

## Further Mathematics in 2011

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### IMPORTANT DATES

#### National Meetings for Area Coordinators

- Summer 2011, 1st July 2011, Keele.
- Autumn 2011, 13th - 14th September 2011, Warwick.

Some really excellent news is that the FMSP's funding from the DfE has been extended, which means we can continue to build on our work to ensure that all students have access to study Further Mathematics.

The FMSP will continue to:

- Promote the study of mathematics beyond GCSE-level
- Provide specialised professional development to enable more A level Mathematics teachers to teach Further Mathematics
- Provide expert tuition for students when it cannot be provided by their own school or college
- Support schools and colleges to provide Further Mathematics tuition themselves, or by collaborating with other schools and colleges.

The proportion of state-funded schools and colleges with students taking A level Mathematics that also have students taking A level Further Mathematics continues to grow. In 2010 it was 62.5%, up from 60% in 2009; in 2005 the figure was just 40%. The FMSP will continue its work to increase the uptake of Further Mathematics, including specific support for schools and colleges with students from the most disadvantaged backgrounds. See page 2 for details of four highly successful 'Access to Further Mathematics' events held this March, aimed at helping schools and colleges offer Further Mathematics.

Professional development, both through face-to-face events across the country and delivered live over the internet, is vital for the long-term provision of Further Mathematics. Developments in Live Online Professional Development are especially encouraging – see page 4.

An important new initiative to help schools and colleges to offer Further Mathematics, 'Live Interactive Lectures for Further Mathematics' is discussed on page 3. This enables schools and colleges to offer Further Mathematics through a blend of live online tuition from expert FMSP tutors, combined with local face-to-face support from teachers in students' own schools and colleges. It is hoped that this support will help more schools and colleges to offer Further Mathematics.

A great success this year for promoting and enriching mathematics in schools and colleges was the Senior Team Mathematics Challenge. Almost 4000 students took part, from nearly 1000 schools and colleges. The competition is only in its 4<sup>th</sup> year but it is already an established national event, engaging young people from schools and colleges across the country in challenging mathematical problem-solving. A report on this year's final appears on page 3.

The FMSP's most recent evaluation report has just been completed and can be downloaded from the FMSP website at: [www.furthermaths.org.uk](http://www.furthermaths.org.uk).

This is my last FMSP newsletter. Following my appointment as MEI's Chief Executive, and confirmation of continued funding for the FMSP, I am stepping down as FMSP Programme Leader. After a competitive selection process, Dr Richard Lissaman has been appointed as the new Programme Leader from 1 May. Through his role as FMSP Student Support Leader Richard has been a key factor in the FMSP's success so far and I'm sure he will do an excellent job.



Richard Lissaman

*Charlie Stripp, MEI Chief Executive*

## Teaching Further Mathematics

Teaching Further Mathematics (TFM) provides an extensive course of professional development for teachers who have some experience of teaching A level Mathematics and who are starting to, or may wish to, teach Further Mathematics at some point in the near future. The course covers the Pure Mathematics content of all English Further Mathematics specifications offering participants the opportunity to study the content of A level Further Pure modules from a teaching and learning perspective. The emphasis is very much on expanding the participants' mathematical horizons and giving them a deeper understanding of the links within mathematics.



TFM can be studied alongside research units to gain a Postgraduate Certificate in Teaching and Learning Further Mathematics through the University of Warwick Institute of Education. Completion of the PG Cert counts for 60 points towards a Masters degree in Education.

TFM 2011 is now taking applications. For more information or to complete the online application form please go to [www.furthermaths.org.uk/teacher\\_area/tfm.php](http://www.furthermaths.org.uk/teacher_area/tfm.php)

*Sue de Pomerai, Deputy Programme Leader and Teacher Support Leader*

In March the FMSP ran four 'Access to Further Mathematics' events, held in Manchester, Warwick, York and London. The events were aimed at mathematics teachers and school/college senior managers who are interested in developing Further Mathematics provision within their school or college. They provided detailed advice on how schools and colleges can offer AS/A level Further Mathematics and the benefits to students, staff and schools/colleges as a whole of doing so. Sessions featured speakers from schools that have recently introduced FM, describing how they had achieved this, speakers from universities, explaining the advantages to students of studying FM, and FMSP staff giving advice on promoting and teaching FM and demonstrating the resources and support that are available.

