

Welcome to November's edition of Secondary Magazine. This month, we are excited to be launching the NCETM's [Qualifications and Curriculum microsite](#) to provide all the latest information, in the ever changing world of qualifications and curriculum.

Alongside, we suggest reasoning lesson resources from both ends of the age spectrum – an activity for Y7s learning to expand and factorise single brackets, and for A level, tasks with an emphasis on verbal reasoning for introducing scalar and vector quantities (distance/displacement and speed/velocity). And for those moments of pedagogical reflection, we have an NQT's thoughts on her first half term in the classroom, plus some unusual ideas on marking from Colin Foster, Assistant Professor at the University of Nottingham.

## Contents

### [Heads Up](#)

Here you will find a checklist of some of the recent, or still current, mathematical events featured in the news, by the media or on the internet: if you want a "heads up" on what to read, watch or do in the next couple of weeks or so, it's here. If you ever think that our heads haven't been up high enough and we seem to have missed something that's coming soon, do let us know: email [info@ncetm.org.uk](mailto:info@ncetm.org.uk), or via Twitter, [@NCETMsecondary](#).

### [Classroom View](#)

Rachel Lintott is an NQT in Devon. This account of her first half term reflects thoughtfully on the realisation that a full timetable makes it impossible to teach 'all-singing-all-dancing' lessons every lesson, without burning out very quickly. She recognises that, equally, pupils benefit from more low-key lessons at times, and the strategies she has tried are built on their learning needs.

### [Sixteen Plus](#)

In this month's *Sixteen Plus* we are suggesting a visit to an MEI resource, published last year in their M<sup>4</sup> magazine. The resource, an introduction to scalar and vector quantities in one-dimensional kinematics, uses a PowerPoint presentation to lead students in discussion and reasoning to embed deep understanding.

### [From the Library](#)

In this article, reproduced with permission from the Association of Teachers of Mathematics, Colin Foster reports on a method of marking he has trialled that asks students to rate their level of confidence in their answers. Accurate levels of confidence, as well as accurate answers, are rewarded.

### [It Stands to Reason](#)

Teaching pupils to expand and factorise single brackets is a topic that is often taught in context-free isolation. As a procedure, it is much easier to teach than it is to get pupils to understand why they are learning it: the need to use it often comes much later. Taught as a mysterious procedure that must simply be memorised, it is one that is often difficult to retain. Here we offer a pattern-spotting task using diagrams to understand the equivalence of expressions  $a(b+c)$  and  $ab+ac$ .

### [Qualifications and Curriculum](#)

This month, we are pleased to announce the launch of our new [Qualifications and Curriculum microsite](#). Designed as a one-stop-shop for all those bits of important information that you might need from the statutory bodies, exam boards and others, the site is easy to interrogate to find exactly what you need



quickly. It'll be constantly updated, so you can expect it to carry all the latest information.

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## Heads Up



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On 8 December the Science Museum will open [The Winton Gallery](#), a pioneering new Mathematics gallery exploring how mathematicians, their tools and ideas have helped to shape the modern world over the last 400 years.



New to secondary maths teaching and planning on teaching A level? [Advanced Mathematics Teaching in Early Career](#) is a new, free course, funded by the [Further Mathematics Support Programme \(FMSP\)](#) and run by the UCL Institute of Education.



The Mathematical Association is running a new 60 Second Survey, [Enjoyment and Priorities for Maths Teaching in Secondary Schools](#), asking what you most and least enjoy, and what your priorities are and should be.



There's an additional cohort of the [Advanced Mathematics Professional Development Lead Development and Accreditation Programme](#), run by the NCETM and the FMSP. The free programme supports teachers and others who design and lead advanced mathematics professional development opportunities for groups, and is open to teachers from all parts of London and adjoining regions. The current application deadline is **18 November**.



The awarding body OCR is inviting teachers to complete a [short survey](#) to help them tailor support for new Further Maths A level



Following the publication of our new [marking guidance](#), Charlie Stripp has written a new blog, [Questioning Marking?](#). In it, he shares his thoughts about how to use marking to have the maximum positive effect on pupils' learning.



