Welcome to Issue 53 of the Secondary Magazine. Half term – phew. There are definite signs that spring is around the corner - snowdrops out, a few brave daffodils just showing some yellow, and lighter evenings. Have a good break.

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From the editor – Plus Magazine

I went out for a great walk along the riverbank yesterday – a look at the wading birds, round onto the beach, a quick snack sitting in the sand dunes, followed by a brisk walk back to the car. I thought I'd left myself plenty of time to come home and get myself ready for the week ahead but when I logged on to my emails I found a colleague had forwarded me the link to the latest issue of Plus magazine – and I was hooked. Several hours later I still had un-ironed shirts and unwritten reports but felt mentally stimulated. Let me take you on a tour:

How could I fail to be engaged by an opening sentence that said "When I was nine I was an origami master." I've always been interested in origami – I like to use some paper-folding as a way of pupils following instructions in unfamiliar contexts which end up with a hands-on resource to aid their problem solving with shapes – but this article took the art of origami into another realm and proved fascinating reading.

I'm not a bell ringer, but I could not fail to be impressed by the level of intricacy and commitment demonstrated by the bell ringers in this article. When ringing bells, one of the grand goals is to ring a sequence that includes every possible change. This is known as an 'extent'. It talks about the longest extent that has been performed with one ringer to a bell: "With one ringer per church bell, probably the largest extent that is humanly possible is an extent on eight bells. This has apparently been achieved only once, at the Loughborough Bell Foundry in 1963. The ringing began at 6.52am on July 27, and finished at 12.50am on July 28, after 40 320 changes and 17 hours 58 minutes of continuous ringing, and an unknown number of complaints to the police." And the ringers are not allowed 'music' or aide memoires!

Other articles included 'Uncoiling the spiral: Maths and hallucinations', 'How long is a day?' and 'Modelling catastrophes'. All of which kept me away from the ironing. And is this a good thing? I feel lucky that I am drawn to reading about mathematically-related topics and know that colleagues are also interested by mathematical websites, magazines and articles – but how does this help our teaching? Is it just a leisure interest or is it a form of professional development?

Have you looked at the NCETM Excellence in Mathematics Leadership microsite? Looking at the Core Responsibilities on the Secondary part of the site (Developing a common purpose and developing a shared culture) there is specific mention professional discussions about mathematics: 'Mathematics and the teaching of it are discussed regularly, both formally and informally, as a matter of habit'. Building up a culture within the department where staff (and students) regularly talk about mathematics is an integral part of our professional life – what a good thing it is so enjoyable!

If you have a good way of encouraging mathematical talk within your department, why not tell us about it?

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.

The tallest building in the world has just opened in Dubai. Work began on the 828m Burj Khalifa in September 2004 and it was officially opened on 4 January (with a last minute name change from the *Burj Dubai*). The building breaks many records. This resource allows students the opportunity to explore proportionality in similar triangles and, in doing so, could provide an introduction to trigonometry.

The activity explores similar triangles (although explicit mention of triangles is not made in the PowerPoint). The idea of a fixed angle to observe a distant object is used as a context (a camera tripod at a fixed angle viewing the top of Canary Wharf) and students are given an opportunity to explore how much further away they would need to be to use the same angle to photograph the top of the Burj Khalifa initially, and then other tall buildings.

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 this Up2d8 Maths resource - in PowerPoint format

Download this Up2d8 Maths resource – in PDF format.
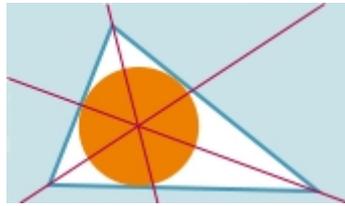
Focus on…the centre of a triangle

- Defining the centre of triangle can be challenging – there are many different 'centres' to choose from! The ancient Greeks discovered some of the classic centres of triangles but didn't give a formal definition for the centre of a triangle. The online Encyclopaedia of Triangle Centers now lists over 3 500 types of centres of triangles!

