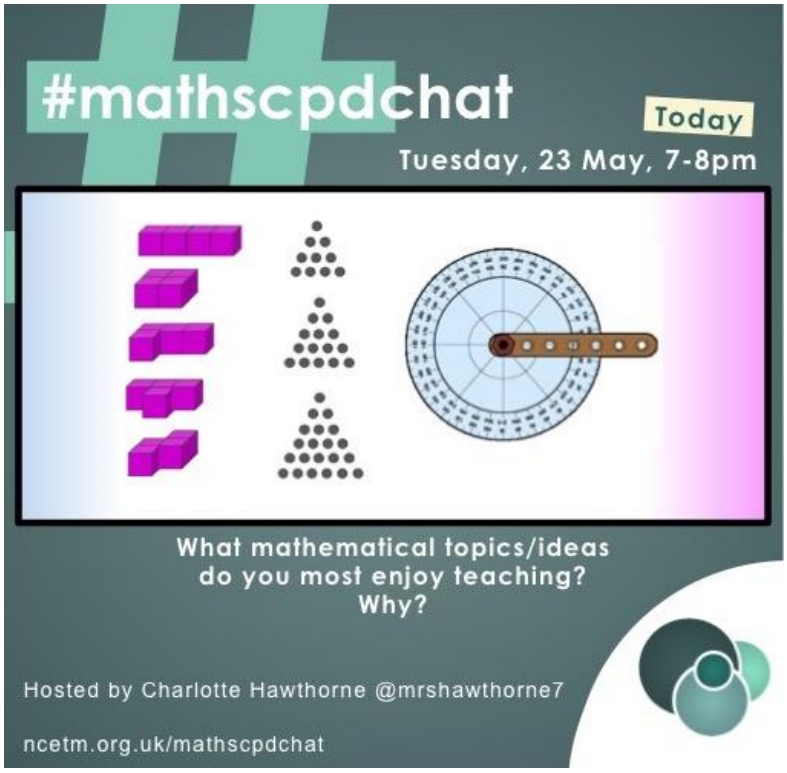
#mathscpdchat 23 May 2023

What mathematical topics/ideas do you most enjoy teaching?

Why?

Hosted by Charlotte Hawthorne

*This is a summary of the discussion – to see all the tweets, follow the hashtag **#mathscpdchat** in Twitter*



The links shared during this discussion were:

Simultaneous equation deductions which is a collection of tasks on Don Steward's blogspot. These tasks are intended for students who are starting to solve simultaneous equations by considering what can be deduced from two initial statements. It was shared by Charlotte Hawthorne

Checkpoints which are diagnostic maths activities on the NCETM website. These attractive materials are designed to help teachers develop their assessment of students' prior learning for KS3. It was shared by Anthony Shaw

Seven Squares which is a problem from NRICH. It contains short videos, each showing how a different pupil draws and continues the same given repeating matchstick pattern. In each video the pupil draws the pattern in a different way. Viewers are challenged, by means of specific targeted questions, to describe these different ways. It was shared by Pete Mattock

Numbers as Shapes which is another problem from NRICH. The numbers 1 to 6 are represented by the appropriate number of identical yellow squares arranged edge to edge to form rectangles. Students are challenged to decide for each whole number up to 20 whether it can be represented by identical squares arranged to form a square, arranged to form a rectangle at least two squares wide that is not a square, or only as a 'stick' (single-thickness-rectangle). It was shared by Isaac Howarth

Hyperbolic Functions which is a well-illustrated blog by Paddy MacMahon. It is a resource intended for students of A level maths, and aimed at showing how the hyperbolic functions can be derived from their definitions in terms of the area enclosed by a hyperbola and rays from the origin. It was shared by Paddy MacMahon

An illustrated summary of the discussions in this #mathsCPDchat follows.

The host's welcome tweet …

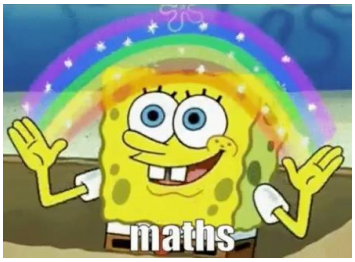
Charlotte Hawthorne @mrshawthorne7 · 19h

Hello!
And WELCOME to tonight's #mathsCPDchat

Please remember to include the hashtag (above) in all tweets and replies so I don't miss any.

Let's talk MATHS!

Who's joining us tonight? (To comment or to simply watch 😃)
Likes/comments/retweets appreciated 🥰



… prompted three people to communicate their presence …

Karen @karenshancock · 19h

I'm here... (Does that need a hashtag?)

