Secondary Magazine Issue 45

National Centre for Excellence in the Teaching of Mathematics

Welcome to Issue 45 of the Secondary Magazine. Are you going to a firework display to put a bang or zoom into your day? Enjoy the autumn colours as we begin to prepare for winter and use those reduced daylight hours to read the Secondary Magazine.

Contents

From the editor

Have you seen the new What makes a Good Resource microsite on the portal? The main page of the site states that:

> *'Classroom resources alone cannot guarantee effective learning and teaching. But they do have the potential to trigger new approaches and behaviours – i.e. changes in our classroom. In this way, good resources can provide a great source of professional development.'*

I'm always on the look out for new resources but this site seems to offer a bit more than that. I started to have a look at some of the links. The title Simultaneous Biscuits caught my eye, so I clicked on it. I was initially a bit confused because I didn't get a worksheet or anything to print out, but I persevered and what I did get was a totally different way of teaching simultaneous equations. A teacher generates an equation using the context of biscuits inside different colour packets:

> *"Yesterday, I bought 7 red packs and 3 blue packs, when I got home I opened them up and counted – I had 41 biscuits altogether."* (7r+3b=41)

and then, instead of homing in on the solution, the teacher encourages pupils to write down other things that they know. Eventually someone works out what one of the solutions is, etc.

The account starts off by the teacher saying:

> *"I really dislike the way that simultaneous equations are separated into lots of different types, and students expected to remember the methods for all the cases."*

I can see that this approach relies on pupils developing methods that they can then refine, rather than having all those separate cases with rather arbitrary rules which pupils fails to remember or understand. (A colleague described his memory of simultaneous equations at school being characterised by SSS 'same sign subtract' rather than any underlying intuition!)

I then had another hunt around and landed on the Subtracting Negative Numbers account. This time I did 'get' a resource – an Excel spreadsheet – but accompanied by a nice account of how the teacher used this. She/he says at the end of the account:

> *"I now always use this activity when introducing negative number arithmetic, and I am convinced that it has improved my students' understanding of the concept."*

So what I think this site is offering is not just a 'good resource' but some sort of rationale from the teacher about *why* it is a good resource. It seems to offer some situations and topics that could be 'difficult' to teach because pupils find the concepts hard, and individual teachers' accounts of how they have made

things more accessible for their students. These teachers have been willing to share their journeys on the site, which certainly made me think.

So what will you do now you know about the microsite? You could follow some of the prompts in How you and your colleagues might use this material, which gives some ideas about CPD activities before, during and after you try some of these ideas in your classroom. Please tell us what effect they have on you.

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.

This Up2d8 resource uses the context of the world's tallest man, Sultan Kosen from Turkey, who has been named by Guinness World Records for the launch of their 2010 book. Sultan Kosen is 2.47m tall and is 10cm taller than the previous title holder. This activity gives pupils the opportunity to explore linear measurements and scale drawings. Students are shown the recent news video of the visit to London by the World's Tallest Man They are asked to consider what would happen if he visited their classroom or their school – could he stand up? Students then have the opportunity to compare their own height to that of the world's tallest man alongside two iconic London images, the double decker bus and the black cab, using a scale drawing. Finally, students have the opportunity to compare the sizes of their hands and feet with those of the world's tallest man.

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: Geoff

About you: I received a Computer Science degree 15 years ago. My first computer job, as a junior software engineer, was legally hacking competitors' databases. I'm currently a technical architect for a sports betting TV and satellite company.

The most recent use of mathematics in your job was... Calculating estimated Forecast and Tricast winnings for a £1 bet on a race.

Some mathematics that amazed you is... That you can have number bases other than decimal – base 10. If we had 16 fingers we'd be counting in hexadecimal – base 16.

Why mathematics? Mathematics is the basis behind computers. Ones and zeroes drive all modern technologies using maths alongside physics.

Your favourite/most significant mathematics-related anecdote is…
The first men who went to the moon used a computer that was less powerful than a mobile phone.

A maths joke that makes you laugh is…
There are 10 types of people in this world: Those that understand binary and those that don't.

Something else that makes you laugh is…
Mock The Week.

Your favourite television programme is… The Wire.

Your favourite ice-cream flavour is… Vanilla with strawberry cheesecake bits.

Who inspired you? My parents, good teachers and Johnny Ball on the TV.

If you weren't doing this job you would… Hopefully be earning more money elsewhere!

