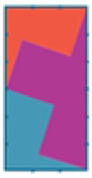
Secondary Magazine
Issue 61



National Centre
for Excellence in the
Teaching of Mathematics

Welcome to Issue 61 of the Secondary Magazine.

## Contents



*Contributors to this issue include: Peter Lacey, Sue Madgwick, Mary Pardoe, Jim Thorpe and Peter Ransom.*



## From the editor

This magazine is just one of the many resources on the portal where we may find materials and ideas that we have not met before. What actually happens when we try out these ideas with our students depends to a great extent on the learning atmosphere that we have created in our classrooms.

In everything that we and our students do, we are sending each other subtle messages about what we believe. We are indicating how we believe people learn, and what we believe doing mathematics involves. And these, usually unintentional, messages create the learning atmosphere.

If we think sometimes about what we may be unintentionally 'telling' students, we may find that by making small changes in our behaviour we can make big changes in the atmosphere; that we can make our classroom a better place in which to learn.

For example, when a student asks 'What do I do now?', is your automatic instinctive response to tell them? If you believe that we always learn by being shown what to do, that is what you will believe a teacher should do – and the student wouldn't have asked the question unless she believed that she was expected to learn mathematics by doing what she was told to do. If, sometimes, instead of telling the student what to do, you prompt them to think about something that will help them work out what to do for themselves, you challenge that student's belief – you begin to change the classroom atmosphere.

Are students in your classroom happy to reveal that they are struggling to 'get their heads round' mathematical ideas? Do they feel that that their efforts to explain things about which they are not yet at all confident will be respected and valued by everyone, at least as much as confident statements from students who know that they are right?

I first encountered the expression 'conjecturing atmosphere' in 'Expressing Generality', a booklet in the Open University Project Mathematics Update series published in 1988. In the introduction, John Mason writes: *"A conjecturing atmosphere is fostered by simply noticing the manner and content of contributions and responses to others, and modifying that behaviour when appropriate. It is based on the explicit premise that you learn much more from trying to express ideas that are still fuzzy and half-formed, than you do from telling someone things about which you are confident… even though, perhaps because, you are uncertain, others can also learn from your struggle. The essence of working in a conjecturing atmosphere is therefore listening to and accepting what others say as a conjecture which is intended to be modified. Consequently, it is well worth noticing how you go about developing and using a vocabulary which fosters conjecturing ('I suggest that…', 'perhaps…' rather than 'No!' or 'That's right!'), and listening to others and being listened to."*

Asking myself, over and over again, on occasion after occasion, what kind of learning atmosphere I was encouraging, has helped me gradually begin to create better learning environments in which to try out new ideas. Hopefully, there will be some ideas in this issue that are new to you and that you can try out in your learning atmosphere.

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# It’s in the News!
# The World Cup

The fortnightly *It’s in the News!* 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.

You might have heard that the Football World Cup kicks off across South Africa on 11 June this year? Flags of different nations are flying and, as usual, there is plenty of speculation about whether England fans will have something more recent than 1966 to celebrate. But how likely is it that football really will be ‘coming home’? What does the data suggest? This resource provides students with data about some of the teams competing in the competition and invites the students to use this to offer a reasoned argument predicting who they think will win the famous trophy. Data given includes the FIFA world ranking of international teams, data from the International Federation of Football History and Statistics about the strongest team coaches and national leagues and previous head-to-head matches between some of the top teams.

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. The *It’s in the News!* resources also provide the opportunity for students to work on many of the Functional Maths skills.

Download this *It’s in the News!* resource - in PowerPoint format

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## The Interview

**Name:** Peter Lacey

**About you:** I started teaching in 1968 when I was given responsibility for introducing 'modern' mathematics. I spent four days a week in a secondary school and one in a primary. Thank you, SMP for those wonderful hardback numbered books, which enabled and encouraged teachers and students to engage with and discuss their mathematics. Flourishing after-school maths clubs and workshops for parents added to the buzz and excitement. What a lucky start! Two schools later, as head of mathematics responding to Cockcroft, we spent a whole week filming each other's lessons. The replays had an enormous effect on re-motivating us to give time back to the students for their own learning! (It made me understand what Mary Boole described as 'teacher lusts'!)

A career highpoint was my appointment as North East regional co-ordinator for the then DfES-funded Raising Achievement in Mathematics Project (RAMP). Teachers of mathematics were released from their classrooms for one day a week over three years to research, reflect, review and refine their practice. They were known as teacher researchers. The energy created was transformational. Practice changed and an increasing circle of teachers adopted this method for themselves. Another career move brought me to the initial revisions of the mathematics statutory national curriculum and the early national tests. I learnt that expressing a curriculum as words on paper, however well stated, cannot itself capture the essence of mathematical excitement or the complexity of its construction. Arguably, the original non-statutory guidance prompted more response and action! Five years ago, after a ten-year stint in a local authority as deputy director of education, I 'came out' as an independent consultant. My membership of the ATM has shaped much of my work. Sharing struggles and successes in that community has provided me with a 'professional home'. Through membership of its Council I have tried, over my career, to put something back in.

**The most recent use of mathematics in my job was…**
statistics most days: putting data in formation.

**Some mathematics that amazes me…**
the prevalence of the Fibonacci Sequence and Golden Ratio.

**Why did I choose mathematics?**
Because it can be worked on in solitude and in company, so I have a choice.
Because I can use the mathematics I know and can do to access and learn about mathematics beyond this boundary.
Because of its inter-connectedness: by virtue of my knowing something, there is something else I can also know.
Because of its rigour – pure logic; pure joy!!

