



Welcome to Issue 23 of the Secondary Magazine. We include an exciting mixture of features as we continue to consider the ever-changing world of mathematics education. As always we have ideas to stretch your own mathematical mind and resources to develop your skills further. We enjoy hearing from you so please keep those comments coming in and do let us know what you are doing in your work.

## Contents

### **From the editor – Are you a XXX teacher?**

What sort of teacher are you? Do you know? Can you describe your professional practices? Reading this article may help you to answer some of these questions.

### **Up2d8 Maths**

The fortnightly Up2d8 Maths resources explore a range of mathematical themes in a topical context. It is only a few weeks to Christmas so this resource encourages pupils to make decisions about where and how they will buy their Christmas presents this year.

### **The Interview – Tom Rainbow**

This edition features an AST who is well-known in the West Country, but here is a chance for everyone to get to know one of the most respected mathematics practitioners around. Tom is always a source of great ideas, but now he has to answer to our on-line interviewer...

### **Focus on...Polyhedra**

I can guarantee that this item contains some of the longest words on the portal. Not quite sure what a dirhombicosidodecahedron is? Then read on...

### **An idea for the classroom – Teaching Ideas website**

In this edition, we try to give some highlights from the 'Teaching ideas' website. Use these activities with your classes and you will be amazed at the response. They can really have fun while they are dealing with important mathematical ideas.

### **5 things to do**

This time we offer you ideas which will really extend your horizons in many different ways. Why not take up some, if not all of these challenges? Some will develop your teaching and some will stretch your mind, but all of them help to make us more complete mathematical educators.

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

As the dust settles and the cheers fade away following the demise of the KS3 SATS our poor hassled Subject Leader is beginning to wonder if this is the end of one problem, but the beginning of something else. What, he wonders, is around the corner...



## Are you a XXX teacher?

Do you have a 'default setting', or a routine, or things that you do so naturally that you never think about them? I certainly do. Many of my routines centre around the early morning – getting myself out of bed, washed, dressed and ready to face the world. It makes the day less scary, something that I can do! But there are times like weekends and holidays when it's not like that. Sunday morning, tea in bed, papers or out for a run, followed by a leisurely breakfast or a day out somewhere etc.

Similarly, there are times in my professional life when I behave in my default setting and times when I have different ways of behaving. Times when I am a XXX teacher, and times when I select different pedagogical tools from my teaching repertoire.

Being asked if I was a XXX teacher, I initially thought this sounded like getting a gold star or the icing on the cake until I heard about the eXplanation, eXample, eXercise model.

We all teach lessons like that don't we? The Ofsted report [Mathematics: understanding the score](#) talks about such lessons:

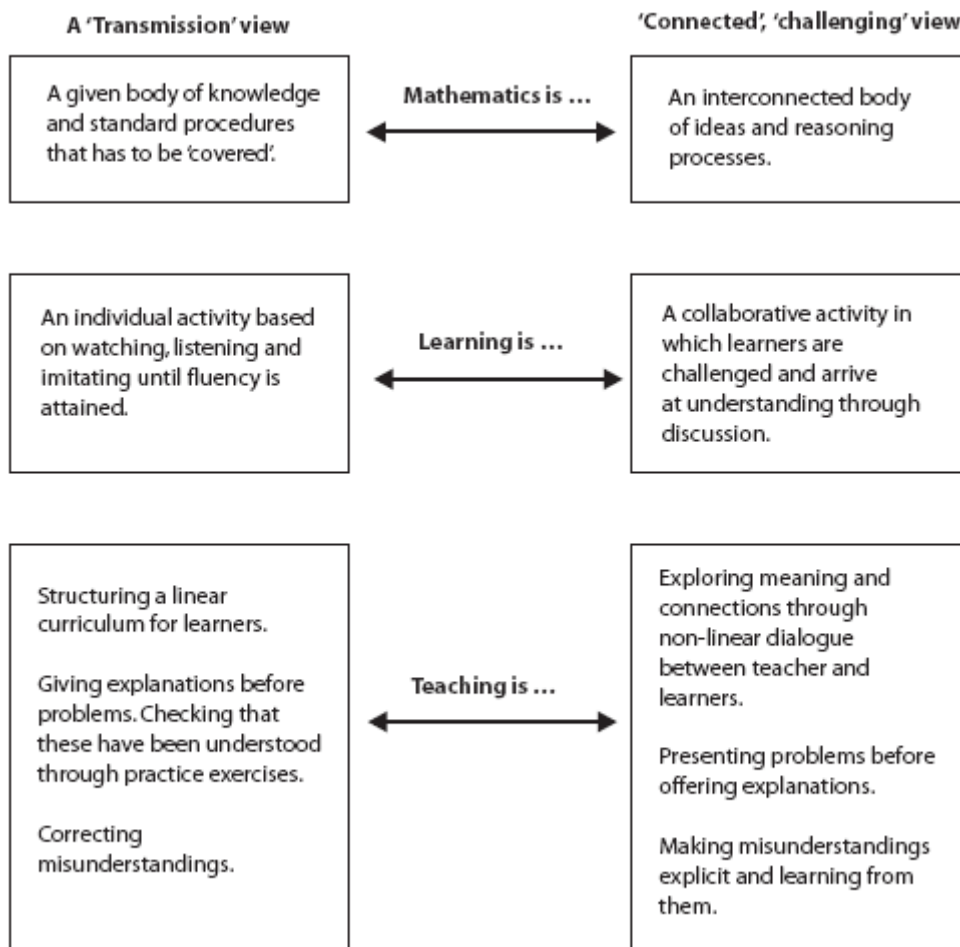
*In the secondary lessons, the most prevalent style was one where the teacher demonstrated a new mathematical method which pupils then practised. When this approach was used well, teachers developed pupils' understanding of why the method worked through explanations and activities. They selected a suitable range of questions so that pupils developed the necessary breadth of skills and understanding of the applicability of the method. A good example of this involved pupils choosing where to start exercises and the questions that challenged them; they enjoyed this responsibility, used it well and said how much better it was than wasting time on repetitive, easy questions. Notably, these good lessons avoided the common pitfalls of demonstrations that were limited to ways of remembering the method, followed by pupils working through similar examples. Such lessons do little to teach pupils how to use and apply mathematics; this style of teaching was noted in Ofsted's report on mathematics for 14–19-year-olds.*

