Secondary Magazine 138

National Centre for Excellence in the Teaching of Mathematics

Welcome to Issue 138 of the Secondary and FE Magazine

Welcome to the October edition of the Secondary Magazine. As half-term approaches, this edition is full of meaty classroom ideas and resources for promoting deep and connected understanding – from multiple ways to approach composite functions (new on the Higher GCSE specification), to a teacher's experience of using a new statistics resource from Oxfam. The Mathematical Association has provided us with an article by Ben Sparks, whose Geogebra resources offer the insight of moving (in both senses) interactive demonstrations. We also have some helpful thoughts on recruiting students to sixth form Core Maths courses, for schools new to providing them.

Contents

Heads Up

New guidance for secondary teachers from the NCETM on marking and feedback encourages teachers to cut down on the quantity of written comments and feedback they put in pupils' exercise books, including specifically 'next steps' and 'targets'. The document is succinct and readable and well worth five minutes of your marking time.

The DfE has decided not to press ahead with plans for Year 7 re-sits in maths and reading. There were to be pilots this December, and a full rollout in 2017. The decision is contained (8th paragraph) within this wider announcement about primary assessment.

National Numeracy is launching a new numeracy app, Star Dash Studios. Primarily aimed at those who don't (or didn't) get on with maths at school, the game emphasises the value of maths in vocational settings. The action takes place on a movie set and will particularly appeal to those keen on runner games. Free to download from today, 20 October.

A ten-part BBC Radio 4 series, A History of the Infinite, in bitesize 15 minute episodes was broadcast last month. Adrian Moore discusses why the Greeks abhorred the concept of infinity, how Aristotle made it more acceptable, and how we, as humans, manage to get our heads around it.

Future Teaching Scholars (FTS) is a new route into teaching, designed to attract sixth-formers who plan to study a maths or physics-related degree, with a £15 000 scholarship over the three undergraduate years. The programme also offers school-based activities during the undergraduate years, a place on a post-graduate ITT course and support during initial the two years of teaching. FTS is currently inviting expressions of interest from Y12 students and applications from Y13s.

A selection of forthcoming maths events you might be interested in:

- A new round of NCETM CPD Providers' Network meetings starts in November - you can book your place now
- British Society for Research into Learning Mathematics (BSRLM) Conference, Saturday 12 November, Brighton
- #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.

Email us if you have an event that you think we should include here.

The Further Maths Support Programme (FMSP) has just published the latest FMSP Regional Newsletters, now available to view on the FMSP website. You can find them on the FMSP Regions page.

Maths in Context is a project from Young Enterprise, which involves training maths teachers to use real-world contexts when teaching maths (especially personal finance), to improve relevance, engagement and exam performance. They are looking for 130 schools to take part in the project, running for a year from September 2017. You can apply to get involved by completing their Expression of Interest form.

The House of Commons Education Committee has launched an inquiry into primary assessment. Submissions are invited by 28 October.

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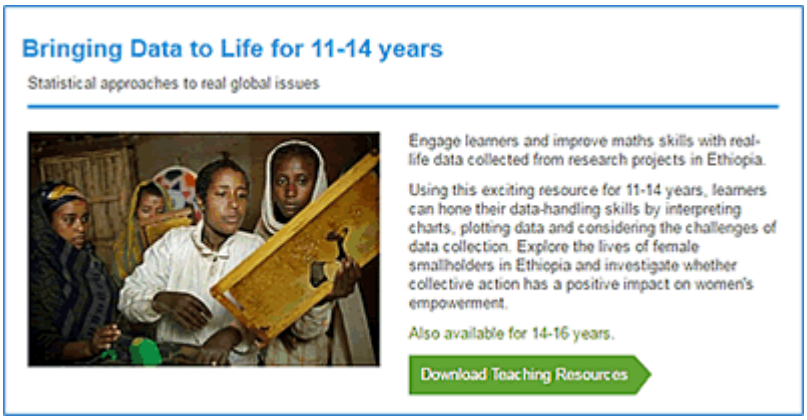
Classroom View

A teacher's experience of teaching lessons from Bringing Data to Life (11 – 14), a new resource developed by Think Global and Oxfam

By Rachael Horsman, Maths Lead for Cambridge Mathematics, and chair of the Mathematical Association's Teaching Committee

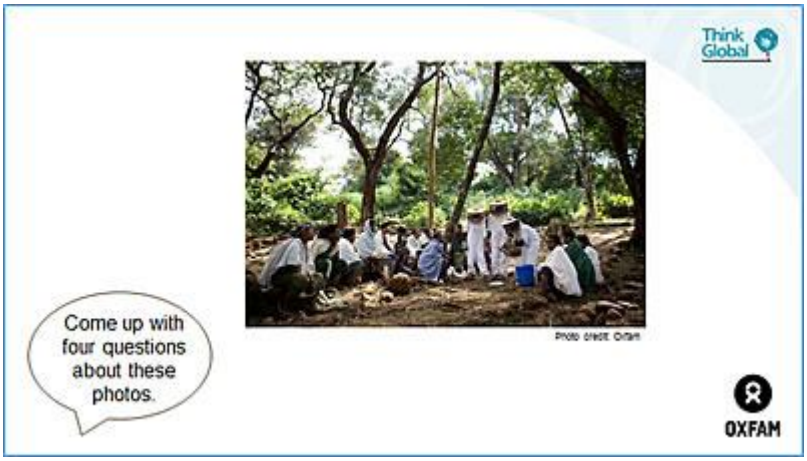
I used a selection of the Bringing Data to Life (11-14) activities in a series of six lessons with my low-attaining Year 9 Maths group. Previously during lessons involving statistics, pupils struggled greatly in making inferences from data. I struggled to find data sets that I felt were interesting, worthwhile, and that would instigate conversation about the data and the real life meaning and implications of an analysis. Lessons had involved suggesting hypotheses about the class, collecting data and analysing results, but more often than not this was boys versus girls in height, time spent playing computer games, or response times - nothing that showed the power of statistics in real life - although we had discussed a number of misleading representations of data.