**A significant mathematics-related incident in my life**
was being contacted last year, out of the blue, by a student I taught 25 years ago who said she still remembered her mathematics lessons and was about to start a degree in mathematics so that she could become a mathematics teacher.

**A mathematics joke that makes me laugh...**

The off-the-wall misinterpretations of expanding brackets, dropping perpendiculars, partial fractions and numerical eccentricity are amusing.

This oddity from Euler's Identity makes me smile:

| | | | |
|---|---|---|---|
| | $e^{i\pi} + 1$ | $= 0$ | *subtract 1* |
| $\Rightarrow$ | $e^{i\pi}$ | $= -1$ | *take the square root* |
| $\Rightarrow$ | $e^{i\pi/2}$ | $= i$ | *take the $i^{th}$ root* |
| $\Rightarrow$ | $e^{\pi/2}$ | $= i\sqrt{i}$ | |

which suggests that the $i^{th}$ root of $i$ is real with a value around 4.81!!

**The best book that I have ever read**

It's hard to pick out just one. Some which stick in my mind are: *Pi in the Sky* by John Barrow; *Deep Simplicity* by John Gribben is a must; *Mind Tools* by Rudy Rucker; *The Man Who loved Only Numbers, the biography of Erdős* by Paul Hoffman; *Number Sense* by Stanislas Dehaene. The list goes on: other books by Barrow, Wells, Paulos, Stewart and, of course, Du Sautoy, are all well 'thumbed' on my bookshelves. *How Children Fail* by John Holt significantly shaped my early teaching. Gattegno's works significantly influenced my thinking about my teaching and my later practice.

**Who inspired me?**

This may sound trite and syrupy, but it's true: in my teaching days when students were intensely busy making their own mathematics learning journeys, some of their challenging questions forced me to deepen my own mathematical understanding. You may have heard me tell the story of the 15-year-old student who asked the question: "What's the equation of the curve that's parallel to the parabola $y = x^2$ ?" It lit us all up!! There were many more and, in this sense, my students inspired me. The RAMP teacher researchers inspired me with their dedication and effort to make mathematics a better experience for all learners in school. And they did!

**If I wasn't doing this job...**

This is a scary thought!! I don't really know. I used to say that I would walk the dogs along the banks of the beautiful Humber estuary, buy the Yorkshire Post, drop in at the pub, read the paper, do the crossword, and walk back home. When I had this chance I couldn't stand it!! I'll probably slow down, return to my writing and become even grumpier. With the impending demise of the central control of education in this country, which currently tells teachers what they should be doing, I would like to think that all the subject associations will be there to offer professional homes to these teachers; to assure their nourishment and independent growth, and to shape that better world for all learners of mathematics. If I'm around, I want to be a part of that. It might take me back to the beginning of the page – a sort of re-incarnation!!

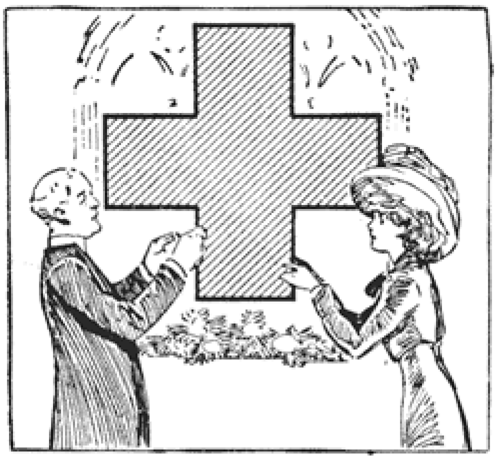
## Focus on…Dudeney's Greek cross dissection puzzles

*"Puzzles have infinite variety, but perhaps there is no class more ancient than dissection, cutting-out, or superposition puzzles. They were certainly known to the Chinese several thousand years before the Christian era.*

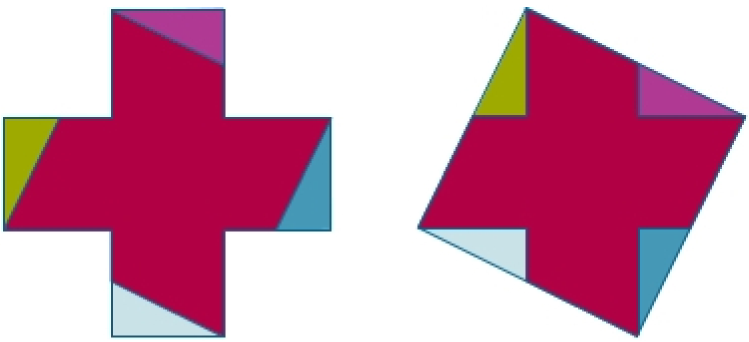
*"All good dissection puzzles are really based on geometrical laws – geometry will give us the 'reason why'. I have known more than one person led on to a study of geometry by the fascination of cutting-out puzzles.*

*"The fact that they have interested and given pleasure to man for untold ages is no doubt due in some measure to the appeal they make to the eye as well as to the brain. There are probably few readers who will examine cuttings of the Greek cross without being in some degree stirred by a sense of beauty."*
Henry Ernest Dudeney, from Amusements in Mathematics, published in 1917.

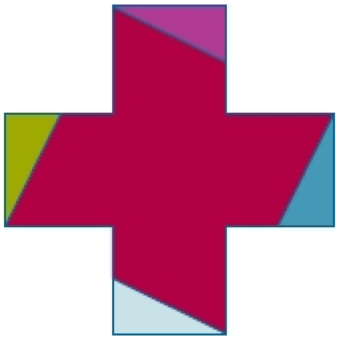
Dudeney tells us that the Greek cross, with four equal arms and formed from five equal squares, was regarded for thousands of years as *"a sign of the dual forces of Nature - the male and female spirit of everything that was everlasting"*.