Jenny Hill-Parker @JennyHillParker · 19h

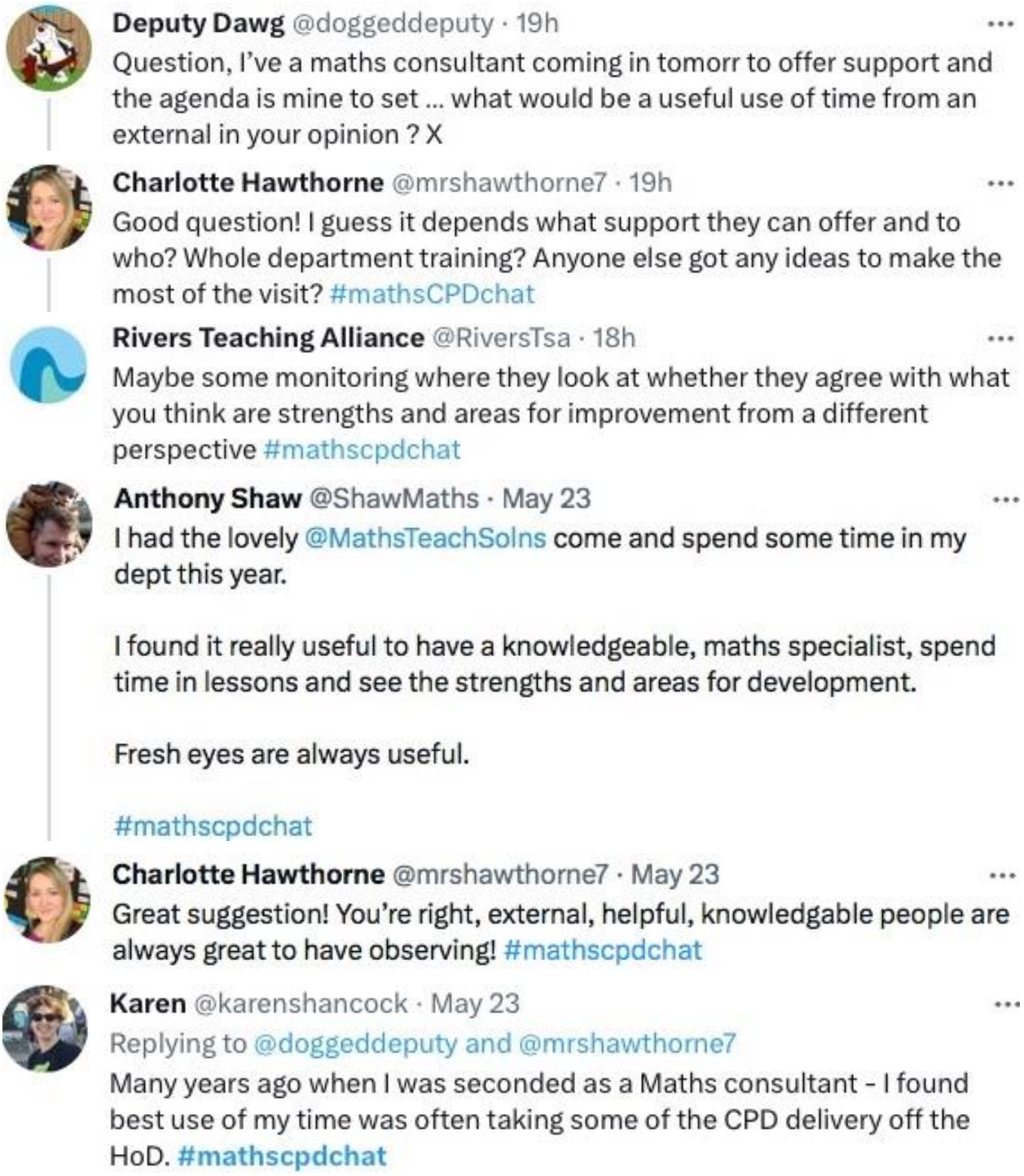
Me!

Neil Almond 🇺🇦 @Mr_AlmondED · 19h

Charlotte Hawthorne @mrshawthorne7 · 19h

Love this reply!

… and, also in response to the host's welcome tweet, and possibly because the specific topic of this chat had not yet been mentioned, one person asked for some urgent advice:



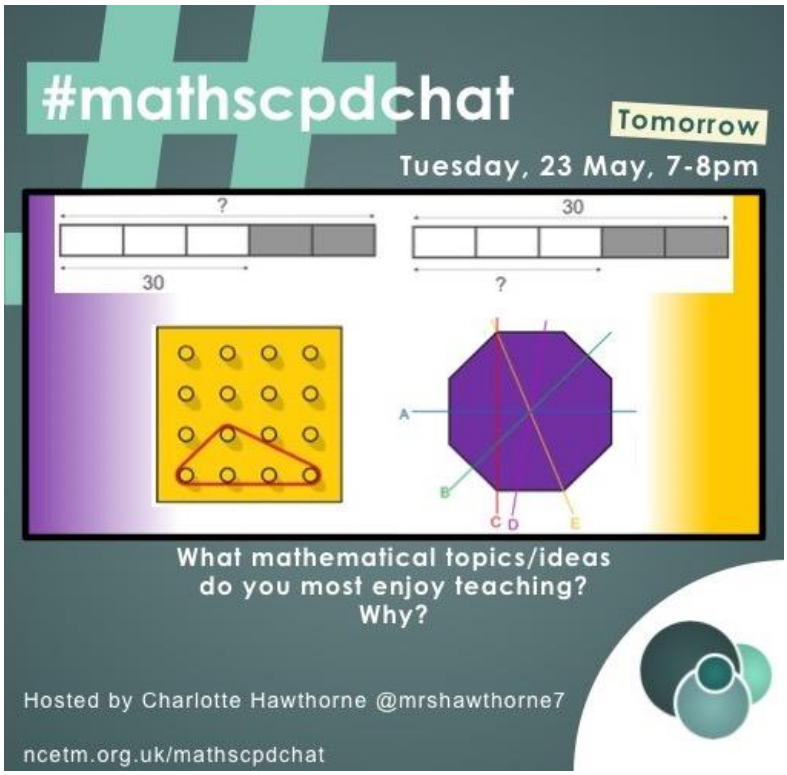
A short conversation was also generated at the start of the chat by a greeting that might have been a reply to the host's welcome tweet, but which was actually a 'reply' to a tweet-notice which had been posted on the previous day …

mathscpdchat @mathscpdchat · May 22

Which mathematical topics/ideas do you MOST enjoy teaching? Why?

Join #mathscpdchat TOMORROW at 7-8 pm to share and discuss your own and other maths educators' thoughts!

Share examples and resources with host Charlotte Hawthorne, @mrshawthorne7, & other contributors/observers.



… and which started with this view and conjecture:

Yorkshire Steve @Yorkshire_Steve · May 23

Good evening all. For me I always loved teaching trigonometry. Perhaps because it was something many pupils had heard was 'really hard' and then sense of pride when realising they got it!

#mathscpdchat (remembered the hashtag this time!)

Charlotte Hawthorne @mrshawthorne7 · May 23

Replying to @Yorkshire_Steve and @mathscpdchat

Evening! This is a lovely moment, when they realise they can do something that 'sounds' difficult or they've heard older student talk about. I wonder what other topics have this? #mathscpdchat

Yorkshire Steve @Yorkshire_Steve · May 23

Definitely Pythagoras' Theorem.

Yorkshire Steve @Yorkshire_Steve · May 23

Or when they come in the next day, having told their parents what they learned in maths, and the parents were wowed.