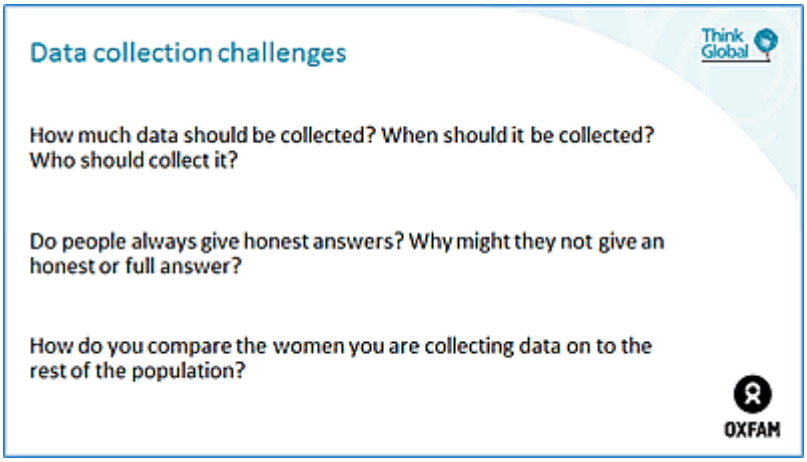


The Mathematical Association has been involved in a number of maths development projects in partnership with Oxfam, and I enjoyed trialling these materials a great deal. I didn't use every resource in exactly the way it was written, but adapted them for the pupils in the class over a week and a half.

The series of lessons can be used with KS3 and KS4 pupils [also see footnote]. It involves analysing data about women's collective action projects in Mali and Ethiopia, and the impact they have on women's empowerment. Students use a variety of statistical techniques to analyse the data and finally produce a report backed up with evidence. In their reports, pupils are encouraged to draw conclusions about whether or not the collectives have had a positive effect on the women's lives, and put forward an argument to continue or halt the project.

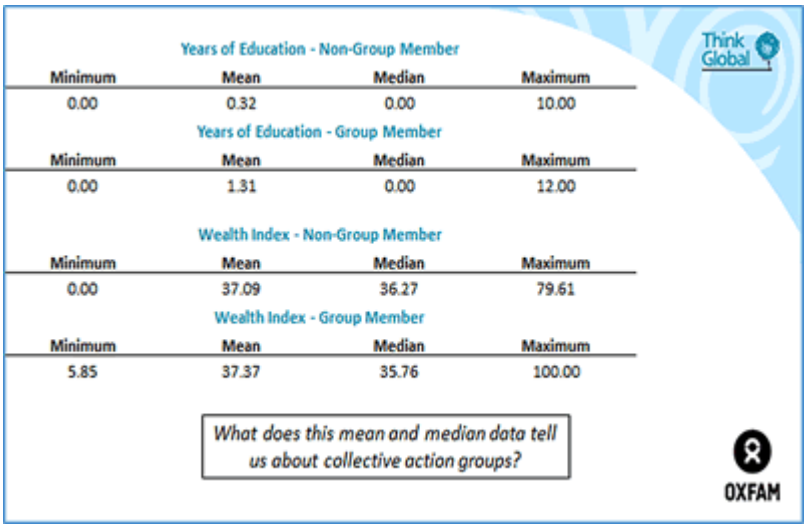
The series can be run across maths and geography lessons. I used a selection of the materials over six maths lessons, and I was keen to have a clear picture of how pupils interacted with the data, and the conclusions they drew about the collectives and countries discussed. We spent a reasonable amount of time discussing issues facing Ethiopia: the history and culture of the country and the effect that this may have on the lives of women, particularly in rural areas. Pupils' preconceptions of life in Africa came through clearly, as did some commentary on why women may need specific support. Several pupils commented on the importance of such projects as a way to make communities self-sustaining, and this promoted discussion of equality between genders.





Just getting pupils to recognise the difficulties of collecting data in such environments was worthwhile – as one pupil pointed out, "Just standing outside your local supermarket doesn't work". Pupils also recognised the bigger picture of how important it is to get the analysis right: does the work of Oxfam support women? Is it a worthwhile way to spend the funds they raise? Should work continue or should alternative interventions be investigated?

One of the best activities prompted by the materials was getting pupils to find the averages of various sets of data (session 3). They automatically realised that in some instances this wasn't meaningful, such as the way marital status had been quantified. "Your marital status can't be 2.05, how can you be a little bit more than married?" In others they carefully weighed the relevance of the results calculated and how it implicated on the report, such as the given wealth indices. In this instance pupils wanted to understand more clearly what a wealth index was and how it was calculated.



