



Welcome to Issue 44 of the Secondary Magazine. With Halloween in sight and the clocks about to change, summer is definitely over and those autumn colours are looking lovely. This issue should take you into half term – enjoy your break.

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Have you looked at the [As the Bell Goes](#) microsite on the NCETM portal? Listen to some teachers talking about what happened in their classrooms.

Up2d8 Maths – A Big Squash!

The fortnightly Up2d8 Maths resources explore a range of mathematical themes in a topical context. This Up2d8 resource uses the context of pumpkins at Halloween to explore the impact of enlargement on volume. If possible it would be useful to have a normal-sized pumpkin to hand!

The Interview – Mark

Mark is a chartered engineer. He says that 'Mathematics underpins all aspects of engineering, technology and business. In our increasingly complex and fast-moving modern world, it is as fundamental as being able to read and write. I simply wouldn't be able to do my job without it!' Find out how Mark uses mathematics in his job.

Focus on...magic squares

Magic squares fascinate pupils and adults alike. Can you construct 4x4 magic squares? Find out how to do this, here.

An idea for the classroom – MangaHigh.com

I heard about this idea for the classroom on my car radio. Do you agree with Professor Marcus du Sautoy? Are you a fan of the 'BIDMAS Blaster' or is 'Pyramid Panic' more your style?

5 things to do

This issue has details of the Further Mathematics Support Programme, the Royal Statistical Society Centre for Statistical Education, Functional Skills, sundials, and a lie-in!

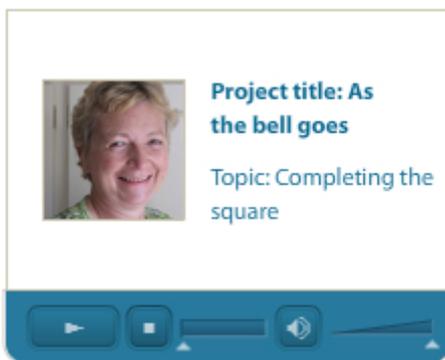
Diary of a subject leader – Real issues in the life of a fictional Subject Leader

It's Performance Management time. Our Team Leader reflects upon how performance management can be a useful process which is integrated into the ongoing business of the department.

From the editor

Have you had a look at this [microsite](#) on the NCETM portal? When I read some of the introductory blurb, which asked: “How often have you finished a lesson with a class and been burning to tell someone about an incident that had occurred?” I was intrigued to hear what people were going to say about their lessons – and I wasn’t disappointed!

The microsite allows 19 practitioners from Early Years, Primary and Secondary to record their thoughts as they leave the classroom. There is also [a thread](#) in the Maths Café where you can respond to these audio clips.



The first clip I listened to ([Actively preventing learning](#)) was from Jill Mansergh talking about how two of her students had helped each other to solve a problem and how she felt about not being the only person in the classroom who can provide all the answers. That struck a chord with me and inspired me to listen to a few more of the sound bites.

Some of my favourites from secondary classrooms were:

- Dene Williams – [The average year 7 pupil](#)
- Nat Parnell - [Good old repeated addition](#)
- Mike Davies - [Sudoku](#)

Once the novelty had worn off, and I had listened to several clips, I wondered how useful this material would be - there is also a part of the site which gives some suggestions for how you might use this material. There is nothing like falling out of your classroom into the company of supportive colleagues and having those ‘you’ll never guess what’s just happened’ conversations. This site gives me the opportunity to listen to people that I don’t know, in different school settings, talking about what has just happened to them and will inevitably broaden the range of anecdotes and the thoughts that they provoke.

If I’m honest, there are times at school when it is very easy to talk about the personalities in the classrooms – after all it is our excellent relationships with pupils that create a good climate for learning in the classroom. By listening to these clips I was not distracted by individual pupils and was not able to make the ‘Is that Fred’s sister? She would say that!’ comments. Instead, it allowed me some distance to consider the anecdotes, decide if there was a more general point that I could extract from them and see how they might give me an added insight into pupil learning.

What do you think about the audio clips? Why not tell us how you have used them?



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.

[Wikipedia](#) says 'A jack-o'-lantern is typically a carved pumpkin. It is associated chiefly with the holiday Halloween, and was named after the phenomenon of strange light flickering over peat bogs, called ignis fatuus or jack-o'-lantern. In a jack-o'-lantern, typically the top is cut off, and the inside flesh then scooped out; an image, usually a monstrous face, is carved onto the outside surface, and the lid replaced. At night a light is placed inside to illuminate the effect. The term is not particularly common outside North America, although the practice of carving lanterns for Halloween is.'