All the events were fully booked and feedback was universally positive, with one teacher describing the event as 'Inspirational'.

Other comments from participants:

*"Gave me the opportunity to get 'the bigger picture'." (senior leader)*

*"Motivational" (senior leader)*

*"Lots of ideas and suggestions that I can use. Good information for a person new to A level maths/further maths." (teacher)*

*"Exceeded my expectation and provided much information." (teacher)*

*"Excellent. I am really pleased that I came." (teacher)*

*"It was particularly useful to hear how desirable Further Maths is in regard to university entrance and also figures about numbers of schools now taking FM." (teacher)*

*Sue de Pomerai, Deputy Programme Leader and Teacher Support Leader*



Leading up to the summer examinations the FMSP will be running more than 50 revision days to support AS/A Level Mathematics and Further Mathematics. These will be taking place across England, mainly hosted by universities. Details can be found on the Revision Days Page of the FMSP website: [www.furthermaths.org.uk/revision.php](http://www.furthermaths.org.uk/revision.php)

In addition to these revision days there will also be live online revision sessions. These usually last around two hours and are delivered via a web-based learning environment. Details of these can be found at: [www.furthermaths.org.uk/onlinerevision.php](http://www.furthermaths.org.uk/onlinerevision.php)

There were over 7000 viewings of the recordings of live online revision sessions from the December 2010/January 2011 programme. This extends their reach significantly compared to when such recordings were not available.

*Stephen Lee, Data Analyst / Web Manager*

## 'Access to Further Mathematics' events

## Revision Events

## FMSP/UKMT Senior Team Mathematics Challenge Final



On February 2<sup>nd</sup> at the Camden Centre, London, 65 teams competed in the 2010/11 FMSP/UKMT STMC national final. The teams had qualified from regional heats involving 973 schools and colleges from across the country. The overall winner of the competition was the team from Harrow School (pictured below left). Second place went to Colchester Royal Grammar School. There was a three-way tie for third place. During the day there was also a poster competition, won by North London Collegiate (pictured below right). Prizes were awarded by Karen Fitzgerald from the event sponsor, Hewlett Packard.

*Richard Lissaman, Programme Leader*



*Photographs from the FMSP/UKMT Final are courtesy of Chris Saker.*

## Live Interactive Lectures for Further Mathematics

For 2011-12 the FMSP is planning a new type of live online support for FM in schools and colleges. For a range of modules and specifications the FMSP will provide a series of live interactive lectures, which students can access from any computer connected to the internet. These will take place approximately fortnightly and introduce all the main content for a particular module. Typically there will be around 7-8 sessions for applied modules and 10-12 sessions for FP1 and FP2. Attendees will be given opportunities to interact during the sessions via polling, instant messaging and via sharing software. Attendees will also receive specially written resources to accompany the sessions.

The intention is that schools/colleges will provide teaching sessions between the lectures, which follow-up and build upon their content. This means that the teaching sessions can focus on consolidation and deeper exploration of ideas, with the key initial ideas having been introduced during the lectures. We think that blending the introduction of ideas via live online sessions with further investigation in class time will provide a powerful and efficient way to support students studying FM.

The FMSP is currently reviewing the fee structure for this support. The intention is that this will provide a good value option to schools/colleges wishing to offer their students more support with FM than they are currently able to, or to schools/colleges who are new to teaching a particular module, and would benefit from the input of an experienced practitioner. The local teacher supporting the students is welcome to attend the live online sessions or view recordings of them.

The package of support includes:

- Access to the series of interactive lectures for students and their local teachers.
- Access to the Integral online resources for the modules covered for students and their local teachers, including records of students' performance in the online tests.
- Worksheets designed to provide immediate follow-up to the live online sessions.
- Worksheets suitable for use in regular teaching sessions to cover material from the lectures in more depth.
- Immediate reports to teachers following the live online sessions on the attendance of their students.