A Greek cross puzzle, known as the Hindu problem, is supposed to be three thousand years old. It appears in the seal of Harvard College. The challenge is:
***cut the cross into five pieces that will form a square***.

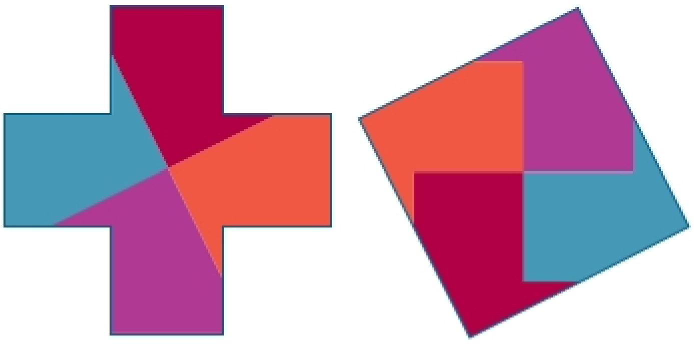


*Does each cut have to be from a corner to the mid-point of a side?*
*Or is this also a solution?*



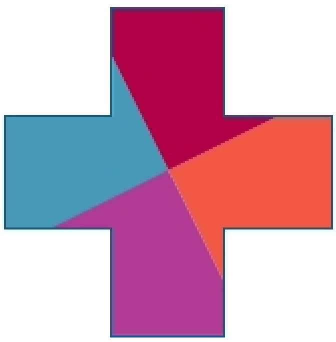
*Can you justify what you believe by thinking about half-turns?*

The same puzzle with only four pieces was not solved until the middle of the nineteenth century: ***cut the cross into <u>four</u> pieces that will form a square.***

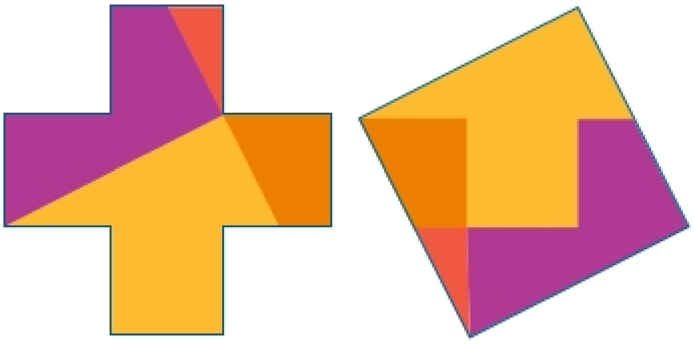


Dudeney wrote in 1917 *"Here we have the great Swastika, or sign, of 'good luck to you' - the most ancient symbol of the human race of which there is any record. One might almost say there is a curious affinity between the Greek cross and Swastika!"*
(This, of course, was before it was misappropriated by Nazi Germany in the 1920s and 30s.)

*Must each cut be from the mid-point of one side to the mid-point of another side?*
*Or are there other solutions, such as this?*

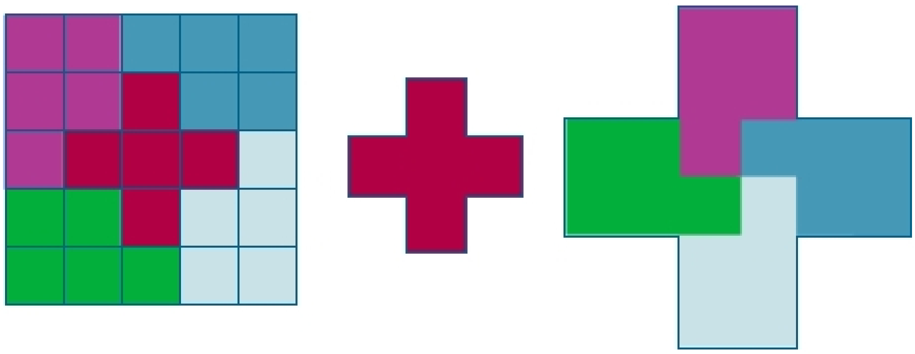


In the previous example, you need to cut the card or paper three times. Learners can make harder puzzles by adding further conditions. For example:
***cut the cross <u>with only two straight cuts</u> into four pieces that will form a square.***



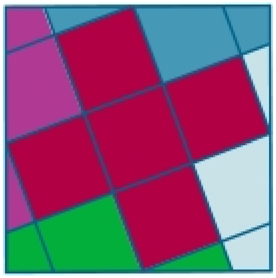
For every challenge to cut the cross into pieces that will form a square, you can ask the reverse question; how do I cut a square into pieces that will form a Greek cross?
For example: ***cut a square into five pieces that will form two separate Greek crosses <u>of different sizes</u>***.

