</p> <p><a href="http://www.cut-the-knot.org/">http://www.cut-the-knot.org/</a></p>
	<p>Vi Hart has produced a variety of intriguing funny and beautiful videos on YouTube sure to catch any pupil's interest – even if it is just to do some doodles!</p> <p><a href="http://www.youtube.com/user/Vihart/videos">http://www.youtube.com/user/Vihart/videos</a></p>
	<p>Understanding Uncertainty. This site is produced by the Winton programme for the public understanding of risk based in the Statistical Laboratory in the University of Cambridge. The aim is to help improve the way that uncertainty and risk are discussed in society, and show how probability and statistics can be both useful and entertaining!</p> <p><a href="http://understandinguncertainty.org/">http://understandinguncertainty.org/</a></p>





## Mathematics related to other subjects or work

	<p>Cre8ate work-related mathematics resources are freely available to download from the website.</p> <p><a href="http://www.cre8atemaths.org.uk/resources">http://www.cre8atemaths.org.uk/resources</a></p>
	<p>StemNRICH provides mathematical-science problems devoted to exploring the richness of the vital mathematical ideas underlying science, technology and engineering in thoroughly physical, relevant and engaging contexts.</p> <p><a href="http://nrich.maths.org/6298">http://nrich.maths.org/6298</a></p>
	<p>Motivate provides free online maths-based resources for schools in which curriculum learning is enriched by a real life and/or cross-curricular context</p> <p><a href="http://motivate.maths.org/content/">http://motivate.maths.org/content/</a></p>
	<p>STEMNET creates opportunities to inspire young people in Science, Technology, Engineering and Mathematics (STEM). This enables young people to develop their creativity, problem-solving and employability skills, widens their choices and supports the UK's future competitiveness. STEMNET runs three programmes – STEM Ambassadors, STEM Club Network, Schools STEM Advisory Network.</p> <p><a href="http://www.stemnet.org.uk/">http://www.stemnet.org.uk/</a></p>
	<p>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.</p> <p><a href="http://plus.maths.org/content/">http://plus.maths.org/content/</a></p>
	<p>A website that has been designed to promote the teaching of mathematics in ways that are visually stimulating, for pupils of a wide range of abilities in Key Stages 3, 4 and even 5.</p> <p><a href="http://motivate.maths.org/content/Maths2art-0">http://motivate.maths.org/content/Maths2art-0</a></p>

## History of mathematics







	<p>The British Society for the History of Mathematics exists to promote research into the history of mathematics and its use at all levels of mathematics education.</p> <p><a href="http://www.dcs.warwick.ac.uk/bshm/index.html">http://www.dcs.warwick.ac.uk/bshm/index.html</a></p>
	<p>Professor Marcus du Sautoy argues that mathematics is the driving force behind modern science. Ten 15 minute podcasts that reveal the personalities behind the calculations from Newton to the present day. How do these masters of abstraction find a role in the real world?</p> <p><a href="http://www.bbc.co.uk/podcasts/series/math">http://www.bbc.co.uk/podcasts/series/math</a></p>
	<p>The Story of Maths. In this four part documentary Marcus du Sautoy looks at fundamental mathematics and shows how numbers underpin the universe.</p> <p><a href="http://www.amazon.co.uk/The-Story-Maths-Marcus-Sautoy/dp/B001M48UTG">http://www.amazon.co.uk/The-Story-Maths-Marcus-Sautoy/dp/B001M48UTG</a></p>





## Mathematics of particular relevance to the students

	<p>The Personal Finance Education Group (pfege) helps with planning and teaching of personal finance relevant to students' lives and needs. Resources are freely available.</p> <p><a href="http://www.pfege.org/index.html">http://www.pfege.org/index.html</a></p>
	<p>The purpose of this article is to have a look at how mathematics is used in computer games. Using examples from computer games which pupils will have probably already played.</p> <p><a href="http://nrich.maths.org/1374">http://nrich.maths.org/1374</a></p>
	<p>The Bank offers a range of resources and services to build awareness and understanding of its role and function, and of central banking more generally. For young people, there is material on money, prices and the economy, including an annual competition for secondary school students.</p> <p><a href="http://www.bankofengland.co.uk/education/Pages/default.aspx">http://www.bankofengland.co.uk/education/Pages/default.aspx</a></p>
	<p>Free-standing Mathematics Activities are available at foundation, intermediate and advanced levels. They were originally designed for use by students post 16, but can in fact be used with students of all ages. They encourage students to use mathematics that is relevant to their other studies or interests. The use of ICT is encouraged wherever possible.</p> <p><a href="http://www.nuffieldfoundation.org/fsmaq">http://www.nuffieldfoundation.org/fsmaq</a></p>