Years of Education - Non-Group Member

Minimum	Mean	Median	Maximum
0.00	0.32	0.00	10.00

Years of Education - Group Member

Minimum	Mean	Median	Maximum
0.00	1.31	0.00	12.00

Wealth Index - Non-Group Member

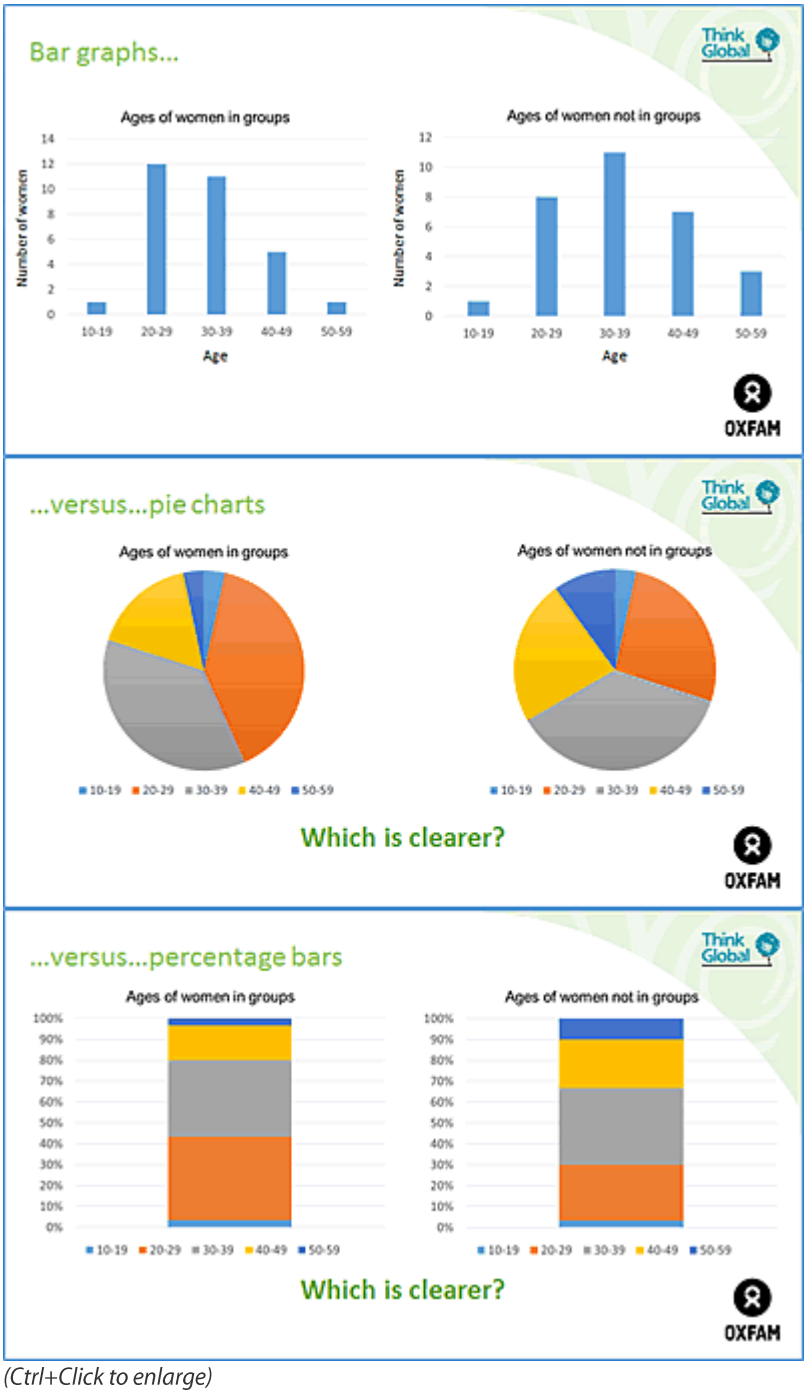
Minimum	Mean	Median	Maximum
0.00	37.09	36.27	79.61

Wealth Index - Group Member

Minimum	Mean	Median	Maximum
5.85	37.37	35.76	100.00

(Ctrl+Click to enlarge)

On several occasions we discussed the benefits, drawbacks and misrepresentations of various graphs, both within the resources and those produced by pupils. Pupils identified graphs that needed axis labels, that were difficult to analyse because of the scale used, or those that could have been represented in a different format. It was also interesting to note that pupils naturally saw which stakeholders would prefer which representations such as those in session 2. Some sample scatter graphs showed more correlation than others; pupils discussed which samples showed positive results for the project. One pupil commented on how that wasn't fair and this gave me an excellent opportunity to discuss how sometimes statistics can be abused.



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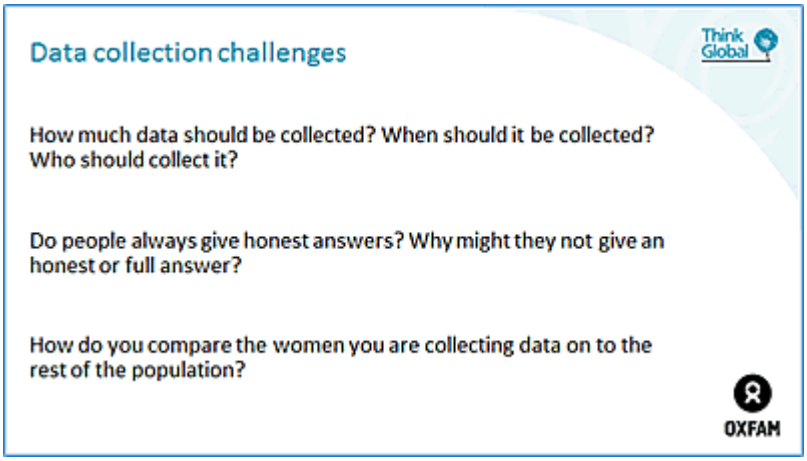
Producing a written report supported by their statistical analysis of the data was a useful and interesting task for the class to do: it gave pupils an experience of how statisticians combine various techniques and results to offer recommendations.