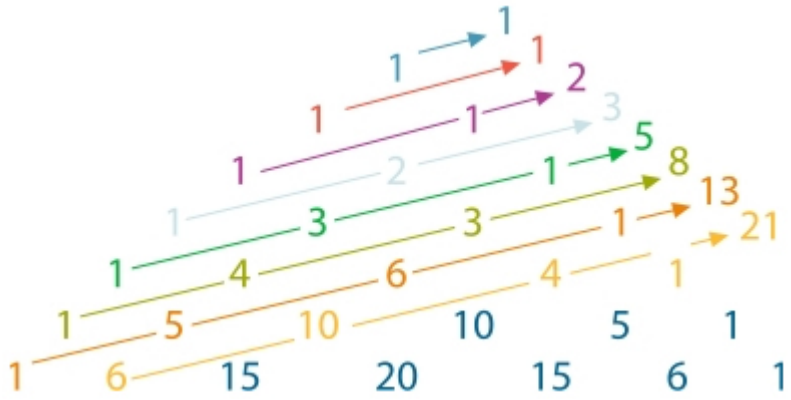
Focus on...Pascal's Triangle

- The rows of Pascal's Triangle are made from the digits of consecutive powers of 11. $11^0 = 1$, $11^2 = 121$, $11^3 = 1331$, $11^4 = 14641$… They are also the coefficients of a binomial expansion.

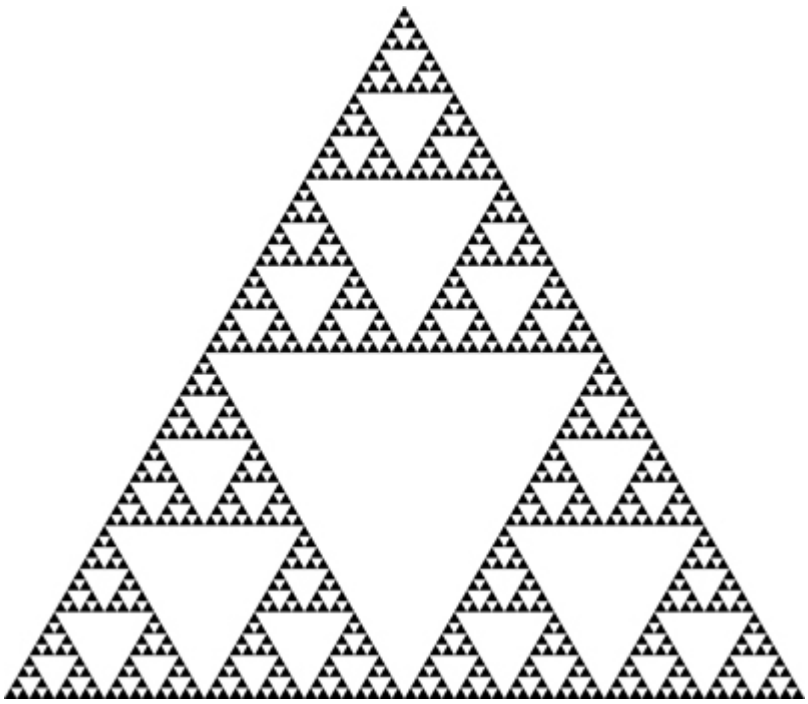
- The Pascal's Triangle was known well before French mathematician Blaise Pascal (1623 – 1662) put his name to it. In 13th Century China, Yang Hui used a triangle which is the same as Pascal's Triangle (Pascal's Triangle is known as Yang Hui's Triangle in China). However, Pascal was the first to draw all the information about it together and developed many applications of the triangle in his 1653 work *Traité du triangle arithmétique*. The triangle was named after him by the French mathematicians Pierre Raymond de Montmort and Abraham de Moivre in the 18th Century.

- Taking the first diagonals as those that contain all 1s, the second diagonal contains the counting numbers, the third diagonal is made from the triangle numbers and the fourth of the tetrahedral numbers.

