

## Fluency and Understanding - A Mathematically Balanced World

Opening Speaker - **Mike Askew** (Professor in Primary Education)  
Primary Speaker – **Ruth Merttens** (Director of Hamilton Maths and Reading Projects)  
Presidential Address – **Lynne McClure** (Director, Cambridge Maths and MA President)  
Closing Speaker – **Alex Bellos** (author of *Alex through the Looking-Glass*)  
After Dinner Speaker – **Andrew Jeffrey** (The Mathemagician)

### Session Titles and Abstracts *(sorted alphabetically under speaker surname.)*

**Wednesday, 8<sup>th</sup> April 2015:** Opening Lecture 13.45-15.00; Session 1 15.30-16.30; Session 2 16.40-17.40  
**Thursday, 9<sup>th</sup> April 2015:** Plenary 09.00-10.15; Session 3 10.45-11.45; Session 4 11.55-12.55;  
Presidential Lecture 13.45-15.00; Session 5 15.30-16.30; Session 6 16.40-17.40  
**Friday, 10<sup>th</sup> April 2015:** Session 7 09.00-10.00; Session 8 10.10-11.10; Closing Lecture 11.30-12.30

#### David Acheson

#### Session 1 15.30-16.30

Title of Session: ***Keeping it Simple***

**Abstract** – Sometimes in mathematics, it is possible to go a very long way with remarkably simple ideas. I will look at a number of examples ranging from elementary geometry to fluid mechanics and superstrings.

**About the speaker** – David is author of the bestseller '*1089 and All That*', and was President of the MA for 2010-2011.

#### Jenni Back

#### Session 5 15.30-16.30

Title of Session: ***Making Numbers***

**Abstract** - This practical workshop will be based on work we have been doing with teachers and children in connection with our Nuffield funded project. We are exploring how to use manipulatives effectively in teaching early arithmetic concepts and skills. Come and find out what we have discovered and try out some rich activities for yourselves.

**About the speaker** –

#### Robert Barbour

#### Session 6 16.40-17.40

Title of Session: ***Can we make maths teaching better?***

**Abstract** - I shall describe ways I have worked with a group of schools to develop mathematics teaching...despite accountability pressures, national curriculum, recruitment issues etc. I shall also look to the future and describe how ACME, of which I am a member, is working to try to bring about a better future.

**About the speaker** - Robert taught mathematics for 21 years in 4 schools and then worked in 3 local authorities in England and Wales. Between 2010 and 2013 he was an HMI and a member of the HMI maths team. Since then he has worked as an independent consultant and member of ACME. He is a former president of the MA.

#### David Bedford

#### Session 2 16.40-17.40

Title of Session: ***How To Solve Peg Solitaire***

**Abstract** - Delegates will have the chance to play, and hopefully solve, peg solitaire as well as look at some of the mathematics underlying this puzzle. No experience necessary!

**About the speaker** - David is a Senior Lecturer in Mathematics at Keele University with over 20 years' experience of lecturing to undergraduates. Alongside his research interests in combinatorics, he has been actively involved in encouraging school children to explore the world of mathematics beyond the curriculum.

## Bob Burn

### Session 2 16.40-17.40

**Title of Session:** *How were logarithms constructed during the 17<sup>th</sup> century*

**Abstract** -- Kepler (1624) with geometric means, after Napier (1614); Briggs (1617 and 1624) with large indices; also with repeated square roots; Brouncker (1668) with a hyperbola and an infinite series of rational numbers; Mercator (1668) with a hyperbola and an infinite algebraic series. Please bring a calculator.

**About the speaker** - For the last 25 years I have been exploring how new concepts in mathematics have emerged historically, in order to understand the process of learning and discovery. Logarithms are a particular case in point, provoking negative numbers, the use of decimal place value, indices and pushing forward trigonometric notions.

## Douglas Butler

### Session 1 15.30-16.30 & Session 8 10.10-11.10

**Title of Session:** *Meaningful Mathematics in HTML*

**Abstract** - More and more standard mathematics software is reappearing to run in HTML, and hence 'on any device'. This session will look at Geogebra, Autograph and other titles that have made the jump, so you can judge how successful they are in their new surroundings. Bring your own device, but not too small a screen!