Pupils were genuinely engaged with the data and were keen to put forward their ideas and evidence.

Bringing Data to Life (11-14) is available to download from Oxfam's website, where you can also find Bringing Data to Life (14-16).

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Sixteen Plus
Promoting Core Maths: Recruitment of Students

As maths teachers, we normally miss out on the scramble for bums-on-seats that we observe teachers of other subjects going through. Since I have worked as a Core Maths Lead, it has become increasingly evident that knowing how to attract students onto a course is not necessarily all that obvious. In the first year of Core Maths (starting September 2014) some centres found it difficult to recruit enough students to run the course, and many struggled to cobble together a class of ten, let alone the required twenty that we were all aiming for when we applied to become pilots for the new qualification. Timing was frequently cited as an issue – there simply was not sufficient time in summer 2014 to get the message out to Year 11 before they went on study leave. As a result, students did not know what they would have been signing up for. But I sensed that there were other factors at play as well and top of these, I suspect, is that we mathematicians are simply not all that practised at having to promote our courses. With this in mind, I took a long hard look at the way we attempt to recruit students!

I was overjoyed when it was decided to make Core Maths optional: for me, it is crucial that it remains that way. It seems to me that Core Maths above all else requires motivated, free-thinking and enthusiastic students; students who enable tasks to blossom and open up through curiosity and enquiry. I worry that if Core Maths were to become compulsory it would be almost impossible to stay true to its ethos (in my opinion, a tricky class is much easier to manage if the task is repetitive, perfunctory and procedural...the antithesis of what Core Maths is about!) . I was concerned that if we were not successful in recruiting students this year, there might be pressure to make it a compulsory course. We needed to get bums on seats so that, if nothing else, we could set minds at rest that the government targets for 2020 will be reached. This leads to the million dollar question...how best to go about attracting students onto the course?

It would be arrogant of me to suggest I have the answers; I feel I still have much to learn and improve in the way this is done, but with 28 students in Year 13 and another 28 in Year 12 this year, I am pleased (and relieved) at how the recruitment process has worked at Ivybridge.

Here are my top tips:

- Ensure that the department are aware of the course and that students are having conversations with their own maths teachers about it on a semi-regular basis to build up an awareness of the course. A Year 9 student I am currently teaching mentioned to me that she would consider taking Core Maths when in the sixth form (I was trying to persuade her to consider A level maths as an option). I am not sure how she knew about the course but somehow word has got round.
- Try to talk to classes (and be selective as to which ones) rather than using an assembly as a platform – students need to feel comfortable to ask questions and you can be more interactive when talking to a smaller group of students.
- Get in early in the school year. I visited the Year 11 classes in my college in February, before they had to complete their option forms.
- Talk about their options later on in life, university prospects and a student's place in the global market. I use Jeremy Hodgen's 2013 report for The Nuffield Foundation, Towards Universal Participation In Post-16 Maths, in particular this table:

TABLE 2: WHAT ARE THE PARTICIPATION RATES IN UPPER SECONDARY MATHEMATICS EDUCATION?

	Studying any mathematics	Studying advanced mathematics
England	20%-26%	13%
Germany (Rhineland-Palatinate)	>90%	8%-14%
Hong Kong	>95%	22–23%
New Zealand	71% (Y12), 44% (Y13)	66% (Y12), 40% (Y13)
Scotland	48% (S5), 21% (S6)	27%
Singapore	66%	39%
USA (Massachusetts)	>84%	>16%

I tell the students the 'Studying Any Mathematics' figures for Germany, Hong Kong and Massachusetts and they then try to guess the figures for England. I think this is particularly powerful in making students realise that a lack of mathematics post GCSE would be particularly disadvantageous when competing for university places or jobs with people from other countries.

- I have kept my talk as anecdotal as possible. I think this helped. It was also quite brief (about 10 to 15 minutes). I think this helped too. I started off using a PowerPoint presentation but I quickly realised this was having a negative effect and have found that 'just having a chat' has been far more effective. I talk about my own experience of meeting up with a friend in my first term at university who was doing a course that sounded fascinating but, upon enquiring into a transfer, realising I couldn't because I didn't have the required A levels.
- At the Year 11 transition evening, one of our Year 13 Core Maths students attended, to talk to Year 11s about the course.

One final point: having taught a very small core maths class in the first year (they were a class of five students for the bulk of the year), I was surprised at how frequently the size of the class has hindered the learning experience (much more so than with a small class of Further Mathematicians for example). The bigger classes offer much more scope and better discussion - reasonable size primary data sets can be collected from them and there is always a point of view regarding the context from which the maths stems which enables the class to explore the context prior to embarking on the mathematical processing. This is very helpful as it's almost always the context and how that relates to the maths that trips the students up, not the mathematical processing itself.

I have been very much looking forwards to teaching Core Maths this year, in part because I have been through the process already and so have a much better idea of what to teach and how to teach it but also because I now have a class that is big enough to really allow the students to take control of their learning in a way that was only partially possible last year.

From the Library

Ben Sparks suggests that a visual example can easily lead the mind to a generalisation, if elements of the example can be varied, so that the image moves.

