



Welcome to Issue 37 of the Secondary Magazine. Are you enjoying the summer? As we are preparing for the end of term it is time to reflect upon the achievements of the academic year and start to plan for September. Perhaps you will find some 'things to do' to help your planning, or perhaps you will be inspired by our interviewee. Happy reading.

Contents

From the editor

Isn't it fantastic when the librarian comes to you with money to spend for the school library. Here are suggestions for two very different books which earn their places on the shelves.

Up2d8 Maths

The fortnightly Up2d8 Maths resources explore a range of mathematical themes in a topical context. A huge jellyfish shape recently appeared in a field of crops in Oxfordshire – who did it and how did they do it? This Up2d8 resource uses the context of crop circles to explore geometric reasoning and construction on a grand scale.

The Interview – Andrew Lovett

Have you ever met a man with a passion for rugby and mathematics? In this issue, a headteacher in Devon talks about his enjoyment of mathematics and the inspiration provided by Martin Johnson.

Focus on...square numbers

Did you know that a square number can only end with digits 00, 1, 4, 6, 9 or 25? This and other interesting features of square numbers are explored in this Focus on.

An idea for the classroom – Plans and elevations

Do you get some satisfaction from solving difficult problems? This highly addictive computer-based resource invites you to construct a 3D solid based on three different views.

5 things to do

Are you interested in paper folding or beer drinking? ICT or APP? Whatever your habit or acronym, it may be mentioned in our topical list of things to do this summer.

Diary of a subject leader – Real issues in the life of a fictional Subject Leader

How is your department reacting to the developments in Functional Mathematics? Our subject leader shares some thoughts about the place of Functional Mathematics in our mathematics curriculum - and seems strangely cheerful!



From the editor

Isn't it great when your school librarian comes to you and says there is money to spend on books for the mathematics section in the library? And don't you feel inadequate when you can't find anything that would really appeal to teenage mathematicians? So when I find two books in a week that would sit proudly in the library, I feel elated! These two books are very different, but both earn their place on my bookshelves.

The first is a really enchanting novel *The Housekeeper and The Professor* by Yoko Ogawa (ISBN 978-1-846-55250-2). The novel is not about maths, but a love of mathematics is the consuming passion of The Professor in the title. The narrator is a woman hired to be a housekeeper for a retired maths professor. The professor's short term memory only lasts for 80 minutes, so each day he meets his housekeeper and her young son afresh. She quickly learns how the professor copes with his memory loss and is herself inspired to think differently about problem solving and numbers. The result is a charming story about relationships which has mathematics and baseball centre stage. The professor uses quirky mathematical facts and number relationships to break the ice in difficult situations, he also introduced me to a mathematical palindrome:

I PREFER PI

The second book is *The Story of Mathematics* by Anne Rooney (ISBN 078-1-84193-940-7). This book is attractively presented with many colour illustrations, making it appealing and accessible. It is the sort of book that can be read from cover to cover to gain an overall picture of the significant events in the history of mathematics, or just dipped into to find interesting facts and anecdotes. For example: The Greeks disliked irrational numbers to the point, perhaps, of murdering Hippasus for proving their existence. And, Galileo discovered a practical solution to the problem of finding an area under a curve. He would plot his curve, then cut it out and weigh the paper. By comparing the weight with the weight of a piece of paper of known area, he could work out the area under the curve.

There is a wide range of topics which include:

- counting and measuring
- geometry and its roots in Ancient Egypt
- the movement of the planets
- algebra
- the first computers
- chaos theory and fuzzy logic
- set theory.

There are some topics, like the development of the underground system in Sendai, Japan, and the SETI project (Search for extra-terrestrial intelligence) that are governed by mathematical principles and may be of interest to learners. It is useful to be able to set the life and work of great mathematicians into the wider context of mathematical developments, and to contrast the sophistication of mathematical discoveries with other developments of their times.

Have you got some favourite mathematical books? What takes pride of place in your library? Why not tell us about it here...



Up2d8 maths

The fortnightly Up2d8 Maths resources explore a range of mathematical themes in a topical context. The resource is not intended to be a set of instructions but rather a framework which you can personalise to fit your classroom and your learners.

A huge jellyfish shape recently appeared in a field of crops in Oxfordshire – who did it and how did they do it? This Up2d8 resource uses the context of crop circles to explore geometric reasoning and construction on a grand scale.

Students are introduced to the appearance of crop circles through the news story about the jellyfish that appeared in the Oxfordshire field. Using this context, it is possible for students to engage in a range of practical construction activities on paper, in your classroom or on your school field.