- The 'incentre' of a triangle is the centre of the inscribed circle – that is, the circle with the largest diameter that will fit inside the circle. The centre of the incircle is the point at which the three angle bisectors of the interior angles of the triangle meet.
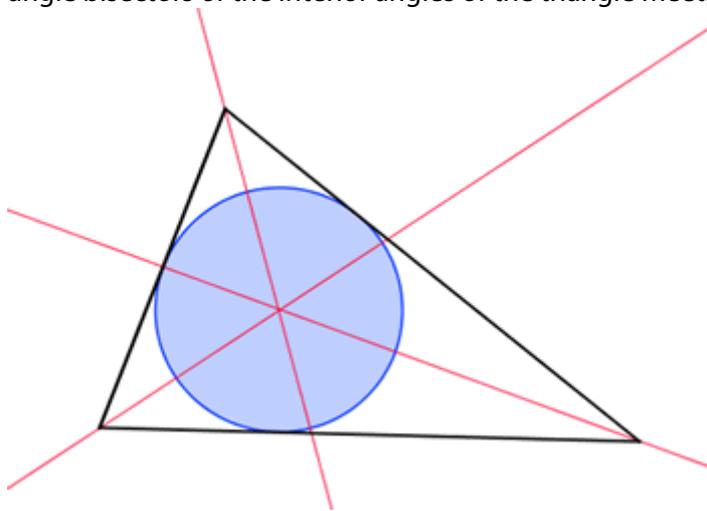
- The 'circumcentre' of a triangle is the centre of the circumcircle – that is, the circle whose circumference goes through each vertex of the triangle.
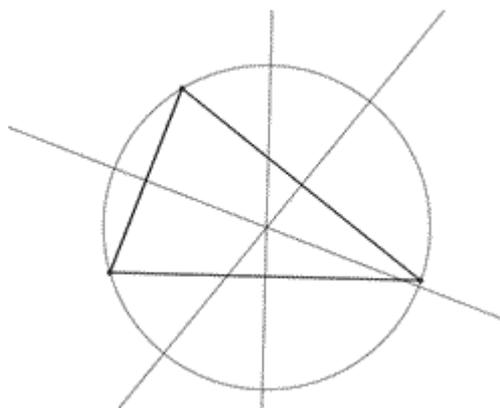
If all angles in the triangle are acute then the circumcentre is inside the triangle.

If one of the angles of the triangle is obtuse, then the circumcentre lies outside the triangle and, if the triangle has a right angle, the circumcentre will lay on the hypotenuse of that triangle.

The diameter of the circumcircle is the length of a side of the triangle divided by the sine of the angle opposite that side.
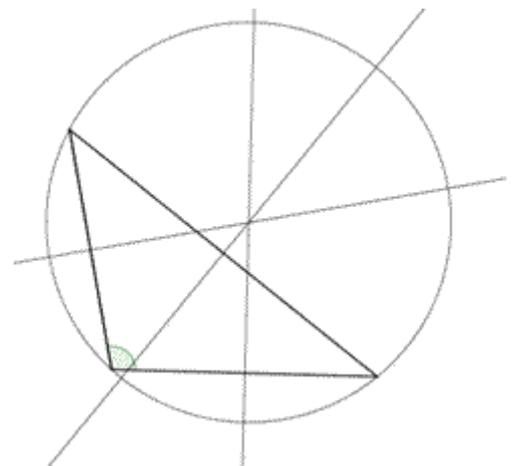
- If the sum of the distances from a point, p, to the vertices of a triangle is the minimum possible then the point is described as the Fermat (or Toricelli) point. The strategy for finding this point was posed by Fermat to the Italian physicist and mathematician Evangelista Torricelli (1608-1647). The solution, for triangles with angles less than 120°, is to construct an equilateral triangle on each side of the original triangle then join the peak of each equilateral triangle to the opposite vertex on the original triangle. The crossing point of these three lines is the Fermat Point.
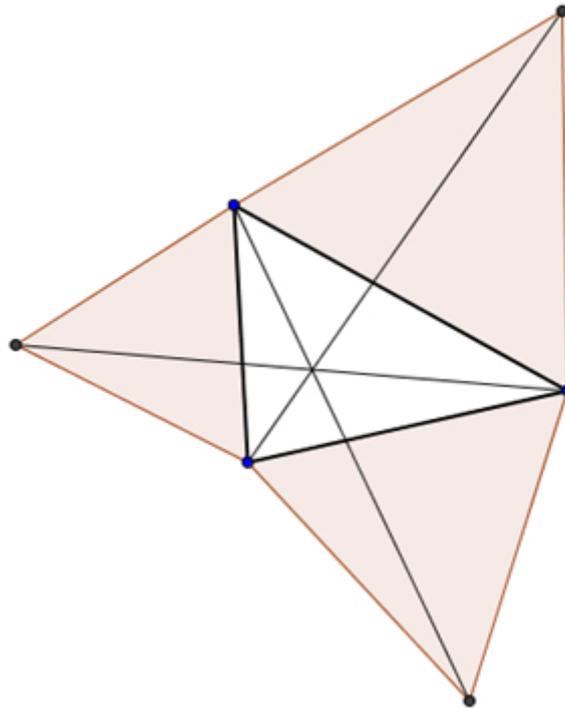