**About the speaker** - Mathematics teacher for 30 years, now concentrating on TSM workshops and Autograph development.

## Tom Button & Richard Lissaman

### Session 3 10.45-11.45

**Title of Session:** *tbc*

**Abstract** - tbc

**About the speaker** - tbc

## Alison Clark-Wilson

### Session 1 15.30-16.30 & Session 7 09.00-10.00

**Title of Session:** *Supporting all students to access the challenge of the key stage 3 mathematics curriculum through dynamic technology – the Cornerstone Maths approach.*

**Abstract** - In this workshop, you will find about and use some of the Cornerstone Maths curriculum resources, which aim to resolve some of the issues around widespread uses of technology and provide teachers and pupils with research-informed approaches to access challenging topics in the new key stage 3 programme of study.

**About the speaker** - Alison Clark-Wilson, a former secondary mathematics teacher, works as a Research Fellow at the London Knowledge Lab, Institute of Education, London on the ambitious Cornerstone Maths project, which has developed curriculum units and professional development for key stage 3 mathematics ([www.cornerstonemaths.co.uk](http://www.cornerstonemaths.co.uk)).

## David Crawford

### Session 5 15.30-16.30

**Title of Session:** *Mathematical Magic Tricks*

**Abstract** - In this session I will demonstrate some mathematical magic tricks using numbers and cards that could be used to add a bit of a "wow" factor in the classroom. Please bring paper, a calculator if you want and plenty of willingness to participate. Intended Audience: Teachers of KS2, KS3 and KS4 plus anyone who enjoys tricks.

**About the speaker** - David has been Head of Maths at Leicester Grammar School for 17 years. He is a regular speaker on Mathematical Magic at conferences for both adults and pupils and has written a book on the subject. He is also involved with editing Kangaroo papers for UKMT.

## Terry Dawson

### Session 2 16.40-17.40

Title of Session: ***Critical Maths : A discussion based approach to learning***

**Abstract** - It is well documented that many students fail to see how mathematics is relevant to their everyday life and future career. Critical Maths is a DfE funded project which attempts to address these issues by offering a curriculum which demonstrates how mathematics is crucial when making important decisions and interpreting/understanding everyday information. This session will examine some of the free resources available, and demonstrate the discussion based teaching approach, which starts with a simple question and ends with a mathematical structure.

**About the speaker** Terry is a curriculum developer working for MEI on the new core maths qualifications. Prior to joining MEI, Terry taught mathematics for over 20 years including 13 years as a Head of Mathematics, 2 years as an Assistant Head, and a spell as Local Authority consultant for functional mathematics and STEM.

## Stella Dudzic

### Session 6 16.40-17.40

Title of Session: tbc

**Abstract** - The introduction of Core Maths qualifications has highlighted the question of what mathematics everyone needs to be able to do post-16. This session will look at some situations that can be sources of mathematics for students undertaking such qualifications. It may also be of interest to teachers who are interested in exploring examples of mathematics in life.

**About the speaker** - Stella is an experienced teacher, author and curriculum developer. She is Programme Leader (Curriculum) for Mathematics in Education and Industry, which is an independent curriculum development body. She has taught mathematics in secondary schools for 22 years and was a head of faculty before taking up her current post in 2006.

## Samantha Durbin & Ben Dornan

### Session 5 15.30-16.30

Title of Session: ***Royal Institution Masterclasses***

**Abstract** - Royal Institution Masterclasses aim to encourage, inspire and engage young people in the art, practice and value of mathematics and help develop mathematical understanding. Come along to meet us, try out some Mathematics, Engineering and Computer Science Masterclass activities and find out how you and your students can get involved.

**About the speaker** - Samantha Durbin is Clothworkers' Associate in Mathematics at the Royal Institution, responsible for coordinating our national networks of Secondary Mathematics Masterclasses and Primary Mathematics Masterclasses. Dr Ben Dornan is Causeway Associate in Computer Science, coordinating our brand new Computer Science Masterclass Network. Our Masterclass programme also includes Engineering Masterclasses.

## Michael Fox

### Session 3 10.45-11.45

Title of Session: ***Enrichment in GCSE Geometry***

**Abstract** - Investigations are a useful form of enrichment: they can be directed or open-ended; as easy as using software to discover the properties of a given diagram, or as hard as proving or disproving the discoveries. We shall investigate a particularly "rich" diagram, and there will be some tantalising challenges. Please bring a laptop with Geogebra or similar software.