By exploring possibilities on a square grid, a student might arrive at this solution:

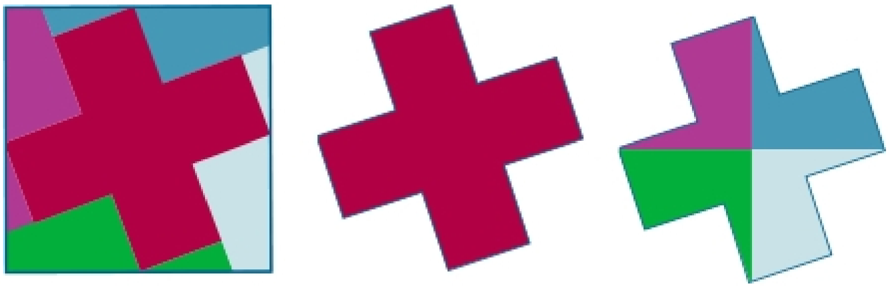


A learner might modify the previous challenge, for example by changing it to: ***cut a square into five pieces that will form two separate Greek crosses of exactly the <u>same size</u>.***

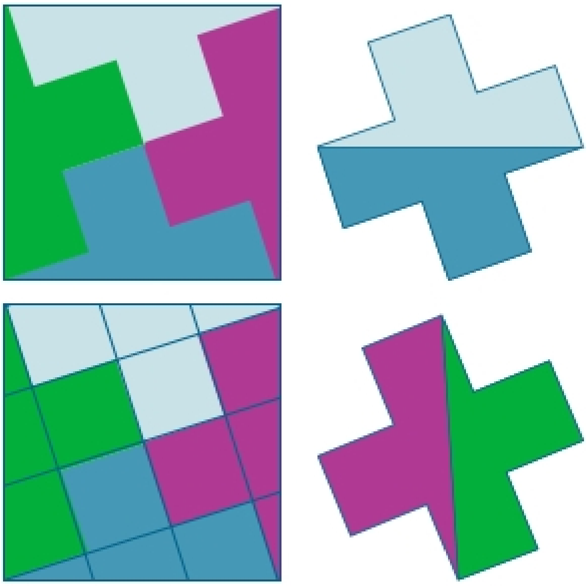
A possible strategy is to consider the reverse problem – how to form a square from two identical Greek crosses. A student who sketched a Greek cross on a square grid visualised this:



Mentally splitting the red cross into four identical pieces with perpendicular cuts led to a solution:



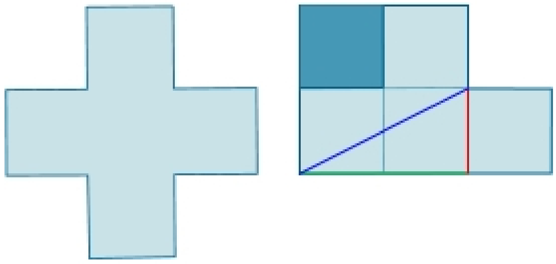
This way of 'seeing' how to cut a square into **five** pieces to make two identical crosses may suggest how to: ***cut a square into <u>four</u> pieces that will form two separate Greek crosses of exactly the same size***.

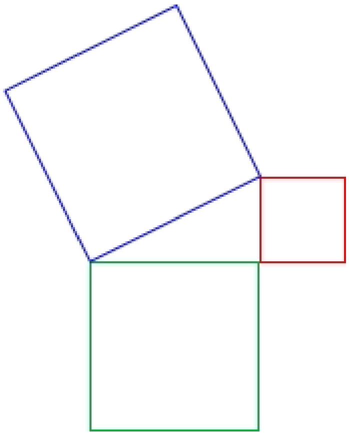


It is natural to visualise the same square grid superimposed over the square.

In *Amusements in Mathematics*, Dudeney sets out to show readers how the side-length of the square that has the same area as a Greek cross is related to the dimensions of the cross, and gives an explanation. Students may discover this themselves, and then, perhaps in response to a little questioning, explain their thinking in their own ways. When students try to convince each other that what they believe is true, and explain their reasoning, they are truly doing mathematics.

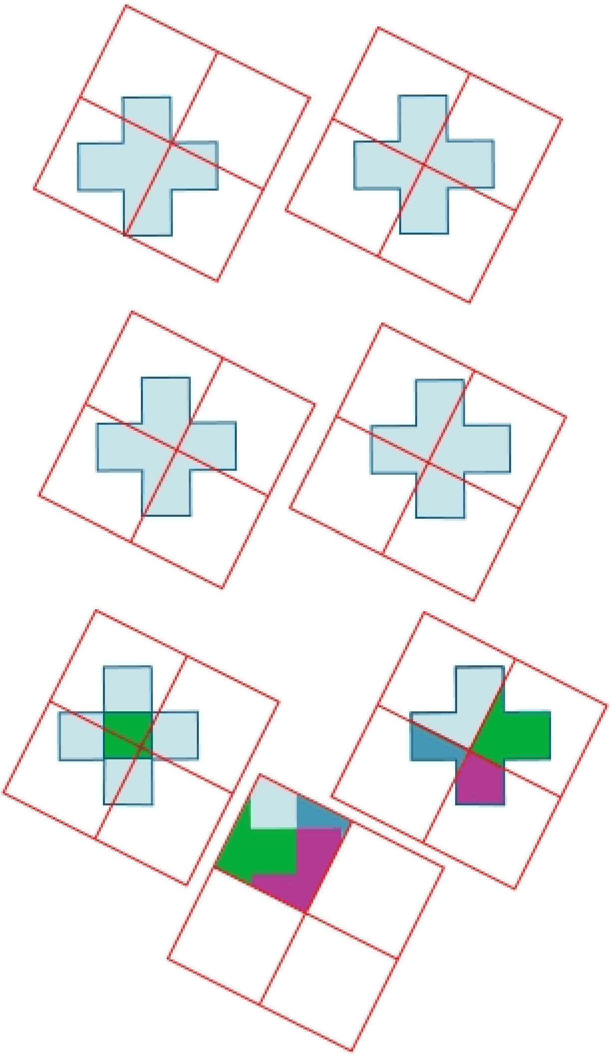
This is Dudeney's explanation, using Pythagoras' Theorem:





Imagine moving the bottom square of the cross to complete the square on the green side of the right-angled triangle. The area of the cross is the area of the square on the red side plus the area of the square on the green side – which is the area of the square on the blue side of the right-angled triangle. So the area of a Greek cross is the same as the area of the square on the diagonal of a rectangle composed of two of the five small squares making the cross.