- The centroid of a triangle is the centre of gravity (assuming that the triangle is constructed from a solid, uniform sheet). It's ⅓ of the distance across the triangle from each of its edges. The centroid is found by joining the midpoint of each side of the triangle with the opposite vertex. The coordinates of the centroid is the mean of the vertices of the coordinates of the vertices (that is, if the coordinates of the vertices are (1, 5), (2, 4) and (4, 7) then the x coordinate of the centroid will be found at ⅓(1+2+4) and the y coordinate will be at ⅓(5+2+7)).

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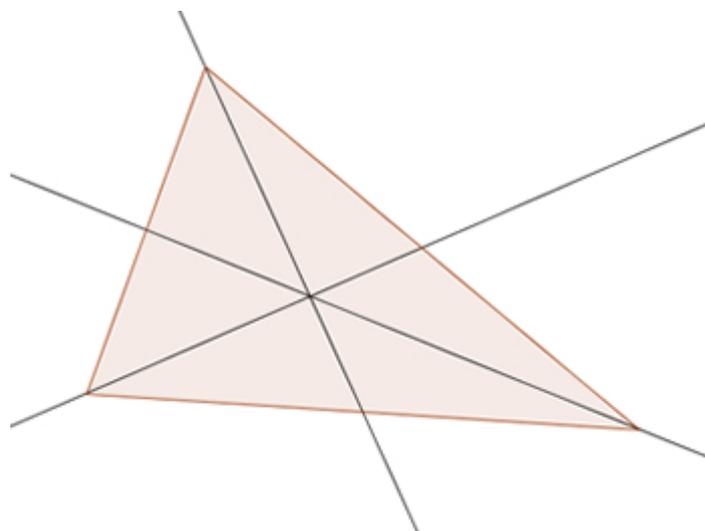
- The orthocentre of a triangle is the point at which the three altitudes meet (the altitude of a triangle is the perpendicular distance from one side to the opposite vertex). The orthocentre will lie within the triangle if, and only if, the all interior angles of the triangle are less than 90°.
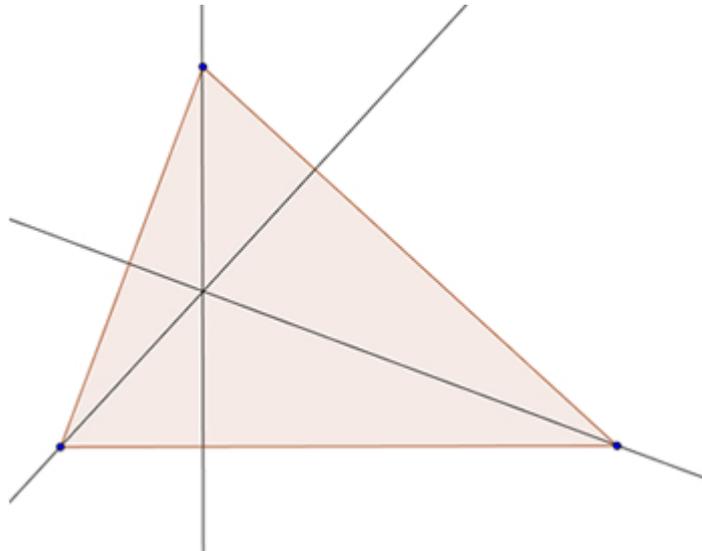
- The Euler line is the straight line passing through several important points in a given triangle. It passes through the orthocenter, the circumcenter, the centroid, and the center of the nine-point circle of the triangle. In an equilateral triangle these four points coincide.

- The nine-point circle of a triangle is a circle which passes through nine significant points:
    o the three midpoints of the sides of the triangle
    o the foot of each of the three altitudes
    o the midpoint of the line segments from each of the three vertices of the triangle to the orthocenter.

The nine point centre (the centre of the nine point circle) can be found at the midpoint of the orthocentre and the circumcentre.