There are some interesting pointers here to 'raise the game' in these lessons, which would be quite easy to incorporate, and a reminder that we also need to have opportunities for pupils to use and apply their mathematics.

Malcolm Swann talks about traditional mathematics teaching in his book [Improving learning in mathematics: challenges and strategies](#):

*Traditional teaching methods are sometimes called 'transmission' approaches; methods are explained to learners one step at a time. Teachers only question learners in order to lead them in a particular direction or to check they are following the taught procedure. Learners are expected to achieve fluency through practising these methods on lists of graded exercises. Transmission approaches can appear superficially effective when short-term recall is required, but they are less effective for longer-term learning.*

He talks about different models of teaching, which are summarised in the following diagram, and argues that the 'connected' model encourages pupils to become active learners:



This clearly presents us, as teachers, with some food for thought as we examine our own practice and make careful choices in our lessons to give our learners the best possible chances to make sense of our fascinating subject.

So, I expect you are a XXX teacher sometimes, but only when you have carefully selected this pedagogical approach from a range of other strategies to fit the current needs of your learners. Why not tell us about some of 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.

There are just a few short weeks before the Christmas holiday! Where's the best place to do your shopping? Is it cheaper to shop on-line or to brave the city centre? Maybe, with clever planning and a good exchange rate, it's possible to take a trip abroad and save money on your Christmas gifts! This Up2d8 Maths resource starts by exploring whether it's best to buy from the UK, France or the US and then develops to explore the possibility of a 'free' trip abroad. In working with exchange rates, students will practice proportional reasoning and, in exploring the possibility of an overseas trip to buy presents, will be given the opportunity to experience many of the key processes.

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:** Tom Rainbow

**About you:** Due to a curious glitch in the space-time continuum three years ago, I was made into a mathematics AST...in Devon!

Having previously been Second (and for a brief time Head) of Department, I know that I am extremely fortunate to hold this position. All the AST work I carry out is maths-centred, and I enjoy working with many different groups of teachers and educationalists – work carried out in the last three years has involved many of the secondary schools in the county, most of the feeder primary schools for Ivybridge, the Devon Advisory team, the NCETM, even Plymouth University, as well as working within Ivybridge Community College with members of my own and other departments!

Among the most rewarding work I have carried out thus far, has been the non-accredited departmental research that has been supported and funded by the Advisory team and that last year stemmed from a filming project I was involved in with the NCETM called [Teachers Talking Theory: In Action](#).

I find all my AST work interesting and am consistently impressed and humbled by the work being done throughout the county at all levels.

**The most recent use of mathematics in your job was...** calculating how many minutes of block 5 (11y6) were left.

**Some mathematics that amazed you is...** staring me in the face whenever I explore a function on Autograph. I am constantly astounded by the algebra/graph mirror and unpicking the shape of a function is probably the most fun that anyone can have without breaking the law.

I also find the Mandelbrot set pretty spine tingling. How can something that complex be rooted in such a straightforward starting place?