In this article from the Mathematical Association's *Mathematics in School*, he points us to his favourite Geogebra demonstrations, and advocates strongly for their use in the classroom.

- Read Ben's article

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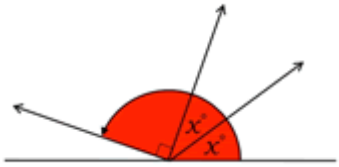


It Stands to Reason

At various stages previously, pupils will have encountered various ideas from which the concept of a function gradually develops. The introduction into GCSE of ***composite functions*** and (by some boards) the formal *fg*(*x*) notation, signals the expectation that by Year 11 pupils are beginning to have a deep basic understanding of the nature of functions.

Composite functions: a possible starting point

'As I go round the class you will each say any number that you like. As you say your number I will write it on the board under the heading …

independent variable
x

I will then convert your number, using a secret 'rule', into another number, which I will write under the heading …

dependent variable
f(x)

… because what number I write ***depends on*** *what number you give me.'*

independent variable *x*	*dependent variable* *f(x)*
3	*7*
15	*31*
0.1	*1.2*
121	*243*

'If you know what my secret 'rule' is you can come up and write a number for x and the value of f(x) that it gives. We will carry on until everyone knows what my rule is. Then I will write up the rule as …

f(x) = ……

You can say, with your reasons, what you think I should write after the equals sign.'
Your aim is for pupils eventually to instruct you to write …

f(x) = 2x + 1

Repeat the whole process with another simple function such as …

$g(x) = 3x - 1$

Now say that you are going to use both 'rules' together. That is, you will apply (to any number that they give you) one of the 'rules', and then to the outcome apply the other 'rule'. Say that you will do it in both possible orders, writing the final outcomes under the headings $fg(x)$ and $gf(x)$ …

x	$f(x) = 2x + 1$	$g(x) = 3x - 1$	$fg(x)$	$gf(x)$
2	5	5	11	14
5	11	14	29	32
1	3	2	5	8

*'For each of fg(x) and gf(x) decide which 'rule' I am applying **first** to x, and explain how you know.'*

This is a good opportunity for pupils to reason mathematically! There are likely to be, as in this example, several facts, observable in the lists of numbers, from which pupils can ***deduce*** the correct convention. In this example they could argue that …

- the numbers in the $fg(x)$ column are all odd, whereas all the numbers in the $gf(x)$ column are even. Since one-more-than double any number must be odd, $f(x)$ must have been done last in the $fg(x)$ column.
- the top row shows $f(2)$ and $g(2)$ are both 5. The second row shows $g(5) = 14$ and $f(5) = 11$. Therefore $fg(2) = 11$ shows the result of applying f to 5 [which could be $f(2)$ or $g(2)$], and $gf(2) = 14$ shows the result of applying g to 5 [which could be $f(2)$ or $g(2)$]. So, in the fg column f was done last and in the gf column g was done last.
- similarly, the bottom row shows $g(1) = 2$, and we know from the top row that $f(2) = 5$. So, since $fg(1) = 5$, $f(x)$ must have been done last.

For both of these composite functions …

$fg(x) = \ldots\ldots\ldots\ldots$ $gf(x) = \ldots\ldots\ldots\ldots$

… invite pupils to suggest, with justification, what to write after the equals sign. Eventually you should have

$fg(x) = f(3x - 1) = 2(3x - 1) + 1 = 6x - 2 + 1 = 6x - 1$

$gf(x) = g(2x + 1) = 3(2x + 1) - 1 = 6x + 3 - 1 = 6x + 2$

which shows, incidentally, since $6x$ is even for all x, why all the numbers in the $fg(x)$ column are odd, and in the $gf(x)$ column they are all even.

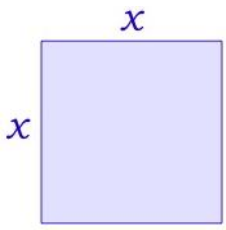
The meaning of the word 'function' in mathematics is not easily reached by thinking about its various meanings in ordinary language, and true understanding of what it denotes mathematically is 'a long time a-coming' … until way beyond GCSE level! In this article we merely give some pointers to ways of working and examples to help pupils acquire the depth of understanding necessary to cope with GCSE-level reasoning with and about composite functions. The aims of classroom procedures of the kind suggested above include pupils …

- beginning to see a function as a relation between variables in which the value of one variable (the dependent variable) depends on the value of one (or more) other variable(s) (the independent variable(s))
- interpreting correctly the conventional notation $fg(x)$ for the composite function in which the function $f(x)$ is applied to the outcome of previously applying the function $g(x)$. Writing $f(g(x))$ suggests this.

The variables that are related by functions are often abstract numbers, as in the starting tasks described above, but they don't have to be. Composite functions can be 'brought-to-life' for pupils when the variables can (literally) be ***seen***, … when they are lengths, angles, areas, and so on, as in the following two examples.

Example 1: the independent variable, *x*, represents the side-length of a square.