Tends to be things with catchy 'titles'.

Finding the mean from a grouped frequency table ... not as catchy!

Charlotte Hawthorne @mrshawthorne7 · May 23

Perhaps we need to come up with catchy names for these things 😅 #mathsCPDchat

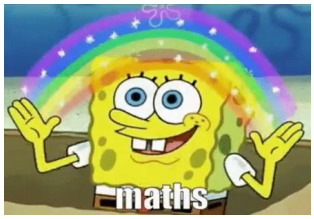
The host's first main question …

Charlotte Hawthorne @mrshawthorne7 · 19h

Let's begin! (Yes, I'm re-using the same gif because it's fabulous and is about the only positive maths gif in there!)

Let's kick off with the main one:

Question:
What topic in maths do you look forward to teaching the most?
#mathsCPDchat



… prompted nine conversations (threads of at least two tweets) and nearly 30 single replies. The observation about the lack of Twitter-Gifs showing mathematics in a positive light is not as trivial as it might seem, as was noted:

Helen Drury @DrHelenDrury · May 23

Hang on - sounds like there's a real need for positive maths gif generation?! #mathsCPDchat

Charlotte Hawthorne @mrshawthorne7 · May 23

There absolutely is! 🙏 #mathsCPDchat

The next discussion focussed on the unifying nature of hyperbolic functions in A level and Further Maths …

… while in this thread attention was on algebra in earlier Key Stages:

Lizi Pepper @mathspeptalk · May 23

It's hard for me to pick just one. I love sharing ratio using a bar model, but more recently all things algebraic manipulation with algebra tiles! #mathsCPDchat

Charlotte Hawthorne @mrshawthorne7 · May 23

Great choices! It really is hard to pick one! Maybe a top three? #mathsCPDchat

Mary Pardoe @PardoeMary · May 23

I like students using algebra to reconcile different ways of seeing ... particularly when what students are looking at is sequences of patterns. #mathsCPDchat

Mary Pardoe @PardoeMary · May 23

Bits of an example ... #mathscpdchat

Using algebra to reconcile different ways of seeing.

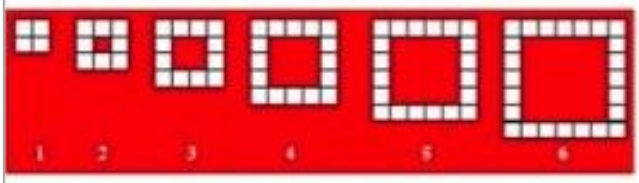
Learners arrive at equivalent algebraic expressions for the general term of a sequence by seeing the structure differently.

Learners study a sequence of drawings. They are first challenged to describe in words how they 'see' the general structure of the 'drawings', and how that structure gives the number of a component in each drawing. They then express their different generalisations algebraically. Having arrived at different equivalent algebraic expressions for the same thing, they feel the need to understand how the expressions are the same.

An interesting way to help learners appreciate that algebraic manipulation is both useful, and derived from 'ordinary' thinking about numbers, is to present them with a structure that can be seen in different ways. Then challenge them to describe the structure as they see it, at first in words and then algebraically. When they arrive at different expressions for the same structure, they feel the need to be able to convert one expression to the other.

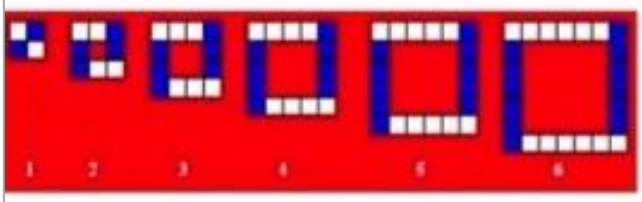
If the challenge is to describe the general structure of drawings in a sequence of drawings, it leads naturally to 'the nth term' of a sequence.

For example, the sequence might be a sequence of 'hollow' squares made with small squares (such as square ATM MATs) :

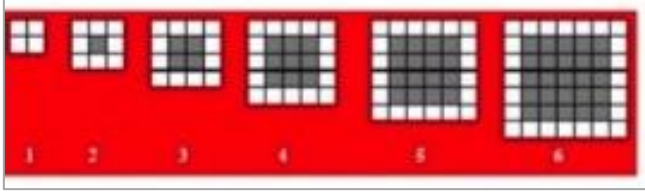


So the number of squares in a ring is four, plus four times one-less-than-the-position-of-the-ring.

B: You can split a 'ring' into four equal bits. It's just four times its position!



D: They are proper whole squares, with smaller proper whole squares removed from the middle.



So the number of squares in a ring is the square of 'er' the number that is the position plus one, minus the square of 'er' the number that is the position minus one.

T: Choose a letter to be the number that gives the position of the ring in the sequence.
What is your letter?

D: p

T: What is the number of squares in the pth ring?

D: p plus 1 squared, minus p minus one squared.

T: Can you write that without words?

D eventually writes: $(p + 1)^2 - (p - 1)^2$

T: So the number of squares in the pth ring is that (pointing to $(p + 1)^2 - (p - 1)^2$)?

A: But my way it's not that complicated! It's four, plus four times one less than p.

T: Can you write that without words?

A eventually writes: $4 + 4(p - 1)$

T: So the number of squares in the pth ring is that (pointing to $4 + 4(p - 1)$?