Suitable for teachers of KS4 and anyone with an interest in elementary pure geometry.

**About the speaker** - Michael Fox is a former maths teacher, head of department, and school head, working in selective and comprehensive schools. He has contributed articles to MIS and the Gazette, and is a regular speaker at MA conferences.

## Sarah Giles – Royal Society

## Session 2 16.40-17.40

Title of Session: *Let's talk Vision*

**Abstract** - The Royal Society Vision for science and mathematics education report sets out a route map for transformation of the quality of science and mathematics education over the next 20 years. This event will comprise of a panel debate that opens up to the audience, debating the recommendations of the report.

**About the speaker** -

## Jonny Griffiths

## Session 1 15.30-16.30

Title of Session 1: *Madness and Mathematics* (General)

**Abstract** - Cantor spent part of his life in a lunatic asylum; could this have been the result of his groundbreaking reflections on the concept of infinity? Ramanujan said some of his theorems were granted to him by a higher power when in a trance-like state. John Nash's battle with psychiatric illness has been well-documented in the book and film, 'A Beautiful Mind' - how did his mathematics relate to his illness? The session presenter also encountered psychiatric illness in his youth, and he would argue maths played a large part in his recovery. The interplay between mathematics and madness is a perennial theme for us to explore.

**About the speaker** - Jonny Griffiths teaches at Paston Sixth Form College, where he has been for over 20 years. He's studied mathematics and education at Cambridge University, the Open University, and the University of East Anglia. He was a Gatsby Teacher Fellow in the year 2004-5.

## Jonny Griffiths

## Session 4 11.55-12.55

Title of Session 2: *Hikorski Triples. (Number Theory)*

**Abstract** - We have all encountered the Pythagorean Triples  $(a, b, (a^2+b^2)^{0.5})$ . There are infinitely many of the primitive variety, and they can be parameterised simply. This session introduces a new collection of natural number triples  $(a, b, (ab+1)/(a+b))$ , that arise from a simple yet evocative mathematical situation. What resonances does the expression  $(ab+1)/(a+b)$  have for you? We shall explore the parameterisation of these triples.

## James Grime

## Session 6 16.40-17.40

Title of Session: *Enigma and the Secret World of Codes and Code breaking*

**Abstract** - Secret messages and code breaking are a wonderful way to engage students of all ages with mathematics. We will see a lot of different mathematics arise naturally, as well as practising our problem solving skills. Participants will get to test their own code breaking skills - and a chance to see an original WWII Enigma Machine! Suitable for KS2, 3, 4, 5, college, university.

**About the speaker** - James Grime has been running The Enigma Project for KS2-5 in schools for seven years. Feel free to quiz him with any questions you may have about codes, Enigma and beyond!

## Paul Harris

## Session 7 09.00-10.00

Title of Session: *An application of Mathematics to image analysis.*

**Abstract** - Digital images are an important feature of modern life, with uses ranging from photographs of family holidays to images of the inside of the human body obtained using MRI. However, these images can be contaminated with noise or may be blurred. Mathematical methods for removing these unwanted artefacts from the image lead to non-linear partial differential equations which need to be solved to obtain the original uncontaminated image. This talk will look at how these differential equations are obtained, and then consider a numerical method for obtaining the required solution. The numerical solution process leads to a large system of non-linear algebraic equations which has to be solved (with typically tens or hundreds of thousands of equations and unknowns) and the talk will discuss the special techniques which have to be used to implement the methods on a PC. The talk will be illustrated with a number of typical examples.

**About the speaker** - Paul is a Reader in Mathematics at the University of Brighton where he has worked for over 20 years. His research interests are in the use of numerical methods to solve problem applied mathematics, some of which he will talk about in this session.

## Rachael Horsman

### Session 8 10.10-11.10

Title of Session: *Ideas you can use tomorrow...*

**Abstract** - During this session we will trial a variety of ideas and resources developed to engage pupils with their learning. Be prepared to move, laugh and enjoy some activities, but also consider why they are beneficial to our pupils

**About the speaker:** I am an experienced classroom teacher and head of department. I have worked in grammar schools, those requiring improvement and those with 50% EAL pupils. I have delivered training all around the world. My aim is to make pupils enjoy and understand their maths.