Note: on the portal there is an interactive diagram created with GeoGebra.

This interactive diagram requires you to have Java installed. If you cannot see the diagram, you will need to install Java to be able view it. Java software is available at no cost from http://java.com/.

If you can see the diagram but it doesn't appear to work, your copy of Java may be out of date. You can download the current version of Java from http://java.com/.
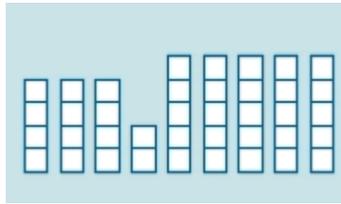
An idea for the classroom – multiple representations

A couple of years ago, I was working with a group of pupils on averages, in particular the mean. The pupils were pretty good at the 'add them all up and divide by how many there are' routine – they would have been even better if they had known the 'Hey diddle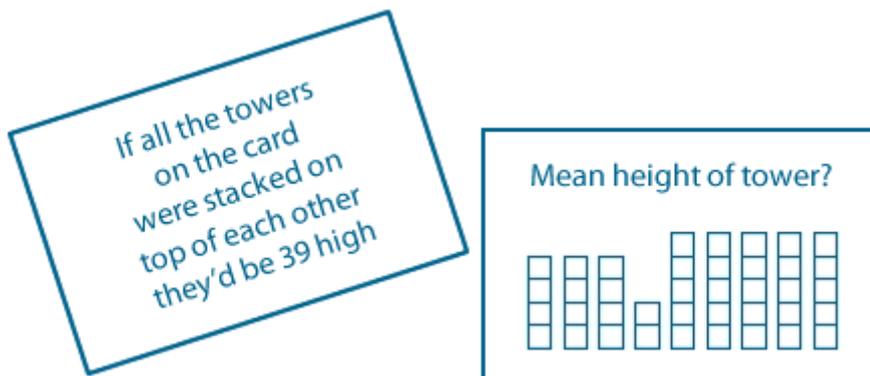 diddle' rhyme we talked about in Issue 48 – but when I asked them to make some sense of this routine I wasn't convinced by the responses. I started another lesson by talking about things being fair – always a huge bone of contention in my house when I was a kid! If my brother was allowed sweets – I had to have the same number, if he had pocket money – I had to have the same amount. I went on to talk about my poor brother's suffering now he has three children and introduced the concept of redistributing sweets (or whatever) to keep the total the same but make it 'fair'. The pupils in my class were pretty happy about the concept and gradually began to tell me that they were finding the mean!

In an attempt to develop this idea a bit further, I recently used this multiple representation exercise. Pupils are getting used to doing this sort of activity so they were asked to 'sort out' the cards. Most cards were placed quite quickly, but there were a few problems which gave pupils some extension activities to do – they initially thought that I had made a mistake until I confirmed that this might generate a new set of cards! I feel that it is the creation of a new set of cards that really pushes their understanding a stage further and also gives pupils the opportunity to generate their own mathematics – a step towards becoming 'independent' in the functional sense?

I hope your pupils enjoy doing this activity – do tell us about your experiences.

If all the towers on the card were stacked on top of each other they'd be 39 high

Mean height of tower?

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A Department for Children, Schools and Families initiative to enhance professional development across mathematics teaching

5 things to do this fortnight

- Do you see exploring ways that you can improve learning in mathematics for your students as part of your job? Is there an aspect of teaching and learning that you and some colleagues would like to explore but time and money are getting in the way? The next round of Teacher Enquiry Funded Projects (TEFP) applications is now open. Applications should be based around one the specified broad themes – these include *Using ICT in ways that focus on mathematics learning and reacting to student feedback*. The closing date for applications is **8 March**.

- The Advisory Committee on Mathematics Education (ACME) provides a two-way channel between the mathematics community, the Government and its agencies, and other policy makers on mathematics education issues. It is now looking for two new members including one from the secondary mathematics community. Candidates for the positions are expected to have current or recent experience of teaching within schools and/or colleges. They will also have some knowledge of the education policy landscape and/or be willing to develop associated skills through membership of the Committee. The deadline for applications is **8 March**. More details about the responsibilities and commitments, along with an application form, can be found on the ACME website.