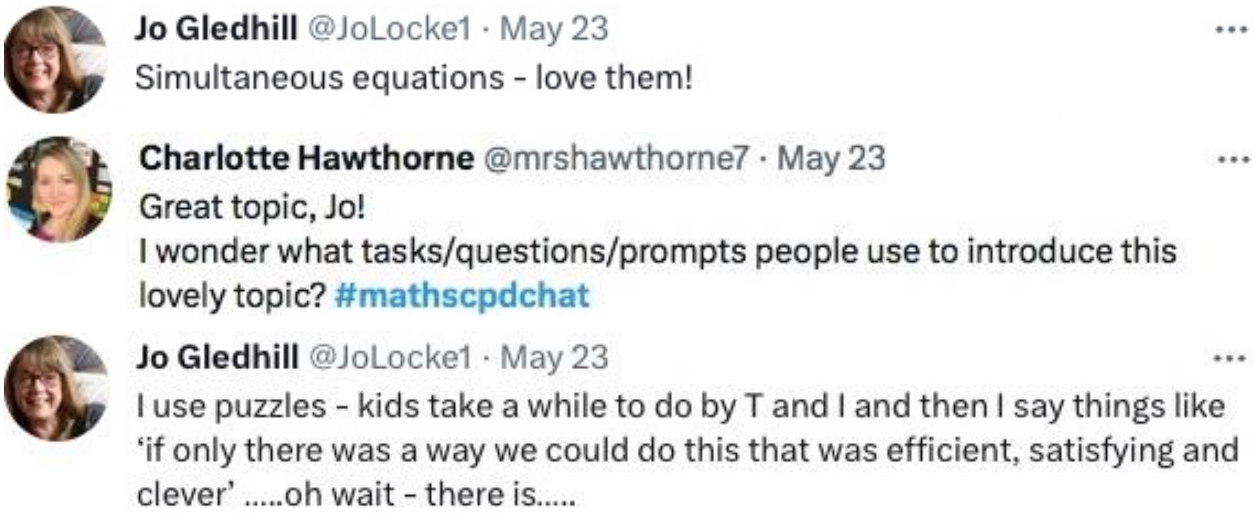
B: But it's just 4p! That was what I said.

E: But it's - they're all the same! How can it be $(p + 1)^2 - (p - 1)^2$ and also $4 + 4(p - 1)$ and also just 4p?

In this episode did the teacher ever give the impression that 'THE' right answer had been given?

How do you create an atmosphere in which learners share their ideas even when they are not sure where they will lead?

Several different people contributed to a (branching) conversation (about teaching simultaneous equations) that developed from the following comment and Charlotte's reply to it:



Ben Farren @circadian_ · May 23

I find it amazing how easy most kids find sim eqs with pictures and diagrams, as soon as it gets algebraic and abstract they say it's a hard topic!

Charlotte Hawthorne @mrshawthorne7 · May 23

I encourage mine to turn the algebra into pictures! (Gets a bit harder for negative coefficients 😬)

Lizi Pepper @mathspeptalk · May 23

I love the legend Don Steward's ducks and tops to start simultaneous equations! #mathsCPDchat

KarenB @brockway_karen · May 23

I like the Don Steward tasks too. Last time, I put up a pair of linear simultaneous equations and got them to find as many ways as possible to find values of x and y which worked in both. Amazing discussion and ways which didn't occur to me! #mathscpdchat

Charlotte Hawthorne @mrshawthorne7 · May 23

YES! donsteward.blogspot.com/2011/10/simple... this is the link for those interested! #mathscpdchat

Laura Deamer @LauraDeamer · May 24

@MrBlythJB @KellyLodge5 @Rachael23377957 @rach_wiggett these are nice intro questions for simultaneous equations!

MrHawesMaths @HawesMaths · May 23

Deal or no deal box task.
2 of the red boxes plus 4 of the blue equals £22
10 red boxes and 3 blue boxes equals £42.

Which box do you choose? Red or blue #mathscpdchat

Charlotte Hawthorne @mrshawthorne7 · May 23

Nice hook there! #mathscpdchat

MrHawesMaths @HawesMaths · May 23

Try to make it relevant. Rather than a typical coffee shop style task. Plus I get them to collaborate and find an answer. The key for them is recording their working and then seeing how close they are to Simultaneous equations solving. #mathscpdchat

C J @jdw137 · May 23

As well as the visual / concrete approaches it is sometimes showing them that for example 5x+19=2x+7 is two eqs y=5x+19 and y=2x+7 and the subtraction and/or adding we do to the former we do with the two latter separate equations. Making the connections. 🤔

Nathan Day @nathanday314 · May 23

Love lots of the suggestions from others.

I also liked doing this task just before starting simultaneous equations which highlights why sometimes one equation isn't enough, and generated some really interesting discussions.

#mathsCPDchat

Task 2 Either find the value of x, or explain why it is impossible to do so.	
a. $7x - 14 = 7$	
b. $7x - 14y = 7$	
c. $7x - 14 = 7x$	
d. $7x - 14 = -7x$	
e. $7x - 14 = 7(x - 2)$	
f. $7x - 14 = 2(x - 7)$	
g. $7x - 14 = 2(y - 7)$	
h. $7x - 14y = 2(21 - 7y)$	
i. $x^2 - 2x + 14 = 7x$	
j. $(x - 2)(y - 7) = 0$	
k. $7x + c = 14$	
l. $(x - y - 3)^2 + (x + y - 7)^2 = 0$	

SHobbs @SHobMaths1095 · May 23

1 Burger and 1 bag of chips cost £4. What is the cost of 1 Burger? What is the cost of 1 bag of chips? ... I don't know. Hmmm... infinite solutions (well not quite). Ahh well 2 Big Macs and 1 bag of chips cost £7. Can you now answer the question?

Using algebra tiles to support pupils' learning to factorise algebraic expressions was mentioned briefly:

Ruth Patrick @RuthPatrickNE · May 23

Factorising quadratics..watching the thinking develop whilst algebra tiles are out on desks!

Charlotte Hawthorne @mrshawthorne7 · May 23

Factorising with algebra tiles is 😍😍 #mathscpdchat saw a lovely tweet by @Mamamatician about this!

Another teacher revealed (as did Susan Whitehouse … in a discussion shown earlier above) how he enjoys linking together topics that he particularly likes teaching:

Jonathan Hall @StudyMaths · May 23

FToA.
Product rule for counting.
Square, Cube, Triangle numbers.

I reckon I could write a full book of tasks linking those topics together.