This resource is not year group specific and so will need to be read through and possibly adapted before use. The way in which you choose to use the resource will enable your learners to access some of the Key Processes from the Key Stage 3 Programme of Study.

[Download](#) the Up2d8 maths resource - in PowerPoint format.



The Interview

Name: Andrew Lovett

About you: Andrew is headteacher of Tiverton High School, a co-ed 11-16 comprehensive in Devon. After graduating from Leeds and completing a PGCE, he taught in Leicestershire, Cumbria and Grimsby, leading two maths departments. He joined the advisory service in South Humberside before moving to Portsmouth as a maths inspector, where he led the introduction of the NNS. Andrew decided he preferred children to DfES and Ofsted and returned to work in school leadership.

The most recent use of mathematics in your job was... Cutting my deputy head's birthday cake fairly. A more profound recent use however was proving to an HMI who was leading our inspection that our achievement was 'good' rather than 'satisfactory' with the help of some nifty gradients.

Some mathematics that amazed you is... I love fractals, curiously simple and yet gloriously complex, and always beautiful.

Why mathematics? I love knowing why things are the way they are. It makes me feel safe. And the more mathematics you know, the simpler the world gets.

Your favourite/most significant mathematics-related anecdote is... Charles Babbage wrote to the young poet Tennyson: "In your otherwise beautiful poem, one verse reads, 'Every moment dies a man, Every moment one is born.' If this were true, the population of the world would be at a standstill. In truth, the rate of birth is slightly in excess of that of death. I would suggest [that the next edition of your poem should read]: Every moment dies a man, Every moment $1 \frac{1}{16}$ is born."
"Strictly speaking," Babbage added, "the actual figure is so long I cannot get it into a line, but I believe the figure $1 \frac{1}{16}$ will be sufficiently accurate for the purposes of poetry."

A maths joke that makes you laugh is...

1. Q: What's red and invisible? A: No tomatoes
2. Heard about the statistician who always carried a bomb when he flew? ...because he knew the chances of there being TWO bombs

Something else that makes you laugh is... Teenagers. I love being with them, listening to them as they grow.

Your favourite television programme is... Sky Sports Rugby

Your favourite ice-cream flavour is... the flavour isn't important – as long as it's made from real cream not frozen vegetable fat.

Who inspired you? In mathematics teaching, Peter Lacey – adviser, RAMP man, NCC (remember them) subject officer. As a leader, Martin Johnson – Leicester Tigers and England; loyalty, commitment and, if that wasn't enough, the ability to intimidate!

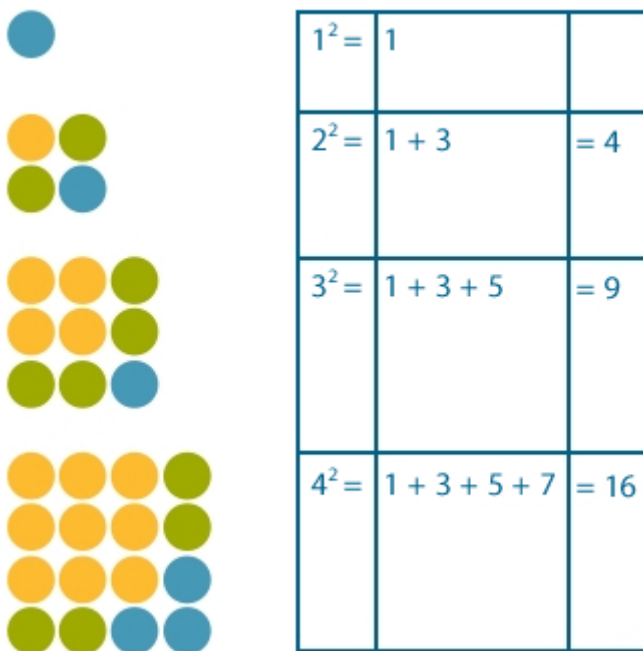
If you weren't doing this job you would... be fairly talentless – I'd have to find another field in which to boss people about.



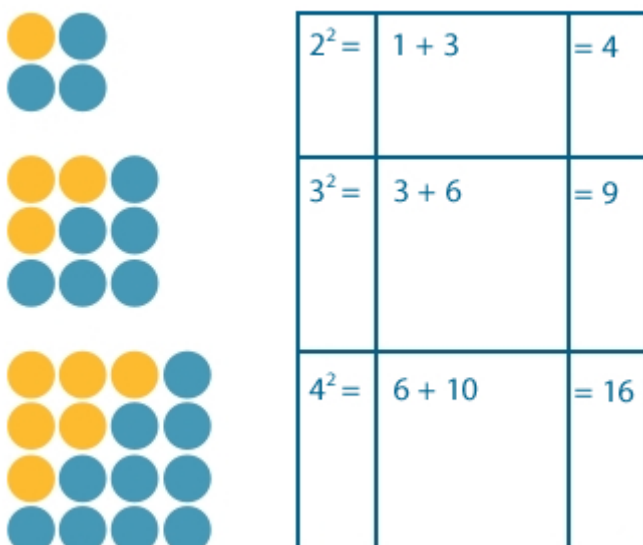
Focus on...square numbers

The n th square number can be found by squaring n and also by summing the odd numbers up to the n th odd number.

