

Summary

This advice sheet is aimed at parents and carers. It covers how to recognise high learning potential in Maths at the Secondary level, as well as how to support a child with high learning potential and/or a strong interest in this. There are also links to further resources in this subject area.

Introduction

Children with high learning potential in mathematics at secondary school quite often need specific guidance and support to maximise their mathematical potential. This can seem as a daunting task for parents who are not gifted mathematicians themselves. The ideas outlined here will complement these children's secondary school numeracy lessons and provide further enrichment throughout their education.

Spotting a Child with High Learning Potential in Mathematics

A child with high learning potential in mathematics is in their element when they can incorporate the use of numbers in problem solving, reasoning and questioning. It is essential that such a child is supported correctly at home and at school to enable them to use and develop these important analytical thinking skills and problem solving strategies. A natural mathematical ability must be nurtured and developed consistently to ensure steady progression in the subject as well as catering to their passion for all things mathematical.

Typically, children with high learning potential in mathematics will grasp new material quickly, be prepared to approach problems from different directions and persist in finding solutions. They may also generalise patterns and relationships, use mathematical symbols confidently and develop concise logical arguments.

Having high learning potential in numeracy can mean being able to understand mathematical ideas rather than show great knowledge, speed in answering questions or getting them always right. If your child has an intuitive approach to problem solving, he or she may struggle to communicate their reasoning and justify their methods. This is why it can be difficult to spot the natural mathematician in a classroom as they may be lost in deep thought pondering over a particularly complex equation and not appear to be concentrating on set tasks or time limits.

Supporting High Learning Potential in Mathematics

Support for the young mathematician needs to be in the form of interesting and challenging mathematical problems of a wide variety. There are several resources that you can help your child to access to ensure a fulfilled and flexible mathematical curriculum catered to their individual needs and interests. For example, books, websites, summer schools, examinations, mentoring and competitions.

Mentoring

Your child could take on independent exploratory tasks involving formulas, patterns, problem solving, looking for underlying principles, etc. If you are not mathematically inclined yourself, encourage them to discuss their findings with like minded people on specialist maths websites. Examples of such websites include www.nrich.maths.org , <http://mathworld.wolfram.com> , or www.waldomaths.com .

The UKMT (United Kingdom Mathematics Trust) has a mentoring scheme via email which presents a series of challenging mathematical problems, requiring full written solutions, to stretch and inspire the most able secondary school pupils. Participants are provided with a mentor who will be able to discuss the problems and other mathematical ideas, read and return their solutions with helpful comments. This mentoring scheme is available to talented young mathematicians who have been successful in the UKMT Maths Challenges as outlined below.

Challenges and Awards

The UKMT Individual Maths Challenges are lively, intriguing multiple choice question papers, which are designed to stimulate interest in maths in large numbers of pupils. The three levels cover the secondary school range 11-18 and together they attract over 600,000 entries from over 4000 schools and colleges.

The British Mathematical Olympiad is the UK's biggest national maths competition. Each challenge leads into a follow-on Olympiad round. A team of six talented mathematicians are selected from the rounds to represent the UK in the International Mathematical Olympiad.

If your teenager is keen to read maths at a top UK university, they will be required to undertake the Advanced Extension Award (AEA) in Mathematics or the Sixth Term Examination Paper (STEP) in addition to their A levels. Certain universities require applicants to sit these examinations because the content is in the style of the mathematics they will encounter at university. Also, the results of these examinations allow universities to make a more informed selection between highly able students. If your child's school does not offer help with these papers, they will still be required to sit the examinations independently. Currently, the University of Warwick, the University of Bristol, the University of Oxford, Cambridge University and Imperial College London all encourage applicants to take the papers. These qualifications are included in the UCAS tariff.

Literature

To boost your child's mathematical knowledge, reading a wide range of literature on the subject of mathematics is vitally important. Mathematics departments of universities publish recommended mathematics reading lists which will be very important for your child to read if they want to go to a prestigious university. These books can be referred to in their university applications to illustrate a strong and active interest in maths and can later be mentioned in an entrance interview as a topic for debate and discussion.

Summer Schools

Your teenager could attend maths Summer schools at top universities which would give them a first-hand idea of what studying maths at a university would really be like. Cambridge University, Oxford University, Warwick University and Durham University all offer Summer schools/taster courses for mathematics AS and A level students.