NRICH is providing its popular [Teacher Inspiration Programme](#), a free three-day professional development programme for teachers of mathematics at Key Stages 3, 4 and 5. This programme includes three linked full-day events over the 2016/17 school year



The TES recently had a report on a speech by Paul Joyce, Ofsted's deputy director for FE and skills, in which he questioned the current GCSE resits policy on English and maths. [Read the TES report on his speech](#).



And finally, a selection of forthcoming maths events you might be interested in:

- A new round of [NCETM CPD Providers' Network meetings](#) starts at the end of November - you can book your place now
- [#christmaths16](#): Prosecco, mince pies and maths, Thursday 22 December, London
- [Association of Teachers of Mathematics \(ATM\) 2017 Annual Conference](#), 10-13 April, Stratford-upon-Avon. Booking now
- [Mathematical Association \(MA\) 2017 Annual Conference](#), 7-9 April, Surrey. Booking now
- [National Association of Mathematics Advisers \(NAMA\) Annual Conference](#), 2-4 March, Moreton-in-Marsh, Gloucestershire.

[Email us](#) if you have an event that you think we should include here.

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## Classroom View Reflections from an NQT

*Rachel Lintott is a newly-qualified teacher in Devon*

By June of this year, I was longing for my own classroom, my own classes, the ability to close the door and teach as myself without being under constant scrutiny. Half a term into my NQT year and it feels a lifetime since I was a trainee. Having gone through a school based training programme, predominantly in the school in which I am currently working, I felt well prepared and ready to start. Of course I was prepared for this year to be hard work, long hours and full of lessons which were not always outstanding. The most reassuring conversations are those with long established teachers reflecting on 'nightmare' lessons they've had and the realisation that it's impossible to get it right every lesson.

With this in mind, one of the striking differences between this year and last is the need for some lessons to be 'run of the mill' by design. As a teacher, my default tendency is to lead from the front and to be generally quite energetic in lessons. During my training year, I had the time for this style to permeate the majority of lessons. I fairly rapidly came to realise this year, that this is impossible to sustain in every lesson with an increased workload. The question therefore is how best to design lessons which are easy for me to prepare and run, while providing an appropriate and worthwhile learning environment for the pupils.

The more I reflect on the long term planning of a scheme of work, the more I realise that 'easy' lessons (from a teacher's point of view) are also valuable, and needed by the pupils. They need time built in, to practise skills, to make mistakes, to get instant feedback about whether they have made these mistakes, and to make progress. At this stage of the year, these are taking the form of 'textbook' lessons, with minimal instruction and teacher talk, and maximal student-led work. One of the key benefits of using textbooks is that pupils have the autonomy to check their own answers, look back at worked examples, and to move through exercises at their own pace. Other activities such as the ubiquitous [Tarsia](#) puzzles (referred to by my Y12 class as 'maths teaching 101') provide a bank of questions and solutions to be worked through in an engaging way, allowing students much needed practice, revision or consolidation of a topic. [Mathsbox](#) provides (by its own admission) 'a big box of resources for busy teachers', and some of their resources have become a staple part of such lessons; although this is a subscription service, free samples are available. *Skills Checks* provide a framework for KS4 pupils to revise a range of topics and to track their improvement. *NUMBERUP* have proved very popular as starters with my nurture group, with pupils having the option to swap questions with each other and work collaboratively to complete the task.

In addition to content, there is also the issue of timing for consolidation lessons. I am increasingly aware of which lessons will need to be less active from my perspective. Full teaching days are the obvious place for me to include consolidation (often I forget this when planning), but the timing of the day from the pupils' point of view also makes a big difference. Lessons after lunch present a much less ordered and focussed group of pupils than first thing in the morning. At these times, when pupils are less receptive to being actively taught, I find it is much more beneficial to let them get on with a task, and stop talking to them as a whole class.