## Visits, visitors and challenges

 <p><b>The Mathematical Association</b> Supporting Mathematics in Education</p>	<p>86 590 pupils sat the Challenge this year in 2 425 schools. Schools all over the UK (and beyond) have been celebrating their pupils' achievements in the Primary Mathematics Challenge</p> <p><a href="http://www.m-a.org.uk/jsp/index.jsp?Ink=250">http://www.m-a.org.uk/jsp/index.jsp?Ink=250</a></p>
	<p>The UKMT Primary Team Maths Resources (PTMR) have been produced with the aim to facilitate secondary schools in running maths events for feeder schools. Schools may choose to use the materials in other ways and the UKMT does not seek to restrict their use.</p> <p><a href="http://www.mathcomp.leeds.ac.uk/team-challenges/primary-team-maths-resources/">http://www.mathcomp.leeds.ac.uk/team-challenges/primary-team-maths-resources/</a></p>
	<p>The UKMT Junior and Intermediate individual challenges are for students in Year 8 or below and Year 11 or below respectively. The challenges consist of 25 intriguing multiple choice questions, which are designed to stimulate interest in mathematics. Questions from the challenges are available and can be used as enrichment material in the classroom across the ability range.</p> <p><a href="http://www.mathcomp.leeds.ac.uk/individual-competitions/">http://www.mathcomp.leeds.ac.uk/individual-competitions/</a></p>
	<p>The UKMT Team Challenges for pupils in Years 8 and 9, and Years 11 – 13, promote mathematical dexterity, team working, and communication skills. Materials are available to download for use with pupils in school.</p> <p><a href="http://www.mathcomp.leeds.ac.uk/team-challenges/">http://www.mathcomp.leeds.ac.uk/team-challenges/</a></p>
<p><b>Kjartan Poskitt</b></p>	<p>The author of the Murderous Maths books is available for a range of different types of events in schools.</p> <p><a href="http://www.kjartan.co.uk/gigs/index.htm">http://www.kjartan.co.uk/gigs/index.htm</a></p>
<p><b><u>The Mathemagician</u></b></p>	<p>Andrew Jeffrey performs for school children in Key Stages 1-4 (and often foundation stage). His audience is taken on a magical journey that subtly changes their attitude to mathematics. Containing, alongside the magic, are clear positive and motivational messages about the learning of maths. As an experienced teacher, Andrew knows how to communicate with children who find maths hard, as well as giving a challenge to those for whom maths is a joy.</p> <p><a href="http://www.andrewjeffrey.co.uk/schoolshow.asp">http://www.andrewjeffrey.co.uk/schoolshow.asp</a></p>
	<p>Maths Inspiration is a mathematics enrichment programme which provides a chance for Year 11 and sixth form students to experience some of the UK's most inspiring mathematics speakers live, in big venues, presenting mathematics in the context of exciting, real-world situations.</p> <p><a href="http://www.mathsinspiration.com/index.jsp">http://www.mathsinspiration.com/index.jsp</a></p>
	<p>The Enigma Project is a presentation about the history and mathematics of codes and code breaking, from ancient Greece to the present, including a demonstration of a genuine WWII enigma machine. Then later, in the workshops, it is the students' turn to be the codebreakers! Cryptography is one of the most interesting, inspiring and exotic applications of mathematics.</p> <p><a href="http://enigma.maths.org/content/">http://enigma.maths.org/content/</a></p>

	<p>This Maths of Sport Roadshow is suitable for Key Stages 2,3 and 4, and can be booked to visit schools for a special maths event. Pupils will explore some of the underlying mathematics of the Olympic and Paralympic Games through a Maths Pentathlon: students compete in teams on five hands-on mathematical activities focused on Olympic and Paralympic sports and infrastructure planning and design.</p> <p><a href="http://sport.maths.org/content/roadshow">http://sport.maths.org/content/roadshow</a></p>
	<p>The Hands-On Risk and Probability Show can be brought to schools to run a mathematics enrichment event for Key Stages 2 to 5. The aim is to bring mathematics alive, complementing what students learn in class and helping to bridge the gap between curriculum mathematics and real-world applications.</p> <p><a href="http://www.mmp.maths.org/risk">http://www.mmp.maths.org/risk</a></p>
	<p>The Cambridge Science Festival runs every March and features more than 180 free events organised by departments within the University of Cambridge.</p> <p><a href="http://www.cam.ac.uk/sciencefestival/">http://www.cam.ac.uk/sciencefestival/</a></p>
	<p>The FunMaths Roadshow is a collection of 350 mathematical activities suitable for use with school pupils, college students, and university undergraduates, overall between the ages of 5 and 20. The first 100 were developed to celebrate the centenary of the Liverpool Mathematical Society in 1999, and the further 250 have been developed subsequently.</p> <p>Led by members of the Liverpool Mathematical Society, the development of the Roadshow is an ongoing attempt, in part, to provide a brief experience of some elements of what practicing mathematicians do in real-life.</p> <p><a href="http://www.maths.liv.ac.uk/lms/funmaths/">http://www.maths.liv.ac.uk/lms/funmaths/</a></p>
	<p>Puzzle Challenge Day programmes are designed to suit students of all abilities at Key Stages 1, 2, 3, 4 and '16 to 19', and they are also of great benefit to students with special educational needs. Challenges are age-appropriate and will link to a variety of areas across the curriculum, but especially maths.</p> <p><a href="http://www.happypuzzle.co.uk/">http://www.happypuzzle.co.uk/</a></p>
	<p>THE GREEN BOARD GAME COMPANY (who own BrainBox) was set up in 1991 to invent games for people to play and learn together. <a href="http://www.brainbox.co/">http://www.brainbox.co/</a></p>

These links are in no way an exhaustive list, but a selection of our favourite places to visit for inspiration. If you know of any additional sources of enriching activities both the Primary and 11 – 16 Subcommittees would be very keen to hear from you. Please note that references to key stages refer relevant to England and Wales.

- |                            |                              |
|----------------------------|------------------------------|
| Key Stage 1 – ages 4 – 7   | Scottish Nursery and P1 - P2 |
| Key Stage 2 – ages 7 – 11  | Scottish P 3 - P6            |
| Key Stage 3 – ages 11 – 14 | Scottish P 7, S1 - S2        |
| Key Stage 4 – ages 14 – 16 | Scottish S3 - S4             |
| Key Stage 5 – ages 16 – 19 | Scottish S5 - S6             |