The Sutton Trust runs a Summer school in mathematics for students who come from schools and families with little or no experience of Oxbridge or Higher Education, as well as being selected on academic grounds. The aim of the Summer school is to give the students a sense of what university mathematics, and more generally what the whole university experience is like.

Villiers Park Educational Trust runs a five-day residential maths course at their conference centre near Cambridge. Students attending this course consider the nature of proof and the extent to which mathematics can provide clear cut answers to nature, the universe and life. The content of the course includes interactive lectures, presentations and group discussions.

Enrichment and Enhancement Materials

Your child may find mathematical magazines interesting; they could even write article for one of these or read news of the latest developments at the forefront of mathematical research (an example of such publications is *Plus* (<http://plus.maths.org>)). Your teenager may even be ready for a more challenging, extensive programme of study, going deeper into curriculum topics or studying outside the curriculum to match their interests. If you live in Scotland, The Open University's Young Applicants in Schools and Colleges Scheme (YASS) might be worth considering. YASS enables academically gifted students in Years 12 and 13 to study a wide range of undergraduate modules at first-year university level alongside their AS and A levels. The scheme gives students the opportunity to experience learning at university level, building confidence, encouraging independent learning, and can also help differentiate them from other students when it comes to applying to universities.

Open Days and Lectures

Mathematics departments at universities run open days which would be very beneficial for your teenager to attend. A visit to a maths open day will allow them to experience the atmosphere of the university and the style of the mathematics they teach. Your teenager would have the opportunity to meet members of staff, to ask questions about courses and campus life, and to talk to students.

The programme of events at maths open days often includes experimental maths demonstrations, presentations by undergraduates on their degree work and lectures from professors. Please be aware that university open days get booked up early. For more information go to the university's maths department website early in the academic year.

Maths Inspiration (www.mathsinspiration.com) runs a series of maths enrichment programmes for teenagers across the UK. Year 11's and sixth formers can listen to inspiring maths speakers live, in big venues, presenting mathematics in the context of exciting, real-world situations. At each event, the speakers include one pure mathematician, one statistician and one engineer.

Further Information

Websites	
www.nrich.maths.org	They provide children with engaging mathematical activities that provoke mathematical thinking, it is also a place to explore, question, notice and discuss.
www.murderousmaths.co.uk	Website which extends beyond the book series.
www.worldclassarena.org	International competitions in mathematics that schools or individuals can sign up to.
www.ukmt.org.uk	Website for United Kingdom Mathematics Trust, who run national competitions for schools to enter.
mathshelpforum.com	Online maths forum
mathforum.org	Online maths forum
mymathforum.com	Online maths forum
abstractmath.org	Higher/pure maths website
www.thestudentroom.co.uk	Search for TSR Mathematical Society for help on maths revision and coursework
http://academicearth.org/online-college-courses/mathematics/	Academic Earth is an organisation founded with the goal of giving everyone on earth access to a world-class education. It aims to provide on its website video courses and lectures from leading scholars. The mathematics section of Academic Earth currently includes videos on calculus, differential equations, linear algebra, mathematics for engineering, etc.
Books	
<i>Professor Stewart's Cabinet of Mathematical Curiosities</i> and <i>Professor Stewart's Hoard of Mathematical Treasures</i> by Ian Stewart	Two books of mathematical oddities: games, puzzles, facts, numbers and delightful mathematical nibbles for the curious and adventurous mind.
<i>How to Cut a Cake: And other mathematical conundrums</i> by Ian Stewart	Welcome to Ian Stewart's magical world of mathematics! Each quirky tale presents a fascinating mathematical puzzle in a challenging, fun and engaging way.

<i>How Many Socks Make a Pair?: Surprisingly Interesting Maths</i> by Rob Eastaway	How many socks make a pair? The answer is not always two. And behind this question lies a world of maths that can be surprising, amusing and even beautiful.
<i>The Moscow Puzzles</i> by Boris A Kordemsky	A classic collection of puzzles to suit higher level mathematical thinkers.
<i>Why Do Buses Come in Threes?: The Hidden Mathematics of Everyday Life</i> by Tim Rice, Rob Eastaway and Jeremy Wyndham	An entertaining book full of fascinating questions that shows how maths are involved in everything we do – cooking, travelling by car, life-saving techniques, etc.
<i>Mathematics Of Life: Unlocking the Secrets of Existence</i> Ian Stewart	Ian Stewart, in characteristically clear and entertaining fashion, shows how far mathematicians and biologists are succeeding in tackling some of the most difficult scientific problems the human race has ever confronted and where their research is currently taking us.

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