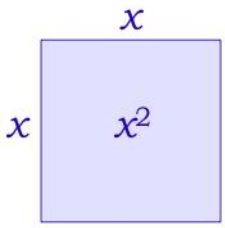
Suppose x is the side-length of a square …



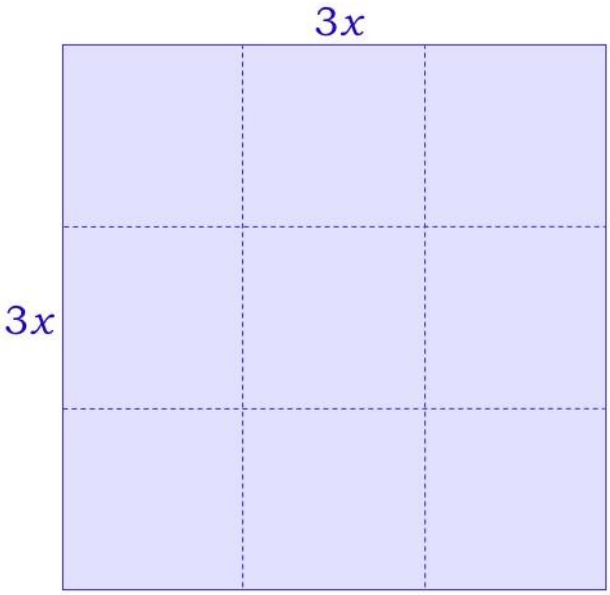
… and $f(x) = x^2$ and $g(x) = 3x$.

You can challenge pupils to interpret $f(x)$, $g(x)$, $fg(x)$ and $gf(x)$ geometrically …

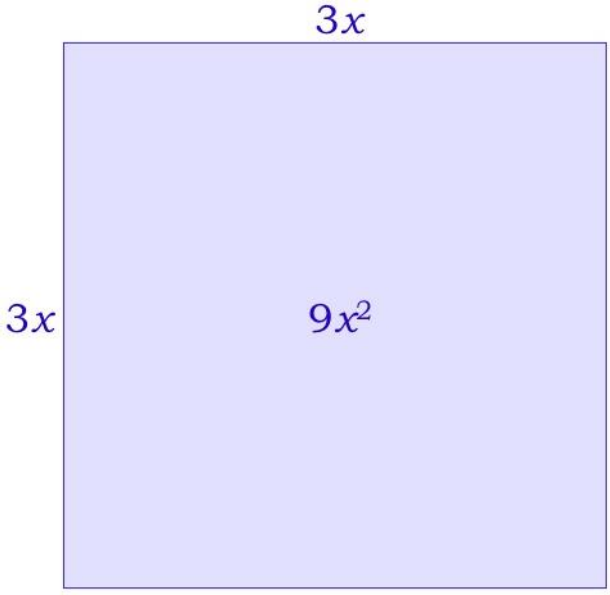
- $f(x) = x^2$ gives the area of the square …



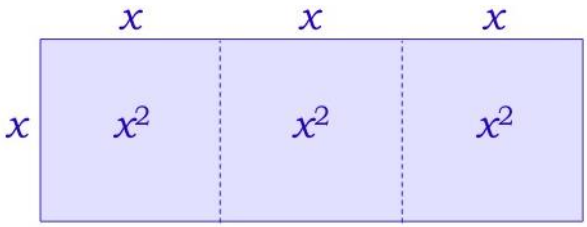
- $g(x) = 3x$ gives the side-length of the square after enlargement by linear scale-factor 3 …



- $fg(x) = f(3x) = (3x)^2 = 9x^2$ gives the area of the enlarged square …



- $gf(x) = g(x^2) = 3x^2$ gives the area of a rectangle composed of three copies of the original square …

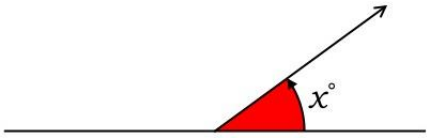


Pupils are able to see that …

- $fg(x)$ first triples the square's side-length then gives the transformed square's area
- $gf(x)$ first gives the area of the square then triples that area.

Example 2: the independent variable, *x*, represents the number of degrees turned through in the positive (anti-clockwise) direction by a pointer that initially points horizontally to the right

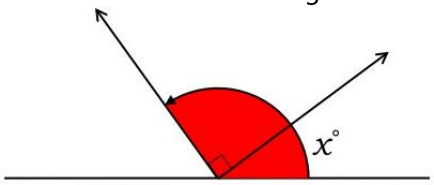
Suppose x is the number of degrees through which a pivoted pointer (originally pointing to the right) has turned through in the positive (anticlockwise) direction …



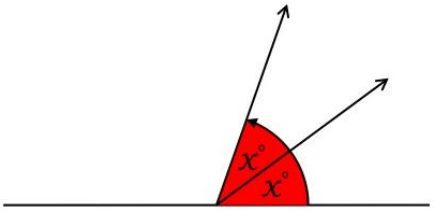
… and $f(x) = x^\circ + 90^\circ$ and $g(x) = 2x^\circ$.

You can challenge pupils to interpret $f(x)$, $g(x)$, $fg(x)$ and $gf(x)$ geometrically …

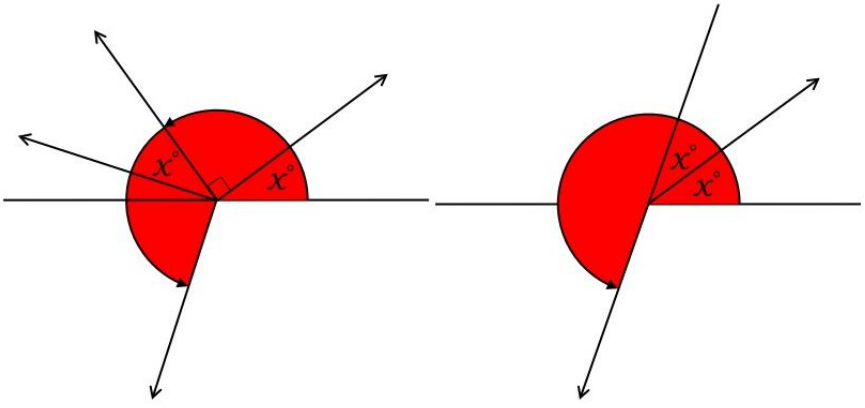
- $f(x) = x^\circ + 90^\circ$ rotates the pointer anticlockwise through 90° …