Giant pumpkin-growing competitions are common in the USA with some competitions awarding up to \$6 per pound for the winning pumpkin! The activity explores the impact of enlargement on volume. Students are introduced to a pumpkin which broke the world record and are then shown a recipe which feeds six people. Students will first need to decide whether to work in imperial or metric units and are then asked to consider how big the world record pumpkin might be. *If possible it would be useful to have a normal-sized pumpkin to hand to allow them to measure circumference and diameter etc.*

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 resource](#) - in PowerPoint format.



The Interview

Name: Mark

About you: Mark is a Chartered Engineer who advises customers on major ship and submarine programmes. After completing his engineering degree he embarked on a career in engineering and technology, working at the sharp end on a number of £bn UK and overseas defence programmes. He has been responsible for leading the development and delivery of complex and challenging £m projects over the past 23 years.

The most recent use of mathematics in your job was... Calculating the level of manpower effort and material expenditure required to deliver a complex and pan-industry new technology development, for a new submarine programme. Working to a limited client budget, I needed to calculate the overall pricing that would ensure that we could deliver the contract scope within budget and yet still make a profit for the company.

Some mathematics that amazed you is... The Royal Navy's new Queen Elizabeth Class aircraft carriers will displace 65 000 tonnes, which is over three times the size of the current 20 000-tonne UK Invincible Class carriers.

The new ships will have an overall length on 284m and be 73m wide. They will carry up to 1 500 people (up to 900 of whom will be aircrew).

Maximum speed will be 25kt (a knot is nautical measure of speed, equivalent to 1.15mph), with a range of 10 000nm at 15kt (1 nautical mile = 6 080ft or 1 853.18m).

The new carriers will be able to launch up to 24 aircraft in 15 minutes and recover the same number in just 24 minutes.

The ships will be built in various shipyards around the UK and floated to Rosyth, where they will be assembled into the finished ship in a huge dry dock.

Why mathematics? Mathematics underpins all aspects of engineering, technology and business. In our increasingly complex and fast-moving modern world it is fundamental as being able to read and write. I simply wouldn't be able to do my job without it!

As an engineer, I use mathematics in the calculation, estimation and analysis of complex requirements, quantities and performance parameters. In a business sense, I use it to calculate timescales, resources, material costs, budgets, pricing, turnover and profit. If I get the mathematics incorrect, the product may not operate correctly or safely. It could fail catastrophically, or we might not have the correct numbers of spare parts we need to maintain or repair it. It could also mean the difference between the company making a profit or not...and if we don't get the calculations right we might not actually win the work in a competitive scenario. Finally, if we exceed the customer's budget or deliver his project late, he might not give us any more business!

Your favourite/most significant mathematics-related anecdote is...

A modern Formula One racing car is a technological marvel, and the margins between success and failure are very slim. Pit stop precision plays a key role in success, with up to 25 people working like a well-oiled machine

in a very small space and under extreme time pressure to refuel the car, change all four tyres and adjust the front wing (if needed) in under 10 seconds!

A maths joke that makes you laugh is...

Q: Why was 6 afraid of 7?

A: Because 7, 8, 9.

The Ark lands after The Flood. Noah lets all the animals out, saying "Go and multiply." Several months pass. Noah decides to check up on the animals. All are doing fine except a pair of snakes. "What's the problem?" asks Noah. "Cut down some trees and let us live there", say the snakes, "then we'll be fine". Noah follows their advice. Several weeks later, Noah checks on the snakes again. This time, there are lots of little snakes! Noah asks "How did the trees help?" "Well", say the snakes, "we're Adders, and we simply needed logs to multiply!"

Something else that makes you laugh is...

[The Young Ones](#), [Yes \(Prime\) Minister](#), [Top Gear](#), [The Apprentice](#), [Monty Python's Life of Brian](#).

Your favourite television programme is... [Top Gear](#).

Your favourite ice-cream flavour is... Chocolate.

Who inspired you? Initially...My (maternal) grandfather: someone who, though not formally trained in engineering, was extremely adept and could turn his hand to the construction and repair of almost any mechanical and electrical device, often from first principles or using innovation and basic workshop equipment. A strong character with a sense of purpose, he was very much a family person, with strong morals, a community spirit and good sense of humour. He fought the London dock fires during WW2, also driving and maintaining the fire engines for the London Fire Brigade. He started his own garage business after the war, subsequently retiring from a major local motor retailer as Workshop Foreman.

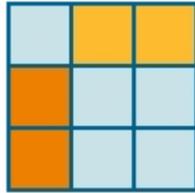
Later...Colin Chapman: founder of Lotus Engineering and Team Lotus and one of the greatest innovators in F1 and road car design and engineering through the late 20th Century. He leaves an engineering legacy that is still apparent in the modern single seater racing car and road car design and production.

Sir Jackie Stewart: triple F1 World Champion who battled against dyslexia at school to become a world-class clay pigeon shooter. A strong advocate for improving safety in F1, he later became a successful team owner, broadcaster and businessman.

