



Welcome to Issue 32 of the Secondary Magazine. As the summer term starts and the exam season rapidly approaches, now is the time to plan what you will do with some of that time gained when Year 11 have departed. In the meantime, there is a lot of revision to do!

Contents

From the editor – Gauss

I can remember my primary school teacher teaching me a ‘trick’ to quickly add up a set of consecutive numbers to ‘amaze my friends’. It wasn’t until much later that I discovered that this ‘trick’ had been used by Gauss whilst a schoolboy. Perhaps your pupils would like to perform this ‘trick’ to honour Gauss’ birthday?

Up2d8 Maths

The fortnightly Up2d8 maths resources explore a range of mathematical themes in a topical context. What makes a rollercoaster scary? *SAW - The Ride* carried its first passengers earlier this year and has claimed to be the scariest roller coaster in the world. In this resource, students use this claim as the basis for a statistical investigation into what makes a roller coaster scary.

The Interview – Peter Ashwin

Peter is a professor of mathematics at the University of Exeter. Here he shares a snapshot of his work and an insight into his personality.

Focus on... 10

Is it true that some numbers have greater prominence than others? As the basis for the metric system, 10 is certainly an important number. Here are some facts to help you form an opinion.

An idea for the classroom – 3D co-ordinates

A colleague recently went for an interview and was asked to teach a lesson on 3D co-ordinates. He devised an activity which is shared with you here.

5 things to do

Following the Easter break, there are some mathematical and general ideas to stay on top of things at this busy time of year.

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

Literacy and numeracy are key basic skills that equip pupils for life. We certainly play our part in developing numeracy skills, but what about literacy skills? Our subject leader considers his role in focussing on literacy in mathematics.



Gauss

Carl Friedrich Gauss did not come from an academic family – he was born on 30 April, 1777, and his father was a mason in Braunschweig, Germany. His father wanted Carl Friedrich to follow his profession: it was his mother who supported his education. There is a story that when Gauss was about 10, his teacher set the class a problem:

Add up the first
100 integers ?

Whilst most of the class started to add up

$$1 + 2 = 3$$

$$3 + 3 = 6$$

$6 + 4 = 10$ etc, Gauss finished quickly because he had seen a short cut:

$$1 + 2 + 3 + 4 + \dots + 48 + 49 + 50$$

$$100 + 99 + 98 + 97 + \dots + 53 + 52 + 51$$

$$101 + 101 + 101 + 101 + \dots + 101 + 101 + 101$$

$$50 \times 101 = 5050$$

At the age of 17, Gauss proved that a regular 17-sided polygon could be constructed using just a compass and straight edge (in fact, he proved that any regular polygon with a number of sides which is a [Fermat prime](#) could be so constructed). His relatives later requested that this shape should be engraved on his tombstone, but the mason thought this would look too much like a circle so he replaced it with a 17-pointed star.



Gauss is well known for his work on number theory; shortly after his work with the heptadecagon, he invented modular arithmetic and published a book [Disquisitiones Arithmeticae](#) to present some of his work. Gauss accepted a position as professor of Astronomy in Göttingen and predicted the position and timing of the next appearance of the dwarf planet, Ceres.

When Gauss died, his brain was preserved: it weighed 1 492 grams, and the cerebral area was equal to 219 588 square millimetres. Perhaps there is a connection between brain mass and intelligence?!



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.

What makes a roller coaster scary? *SAW - The Ride* carried its first passengers earlier this year and has claimed to be the scariest roller coaster in the world. In this resource students use this claim as the basis for a statistical investigation into what makes a roller coaster scary, and are encouraged to use the results of their investigation to rate how scary different roller coasters are (did you know that there's a roller coaster in New Jersey with a 418ft drop? Terrifying!). There's also the possibility of working on some proportional reasoning by comparing the relative heights and speeds of some world record-breaking roller coasters.

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.

[Click here](#) to download the Up2d8 maths resource - in PowerPoint format.



The Interview

Name: Peter Ashwin

About you: I'm a Professor of Mathematics at the University of Exeter. I teach a variety of levels; my research area is dynamical systems and applications. I help out on the board of the Devon Further Mathematics Centre.

The most recent use of mathematics in your job was... well, in my job I find it hard to name a day when mathematics is not central to many things I am doing. At the moment, I'm working with a colleague in cell biology doing some mathematical modelling of transport on the cytoskeleton of cells, the internal scaffolding that gives cells structure. It has involved me learning a bit of biology, which I found very exciting. It has also showed me that mathematics developed for modelling motorway traffic and call centre queuing is relevant to what is going on inside every living cell.

Some mathematics that amazed you is... the dynamics of piecewise isometries have fascinated me for several years now. These are objects somewhat like jigsaw puzzles made from exchanging very simple convex polygons. Their dynamics gives rise to fascinating and beautiful patterns on the plane. They look like they should be easy to understand, but there remain a large number of very basic open problems in this area with a number of researchers dedicated to looking at them.