## Rachael Horsman

### Session 4 11.55-12.55

Title of Session: *tbc*

**Abstract** - tbc

**About the speaker:** I am an experienced classroom teacher and head of department. I have worked in grammar schools, those requiring improvement and those with 50% EAL pupils. I have delivered training all around the world. My aim is to make pupils enjoy and understand their maths.

## Ray Huntley

### Session 7 09.00-10.00

Title of Session: *A fresh slice of Pie?*

**Abstract** - In this session, Ray looks back into MA archives and explores some problems from early issues of Mathematical Pie. He will offer updated versions of old problems and consider how this great resource might be employed today, linking to the National Curriculum fluency, reasoning and problem solving.

**About the speaker** - Ray spent 18 years teaching and leading in several primary schools in Essex and Melbourne. He now lectures on ITE programmes for primary teachers. Ray has been a member of the MA for many years and enjoys sharing maths problems old and new.

## Andrew Jeffrey

### Session 3 10.45-11.45

Title of Session: *Adventures in Six-Land*

**Abstract** - The 2014 Curriculum requires children to have mastered place-value by the end of Y2. Yet surprisingly few teachers have ever studied bases other than base 10. This fun hands-on workshop will help teachers to both understand the benefits and teach all number bases to children from Reception age upwards, so that they will have a deep understanding of their own number system.

**About the speaker** -

## Alison Kiddle

### Session 4 11.55-12.55

Title of Session: *tbc*

**Abstract** - tbc

**About the speaker** - : tbc

## Philipp Legner

### Session 3 10.45-11.45 & Session 4 11.55-12.55 & Session 7 09.00-10.00

Title of Session: *The Virtual Classroom*

**Abstract** - Journey into the future of digital education, where textbooks, exercises and the curriculum adapt seamlessly to every individual student. We will explore cutting-edge prototypes and discover the challenges and opportunities for education, offered by the internet and artificial intelligence.

**About the speaker** - : Philipp has studied Mathematics at Cambridge University and Mathematics Education at the Institute of Education in London. He has worked at Wolfram Research, Touch Press and the BBC, and is currently a software developer at Bloomberg. Philipp is also the creator of the award winning mathematics outreach website *Mathigon*.

## Stephen Lyon

### Session 6 16.40-17.40

Title of Session: ***Using Resources to Develop Fluency and Understanding***

**Abstract** - Join me on a journey through the National STEM centre's eLibrary to discover mathematics resources freely available that can be used in the classroom to develop fluency and understanding. Meet some old favourites as well as a wealth of new mathematics resources; stopping off to try some resources yourself.

**About the speaker** - Stephen Lyon taught mathematics for over 20 years in a variety of secondary schools, to all abilities and age ranges up to further mathematics. After being head of mathematics at a school in the first cohort of mathematics and computing schools he became an advanced skills teacher working in primary and secondary schools in York. For the last three years he has been mathematics specialist at the National STEM centre.

## Adam McBride

### Session 4 11.55-12.55 & Session 8 10.10-11.10

Title of Session: ***The Eternal Triangle***

**Abstract** The geometry of the humble triangle contains an almost endless supply of beautiful results. We shall look at a few such results, some familiar and others perhaps less so.

**About the speaker** - Past President of the MA and of the Edinburgh Mathematical Society. Past Chairman of the Scottish Mathematical Council and the British Mathematical Olympiad Committee. Currently Chair of MA Council and Treasurer (formerly Vice-Chairman) of the United Kingdom Mathematics Trust. From 01/10/11 Adam became Emeritus Professor.

## Niamh McMahon

### Session 6 16.40-17.40

Title of Session: ***tbc***

**Abstract** - tbc

**About the speaker** -tbc.

## Peter McOwan

### Session 3 10.45-11.45 & Session 7 09.00-10.00

Title of Session: ***Teaching maths using magic***

**Abstract** - This workshop will demonstrate how simple, self-working magic tricks can be used to teach basic mathematical and computer science principles.

**About the speaker** - Peter is a of computer science at QMUL researching robotics and artificial intelligence. He is also actively involved in outreach around maths and its applications and was awarded a National Teaching Fellowship in 2008.