During my training year, my focus was too often on myself, what I was doing in the lessons, the questions I would ask, and the explanations I would give. Throughout the year this focus shifted to build lessons around the learning, and my lessons became more student-focussed. At this stage, seven weeks in, I feel that this has been my biggest learning curve. Because I can close the door - and for the most part assume full responsibility for the class - I am less worried about appearing to be doing what a teacher does. The



NQT year so far has given me the freedom to develop my own teaching style in a much more personalised way than last year. A big part of that has been the management of my own time, and energy reserves, which has in turn made me focus on learning in a way I had not considered. For me there is an excitement about this year: I am carving out my own path, and my personal learning curve is steeper than ever.

I had looked forward to the point where I have this teaching thing sussed. However, the more time I spend in the classroom, the more I am learning, and I hope that doesn't stop.



## Sixteen Plus

Now that mechanics is firmly on the curriculum for all future A level maths students, it is important for students (and teachers new to teaching the subject) to begin with a strong understanding of the distinction between distance and displacement, speed and velocity. Additionally, these concepts are referred to within the DfE objectives for KS4 mathematics and within several exam board specifications. While understanding the distinction between scalar and vector quantities is not a specific requirement in GCSE Maths, it is a requirement in GCSE Science.

This resource from MEI's  $M^4$  Magazine, presented on a set of PowerPoint slides (with supporting teacher notes at the end) attempts to avoid the confusions that can be caused by using the terms interchangeably. Diagrams, definitions and prompts are used to encourage students to explore, challenge and explain their understanding.

- Go to the resource on [MEI's  \$M^4\$  Magazine page](#) (scroll down to **Kinematics** in the September/October 2015 issue)

*Our thanks to [Mathematics in Education and Industry \(MEI\)](#) for allowing us to use the resource; it remains copyright of MEI.*



## From the Library

Marking books has, in recent years, threatened to take over the life of many a teacher, with education ministers, among others, recognising how this contributes to high levels of workload. At the NCETM, we have recently published [guidance](#) (confirmed by Ofsted to be compatible with their [School Inspection Handbook](#)) encouraging teachers to mark less, emphasising that time spent marking should not steal time from the most important activities of designing and teaching lessons. In this article, reproduced with permission from the [Association of Teachers of Mathematics \(ATM\)](#), Colin Foster considers an in-class marking strategy which he suggests gives the teacher more detailed formative assessment information, as well as encouraging pupils to judge how confident they are in their answers:

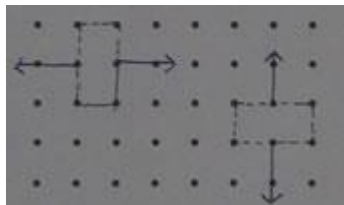
- Read [Colin's article](#)
- Read the NCETM's [Secondary Marking Guidance](#)
- Read the NCETM Director's blog, [Questioning Marking?](#)

*Our thanks to the [Association of Teachers of Mathematics \(ATM\)](#) for allowing us to use the article; it remains copyright of the ATM.*

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## It Stands to Reason

During Key Stage 3, algebraic symbolism and conventions begin to feature significantly in the mathematics curriculum. But, if what pupils experience as 'algebra' mostly consists of context-less manipulations of algebraic expressions and 'routine' application of procedure, such as...