An image to help see why summing odd numbers generates a square number can be seen below:



Summing two consecutive triangle numbers also generates a square number:



A square number can only end with digits 00, 1, 4, 6, 9 or 25. To square a number that ends in a 5, multiply (*the digits before the 5*) by (*the digits before the 5 + 1*). This gives all of the digits of the square except for the tens and units column which will be 25. For example, to calculate 85^2 multiply 8 by $(8+1)$ which gives 72. So $85^2 = 7225$.

In trying to prove [Goldbach's Conjecture](#), Chinese mathematician [Chen Jingrun](#) has proved that there always exists a number which is either a prime or the product of two primes between any two consecutive square numbers. This is close to Legendre's conjecture, proposed by [Adrien-Marie Legendre](#), which states that there is a prime number between any two consecutive square numbers. Legendre's theorem is currently unproven and is one of [Landau's Problems](#) from 1912.

As a part of the study of [Waring's Problem](#), it has been shown that every positive integer is the sum of no more than 4 positive squares. [This Java applet](#) will break any integer into its square components.

The smallest square number to contain all of the digits 1 to 9 once is $11826^2 = 139854276$, the largest is $30384^2 = 923187456$.

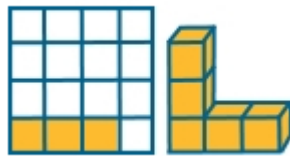
Joseph Madachy, the longtime editor of [Journal of Recreational Mathematics](#), explored numbers that are equal to the sum of the squares of their two "halves" such as:

$$12^2 + 33^2 = 1233$$

$$88^2 + 33^2 = 8833$$

$$10^2 + 100^2 = 10100$$

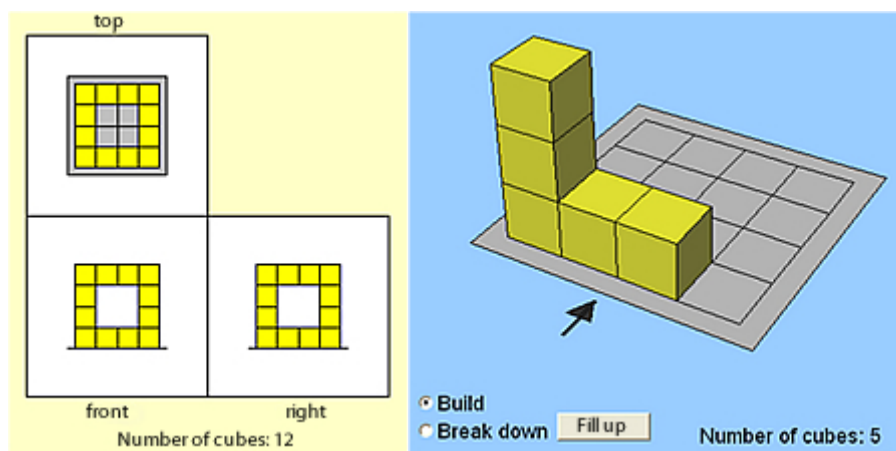
$$588^2 + 2353^2 = 5882353$$



An idea for the classroom – plans and elevations

We have mentioned the excellent resources on [MathsNet](#) in a previous edition but I want to draw attention to a particular feature of the site, recommended by a colleague, which has been driving me mad all week!

This resource provides three views of a 3D shape from the top, front and right. They also provide the tools to enable you to construct the solid on the screen. So far so good, but it also stipulates the total number of cubes that you can use, which was where I came unstuck. My models used far too many cubes so I had to try to eliminate cubes or reconstruct my models to reach the right number.



I must admit that I found it a bit hard to get started on this task so the invitation to watch a possible solution being constructed on YouTube was an excellent way to get going and see the possibilities. The YouTube link is provided on the webpage.

Pupils need to have access to a computer, preferably in pairs, to use this resource: it is excellent for building spatial awareness. There would also be a good opportunity for pupils to talk about how they did the task to give them an opportunity to reflect upon their learning and access the Key Processes. You could ask them:

- did you have a strategy for building the models?
- how did you start? (did you start with an empty sheet and build up the model or start with a 4 x 4 x 4 cube and take blocks away?)
- did you have a picture in your head of the finished model?
- how did the YouTube clips help you?
- how did you help each other?
- how did you check that your model was correct?