## Debbie Morgan

### Session 3 10.45-11.45

Title of Session: ***Mastering Mathematics – The Implications of a Mastery National Curriculum***

**Abstract** - The National Curriculum states that “*the expectation is that the majority of pupils will move through the programmes of study at broadly the same pace*” This has implications for planning, teaching and assessment. This session will explore the implications, offering practical strategies to develop mastery and meet the higher expectations set within the curriculum.

**About the speaker** - Debbie holds a national role as Director of Primary Mathematics at the National Centre for Excellence in teaching mathematics. She has previous experience as a Primary teacher, Headteacher, Mathematics Advisor, Senior Lecturer in Mathematics Education and Director of a Mathematics Specialist Teacher Programme. Her current responsibilities include providing advice and expertise to the Department for Education to support the Implementation of the New Primary National Curriculum for Mathematics and she is a regular keynote speaker at conferences across the country.

## Cherri Moseley

### Session 2 16.40-17.40

Title of Session: ***What is Big Maths?***

**Abstract** - What is Big Maths? Often commented upon in a TTS forum and not always positively, come along and find out what it is and how a daily CLIC session (ACLIC in the Foundation Stage) can help your pupils to develop fluency and reasoning in mathematics.

**About the speaker** - Cherri Moseley is an Independent Primary Mathematics Consultant and author. She is an Accredited Numicon Consultant, Big Maths and Little Big Maths consultant, online trainer for Pearsons and author (or one of the authors) of several well-known mathematics systems, schemes and books.

## Stuart Naylor

### Session 1 15.30-16.30 & Session 6 16.40-17.40

Title of Session: ***Maximising engagement in mathematics***

**Abstract** - Does engagement in mathematics matter, or is mathematics supposed to be tedious for learners? Is dull and boring teaching the best way to prepare for dull and boring tests? This workshop presents a range of quick, simple and effective strategies that can make learning more engaging, lessons more enjoyable and teaching more inspiring.

**About the speaker** - Stuart Naylor has extensive experience as a classroom teacher, teacher educator, researcher, writer, publisher, consultant and CPD provider. He is well known, with Brenda Keogh, as the creator of Concept Cartoons and Active Assessment publications. He has a reputation for innovative publications, thought-provoking professional development and creative ways of enhancing teaching, learning and assessment in classrooms.

## Peter M. Neumann

### Session 2 16.40-17.40 & Session 4 11.55-12.55

Title of Session: ***Words and their Wonderful Ways***

**Abstract** 'Words and their Wonderful Ways' is the title of a masterclass designed for UKMT Mathematical Circles (Y10 students). It is intended to bridge the gap between Y10 knowledge and an area of current research in pure mathematics. My ambition here is to adapt it as an interactive session for schoolteachers.

**About the speaker** - Peter taught for 45 years in The Queen's College, Oxford and in the University of Oxford Department of Mathematics. Since retiring in 2008 he has continued teaching, and he has been heavily involved in various UKMT activities. His research areas are algebra (group theory in particular) and history of algebra (particularly 19<sup>th</sup> Century history). He is currently the MA's President Designate.

## Liz Newbon

### Session 4 11.55-12.55

Title of Session: ***Everyone Counts: using real-life data to enhance maths with 8-12 year olds***

**Abstract** - Explore opportunities for using global citizenship to promote real-life learning in maths. Oxfam's new classroom resource, *Everyone Counts*, brings the maths curriculum to life by comparing children's experiences around the world. Pupils will develop skills and understanding of topics such as time and data handling.

**About the speaker** - Oxfam works to empower young people to be active global citizens. We promote education that helps young people understand the global issues that affect their lives and take action towards a more just and sustainable world. We support teachers through resources, teacher training and partnership work.

## Jennie Pennant

### Session 4 11.55-12.55

Title of Session: ***Problem Solving and Reasoning at the Centre of Every Classroom***

**Abstract** - This practical session will combine theory with doing some mathematics together. NRICH will offer a variety of problem-solving contexts that are easily accessible to a range of learners and encourage reasoning. These will include short tasks that promote fluency and the use of problem-solving skills, plus more sustained investigations.