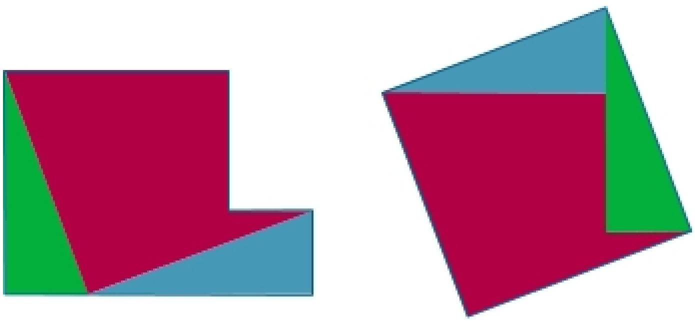
Dudeney also tries to convince readers that ***there are infinitely many different ways of cutting the cross into four pieces that will form a square***. He asks us to visualise, placed over a Greek cross, a grid of squares equal to the square that has the same area as the cross. Providing that you always have the grid lines parallel and perpendicular to the diagonal of a two-square rectangle in the cross, and a point of intersection of the grid within the central small square of the cross, the grid lines will give you the lines of the cuts to make the four pieces. Because there are infinitely many points within the central square of the Greek cross, there are infinitely many ways of cutting the cross into four pieces that fit together to form a square.



Students will see that this always works in every position of the grid, under Dudeney's conditions, that they try. But do they understand WHY it works!

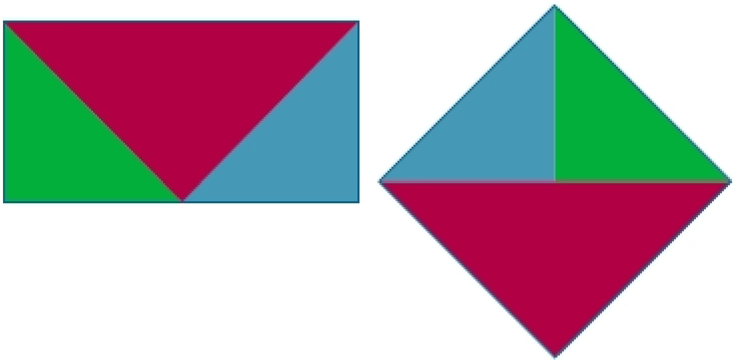
Dudeney reminds us that Pythagoras' Theorem also explains the following dissection.

***Cut a shape made from two squares of any relative dimensions into three pieces that will fit together to form a square*.**



Both cuts are from a point – on the longest side of the shape – that is the same distance from the corner of the larger square as the side-length of the smaller square. (The green and blue triangles are congruent.)

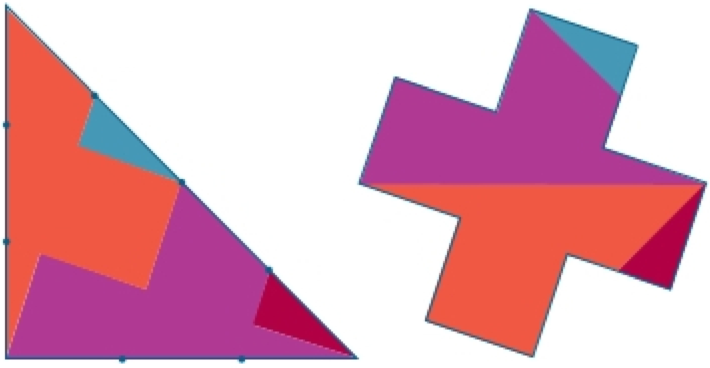
Because the start shape can be made from two squares of **any** relative dimensions, the two squares might be identical, so that the shape is a rectangle. We then have this special case of the previous diagram:



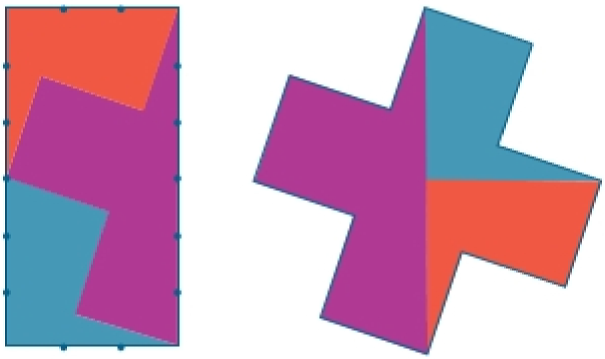
Dudeney writes: *"If you make the two squares of exactly the same size, you will see that the diagonal of any square is always the side of a square that is twice the size. All this, which is so simple that anybody can understand it, is very essential to the solving of cutting-out puzzles. It is in fact the key to most of them. And it is all so beautiful that it seems a pity that it should not be familiar to everybody."*

The following three Greek cross dissection puzzle may challenge students. But if they have explored the previous dissections, they may solve these by thinking about their previous arguments, findings and successful strategies!