- We've mentioned it before but this is a reminder to book your place at the British Congress of Mathematics Education (BCME) which is taking place from the 6-9 April. BCME7 is an event in which all sections of mathematics and mathematical education come together in a single conference to celebrate, enrich, refresh and build mathematical and pedagogical confidence and expertise. You can find out more details by visiting the BCME website.

- There's a number of ATM branch meetings in the coming weeks. If you're in London, you'll have a chance to explore 3D geometry through Cabri on 22 February, and on 11 March, you'll get to explore correlation and regression. Durham, Avon and the Marches ATM branches are also meeting throughout March.

- An early reminder that Mother's Day is coming up on 14 March. The tradition of Mothering Sunday, which is always the fourth Sunday of Lent, is thought to have developed from the 16th Century practice of visiting your 'mother church' annually and this resulted in young apprentices and young women in service being released by their masters that weekend in order to visit their families.

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Diary of a subject leader

Real issues in the life of a fictional Subject Leader

Eighteen months ago, in August 2008, my team and I looked at the OCR Staged Module results of our 'new' Year 11. 'New' because they were going into their final GCSE year and the 'old' Year 11 were off to new pastures, but also new because we, the mathematics team, were all new to our school. The results began to give us second thoughts – why had we come here? More than 70% of students received a grade U. Admittedly, some of those were working at B's, and C's etc. but 70% of them had been unable to do sufficiently well to achieve the minimum grade on their paper.

There was no doubt that starting Year 11 with results like that was a handicap rather than a credit. We quickly changed our plans and went for what we saw as a simple variable rate repayment mortgage – Edexcel's Linear GCSE. (And isn't it interesting that OCR's staged module syllabus has gone the way of so many of those more interesting mortgage products. More's the pity when it comes to my mortgage – and, for some students, more's the pity when it comes to their GCSE. I really liked the staged system and for less confident students it was really helpful.) Anyway, we had no choice but the linear option. A few parents of the very few who had 'banked well' as it were, were less than pleased, but most students were happy for a fresh start.

As we went through that first year we learnt the culture of our new school. And more and more we realised that our Year 11 students were just not able to get the idea of delayed gratification. They wanted success and they wanted it yesterday, so there was no point in working hard for tomorrow, let alone for six months down the line. We wondered how much those very poor module results had affected them. Year 10 were even worse – as you may know! Year 9 however, showed considerable promise. Not only were they statistically a better cohort, but they could be enthused. They would have a go at an investigation and if you gave them a challenge they would make sure they gave it their best shot. We were a little disappointed that the KS3 SATs were cancelled – it felt like our one area of proven success was being confiscated, and we would have to mark the **** papers! We sat the SATs and marked the SATs. The levels were conspicuously good – but then, they were a better cohort.

Given how good the SATs were and, more importantly, just how motivated students were by the results, we took a last minute punt on starting a modular course about six months too late. We spent the last fortnight of the summer term starting on a Data Handling Module to be sat in November. It was hard going right through to the exam. And on more than one occasion, I felt we had reacted too emotionally and not thought through the full implications of pushing the new Year 10s into a module so early, and without more careful planning. Particularly nagging was the effect it was having in some key C/D borderline groups. The required pace left little time for more engaging activities and 'easing-up' on a wet windy Friday afternoon when kids were 'high as kites' was just not an option.

13 January 2010 might become the new Friday 13th. If the results were poor, we could really be back to square one – and we had actually made so much progress over the past 16 months. Our last set of results – Year 11 2009 entry – we were just a few points shy of our 50% A*-C target. How would these modules compare?

Typically, I was just given the individual results sheets for each student, so it was a tale of two piles. Initially it looked grim, then I realised that although in alphabetical order, they were batched by tier of entry and I had just sorted the foundation! With the higher, I thought I had only put four papers on the 'below C' pile. Indeed, the 'made-it' pile appeared a little thicker than the other. We looked to be over 50%. We made 63.9%. It felt great. I have since been more thorough in my analysis and compared it to our FFT targets. It doesn't look as great, but still much better than any year group in the previous five or so years.

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What really is great however, is the impact it has had on students. They actually care about what they got, and what is says about them. To me, it says what a good job my team have done in turning a school totally disaffected with maths into one where achievement in our subject is something that all students wish to take pride in. A number of 'likely lads' have found that their mates who actually knuckled down to some work have outscored them by two, and in some cases three, GCSE grades. And a few of those 'likely-lads' – to use their words – have told me, "That just ain't funny." Did I laugh? Well, I'll let you guess!