Warning – this resource can be dangerously addictive! Enjoy it.



5 things to do this fortnight

- How are your IT skills? At the [Annual TSM \(Technology for Secondary Mathematics\) Workshop](#) for teachers you'll get three days of hands-on practice in Mathematics ICT. The event takes place from 14 - 16 July at Oundle School near Peterborough, and features workshops led by national and international speakers.
- The [9th Annual Institute of Mathematics Pedagogy](#) runs from the 28 - 31 July at Ripon-Cuddesdon College in Oxfordshire. The theme for this event is *Explanation & Proof as Mathematical Story Telling* and will address questions such as:
 - How do we go about producing explanations and proofs?
 - How much do we recall and how much do we re-construct?
 - What is the difference between an explanatory story and a convincing story?
 - How can we help children to become 'story-tellers'?
 - What pedagogical support do they need?

The Institute will be led by John Mason, Malcolm Swan and Anne Watson and will consist of workshops, seminars, readings, reflections and discussions about teaching and learning mathematics.

- Why not set the tone for maths lessons next year at the [2009 British Science Festival](#) which begins early next term at the University of Surrey? The programme includes *Exploring Mathematics with Origami*, an active workshop in which participants learn mathematical ideas through the creative medium of origami, in particular symmetry, proportion, geometry and trigonometry. There are also a number of events organised by the Mathematical Sciences Section:
 - *The Magic of Computer Science*, with Peter McOwan (5 September)
 - *Mathematics and Meltdown: How Financial Systems Collapse* (5 September)
 - *From Flapping Birds to Space Telescopes* (6 September)
 - *Why do journalists love stupid equations?* with Simon Singh (6 September)
 - *Chaos in Climate: An Inconvenient Truth?* with Ian Roulstone and Lucia Elghali (8 September)
 - *Fly Me to the Moon*, with Mark Roberts and Phil Palmer (10 September)
- What are your department priorities for next year? Are you going to be working on assessment and APP? Read and get involved with [the discussion](#) that's happening in the Secondary Forum.
- Feel like celebrating the end of term? Why not get along to the [Great British Beer Festival](#) at Earl's Court from 4 - 8 August? At least 450 beers will be available throughout, including golden ales, fruit beers, stouts, bitters and some international 'real' lagers. As well as beer there is also cider and perry, all available in pint, half pint and third pint measures. Tickets are available in advance from the website.



Diary of a subject leader

Real issues in the life of a fictional Subject Leader

Some would say that I have a 'glass half empty' outlook on life. To some extent, this is true. Scepticism and cynicism are certainly two of my characteristics, however when it comes to education, my glass has recently been topped up.

A while ago, we were becoming increasingly aware of the need to prepare students with the necessary process skills in order for them to pass a Functional Skills exam. Early pilots had proved challenging for students, with some disappointing results, leaving many of us scratching our heads as to what to do next. The relief that a Level 2 Functional Skills qualification was no longer required to attain grade C or above came as a great relief for many in my department. However, this reaction did leave me somewhat heavyhearted. I perceive a real need to develop the process/functional skills within everyday lessons, and if assessment was to be the driving factor, so be it.

I couldn't help but smile upon reading the QCA publication [Changes to GCSE mathematics 2010](#) which describes the assessment objectives of the 2010 GCSE. The hopes of some, that Functional Skills was to be a thing of the past, had been quashed. Students would now be required to interpret and analyse as part of their GCSE. The need to continue developing process skills and student independence was back, much to my relief.

I distributed the QCA publication among my staff and made it a topic for discussion at our next department meeting. Once the sceptics had aired their grievances of the continual changes in government policy, the discussion focused on the practicalities ahead. How were we, as a department, going to ensure students were equipped to cope with this new style assessment?

When I read the assessment objectives within the QCA publication, I recognised the principles outlined within the Standards Unit. Students need the opportunity to explore mathematics for themselves and they can only do this through interpreting and analysing problems in a range of contexts. After all, is that not what we do as adults every day of our lives to some extent or another?

We agreed to continue using the types of activity described within the Standard Unit whenever possible, encouraging focussed discussion and a sense of exploration within the subject. My second in department and I now need to discuss how this ethos transfers to a scheme of work and whether the inclusion of 'rich tasks' is enough. I'm sure that providing we continue to discuss issues, share good practice and experiment with our teaching, the students' skills will develop alongside the pedagogy within the department. It's just a shame that it takes changes in the assessment for this to happen.