If you would like more information about FMSP Live Interactive Lectures for FM then please e-mail Tom Button: [tombutton@furthermaths.org.uk](mailto:tombutton@furthermaths.org.uk)

*Richard Lissaman, Programme Leader*

## Live Online Professional Development

An increasing number of teachers are accessing professional development online. In the autumn term a total of sixty teachers joined one of ten Live Online Professional Development (LOPD) courses, including courses in 'STEP Support' and 'Use of ICT in A level Mathematics'. Normally no more than 8 teachers take part in each course to ensure that all have the opportunity to interact, discuss and ask questions. More than 50 teachers are currently taking courses, which cover a wide range of modules including higher application modules such as Decision 2 and Mechanics 3. The increasing demand for online professional development is supported by twelve experienced online tutors who collectively offer expertise in all Maths and FM modules.

We have also offered teachers free access to live online tuition sessions alongside FM students studying Numerical Methods through the FMSP. Over 20 teachers have taken advantage of this; some have attended the live sessions while some have opted to access recordings.

*"The expertise of the instructor was exceptional."*

*"This course gave me the confidence in my own abilities as an A level teacher."*

*"A great opportunity to engage in maths with other professionals."*

*"Thank you for providing this type of CPD, which is not only convenient but very tailored to my own individual needs."*

*"The course allows you the time to study the modules, which in an otherwise crowded day we would never put aside for doing the bit we enjoy - 'doing maths'."*

*"I found that the course helped me to increase my understanding of the teaching of Decision maths. It has vastly improved my confidence, I now feel ready to teach this subject."*

*"The concept and use of the virtual classroom is a fantastic way to make valuable resources available to both teachers and students. Further Maths is thus made more accessible. There is no way such a course could be run in one area and if it were travelling would take time. My confidence in using the technology (microphone, text writing, emoticons and writing on the electronic whiteboard) has increased tremendously over the course. The tutors are patient, friendly and approachable."*

The screenshot displays a virtual classroom interface. On the left, a 'Participants' list shows eight users, with 'Participant#2 (Moderator)' highlighted. Below this is a 'Chat' window with a message history and an 'Instant messaging' input field. At the bottom left, there is an 'Audio' section with a microphone icon and a volume slider. The main area is a 'Whiteboard - Main Room (Scaled 81%)' displaying a slide titled 'Displacement components'. The slide contains the equations  $x = 20t \cos 60^\circ$  and  $y = 20t \sin 60^\circ - 5t^2$ . A green thought bubble contains the text: 'From these we need to find an equation just involving y and x... have a go on your own slide'. Below the equations, handwritten notes show  $x = 10t$  and  $y = 10\sqrt{3}t - 5t^2$ . A circle around  $t = \frac{x}{10}$  has arrows pointing to the equations. A yellow box at the bottom right of the whiteboard area is labeled 'Shared interactive white board'.

The screenshot above shows features of the online learning environment used for LOPD.

Since 2008 over 250 teachers have accessed one or more of our LOPD courses, taking advantage of this innovative and flexible approach to CPD. It is now possible for groups of teachers to negotiate and commission bespoke courses at times and dates that are mutually convenient. Full details and contact information can be found at:

[www.furthermaths.org.uk/teacher\\_area/rpd.php](http://www.furthermaths.org.uk/teacher_area/rpd.php)

Sue de Pomerai and Sharon Tripconey, Deputy Programme Leader and Teacher Support Leader/Assistant



The Further Mathematics Support Programme (FMSP) Wales was launched in July 2010 and more than 70 schools in Wales (about 30% of all state maintained secondary schools) have registered with the Programme and thus have access to the extensive online resources within MEI's Integral site.

Funded by the Welsh Assembly Government, FMSP Wales offers tuition, advice and guidance, as well as access to online resources to support the teaching of FM. The Programme is currently in a pilot developmental phase (from September 2010 to July 2013) and tuition is only offered in South West Wales (Swansea, Neath Port Talbot, Carmarthenshire and Pembrokeshire). All schools and colleges in Wales can, however, register with FMSP Wales, by going to [www.furthermaths.org.uk/Eregister.php](http://www.furthermaths.org.uk/Eregister.php).

In South West Wales, the FMSP Wales aims to draw together schools/colleges, universities and local authorities to support existing teaching of AS/A level FM, and to encourage more schools and colleges to make FM tuition available to their students, either 'in house' or through tuition provided via the FMSP Wales.