Charlotte Hawthorne @mrshawthorne7 · May 23

You should so do this! Who else would buy this book? #mathsCPDchat
(ps... FToA – fundamental theorem of arithmetic)

Esther @MrsMathematica · May 23

Mr Mattock FCCT NPQSL @MrMattock · May 23

Replying to @mrshawthorne7

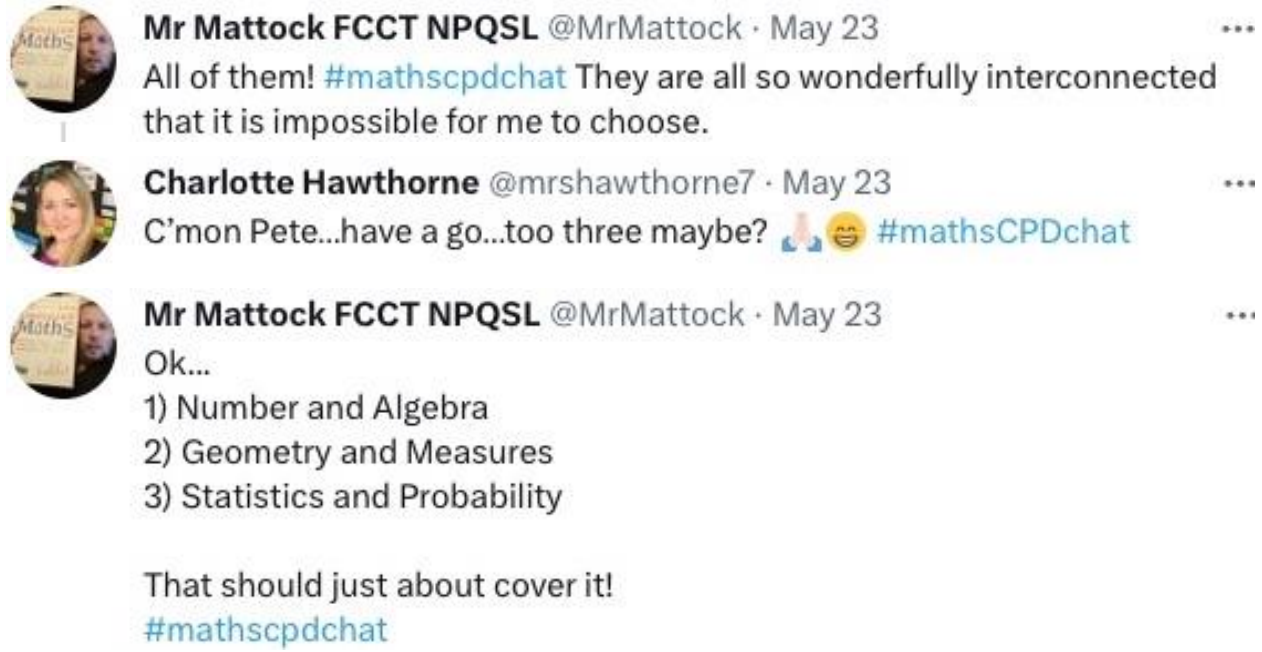
Reckon @Mathematical_A would be interested in publishing it as well. If only Johnny knew a council member or 2...😉 #mathscpdchat

Miss Konstantine @giftedHKO · May 23

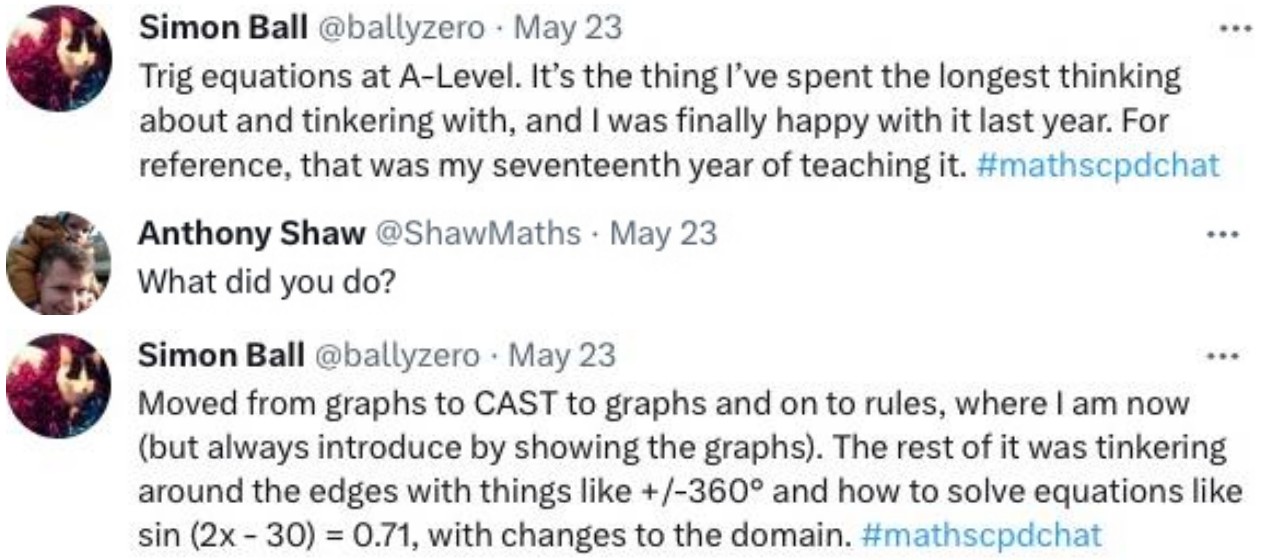
Replying to @mrshawthorne7

id buy it but wouldn't read it because I'm so crap at reading things. Why don't you do a mathsconf session on it :) #mathsCPDchat