Why mathematics? I have found mathematics fascinating as a career because it can be so varied. In terms of applications, I have had the fortune to be exposed to a wide range of sciences and engineering, simply because mathematics gives so many tools that can help.

Your favourite/most significant mathematics-related anecdote is... it's a serious point, but I have been recently reading a wonderfully clear book (available online [here](#)) by David MacKay called *Sustainable Energy – without the hot air*. He suggests that as a society, and especially in relation to energy, we need to stop talking in adjectives and start using numbers.

A mathematics joke that makes you laugh is... a colleague of mine has a jumper with the motto, "Mathematicians are the number $-e^{i\pi}$ "

Your favourite television programme is... I'm not a big TV fan, but I do enjoy a quiet night in with a DVD; a feature film or murder mystery.

Something else that makes you laugh is... I'm an avid reader of *Private Eye*; it manages to be as up to date as many of the newspapers while being hilarious. For example, I love their *Scenes you seldom see* cartoon series.

Your favourite ice-cream flavour is... well, maybe not my favourite, but certainly the most unusual I ever had is mushroom and 7-up flavour. I only found it once; I wonder why that was!

Who inspired you? Many people along the way from school teachers to colleagues, and indeed some of my students continue to inspire me! My PhD supervisor, Ian Stewart, at Warwick, was a stimulating person to work with. He opened my eyes to the many possible uses of mathematics.

If you weren't doing this job you would... probably find another way to do mathematics.



Focus on...10

$10! = 6!7!$ This is the only known solution to $n! = a!b!$ (except for the general pattern $(n!)! = n!(n-1)!$)

The base 10 number system was considered to be so simple that Pierre Simon de Laplace commented that this simplicity 'is the very reason for our not being sufficiently aware how much admiration it deserves'.

The metric system was first recommended in 1791 by the Paris Academy of Sciences. One metre was defined to be $\frac{1}{40\,000\,000}$ part of a circumference of the earth through the poles and the ratios between units was always to be powers of 10. Greek and Latin prefixes are used for larger and smaller units, respectively.

Ten is the smallest noncototient, a number that cannot be expressed as the difference between any integer and the total number of coprimes below it.

A straightforward decimal system, in which 11 is expressed as *ten-one* and 23 as *two-ten-three*, is found in some Chinese languages. Many other languages with a decimal system have special words for the numbers between 10 and 20, and decades. It has been suggested that irregularities of numerals in a language may hinder children's counting ability. Find out more in [this article](#) from the American Psychological Association website.

10 is the second [decagonal number](#) (after 1). The first ten decagonal numbers are 1, 10, 27, 52, 85, 126, 175, 232, 297 and 370.

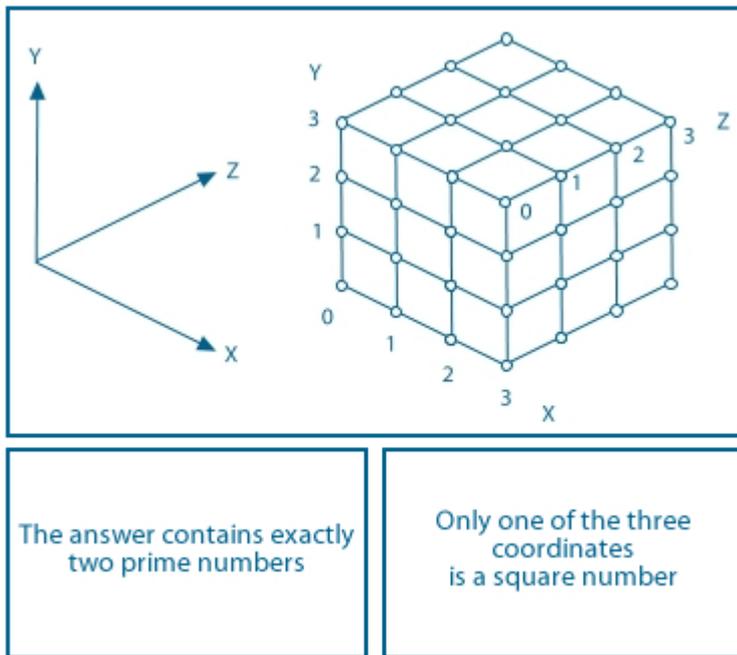
There are 10 types of people in the world. Those that understand binary notation and those that don't.



An idea for the classroom – 3D co-ordinates

Most pupils have understood the idea of using two dimensional co-ordinates to describe a position on a plane and have gone on to use these co-ordinates in working with graphs to increase their understanding of mathematical relationships and functions. The concept of using three dimensional co-ordinates to describe a position in space comes into the GCSE syllabus, but the areas of mathematics in which pupils use this knowledge tend to come outside the scope of the GCSE which can make this a 'hard to teach' topic.