Isambard Kingdom Brunel: a British engineer who applied logic, innovation and determination to solving complex and long-standing engineering problems, and whose influence exists to this day in the engineering infrastructure across the UK.

Jeremy Clarkson: an innovative, capable and very amusing journalist and broadcaster, one of the few journalists who is able to deliver word-perfect copy to requirement and bang on schedule. Although somewhat of a 'marmite character', he is prepared to court controversy, standing up for common sense and not bowing to the 'PC brigade'. He has produced some great TV programmes, including a fascinating study into the life and work of Brunel and his own family history ([Who Do You Think You Are?](#)).

If you weren't doing this job you would... A racing driver or property magnate...or possibly both!



Focus on...magic squares

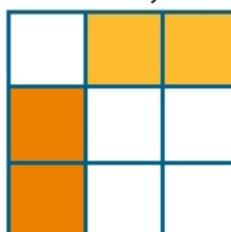
- [Wolfram Mathworld](#) defines a magic square as a square array of numbers consisting of the distinct positive integers $1, 2, \dots, n^2$ arranged such that the sum of the numbers in any horizontal, vertical, or main diagonal line is always the same number. While this definition only allows for the integers 1 to n , it is common for squares to be considered magic if they contain any set of numbers for which the condition the sum of the numbers in any horizontal, vertical, or main diagonal line is always the same number.
- The Lo Shu magic square is the only 3×3 magic square featuring the numbers 1 to 9 and may date from as early as 3000BC. Legend has it that there was a terrible flood in China and the king tried to calm the river god with sacrifice but the sacrifice wasn't accepted. One day a turtle was seen in the river with a pattern of dots on its shell which may have looked like this:

 4	 9	 2
 3	 5	 7
 8	 1	 6

The local people took this as a sign that, to overcome the flood, they would have to increase their offerings to 15. They did this and the river god was appeased.

- Although the Lo Shu is the only 3×3 magic square to feature the numbers 1 to n (all others are simply transformations of the Lo Shu square), there are many ways of creating a 4×4 square (808 unique solutions) and 275 305 224 ways of creating a 5×5 square. It is not known how many possible 6×6 magic squares can be created, but [Pinn and Wiczerkowski](#) use statistical analysis to generate an estimate of a staggering $(1.7745 \pm 0.0016) \times 10^{19}$.
- John Mason uses a magic square with the numbers removed to help develop mathematical thinking and reasoning in this activity.

If the grid below is a magic square then convince yourself that it's true that $\text{sum}(\blacksquare) - \text{sum}(\blacksquare) = 0$



What other arrangements are there in a 3×3 magic square for which this is true?
How about in a 4×4 magic square?

- The 4×4 magic square in Albrecht Dürer's engraving, [Melancholia](#), features the year that the engraving was completed (1514) in the middle two columns of the bottom row.
- In 1690 [Simon de la Loubère](#), the French ambassador to the King of Siam, developed a method for creating a magic square with sides which are odd. The method starts by placing 1 in the top row of the middle column. The aim is to place the next integer one square up and to the right. If this isn't possible because the number would 'fall out' of the top then it rejoins at the bottom; if the number would fall out of the right hand side of the square then it rejoins on the right hand side. If it's not possible to place a number because the square one up and to the right is already occupied then the number is instead placed directly below the most recently placed integer. [An example of this method](#) can be seen on Wolfram Mathworld.
- In 1770, [Euler](#) generated the first known magic square constructed entirely of square numbers, sending it to [Joseph Lagrange](#)

68^2	29^2	41^2	37^2
17^2	31^2	79^2	32^2
59^2	28^2	23^2	61^2
11^2	77^2	8^2	49^2

- Dutch electronic engineer Lee Sallows created this magic square:

five	twenty two	eighteen
twenty eight	fifteen	two
twelve	eight	twenty five

Counting the letters in each word gives:

4	9	8
11	7	3
6	5	10

Which is a second magic square!



An idea for the classroom – MangaHigh

Do you have those sorts of days where things happen in threes, like buses? Last week, as I was driving to school I heard Professor Marcus du Sautoy talking about the new on-line resource [MangaHigh](#) - he says in the introductory paragraph:

“For me doing mathematics has always been like playing a game. At MangaHigh we’ve been working hard to bring out the playful side of maths while ensuring that students get the essential skills to master this important subject.”

The second event was receiving an email telling me that the [NCETM community](#) had begun to talk about it.

By the time I had also received an email from a colleague telling me his score on BIDMAS Blaster, I decided that I had better have a look for myself.

I started off by playing a quick game of ‘Pyramid Panic’ – and that’s exactly what I did! A rather spindly mummy is trying to find its way out of the pyramid, helped by my solving some problems related to area and perimeters of shapes. Despite being a fairly competent mathematician (I hope) I did rather panic as some nasty monster chased the mummy and had the satisfaction of eating it (me?) several times.