***Take a square and cut it in half diagonally. Now try to discover how to cut this triangle into four pieces that will form a Greek cross.***

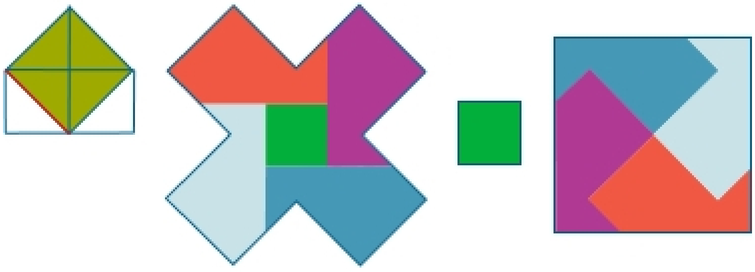


***Cut a rectangle of the shape of a half-square into three pieces that will form a Greek cross.***



***Cut a Greek cross into five pieces that will form two separate squares, one of which contains half the area of one of the five squares that compose the cross.***

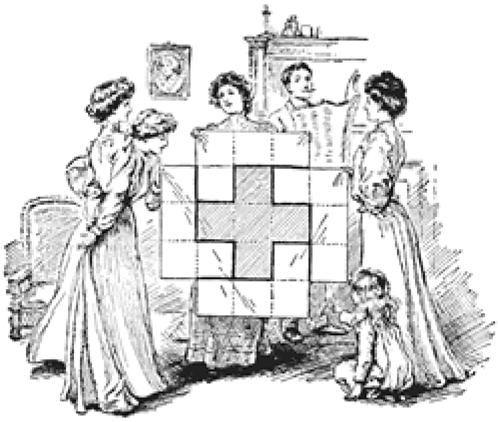
Having previously reminded us of what your students may have observed – *"That the diagonal of any square is always the side of a square that is twice the size,"* Dudeney now prompts us with *"It is also clear that half the diagonal of any square is equal to the side of a square of half the area."* Therefore, if the (pale green) square in the diagram below is one of the five squares of the Greek cross, the small square on half its diagonal is the size of one of the squares required in this puzzle!



Dudeney ends his writing (in *Amusements in Mathematics*) about Greek cross dissections with the following statement:

*"I have thus tried to show that some of these puzzles that many people are apt to regard as quite wonderful and bewildering, are really not difficult if only we use a little thought and judgment."*

Then he provides four more Greek cross puzzles!



- 142 The silk patchwork
- 143 Two crosses from one
- 144 The cross and the triangle
- 145 The folded cross

These can be found at Gutenberg.org.



## An idea for the classroom – Adam's Move

This is an exploration that provides excellent opportunities for students to generalise, and express their generalisations concisely, possibly using conventional notation.

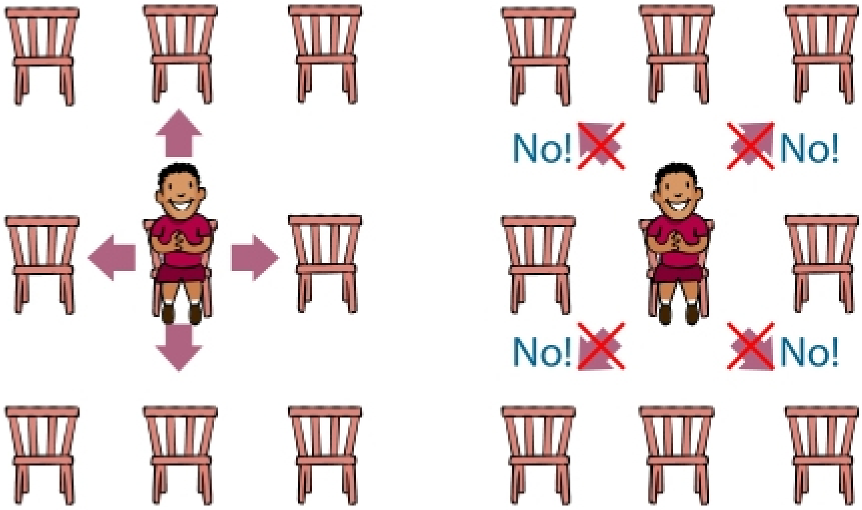
The starting point is a puzzle from Henry Ernest Dudeney.

### Getting started

The most effective way to introduce the puzzle is to challenge the class to solve it by acting it out.

Push all the tables to the edge of the classroom, and arrange chairs in rows to form a rectangle. For example, arrange them in four rows of five chairs. Students sit on the chairs, leaving the chair at one end of the front row empty. The student on the chair at the corner diagonally opposite to the empty chair is special, and is called 'Adam':

The aim is to get Adam *home* (into the initially empty chair in the diagonally opposite corner) in the least number of moves. A student may move into an empty chair that is next to the chair he is on, either to the left or right, or in front or behind. A student cannot move into an empty chair that is next to him diagonally:




**The exploration**

Students are unlikely, at their first try, to get Adam home in the least number of moves. Therefore they will need to have several attempts, before some students begin to see a system that leads them to the minimum number of moves, which is 25.

It is essential to allow students to discover for themselves a sequence of moves constituting a solution.

They will eventually find that it can be viewed as a three-stage process, which is described in the four paragraphs below. You may prefer not to read this before exploring the puzzle yourself.