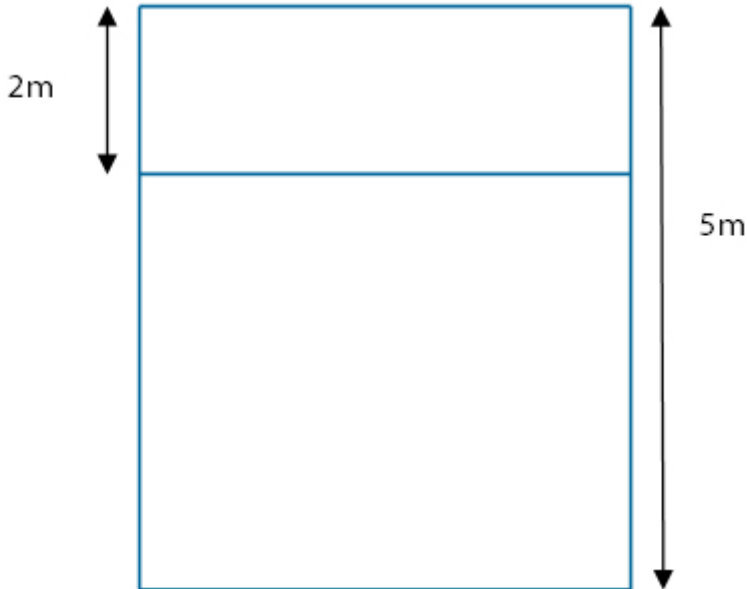
Proving Fermat's Last Theorem all those years ago was also pretty cool, but I didn't want to boast.

**Why mathematics?** Do you need to ask?

**Your favourite/most significant mathematics-related anecdote is...** When I was teaching at my previous school, Vic Stowe (fellow maths teacher) told me this answer to a locus examination question that one of his students had come up with.

**Question:**

Here is a plan view of a dog kennel:



Fido is tethered to a bar that runs across the kennel by a rope that is 1 m long. Shade the locus of points that he can reach.

The student had written that Fido would be dead as the rope was not long enough to reach the floor!

**A mathematics joke that makes you laugh is...** A chap was walking down a country lane with a sack over his shoulder and another chap asks him, "What have you got in that sack?" The first chap says, "Ducks" so the chap says, "If I can guess how many ducks you have in that sack can I have one?" The first chap replies, "If you can guess how many ducks are in the sack you can have both of them!"

**Something else that makes you laugh is...** being tickled.

**Your favourite television programme is...** anything without those two who tell you how to dress but look dreadful themselves.

**Your favourite ice-cream flavour is...** always the one I haven't got!

**Who inspired you?** Pete Griffin, South West Regional Coordinator for the NCETM, of course.

**If you weren't doing this job you would...** be broke.



## Focus on...polyhedra

Polyhedra are usually named according to the number of faces that they have. The naming system is based on the Greek language so a four-sided polyhedron is called a tetrahedron, a five-sided polyhedron is a pentahedron, a six-sided is a hexahedron and so on. Sometimes a description of the type of face that makes up the polyhedron, or the way that the polyhedron appears to have been created from a simpler polyhedron is added to the name. The rhombic dodecahedron, for example, is different to the pentagonal dodecahedron and the truncated cube is a 14-faced polyhedron (a tetrakaidecahedron!) which looks like a cube with its corners cut off.

All polyhedra have a dual – that is a polyhedron where the faces correspond to the vertices of the original polyhedron. The dual of a cube is an octahedron (picture the centres of the faces of a cube being joined)

image from <http://www.math.rutgers.edu/~erowland/polyhedra-project.html>

The first proof of Euler's formula

$$(number\ of)\ Vertices - (number\ of)\ Edges + (number\ of)\ Faces = 2$$

is thought to have been given by the French mathematician Cauchy in 1811. This, along with 18 other proofs, is listed [here](#).

The great dirhombicosidodecahedron has 124 faces, 240 edges and 60 vertices. It is sometimes referred to as Miller's Monster (after JCP Miller). You can find out how to make one [here](#).

There are five Platonic Solids – the tetrahedron, cube, octahedron, dodecahedron and icosahedron. The faces, edges and angles in each of the Platonic Solids are congruent.

A traditional football is a truncated icosahedron with 32 faces, 90 edges and 60 vertices. The faces become rounded because of the air pressure inside the ball. A net for a truncated icosahedron can be found [here](#).