Wales Education Minister Leighton Andrews has greatly welcomed the development of the programme:

*"It's encouraging that over 50 schools have already joined the programme and are making use of resources for Further Pure, Mechanics and Statistics. I'm sure the programme can enrich the educational experience for pupils in Wales. Through the online resources and a range of other support, this programme will provide opportunities for more young people in Wales to pursue studies in Further Mathematics".* See: <http://bit.ly/FMSPWalesQuote>

The FMSP Wales aims to ensure that students, parents, teachers, schools/colleges and universities are aware of the benefits of studying FM and the support that the FMSP Wales can provide. A letter detailing such benefits has already been sent to all schools/colleges in the pilot area. Leaflets with useful information are also available, in both English and Welsh, from the FMSP Wales.

More than 500 Year 11 pupils in the pilot area took part in 'Careers in Mathematics' talks between January and March 2011. These talks were delivered in schools - students were shown various STEM websites with useful tips on how to choose a university/course and make informed A level choices. More Maths Grads in a Box resources were very helpful. Typical comments from students were *"There is more Maths in Engineering than I thought!"* or *"I did not know so many professions require Maths."*

Plans for the rest of this academic year include more revision sessions in Further Pure and Applied Mathematics, plus online training for teachers interested in delivering FM using an online learning environment as part of a local consortium. The concept of online tuition is new to the schools in Wales but could help to minimize the time/cost of transport when moving students between schools.

Gowerton Comprehensive was the first school to apply to FMSP Wales for tuition for a student, Jonathon Mateo. Jonathon says:

*"When I was told that I need to take Further Mathematics at least AS level I was not sure what to do as my school currently does not offer it. I expressed my concerns to my Maths teacher at school and she suggested the FMSP and then got in touch with them. The process was extremely quick, and I would like to thank everyone involved in that process, my teacher, Mrs Parsons and my new tutor and of course my school, Gowerton Comprehensive. I now meet my FMSP Wales tutor every two weeks. It's very different from A level Maths as a lot of work has to be done at home and in spare time, however if you enjoy Maths and want to do well, this is a small sacrifice!"*

Jonathon is planning to study with the FMSP Wales next year as well.

We are looking forward to supporting more schools and colleges to offer FM, helping their students to pursue degree courses and careers in scientific and technological areas.

Sofya Lyakhova, FMSP Wales Programme Leader/Senior Tutor



## News and events from the FMSP Regions

As well as providing Further Mathematics tuition to hundreds of students each year the FMSP Area Coordinators in their regions engage in many other activities to foster interest and provide training in mathematics. Details of just a small number of these can be seen on these two pages.

### **SOUTH WEST**

#### **Continuing Professional Development**

The Plymouth Further Mathematics Knowledge Network (FMKN) was set up at the beginning of February 2011 and has had one meeting to date.

The basis of the FMKN is to promote and enhance the teaching and learning of Further Mathematics and the first meeting started off with establishing the different experiences of teaching FM by those who attended. This was very representative of the local area, some with many years experience, some having taught elements of FM for a year or two, whilst others had never taught FM previously but were anticipating teaching it in the very near future.

Then the practical activities started. The first demonstration was an activity based on the idea of water divining and using the Binomial distribution to test whether there was any validity in rods being able to find water. This is generally in Statistics 1, which some students may take as one of their FM modules. Volunteers had to decide which one of five tables had a glass of water hidden underneath. To do this, water divining rods (or a metal coat hanger cut in half and bent) were used and the volunteers had to walk on top of the tables and decide which table the water was under. This was done by each volunteer independently, with the others remaining outside the room. Although the results did not prove conclusive at a 5% significance level, much fun was had.

Another practical activity, this time directed at finding the centre of mass of a person, was then demonstrated. However before this, a can of coke and a bottle of wine were passed around for all to try and balance. The coke was drunk, but the wine bottle was empty. A volunteer who had to remain perfectly still throughout (a very easy job for some students) lay on a solid plank. Measurements of mass were taken from each end of the plank, and using moments, the position of the centre of mass was established. The plank, complete with person was then lifted slightly so that two small cubes could be positioned under the calculated centre of mass; all support was then taken away, leaving the person balancing solely on two small cubes.