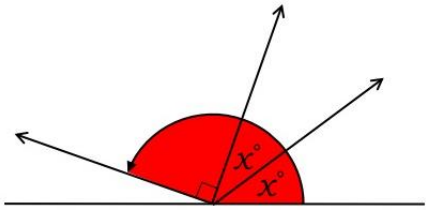
- $g(x) = 2x^\circ$ rotates the pointer anticlockwise so that the existing angle turned-through from the horizontal doubles…



- $gf(x) = g(x^\circ + 90^\circ) = 2(x^\circ + 90^\circ) = 2x^\circ + 180^\circ$ rotates the pointer through 90° anticlockwise, then doubles the angle that it has already turned through from its original horizontal orientation…



- $fg(x) = f(2x^\circ) = 2x^\circ + 90^\circ$ rotates the pointer through a further x° anticlockwise, then rotates it through a further 90° anticlockwise …

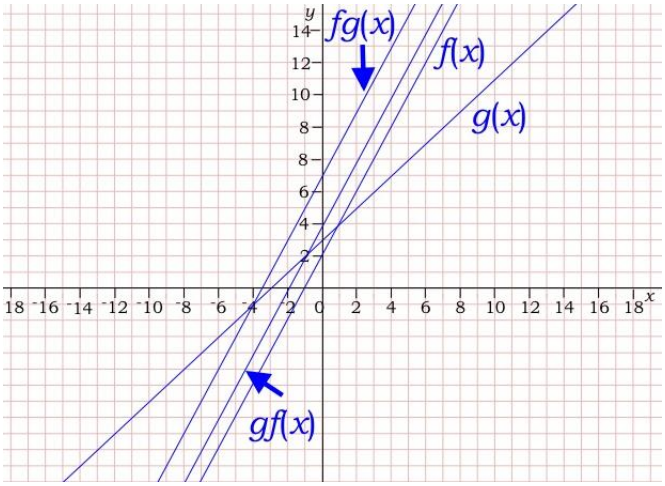


Pupils are able to see that …

- $fg(x)$ first doubles the angle then adds 90˚,
- $gf(x)$ first adds 90˚ then doubles the whole angle.

Sketch-graph explorations

Pupils could create sketch graphs (using graphing software or otherwise) in order to explore how the graphs of $f(x)$, $g(x)$, $fg(x)$ and $gf(x)$ are related when $f(x)$ and $g(x)$ are both linear functions. For example, if they sketch $f(x) = 2x + 2$ and $g(x) = x + 3$ …



… they will find that the graphs of $f(x)$, $fg(x)$ and $gf(x)$ are all parallel.

Algebraic explanations

By reasoning algebraically about linear functions pupils can explain their graphical findings.

For example, if:

$f(x) = ax + b$, and $g(x) = cx + d$, then …

$$fg(x) = f(cx + d) = a(cx + d) + b = acx + ad + b$$
$$gf(x) = g(ax + b) = c(ax + b) + d = acx + cb + d$$

This shows that ***generally*** the gradients of $fg(x)$ and $gf(x)$ are both equal to the product of the gradients of $f(x)$ and $g(x)$.

It is likely that GCSE questions will assess pupils' abilities to reason about algebraic expressions of linear composite functions, as does this sample GCSE question from AQA …

25 $f(x) = 2x + c$

$g(x) = cx + 5$

$fg(x) = 6x + d$

c and d are constants.

Work out the value of d.

[3 marks]

Answer _____

Further recommended reading: '*Functional relations between variables*', Chapter 8 of Key Ideas in Teaching Mathematics

You can find previous *It Stands to Reason* features here

Qualifications and Curriculum

This month in *Qualifications and Curriculum*, we have given the awarding bodies a chance to speak to you directly.

First, this summer, two Maths Hub Leads, Matthew Linney and Dean Rowley (from the North Mids and Peaks and Norfolk and Suffolk Maths Hubs respectively), had the opportunity to meet with representatives from the three main exam boards: Joanna Deko (Pearson [Edexcel]), Neil Ogden (OCR) and Andrew Taylor (AQA). Matt and Dean collected a handful of FAQs from teachers to put to the exam boards and their responses have been compiled, in a comparative table.

Second, we have asked the boards to give us an update on their interpretation of the current curriculum changes at KS4 and KS5, and what they have in place to support teachers and maths departments. Their responses are below:

OCR

Last month, here at OCR, we received Ofqual's announcement of the result of their GCSE grading consultation that ran earlier this year. For the reformed GCSE qualifications, grade 9 (the highest grade) is now to be awarded using a 'tailored approach' that will award the grade to approximately 20% of the candidates that are awarded grade 7 or above *across all subjects*. This is a change to the position previously announced in September 2014, which was that the top 20% of candidates achieving grade 7 or above *in each subject* would be awarded grade 9. The 'tailored approach' comes out of a 2016 research report published by Cambridge Assessment, which takes into account the fact that different subjects have different ability profiles and so now subjects with high-ability cohorts will see more grade 9s awarded than those with lower ability cohorts. A lower proportion of grade 9s will be awarded for the reformed GCSE qualifications compared to the proportion of A*s awarded on the legacy specifications.