*Remove the brackets:*

1.  $2(m+3)$
2.  $n(a-1)$
- etc

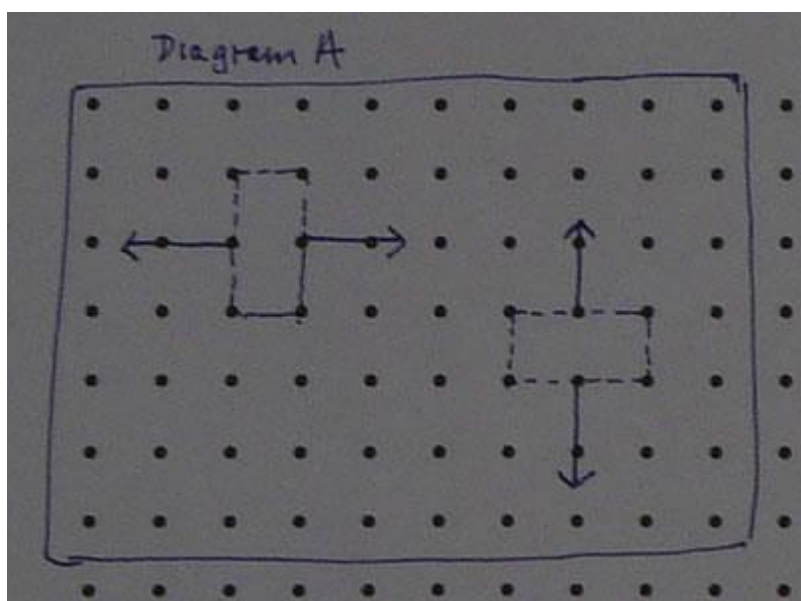
*Factorise:*

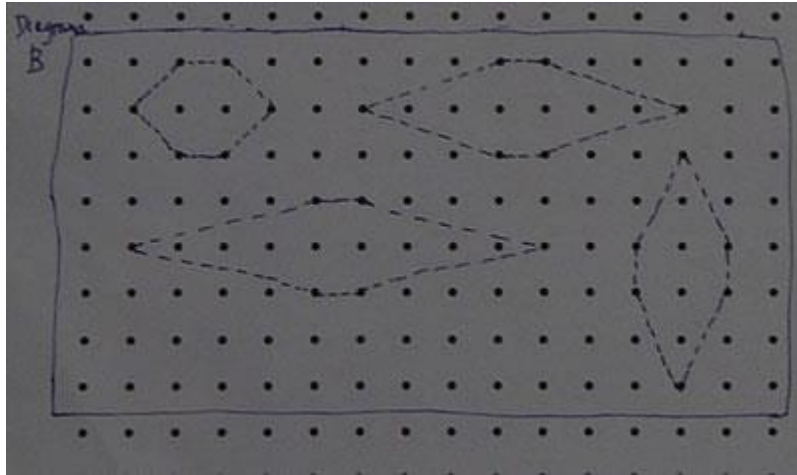
1.  $5a+5b$
2.  $3n-6$
- etc

...the consequences can impede pupils' progress: it can undermine positive attitudes to mathematics at the start of secondary schooling.

Research [see footnote] shows that when tasks that draw on pupils' natural abilities to search out, and describe, patterns (such as those below) play a part in developing their algebraic reasoning, pupils more readily understand some purposes of algebraic manipulation, and 'by-the-way' quickly become fluent with algebraic procedures.

You need a geoboard and an elastic band. Make a 2 by 1 rectangle (with an area equal to 2 geoboard squares). Pull the band outwards from the centre pins, equally on both sides:

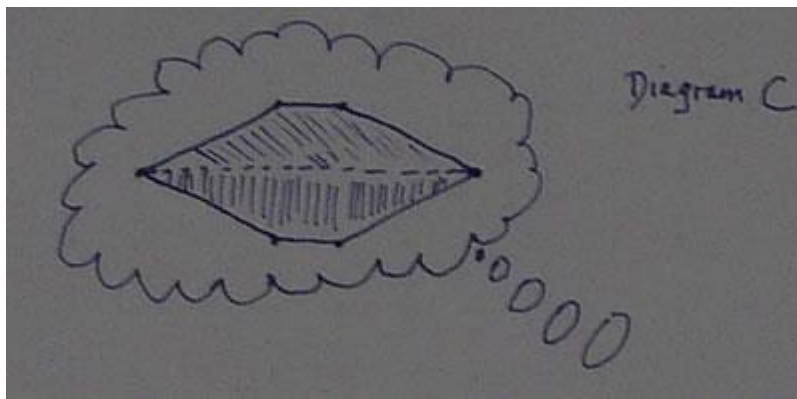




What is the area (in geoboard squares) enclosed in the band?

Exactly how is the area related to how far you pull the band outwards?

By engaging in (well-chosen) pattern-seeking tasks pupils in the same group or class are likely to see relationships in different ways, and therefore to describe them in different ways. For example, 'standard' exercises on the equivalence of simple expressions of the form  $a(b+c)$  and  $ab+ac$  can be replaced by, or supplemented with, more challenging and interesting tasks, as in the present example.