Discussions regarding the use in the classroom and the benefits experienced by students were held.

Practical activities were videoed, with links subsequently sent out.

Finally, teachers planned to look for opportunities to trial the activities demonstrated and report back at the next meeting. The next meeting would also include demonstrations on using Autograph for teaching transformations and aspects of Decision Maths.



*Ted Graham and Jo Sibley, Area Coordinators - South West*

### **YORKSHIRE AND THE HUMBER** **Engaging Students with Statistics**

This course for teachers was postponed from December because of the appalling weather, but went ahead in February. Stella Dudzic (MEI Curriculum Programme Leader) was the presenter. The event was lively - the photo shows delegates creating a Venn diagram in the corridor!

Twenty three teachers attended and some comments on the best aspects were:

*"Thinking outside the box, rather than just what's on the syllabus."*

*"Broad range of topics covered and excellent ways of introducing new concepts to pupils."*

*Jean Smith and Jane West, Area Coordinators - Yorkshire and the Humber*



### **SOUTH EAST**

#### **Sixth Form Business Maths Challenge**

In the picturesque setting of Bearwood College, teams from eight Berkshire Schools competed for the elegant Business Maths Challenge trophy. Each group tackled a problem set by local businesses: Thatcham, Coutts and Detica, and presented their solutions to the rest of the groups. Marks were awarded for teamwork, accuracy and originality. This year the top prize went to the team from Edgbarrow School, Crowthorne.

*Jeff Trim, Area Coordinator - South East*

**NORTH WEST****KS4 Enrichment Days**

Following on from last year's very successful events, described fully in the previous issue of this newsletter, we are very pleased to be continuing to expand this very important aspect of our work. Recent developments include trialling work on a project in the North West entitled 'Sixth Form Maths: What's In It For Me?' The aim of this initiative is to introduce students to some of the material they are likely to encounter in Pure and Applied modules in Mathematics and Further Mathematics utilising existing GCSE knowledge to give an insight into 'what comes next'. For example, a recently-developed task involves students (and many teachers, at conferences and on CPD days) finding the centre of mass of a number of objects in different ways, learning why the information is so useful and practical, and finally constructing a balancing cardboard fish using only scissors, compasses and maths. It's great!

*Abi Bown, Area Coordinator - North West*

**SOUTH EAST****Photo Competition**

The FMSP in Kent ran a photo competition during August 2010. Students were asked to submit a photo with a mathematical theme and explanation. Simon Singh judged the entries and the winner was Hannah Evans of Tonbridge Grammar School with her photo of multiple reflections of light creating a ring of guards.

*Gill Buque, Area Coordinator - South East*

**EAST MIDLANDS**

### Working with local Heritage Sites to enthuse and inspire young people to take an interest in Mathematics and the STEM subjects.

When we attempt to organise enhancement events for students in schools we need to get content, level of difficulty and session structure all correct if we are to be successful. In addition it is so important to have an attractive environment in which to run the sessions and this is where local heritage sites can provide a stimulating setting for both students and teachers.

Over the past few months a series of events have been organised at Snibston Discovery Museum, Coalville, near Loughborough, Leicestershire with the following aim:

Working with Loughborough University Student Outreach and Recruitment Department (SOAR) and the Further Mathematics Support Programme, Snibston Discovery Museum is offering practical and engaging Mathematics, Science and Engineering Workshops aimed at enthusing young people to work hard at their school studies and to begin to think carefully about the importance of the STEM subjects.

Snibston is on the site of a former mine which now hosts a vast array of interesting galleries and a substantial outdoor space which is so attractive to young people.

There is a large number of interactive displays which entice students to experiment and, hopefully, begin to think about the principles behind the activity.