## An idea for the classroom – Teaching Ideas

Have you seen the [Teaching Ideas website](#), and more specifically the mathematics pages? Although this website has a Key Stage 1/Key Stage 2 focus, I found some great ideas which I will definitely use in the secondary classroom. Here are some of my favourites:

### Who is my mother?

There are instructions to make this game which encourages pupils to identify fractions of a variety of 'wholes' as follows:

*'Make a game consisting of strips of same width and different lengths like 20, 10, 12 15, 18 cm. This is the set of 'ones' or 'wholes'. Make another set of smaller strips of the same width and different lengths. Here the lengths are 10 cm, 3 cm 5 cm 6 cm etc. These new strips are the fractions with  $\frac{1}{2}$ ,  $\frac{1}{6}$ ,  $\frac{1}{3}$  etc written on them. The game is 'Who is my mother?'. Children need to take the fraction strip and look for its mother or the 'whole'.*

### Maths Dictionary

The website gives some guidance to lead pupils in making a maths dictionary of their own. A real boost to literacy in mathematics but also, as the site says, *'They are more likely to remember the meanings of the terms if they have made the pages for themselves.'*

### Maths Mat

The site also gives links to enable you to purchase maths resources such as the maths mats featured here. The maths mats can be put on the pupils' desks rather like place mats while pupils are working on their mathematics. You could also ask pupils to make their own maths mats. If you find some other good ideas on this site, why not post them here?





## 5 things to do this fortnight

**You have one remaining opportunity to hear Professor Marcus du Sautoy on Desert Island Discs**  
Friday 12 December at 9.00am, BBC Radio 4 (NB: this is not available on the Listen Again facility).

### **Promote effective teaching, learning and assessment in mathematics**

Concept Cartoons™ in Mathematics Education is designed to promote more effective teaching, learning and assessment in mathematics. They use cartoon-style drawings in which different characters offer their views. They are highly motivating for pupils, provide stimulating starting points for learning, and offer invaluable opportunities for discussion and are easy to use in the classroom as a part of normal teaching.

### **Check out the Mathematical Association Annual Conference**

The joys of the [Mathematical Association \(MA\) Conference](#) are clear to those who attend. Nowhere else do you get such a wide-ranging and enthusiastic bunch of educators of mathematics. University doctors, primary PGCE students and established secondary teachers attend, to mention but a few. The variety of delegates and workshops is immense...

The next MA Conference takes place **14–17 April 2009**, in Cambridge.

### **Don't miss out on the Bowland DVD-ROM**

The DVD-ROM for Bowland Maths contains all the Case Studies and all the Professional Development modules, just as on the website (as at 1 September 2008), but with much faster access speeds. It also includes most of the other descriptive materials on the website. It comes with a printed booklet that provides background material and brief descriptions of all the materials (new Case Studies will be added to the website from time to time).

[Click here](#) for more information, including details of how to order.

### **[Take up the Marcus du Sautoy challenge](#)**



## Diary of a subject leader

### Real issues in the life of a fictional Subject Leader

As I walked into the principal's office, I was met with a beaming smile. The SATs were over and we should all be celebrating ...apparently. I couldn't share her enthusiasm. To be honest, since hearing the news on the radio, the consequences of losing this 'test' started to dawn on me.

For many years, when Year 9 students asked me why they had to do SATs, my answer was always somewhat dismissive. The students' perception was that they were for the benefit of the teachers and not them. To some extent they had a point, however they and many of my staff failed to appreciate the implications the exam had for their learning, both before and after the event.

So what did the SATs ever do for us? Well, five years is a long time to go without any rigid, standardised summative assessment. As with most departments, we created our own internal assessments within both Key Stages. They were however, under continual review and rewrites due to our dissatisfaction with what they tested and what the resulting levels/grades meant. The SATs, if nothing else, provided a standardised national assessment of the students at a crucial stage in their secondary schooling. Yet in theory, where the SATs had been treated as just another test, all existing practices should remain unchanged.

Talk of using the news as an opportunity to start the GCSE course in Year 9 with early entry in Year 10 has also started within my department. My response is always the same. Surely the KS4 curriculum should build upon that of KS3 and not be a case of 'starting something new'. There should be progression through the subject without the implication that GCSE work is in anyway different or more important.

The SATs, rightly or wrongly, forced the implementation of intervention strategies for underachieving students in Year 9. Arguably it made teachers identify curricular weaknesses, both for individuals or cohorts, with the net effect of raising the attainment of a selected few. Will such efforts continue or will all extra support measures only now exist in Year 11?

So what will replace the SATs? I'm assuming that some kind of teacher assessment will still be required at the end of KS3, yet are we, as mathematics teachers, any good at doing this well? What should the assessment be based on? Will it focus around a single test or be from an amalgamation of different sources? Do we even need to test? Will schools be allowed to manipulate the figures to skew their 2 levels progress measure? How will Raise Online report CVA and other such performance indicators?

There are so many unknowns and the implications of this decision to remove the KS3 SATs may be immense. Until we know the answers to these questions, shouldn't we be apprehensive about what's lurking around the corner?

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