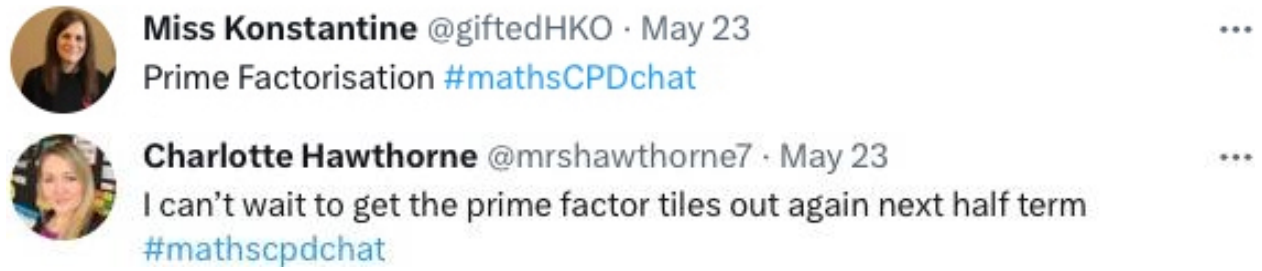
Many contributors were not able to give just one area/topic of maths that they most enjoy teaching …



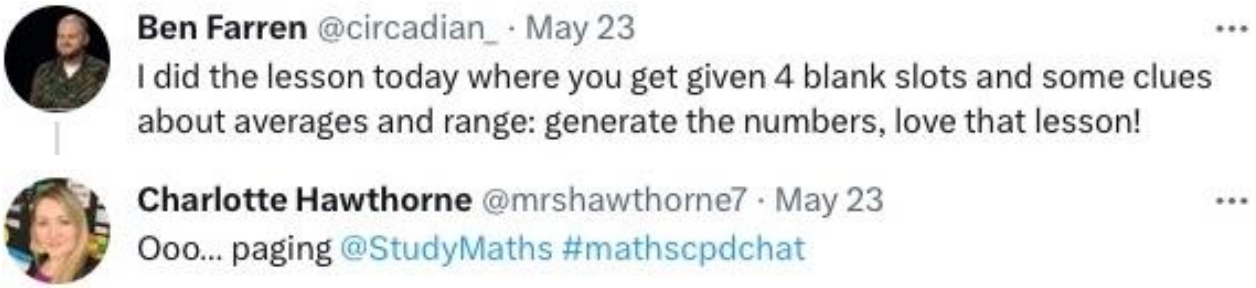
… although some did state just one topic as their favourite, for example …



… and …



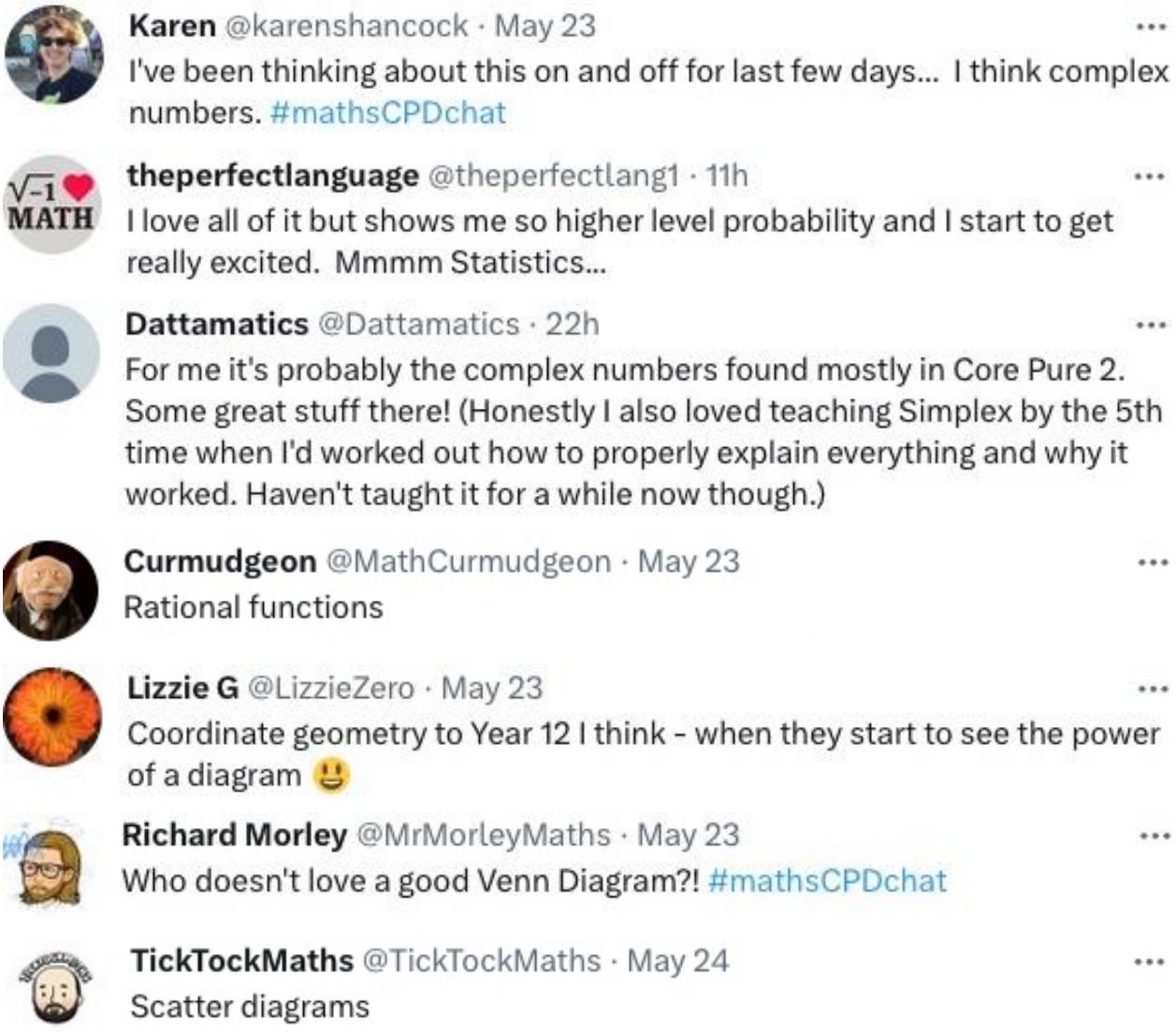
… or even just one lesson:



At this stage in the summary we are still showing responses to the host's first main question:

> Question:
> What topic in maths do you look forward to teaching the most?

The direct replies to that question that were not part of any conversation (the 'single' replies) are shown next.