Pupil A:

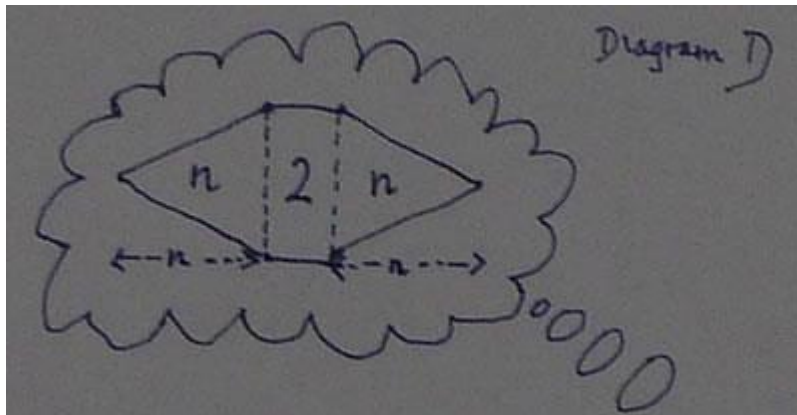
"When I pull out the band by 1 'gap' the area is  $2+2=2\times 2$

"When I pull out the band by 2 'gaps' the area is  $3+3=2\times 3$

"When I pull out the band by 3 'gap' the area is  $4+4=2\times 4$

"When I pull out the band by 4 'gap' the area is  $5+5=2\times 5$

...and so on

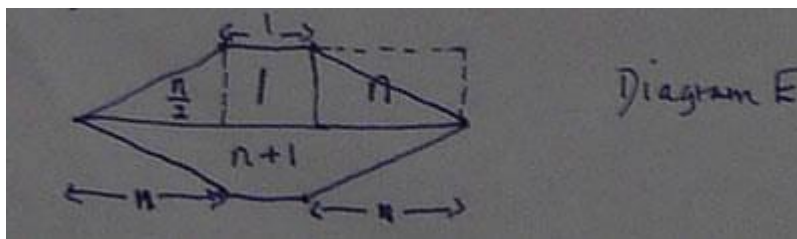


Pupil B:  
"There is always 2 in the middle."

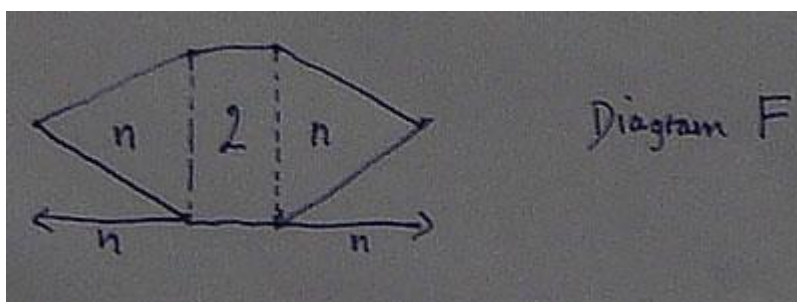
"The side areas are just the same number as how far I pull it out!"

Therefore pupils have opportunities to try to convince themselves and others of the equivalence of different expressions.