> *In the first stage students move, one at a time, until the empty chair is in one of the two positions that enable Adam to move. The least number of moves required to do this is six. There are 35 different ways of doing it – 20 valid routes to one of the two possible positions of the empty chair, and 15 routes to the other.*
>
> *The second stage consists of the one move of Adam into the empty chair in one of the two possible positions.*
>
> *In the third stage, Adam is moved along one of the shortest routes home. Each of the six steps requires three moves in which students rotate round a 2x2 square, either clockwise or anti-clockwise.*
>
> *The minimum number of moves is therefore 6 + 1 + 3 x 6. It is helpful to record the number of moves in this way in order later to make generalisations, in attempts to express the minimum number of moves for an n by m rectangle algebraically.*

Once students have solved the puzzle for four rows of five chairs, they should rearrange the chairs into a different rectangular array, and again endeavour to work out a solution physically by moving themselves around according to the rules. **This will take some time**.

> *For many rectangular arrangements of chairs, any minimum set of moves includes an extra last stage, in which Adam's movement through the last few positions of a shortest route home is in steps of five student moves. This is necessary in order to move Adam to his left when the empty chair is on his right.*

While the classroom is clear of desks, students should try to solve the problem for as many different rectangular arrays of chairs as time allows. Later, they can begin to get to grips with the exploration using counters or coins placed on square grids.

The challenge is to find a general statement of the minimum number of moves required for any rectangle in terms of the number of rows and columns of the rectangle.

Encourage students to express any generalisations at which they arrive, at first in words, and then, possibly, algebraically with the number of rows and the number of columns as the variables.

**Students' findings**

It is important that students keep careful records of their findings. Encourage them to make predictions, and then check them out.

It is relatively easy to arrive at a generalisation for square arrays.

For example, a student showed, in her writing about her findings, how she used her understanding of the common structure of solutions to arrive at an algebraic expression, which she then tested on new examples. She drew sketches showing the positions of 'people' (which were actually counters) after each move for 2-by-2, 3-by-3 and 4-by-4 grids. Then she wrote: *"I predict that the minimum number of moves in a 5 by 5 puzzle will be 7 + 1 + 7 x 3 = 29. Correct! I think the minimum number of moves in an n by n puzzle is the sum of the n-1*$^{th}$ *odd number, 1, and the n-1*$^{th}$ *odd number times 3."*

Understanding, and expressing as generalisations, what is happening in non-square rectangular puzzles is more challenging. However, by being systematic, for example by investigating 2 by *n* puzzles, then 3 by *n* puzzles, then 4 by *n* puzzles, and so on, students will be able to make modest generalisations.

For example they should be able to deduce that:

- *for n by 3 puzzles and n > 3, the minimum number of moves is 6n – 5*
- *for n by 4 puzzles and n > 4, the minimum number of moves is 6n – 3*
- *for n by 5 puzzles and n > 5, the minimum number of moves is 6n – 1.*

Encourage students to write very detailed, illustrated and comprehensive, reports of all their findings.



## Letters between teachers

My children suffer from a mathematics teacher as a parent: the school perhaps even more so, as its over-reliance on drill-and-practice as a way to teach mathematics doesn't go unchallenged.

The advent of Functional Skills in mathematics (FSM) gave me an opportunity last September to send in classroom activity suggestions to the mathematics department of our children’s school. I was keen to do so although my previous offerings had been ignored in their entirety: in contrast, FSM has to be taken seriously as it's in the KS4 curriculum (and linked to KS3 via National Strategies) and, perhaps most important of all, FSM terminates with an examination. From my point of view the sort of FSM preparation needed by school students, such as question modification, including adaptation to different contexts, is simply good practice – something students should be heavily involved in anyway – although the generalisation in FSM is about practical contexts rather than mathematics per se, in contrast to that promoted and exemplified in Prestage and Perks splendid book Adapting and Extending Secondary Mathematics Activities. I think excellent the precepts and exemplification in the document Resources to support the pilot of functional skills: Teaching and learning functional mathematics and was accordingly happy to promote the document to our two children's school.

I was, naturally, pleased to be contacted by the school and assured about the inclusion of thinking skills and use of rich tasks as a priority this year. As it turns out, since September our Y8 child has had but one lesson in which the class worked in groups – something for which I got some stick: “It's your fault”, she said, “I had to sit with people I didn't like and who didn't want to do anything.”

Eventually I wrote again to the school:

> *“I was pleased by your September email to see the inclusion of more varied approaches in the maths classroom, and a small amount of group work has indeed taken place in our daughter Jane's class, but I get the impression that although working IN a group, her teacher needed to develop further the skills of getting the students to work AS a group.”*

Our older child had not experienced group work or investigational activity in mathematics until the advent of an inspector led to desks whipped round, for the occasion of an observation, into blocks of four and, from our child's account of it, an enjoyable exploratory lesson. One not be repeated, however, after the exit of the inspector: lessons then reverted to their former unremitting style.

I am not by nature negative, so when I report the anger expressed by my partner it is not to condemn the school: even the local private school is over-addicted to drill-and-practice, ‘rules without reason’ as I term it. My response as follows to the angry remark was more-or-less as I subsequently wrote to the school:

> “In my experience, policy and schemes of work are insufficient to develop classroom practice: without departmental structures to support different ways of working only a few heroes and mavericks are able to develop and sustain unfamiliar ways of working in the classroom.
>
> “It is a big step to move from the prevailing drill-and-practice or training approach, useful as it may be to develop skill fluency, to the use of small-group work and discussion in mathematics, tools to help learners understand mathematical concepts. I'm not absolutist here – I know that skill fluency alone can underpin understanding, but only for the few: for the many, skill fluency needs explicitly embedding within a context of reasoning, proof and practical activity. This implies provocative group work supported by teacher prompts, probes, and questions of a more-or-less open kind.”