Claire Sidlow @ClaireSidlow · 14h
Surds!

Jemma Sherwood @jemmaths · May 23
Tough but I'll go with...
KS3: ratio, prime factors
KS4: quadratics, probability, vectors
KS5 Pure: integration, trig identities
KS5 Applied: forces and motion, normal distribution #mathscpdchat

Alex Cottonbud @AlexCottonbud · May 23
My fav was sharing their first Algebra lesson with children ... whispering ... now you are really doing maths!
#mathsCPDchat

Nathan Day @nathanday314 · May 23
Sequences.

Love how it allows for some lovely abstract mathsiness, while remaining grounded in something really accessible.

Mr S Maths @MrSMaths11 · May 23
Good question! I love recurring decimals at KS4 because I remember learning it for the first time and thinking it was so clever, and 0.999... = 1 always provokes a bit of a debate in the room! At KS5 I think I'm a fan of polar coordinates and 3D vectors.

W E Cookson @WECmathventures · 19h
@mrshawthorne7 #mathscptchat Circle Theorems when pupils were required to use them all. As much fun as any puzzle.

Peter Williams @MathsImpact · May 23
I adore tangents to circles at GCSE.

It pulls on so many other threads, but remains really visual so it's easy to picture roughly what is going on.

#mathscpdchat

10. Soru @OnuncuSoru · 23h
I think we 'teachers' have the role of a 'translator/interpreter'. I love teaching logic, set, function and geometry(*). Because I believe I can make reachable interpretations about fundamental concepts. More than that, I love thinking and learning with the students on them.

Dafydd Alun Roberts @DafyddAl · 21h
Pythagoras and Right-Angle Triangle Trigonometry

Joanne Green @MsJoanneGreen · May 23
@mrshawthorne7 **#mathscpdchat** Hello Charlotte, I like teaching graphs as graphs are fab. Both yesterday and today the teacher I was supporting taught pie charts. On both occasions, neither class understood their table of data: classes, x; and frequency, f and as (x/f) x 360.

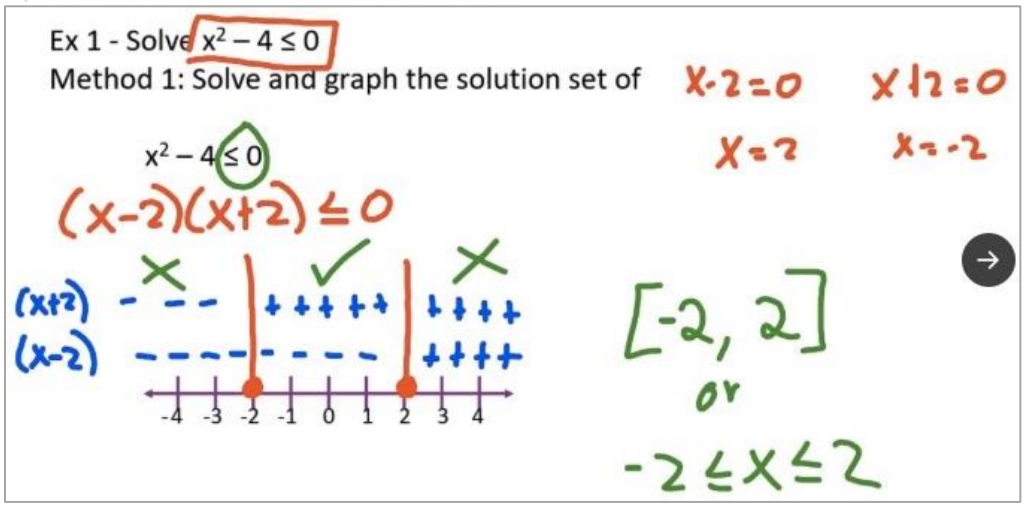
Anthony Shaw @ShawMaths · May 23
Replying to @mrshawthorne7
I got to teach a few Core Maths lessons thus year after a few years off it. I forgot just how much I love tearing apart newspaper headlines.

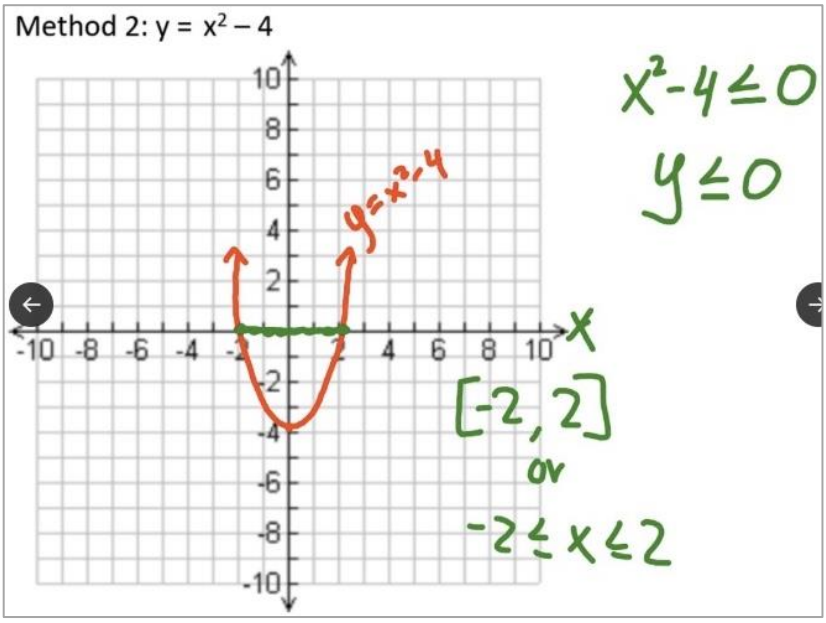
Making my own, crack team of fact checkers!