- The sequence generated by the sum of the 'almost diagonals' is the Fibonacci sequence:



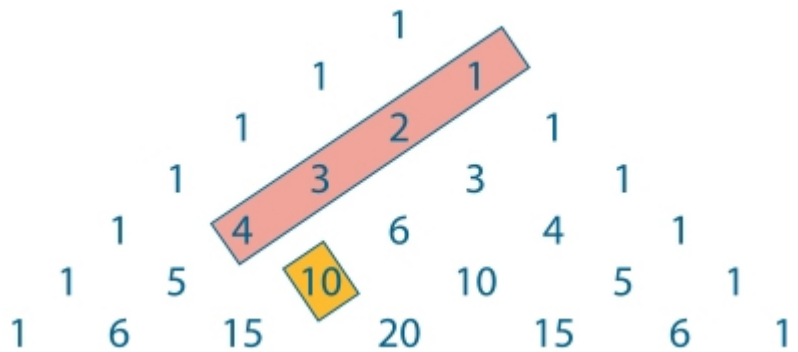
- As the odd numbers are shaded the triangle tends to the Sierpinski Gasket:



- Numbering of the rows traditionally starts with 0, so row 3 is 1 3 3 1.
  The sum of the n^{th} row is equal to $2n$
  The sum of the squares of the nth row is equal to the middle number of the $2n\text{-}1^{th}$ row.

- If the number after 1 in a row is a prime number, then every number in that row will be a multiple of that prime.

- Start anywhere on the edge of the triangle and, following a diagonal, shade the numbers. The sum of the numbers you've shaded will be found at the end of your shaded numbers at a right angle to them. For example,

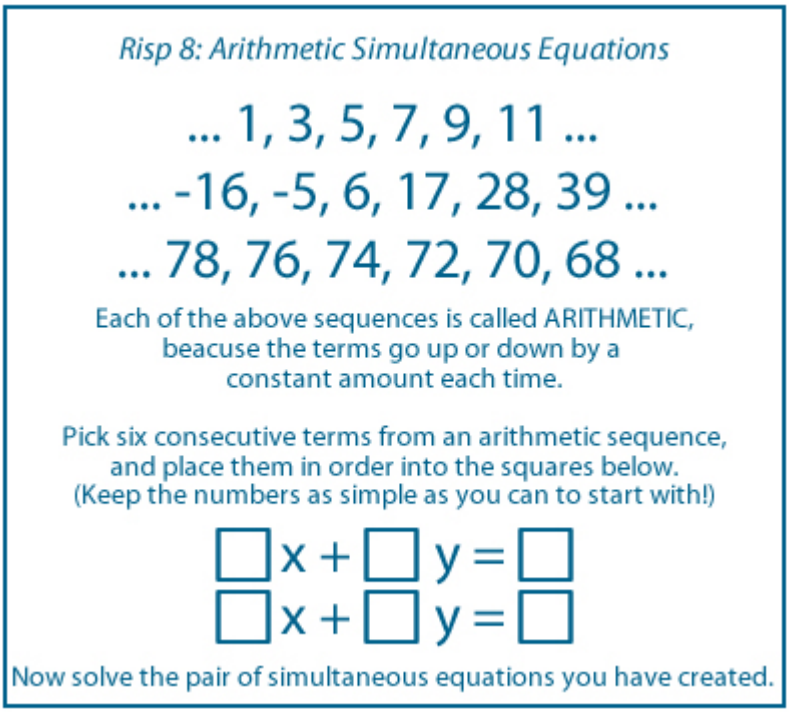


- Substituting fractions for the integers in Pascal's Triangle generates an activity for pupils who already have a good understanding of fraction addition and subtraction. Most benefit can be gained if discussion goes beyond 'pattern spotting' to making the connection between the values in the triangle and the underpinning structure.

An idea for the classroom – Rich Starting Points

Having read Jonny Griffiths' article in *Mathematics Teaching 215*, the most recent journal from ATM, about the use of Rich Starting Points, I was inspired to visit the website and investigate a few for myself. Beware – this is seriously addictive!

The first one I tried was *RISP 8: Arithmetic Simultaneous Equations*.



I won't tell you what happens if you want to try it!

Several things struck me as I worked through the problem:

- Why restrict this to A Level? Surely GCSE students would be able to tackle this activity? Could I run this activity as part of GCSE revision classes?
- This is a great way to have some differentiation in my classroom. Able students would be able to make headway with the investigation, whilst less able students would get the practice that they need in solving simultaneous equations.
- Students are working on their own mathematics, albeit in the same context as other students.
- This activity allows students to generate their own equations to solve, hopefully to try and test out particular ideas which they are suggesting. (Having done two examples, I had a theory involving common differences in my head which was dashed as I tried a third example).
- The activity generates a need to solve the equations – to find something out – rather than wading through a page of questions for the sake of just doing them, which I know is a source of frustration to some of our students.

So would these general points apply to other Rich Starting Points? I had a look at *RISP Brackets In, Brackets Out* and had a similarly rewarding experience. Being a mathematician, I realise that two examples in no way constitute a proof but I did feel inspired to think about using more of these Rich Starting Points within the curriculum.