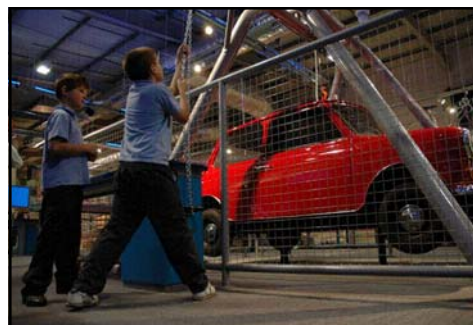
Five sessions have been organised for a range of ages over recent months:

Monday 15 November 2010, **Codes and Ciphers/Packaging workshop** (75 Year 8 students), Monday 14 February 2011 **"I am a Scientist – this is what I do" conference** (75 Year 9 students), Tuesday 8 March 2011 **"I am an Engineer – this is what I do" conference** (100 Year 12 students), Thursday 24 March 2011 **"Maths and Sport" workshop** (75 Year 10 students) and Wednesday 30 March **"The Great Packaging Challenge"** (75 Year 9 students).

Each event was split into manageable periods of time with the emphasis being on interactive activities for the students. In addition students and teachers were invited to visit Snibston's Galleries during lunchtime which is always most interesting and enjoyable activity.

This has proved to be an exciting and worthwhile series of workshops. Working together with the various agencies has enabled us to plan and execute a wide range of activities aimed at promoting the STEM agenda. We recommend this approach - using an attractive heritage site to host the events has been very successful.

*Rod Bond, Area Coordinator - East Midlands*



# Recreational Mathematics

In the last FMSP newsletter we included a nice problem on 'Tom's buttons'.

## Question:

Tom's shirt has 8 buttons in a vertical line with a spacing of one unit between each adjacent pair. He'd normally button them up in the obvious way, starting at the top and fastening them one at a time until he reached the bottom and so, from start to finish, his hands move a distance of 7 units.

Clearly 7 units is the minimum distance his hands could move, but what is the maximum? Using the order shown, the distance travelled is 31 units. Is this the maximum?

And what is the maximum for an  $n$ -buttoned shirt?

## Solution:

Yes, 31 is the maximum, with generalisation to  $\frac{1}{2}n^2 - 1$ . (A blog post on this can be seen at: [http://bit.ly/fmsp\\_button](http://bit.ly/fmsp_button))

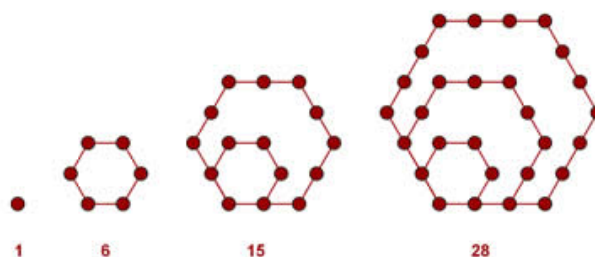
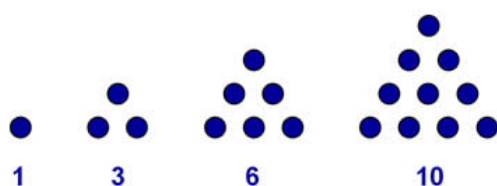
## This issue we give two problems:

- 1) Two prime numbers when added together give 999. How many such pairs of primes exist?
- 2) Not all triangular numbers are perfect, but...

The first two perfect numbers are 6 and 28

A number is perfect if it is equal to the sum of its factors other than itself:

e.g.  $6 = 1 + 2 + 3$  and  $28 = 1 + 2 + 4 + 7 + 14$ .



The first four triangular numbers are 1, 3, 6, 10. Both 6 and 28 are triangular numbers. Are all perfect numbers triangular?

The first four hexagonal numbers are 1, 6, 15, 28. Both 6 and 28 are hexagonal numbers. Are all perfect numbers hexagonal?

6  
2  
4  
8  
1  
3  
7  
5

## Contact details

### Programme Leader

Richard Lissaman

[richardlissaman@furthermaths.org.uk](mailto:richardlissaman@furthermaths.org.uk)

### Enquiries

Please visit our website for details on individuals or direct enquiries to:

[enquiries@furthermaths.org.uk](mailto:enquiries@furthermaths.org.uk)

### MEI Office,

Monckton House,

Epsom Centre,

White Horse Business Park,

Trowbridge,

BA14 0XG

Phone: 01225 774777

FAX: 01225 775755

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Let Maths take you Further...