**About the speaker** – tbc

## Chris Pritchard

### Session 2 16.40-17.40 & Session 5 15.30-16.30

Title of Session: ***Ten Ideas for Teaching Area***

**Abstract** - Both primary and secondary teachers help youngsters to understand area, the concept and the methods. In this session I will endeavour to provide some new insights, approaches and materials, some of which will be taken from a book to be published in 2015. I aim to have something different from what appears in the textbooks for teaching area from Y6 upwards, and with plenty of problem solving incorporated.

**About the speaker** - Chris Pritchard is the Secretary of the MA and Chair of the Scottish Mathematical Council. He is currently working on the first of two books on area arising from his series 'A square peg in a round hole' in *Mathematics in School*, a journal he also coedits.

## Peter Ransom

### Session 6 16.40-17.40

Title of Session: ***Cross-curricular mathematics***

**Abstract** - An interactive session touching on some cross-curricular work in mathematics with science, history, geography and some design technology. This session is more suited to key stage 2 and although it has been done with mixed attainment pupils it is probably more suited to higher attainers. CD-ROM of materials provided.

**About the speaker** - Peter is the MA's Immediate Past President. He spent nearly 40 years teaching in state secondary schools and now does as he pleases (when his wife allows him). He is involved with the Princes Teaching Institute and many professional associations. Peter probably has more period costumes than normal clothes.

## Peter Ransom

### Session 8 10.10-11.10

Title of Session: ***Isaac Newton: contains awe***

**Abstract** - Sir Isaac will deliver an interactive session touching on some of his more obscure experiments. He will tolerate anyone who is willing to try some mathematics. He will attempt to show how STEM work can enrich mathematics, linking this in with the latest Royal Society's Vision report.

## Liz Russell

### Session 1 15.30-16.30 & Session 8 10.10-11.10

Title of Session: ***Who kidnapped Legohead?***

**Abstract** - Come and solve the Mystery of who kidnapped Legohead. I believe that we have to help our students to build resilience to solve mathematical problems and having a story can help. Take away ideas and make your own mystery. This has been tested with students from Y7 to Y10 and all enjoyed it.

**About the speaker**

## Jim Simons

### Session 1 15.30-16.30

Title of Session: ***Football are More Interesting than Football***

**Abstract** - I tried to watch the Football World Cup, but was more interested in the pattern on the balls... Meet the 17 spherical symmetry patterns, and the 17 "wallpaper patterns" in the plane. See the Magic Theorem, which enumerates these patterns, and learn about orbifolds, which explain the Magic Theorem.



**About the speaker** After 35 years working as a professional mathematician at GCHQ, in his retirement, Jim is a private tutor for maths and physics A level, and a member of the MA's Teaching and Membership committees.

### Tabitha Steel and Nathan Barker    **Session 1 15.30-16.30 & Session 5 15.30-16.30**

Title of Session:     **Cambridge Mathematics Education Project**

**Abstract** - Currently in the development phase, the project will provide innovative online resources to help support and inspire teachers and students of A-level mathematics. The aim is to help to make sixth-form mathematics a rich, coherent and stimulating experience for students and teachers. Join us to get a preview of our website, and to work together on some of our new A-level resources

**About the speaker** –

### Sidney Tyrrell   **Session 3 10.45-11.45 & Session 7 09.00-10.00**

Title of Session:     **Statistics – Grasping the concepts**

**Abstract** - This is about grasping the concepts and thinking statistically. Simple bite sized practical ideas which I have found helpful for teaching statistical concepts to students who find statistics boring, hard or both. Ideas and a CD of resources, links to web based resources, useful real data sets, and Excel spreadsheets.

**About the speaker**

A National Teaching Fellow experienced in teaching statistics to non-mathematicians.

### Fran Watson   **Session 5 15.30-16.30**

Title of Session:     **tbc**

**Abstract** - tbc

**About the speaker** - tbc

### Geoff Wake and Colin Foster                         **Session 2 16.40-17.40 & Session 5 15.30-16.30**

Title of Session:     **Lessons for Mathematical Problem Solving**

**Abstract** - This session will present video from a Nuffield-funded project in which clusters of schools have used lesson study for mathematical problem solving. Participants will have an opportunity to try some of the tasks that have been used and comment on a developing toolkit that supports problem-solving in the classroom.

**About the speaker** - Geoff Wake works in Mathematics Education at the University of Nottingham. His recent work is focused on supporting and researching teacher professional development in teaching inquiry skills, problem solving and connecting maths to the world of work.