Having decided that I was not cut out for scary monster games (it’s not that scary – I think most 15 year olds would sleep soundly) I thought that ‘Flower Power’ might appeal to the softer side of my nature. Indeed this is a more peaceful sort of game where large flower stems grow decimals or fractions which needed to be ordered on the stem. It did get a bit difficult when there were lots of stems that needed ordering, but the flowers just withered if they were not in the right place.

Although these games were quite enjoyable, I was slightly disappointed that they provided contexts in which to practise some previously learned mathematics rather than creating a situation which required the use of some mathematics in order to solve the problem.

Perhaps you could have a go at BIDMAS Blaster and tell us what you think?



5 things to do this fortnight

- Did you know that the Royal Statistical Society Centre for Statistical Education is moving? The University of Plymouth will now be home to the RSSCSE and, to celebrate the move, they're hosting a series of events through the week, starting on Monday 16 November. The RSS would like to invite you to 'Teachers' Day' (Improving Statistical Education in schools & colleges) on Tuesday 17 November, where you will have the opportunity to attend excellent cross-curriculum, interactive workshops. More details and a booking form can be found on the [RSSCSE website](#).
- The QCDA Countdown to Functional Skills events continue through to early November. If you're a pilot centre for Functional Skills this could be the event for you. Details of venues and bookings can be found on their [website](#).
- Do you teach Further Mathematics? Would you like to teach Further Mathematics? The Further Mathematics Support Programme has replaced the Further Mathematics Network and is hosting a series of network launches around the country. The first of them is on 4 November at the Science Learning Centre in Durham, with a parallel event running at the University of Birmingham. More details and a full list of events can be found on the [FMSP website](#).
- Has your imagination been captured by the Bowland [Sundials case study](#)? If you'd like to explore the mathematics of sundials then make sure you're in Bath on 2 November for [Delineating a sundial](#), a talk by David Brown which will be held at Kingswood School, Bath.
- Don't forget that the clocks go back in the early hours of Sunday 25 October so you'll have an extra hour in bed!



Diary of a subject leader

Real issues in the life of a fictional Subject Leader

I read [The Interview](#) in the [last issue](#) just before a Performance Management workshop. The honesty appealed and the sense of humour struck a chord. One of my PM targets was to share practice beyond my team, so I felt I had better attend to show willing and tick the box (my review meeting was already lurking in the shadows). I would have gone anyway because I loath the professional isolation of everyday practice in classrooms, and enjoy the chance to compare, contrast and reflect.

Charlie's comment about the chap marking out the rugby pitch probably having to work towards targets, had helped me get over that initial foreboding I often feel about the whole PM process. As I looked around the room, I wondered if that hint of inevitability in Charlie's remark had taken a firmer root in my school. It was just me and two others!

Inevitably the workshop became a very pleasant but nonetheless informative chat. We appeared to take a similar, pragmatic, approach to the purpose of the PM process. It was good to hear how another person outside my own PM process interprets the whole idea. Seizing the possibility to engage in an internal and external dialogue they question how they can really improve practice in their classroom and across the school. I began to reflect on my own perception of the process, and I think I have moved on a little in my understanding.

As a subject leader you are both the do-er and the 'done'. I use those clumsy words because, although I had always fully engaged in the process, I had always felt that it was something that had to be ticked off. In spite of my best attempts, it had always felt parallel to the 'everyday' focus of my job. I did it, and I was done - and then we continued with the rest of the year. How often would I then see evidence of Objectives from Action Plans or the PM process in lesson observations? When I do happen upon such evidence I am ashamed to admit that my more cynical side often questions whether it is a genuine part of everyday practice, or an experienced practitioner knowingly, and quite legitimately, 'playing the game'.

The targets I agreed with my own reviewer last year were and are important to me. If I am judged to have met them, I guess I will have altered the experience of my students, my team, and even in some small way changed my practice. What my targets do not do (and in some years fortunately so) is state that the Mathematics results at GCSE have to improve by a given percentage. But I believe it is this that everybody is really using to measure me.

So, if I accept that actually everybody is looking at the results, do I embrace that, raise the stakes, and make that my most important PM target? Will that allow me to better rationalise the PM process and my everyday job? Or, do I carry on as before, but more carefully agree targets that really pinpoint what I feel I need to achieve to get the Mathematics results up by the given percentage?

I haven't yet decided, which means I probably won't take the punt. Would you? Will you? If I did accept those very high stakes I think the targets would become more real, possibly for me, too real. Whatever my decision, I think the next set of targets I agree will be better for the reflection that the workshop initiated. Perhaps the target I had this year, of sharing practice beyond my own team, was not as trivial as I first thought!