Some would argue that the benefit of doing mathematics as a sense-making activity, rather than as the application of parroted rules, is improved GCSE or A Level results. Others, on the hand, believe that offering opportunities for learner engagement beyond mere routine is to enable students to participate passionately and imaginatively in that part of our culture in which problems are developed, solved and shared. Further, they believe that these opportunities are the right of all learners.



## 5 things to do this fortnight

- Learn the 17 times table in 10 minutes! Jill Mansergh uses questioning and a number stick to enable you, in only a few minutes, to say, from memory and in order, the multiples of 17 from 0 to 170. You are sure to find that her way of teaching you this times table is really brilliant!

- The 2010 annual Technology for Secondary Mathematics (TSM) workshop will take place at Oundle School from Tuesday 13 July to Thursday 15 July. There is still time to book your place at this exciting event, and really get to grips with ICT in mathematics teaching and learning.

- Teaching and learning are co-operative activities. If you live in the Birmingham area you can engage in and discuss creative ideas to use in your classroom at the ATM Birmingham branch meeting on Wednesday 16 June at 7pm. In this session, Katherine Carlisle and David Lawrence will build on their presentation and discussions at the recent British Congress of Mathematics Education (BCME) conference.

- At the Summer Meeting (on Saturday, 12 June at 2pm) of the Yorkshire Branch of the Mathematical Association, NCETM Regional Coordinator Bryony Black will provide an overview of what the NCETM can do for you. This will be an excellent opportunity for you to look at a wide range of resources, explore the portal and share your own experiences.

- Why not make a delicious batch of chocolate and butter fractal cookies? Then you can munch your way through your own lovely, edible fractals!



# Diary of a subject leader

**Issues in the life of an anonymous Subject Leader**

We had made one new appointment to the faculty the last time I wrote. I will be moving on at the end of this term, so a few days after that it was the two-day selection procedure for the head of mathematics post. This started with a lunch that was free to any member of staff who wanted to meet the candidates – it gave the whole faculty an opportunity to meet the applicants who had made it to this stage. Then the interviews began, some with governors, some with faculty members. This was relatively informal, but gave us an opportunity to find out what the candidates had recently read and how they used technology in their lessons. It was interesting to compare the ways we use hand-held technology, software and internet-based resources, with theirs. It was good to see knowledge of the NCETM, the Mathematical Association and the Association of Teachers of Mathematics. Everyone in the faculty is registered with the NCETM. I wonder how many other mathematics faculties have all joined up. Since there is no charge, it would be good to see those who are registered encouraging others!

After the interviews, I had 15 minutes to grab a bite to eat before moving over to the main building for a Year 8 Parents' Evening. I have two Y8 classes so was fully booked for three hours. The appointments system works well most of the time, but there are occasions when someone needs a bit more time to discuss matters. Anyway, time problems got sorted, although I finished far later than expected – and what a great job our students did in keeping us refreshed with liquids!

On Friday, the interviews continued with two other candidates for the post of AST in mathematics. I started the day by arranging a visit to a Y10 student on work experience, and doing an interview with another student and his 'employer' over the phone. That student was in a butcher's shop and still had all his extremities intact! The butcher featured in a UK JMC question many years ago due to some meat comparisons that he had mentioned to me. He makes cracking sausage meat and provides his waiting customers with sherry at Christmas time.

After that interlude, I observed one candidate giving a lesson. We have two observers at each lesson so a joint judgement is reached. After the lesson, the prospective heads of mathematics each gave a 20-minute presentation to senior staff and governors about their vision for 21st century mathematics. These presentations were quite varied and gave us a good idea of what we could expect about vision and how they would tackle the public presentation of mathematics at our school.

I then interviewed the prospective ASTs with a governor and deputy head. Two great candidates and a pity we only had one job! Afterwards, we had a meeting in the headteacher's office with all concerned discussing all the pros and cons of those present, and then left it to the few to make the final decision.

Over the weekend, I was bombarded with messages from faculty staff asking who got the posts – I replied when the all-clear was given. There were good discussions on Monday regarding the appointments – which went down well with the faculty. I made a work experience visit to a local farm known for its school visits – all well there, with the student communicating well with visitors and goats. Back for a faculty meeting where, after we had shared good practice in preparation for linking mathematics with forthcoming sporting events, we dealt with set moves in Year 10, and looked at some innovative proposed changes in the use of Teaching Assistants.

Tuesday went pretty much to plan until late afternoon. I chair the Governors' Curriculum Committee and we met that night. But the person who should have been talking about things that had been requested at the last meeting had been delayed by volcanic ash, so those items were postponed, much to the dismay of many present. My fault – with hindsight I should have foreseen that this might happen and looked for someone else to present the items. Anyway, a paper will be presented before the full Governing Body meets.

Wednesday was different. Since my interests include sundials and history of mathematics - see Bowland Maths, using the Bowland Player to access the case study - I had been invited to give a short talk at the Science Museum in period costume as the mathematician John Blagrave (1561?-1611). The reason was that a prestigious sundial maker, David Harber, has recently found out that he is a descendant of John Blagrave, and has recreated one of Blagrave's magnificent armillary sphere sundials. He had also invited members of the Blagrave family to the unveiling, so despite the slightly rushed departure from school to make it in time, it was a great opportunity to talk to a lay audience about the history of mathematics and its present day applications.

Thursday was busy – UK JMC and we also had two visitors observing lessons. Both visitors were wanting to 'see what mathematics teaching is like' before embarking on either PGCE or GTP courses next year. One was an ex-student who had recently obtained a mathematics degree, so it was good for the teachers who had taught him to see him again.

Met with a colleague on Friday night to catch up with news, before the bank holiday – whoopee!