5 things to do this fortnight

- As part of the ongoing work to support the Learning and Skills Sector, the LSIS STEM Programme is once again running free network events in science, mathematics and engineering during the autumn term. These networks will continue to give you an opportunity to work with colleagues across your region and also to work collaboratively with other practitioners in your specific subject area. The networks are open to everyone involved in STEM from across the learning and skills sector. All practitioners are welcome, whether from a work-based learning provider, college, prison, or adult and community learning.

  To find out about your nearest network or to book a place, contact Alex Perry.

- Mathematical curiosities and treasures from Professor Stewart's cabinet, a free lecture by Ian Stewart at the University of Warwick, is taking place on 5 November. Ian Stewart will present a selection of the contents of *Professor Stewart's Cabinet of Mathematical Curiosities*, a surprise Christmas bestseller, and the new *Hoard of Mathematical Treasures* in an accessible and highly illustrated way. Both books are mathematical miscellanies for the general public, ranging from one-liners to mini-essays on the great problems and applications of mathematics. And, if you've already committed to attending a firework display that evening, you can still watch the lecture as it will be available both live and afterwards from the Royal Society website.

- Are you or your department working on developing resources for a particular area of maths? Read the stories of teachers who wanted to develop their practice through challenging themselves to use different resources. Classroom resources alone cannot guarantee effective learning and teaching, but they do have the potential to trigger new approaches and behaviours – ie changes in our classroom. In this way, good resources can provide a great source of professional development. Find out more on the What Makes a Good Resource microsite.

- Have you booked your place on the NCETM's Engaging with Mathematics - A journey for teachers, learners and families conference yet? Taking place on 1 December in Nottingham, this free, one-day conference hosted by the National Centre will explore learners' attitudes to mathematics. To engage and support learners we need to understand what influences them from their earliest exposure to mathematics through to their career choices, and work together to make their experience positive. This CPD conference will bring together teachers, managers, parents, researchers and mathematics organisations to share and develop practical approaches to engaging learners in mathematics and supporting their progression.

- If Christmas can't come soon enough for you then make sure that you're in London on 3 November for the switching on of the Oxford Street and Regent Street Christmas lights. The event will coincide with the premiere of Disney's *A Christmas Carol* and the launch of the festive season in London. Both famous shopping streets will share Disney's A Christmas Carol theme. Regent Street will be the first Christmas lights to be switched on, followed shortly by Oxford Street and finally the City of London. To add to the entertainment, once the switches have been flicked Regent Street will light up the sky with a pyrotechnic display.

Secondary Magazine Issue 45

National Centre for Excellence in the Teaching of Mathematics

Diary of a subject leader

Real issues in the life of a fictional Subject Leader

The theme of target setting and performance management (PM) is still dominating my time – particularly preparing for the review meetings. My team and I are the most recent addition to my school and as such have to take instructions very much on face value. Now that we are in our second year, it is clear that nearly all other teams in our school take a more flexible interpretation of many instructions. Perhaps this flexibility has resulted in senior leaders taking a more stringent and transactional approach to PM.

We recently participated in workshops developing 'restorative' approaches to behaviour management. Taking my lead from that, I expressed my feelings to those I will 'performance manage'. I am glad I did. In many ways, it was more useful than any of my own previous PM reviews! I know how I am valued, and how I could be more useful to the people that will ultimately determine the success of my performance review.

All very cosy – but what can I actually do? My team had raised the issue of actually finding the opportunities to observe learning within our school that appears to be the 'cost-free' CPD option that supports teachers in meeting targets. That might have been predictable, but in the new 'opening up to feelings' we began to discuss when watching lessons was really useful to professional development.

It quickly became apparent that watching an expert was not always helpful. An expert can provide a vision of where we may want to be in any one aspect of our teaching. But if we want to get to that point, very often we need to watch something a 'bit less than expert' – somebody who is nearer to our level, somebody who has recently made those same steps.

Does this mean that we devalue expertise, we forget what it was like, or perhaps that we have to 'live – through' to get there? I don't think so. As usual, the answer is a balance of expert and peer observation. We need to know where we are heading, and then 'bounce off' a peer to help us identify our own next steps. This all sounds very familiar – just like an APP activity with teacher and peer assessment!

Now I've shared my feelings, am I ready to open up all of my practice and share the bits of my teaching that I know I are weak? Will others too readily find fault? Will this allow a truly reciprocal learning environment within my team? Or will I face the, "If a team leader can't, then how can I?" question?