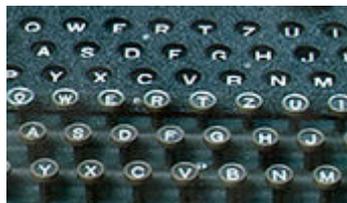
This resource, which you can [download here](#), takes the form of a mystery which requires pupils to use their knowledge of 3D co-ordinates to solve a problem.



The resource has a set of clue cards which pupils use to solve the mystery. It also includes some extra resource sheets, which allow the activity to be differentiated and scaffolded to support all learners. The sheet of possible co-ordinates makes the task very accessible so should be supplied cautiously!

As this is a closed task, it may be appropriate to offer an open extension task: pupils could be asked to select another location and provide a series of clues to allow other pupils to solve the new mystery. Alternatively, pupils could review the existing clues and decide if learners need all the clues to solve the mystery. Which clues are most important? Which clues are not necessary?

Have you got a good way of teaching 3D co-ordinates? Please tell us about it here.



5 things to do this fortnight

- On Tuesday 5 May the Millennium Maths Project is hosting **The Secret World of Codes and Codebreaking**. Ever since the ancient Greeks, people have been using secret codes to keep their communications private. James Grime will be unravelling some of these ciphers and explaining how mathematicians have changed the course of history by cracking codes. He will demonstrate a genuine WW2 Enigma Cipher Machine and explain how the British code breakers at Bletchley Park managed to achieve the apparently impossible by unlocking the infamous Enigma Code. Find out more [here](#).
- Ever wondered why children's mathematical abilities vary across domains such as numeration, calculation, geometry, and measurement? On 5 May at Nottingham University Professor Jo-Anne Lefevre will host a research seminar describing her work modelling the relations among cognitive precursors, early numeracy skill, and mathematical outcomes. Find out more [here](#).
- **Mathematics and Smallpox** – how can you resist a lecture with that title? Exactly 250 years ago, Daniel Bernoulli used mathematics and statistics to try to weigh the risks and benefits of inoculation against smallpox. The arguments of Bernoulli and his critics still remain relevant today. The lecture, by Professor Tom Körner, will be given twice on the 5 May – at 1pm and at 6pm at Gresham College, Holborn. Details of this free lecture are [here](#).
- On the morning of 6 May, the **Great Yarmouth Logistics Event**, in partnership with Panalpina and GIF (Grampian International Freight) Logistics, is open to Engineering Teachers, those involved in the new Diplomas, Connexions Staff, Careers and WRL Coordinators. This event aims to update delegates' knowledge of skills/careers in the logistics sector. This is a huge growth area, particularly in the Great Yarmouth area. As well as general updates on the logistics sector, there will be short presentations from local logistics companies and a tour of GIF. Find out more [here](#).
- Have you started training yet? The next [cheese-rolling event](#) takes place at Cooper's Hill in Gloucestershire on 25 May.



Diary of a subject leader

Real issues in the life of a fictional Subject Leader

For too many years, I had considered literacy to be someone else's problem. I was a numbers man and this was too far removed from my subject and area of expertise. How wrong I was.

Few can dispute that students with poor literacy skills struggle to access parts of the curriculum and therefore increase the chances of underachievement. This was the message echoed by our curriculum deputy this week while speaking to all subject leaders. She acknowledged that as a school we have literacy embedded within our schemes of work and that when formally observed, students' literacy needs are generally catered for. She did however point out that during every day lessons, such considerations were not being addressed. I couldn't argue.

I left feeling unusually guilty and uneasy, not only about my neglect of tackling the issue but also my past reluctance to even take it into consideration. For years, the maths department would display a range of maths-related keywords upon classroom walls. This was pretty much the size of our contribution in addressing the literacy needs of our students. We knew then that our efforts were superficial and merely a tick-box exercise. I was out of my comfort zone, needed advice and who better than the English department. The head of department was excellent and fully understood teachers' reluctance to grasp the literacy nettle. She even had concerns within her own department.

Her advice was simple: understand the needs of the students and be realistic in addressing them. She suggested that I looked at the SEN register to identify individuals. Within lessons, I needed to highlight a maximum of two or three keywords relating to the topic taught. Teachers must model and incorporate short activities within lessons, using writing frames or writing stems when appropriate. Students needed to see and share examples of good practice. In addition, teachers needed to encourage collaborative work and discussion whenever appropriate.

I'm apprehensive about making literacy the next focus for development within the department yet this is largely down to my own insecurities. Nevertheless, it may all prove worthwhile when students readily start to answer questions that include the word 'explain'.