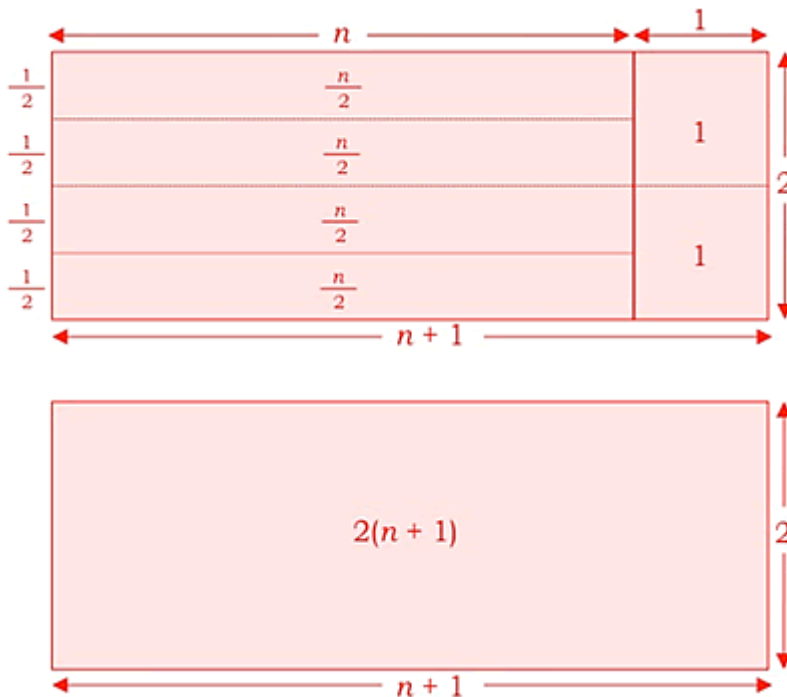
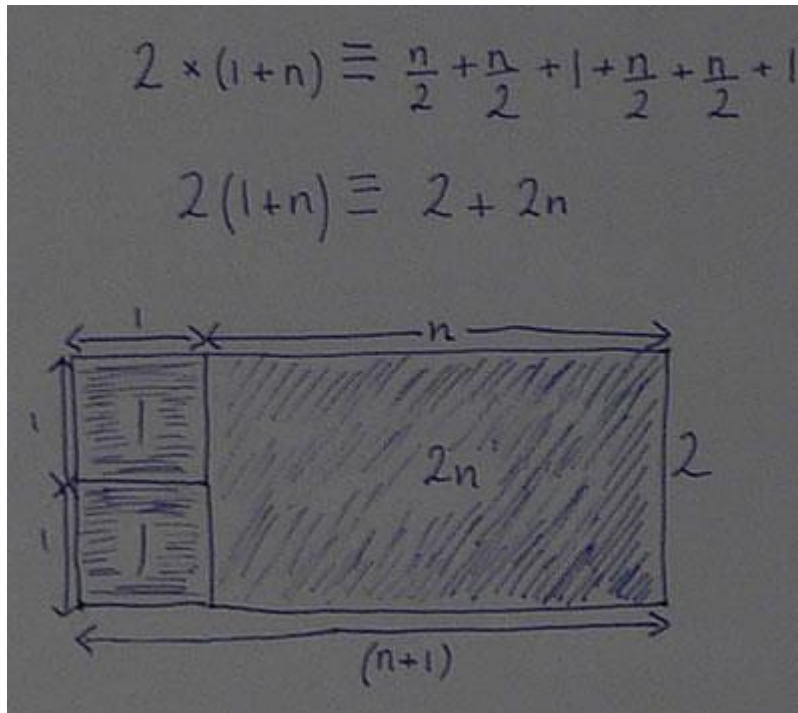
Pupil A:  $2(n+1)$



Pupil B:  $2n+2$



In order to help pupils construct convincing arguments, and to add even more meaning to the expressions, for each pattern-seeking task you can suggest a way of using diagrams that model the algebra to support their reasoning. They would be then challenged to devise and sketch their own diagrams once they have seen examples, such as these...



\* see Watson, A., Jones, K. and Pratt, D. (2013) [Key Ideas in Teaching Mathematics](#), pages 15-27

You can find previous *It Stands to Reason* features [here](#)



## Qualifications and Curriculum

Our new [Qualifications and Curriculum](#) microsite is now live, providing a one-stop-shop source of up-to-the minute information on all aspects of maths qualifications and curriculum. The section, which will be updated as and when new information is released, reflects changes in policy and practical arrangements linked to GCSE, A Level, Core Maths and several more areas. Information comes from Government organisations, exam boards, subject associations, the NCETM and other bodies.

For each sub-section, visitors to the website will be able to see the latest news related to the topic, as well as historical information. Although most of the entries are maths-specific, some generic information, relating to all subject areas, is also included. Examples of entries include:

- Information from exam boards on arrangements for re-sits
- Summaries of maths results in the 2016 SATs
- Timetables relating to the first teaching of the new maths A level in 2017
- The maths-specific paragraphs in the latest Ofsted inspection handbook.

The section is designed principally to be of use to secondary schools heads of maths departments but all teachers of mathematics will, on occasions, find information relevant to their role.

We'd be pleased to hear what you think - and do let us know if there's anything else we should include.

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