The consultation also confirmed that grade 8 will be set arithmetically, at the mid-point between grades 7 and 9. The consultation outcome in full can be read on gov.uk.

At OCR, we've spent much of the summer working on support for our range of qualifications.

- Supporting teaching of GCSE (9-1) mathematics, our range of *Check In* resources continues to grow, and we've updated our Curriculum Planners with more links to resources. Our 2016-2017 CPD programme is now available to book, including new online Q&A webinars.
- This summer saw the first assessment of the new Core Maths qualifications, with many candidates picking up strong results on the new specifications. Resources for our two Core Maths qualifications are available from OCR and from MEI's Integral. Our 2016-2017 CPD programme is now online.
- Ofqual reported back to all awarding bodies last month on the draft reformed AS/A Level maths and further maths qualifications, which you can read more about in our blog. A first sample of resources and our draft qualification documents are all available from OCR A Level page. OCR's 2016-2017 CPD programme is now available to book, including new online Q&A webinars on the new qualifications.
- OCR's new Entry Level Mathematics specification has been developed to reflect the changes in the GCSE (9-1) mathematics content. The new R449 is available for first assessment from September 2016 and the Specification and Sample Assessment Material are available on the qualification's webpage.

AQA

GCSE

We've produced documents to support your understanding of the new problem solving and reasoning requirements for the new GCSE Maths 8300. We've had a look for questions from the legacy and outgoing GCSEs and found relevant examples of the new AO2 and AO3 type questions which we've put together in 13 booklets. These will be available on our All About Maths website within the next few weeks.

Practice Papers Set 3 is now available on All About Maths – in good time for schools wishing to use it for a Y11 mocks. Later in the term we will be providing online marking training for teachers to allow you to mark your students' work as the examiners would. There will be a secure portal for you to submit your students' marks to us: when we have enough results, we will be able to send you back data to show your students' performance compared to other schools.

If you require access to All About Maths, our secure resources site, email maths@aqa.org.uk to request a free login.

Level 3 Mathematical Studies (Core Maths)

We're excited that this year Core Maths is now available to all. Core Maths is a level 3, 2 year mathematics course (with equivalent UCAS points to AS level) for students that want to study maths beyond GCSE without doing AS/A level. More information about AQA Level 3 Mathematical Studies can be found here. Further support can be obtained if you sign up for All About Maths.

A-level Maths and Further Maths

Along with the other exam boards, we received a rejection of our new A-level Maths and Further Maths specification from Ofqual in early September. We are committed to getting this right and are working on our second submission with plans to resubmit A-level Maths in late November, and A-level Further Maths in mid-December.

Headline changes we are working on are:

- Allocation of the Assessment Objectives and Overarching themes
- Strengthening our Mark Schemes
- More detail in our Further Maths content.

Meanwhile, the content for A-level Maths is already set so you can begin to plan your teaching with our customisable route map. Other resources published include our teaching guidance extract, specimen item commentaries, and a formula poster coming at the beginning of October.

Edexcel

GCSE Maths - Back to school

New resources have been written to support teaching and learning of the GCSE (9-1) Mathematics content which is new to foundation and higher tier. Each resource includes worked examples with guidance and comments, exercises with answers and, in some cases, extension material. These can be found in a zipped file on the Edexcel website.

In Spring we ran free online twilight events for teachers of mathematics who wanted to find out more about delivering the new content for GCSE (9-1) Mathematics. Each session covered a different area of content which is new to the GCSE (9-1) Mathematics qualification, and was delivered by a practising teacher who gave a practical insight into teaching these topics. Recordings of those events are available.

In Autumn we will be running Mocks Marking Training events. These face-to-face and online sessions are designed to help teachers apply new mark schemes and confidently mark students' responses to have a clear picture of their progression. These events can be booked via the Edexcel website.

AS and A level Mathematics and Further Mathematics Reform

AS and A level Mathematics and Further Mathematics are changing from Sept 2017. We'll make sure you've got everything you need to plan and implement the new qualification successfully - and with more support than ever before. On the Edexcel website you can download the Subject Guide, specifications, sample assessment materials, teaching and learning resources and book forthcoming Launch and Getting Ready to Teach events.

Eduqas

GCSE Maths

At Eduqas we offer two papers, each of which is 2 hours and 15 minutes long.

To support with the changes that the new qualifications will bring, we have developed Question Bank. This advanced tool enables teachers to create and print tailored test papers similar to real exams. Question Bank aims to help teachers consolidate students' learning and better identify areas of weakness.

Alongside this, our support for the new 9 – 1 GCSE includes

- An Online Exam Review tool to see which questions proved to be the most challenging in previous exam series.
- Sample assessment materials.

For teachers working with students who will be retaking the 9-1 GCSE in one year, there is specialised training in the Spring term.

Core Maths

At Eduqas, we offer a Level 3 Certificate in Mathematics for Work and Life. This Core Maths qualification comprises two components:

- an external assessment (80%) lasting 2 hours and 30 minutes;
- an internal controlled assessment (20%).

The internally assessed component is designed to assess learners' abilities to use the problem solving cycle. We have produced a bank of model assignment briefs for this component. Centres may use or contextualise a WJEC model assignment or create their own.

Further details, including sample assessment materials, can be found on the Eduqas Core Maths page.