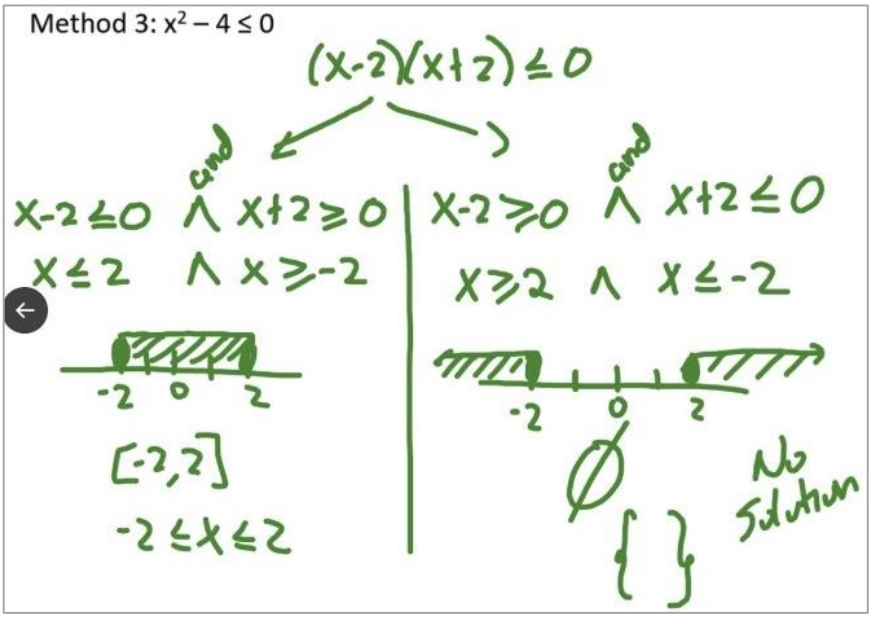
#CoreMaths **#mathscpdchat**

Libo Valencia #MathPlay @MrValencia24 · 21h
Replying to @mrshawthorne7
Quadratic Inequalities is definitely one of my favorites **#MathsCPDchat**

> **Libo Valencia #MathPlay** @MrValencia24 · May 24
> Replying to @MathsCirclesOz
> I REALLY enjoy teaching quadratic inequalities using different approaches. I believe that exploring different paths provides a deeper understanding for all ss #MathPlay
> blog.savvas.com/using-multiple...







USDescartes @nandor117 · 7h

Principle of Least Action. It's a physics topic, but I get to introduce an AWESOME anecdote about Newton, the Brachistochrone Problem, and working with a second-order differential equation. Advanced high school students seem to really dig it.

Our summary of responses to Charlotte's first main question is complete.

Her second main question also generated a great deal of interest, as show next.

Charlotte Hawthorne @mrshawthorne7 · May 23

We've got lots of suggestions already for favourite topic to teach and so far lots of higher level maths

...what's your favourite (or top three if you can't pick one) bit of maths from Early years through to KS3?

#mathsCPDchat

Five conversations were generated by this question, and there were single replies. The discussion shown next focussed on one of the NCETM's Checkpoints tasks:

Anthony Shaw @ShawMaths · May 23

This year I loved using ratio tables to teach compound measures. Speed makes so much more sense and the skill is really useful across the curriculum.

I also loved using @NCETM checkpoint muddy maps to introduce double numberlines. Thanks to @LearningMaths

Charlotte Hawthorne @mrshawthorne7 · May 23

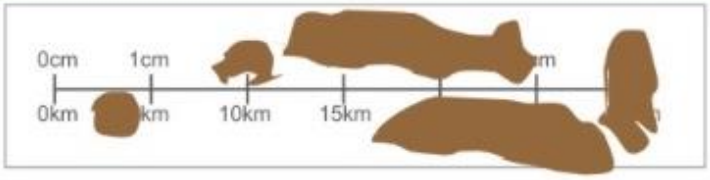
Ooo. It's very busy here tonight so if anyone has that slide to share on here it's a great one! #mathscpdchat

Nathan Day @nathanday314 · May 23

This one?

Checkpoint 6: Muddy map

Bennie is out hiking. His map got muddy so he can't read all of the scale!



a) Fill in the missing numbers.

b) Bennie measures that his campsite is 5 cm away on the map. How many kilometres will he need to walk to get there?

c) He plans to stop at a church that is 10 km away. How many centimetres will this be on the map?

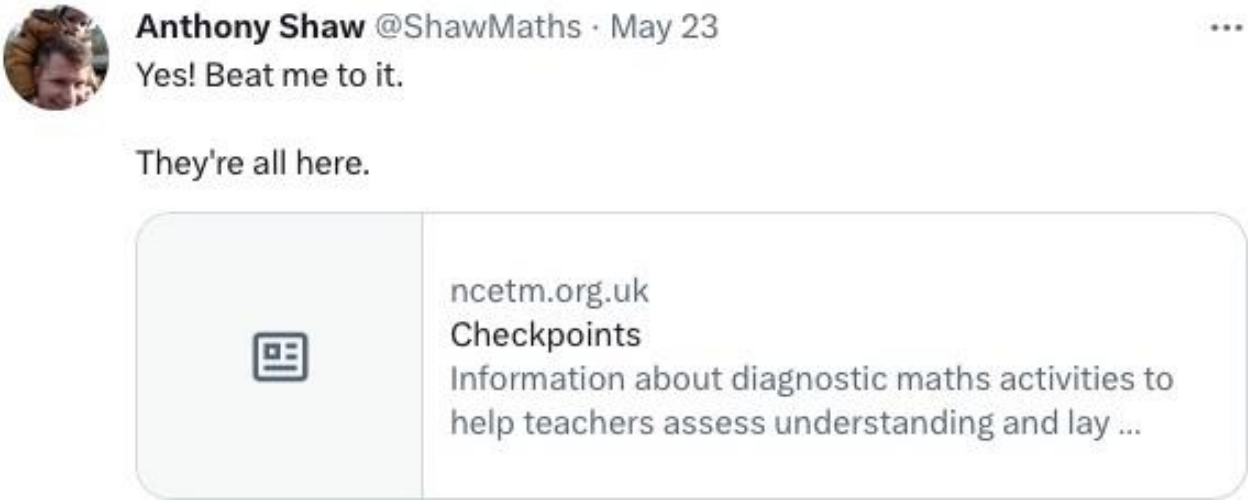
d) Bennie knows that the nearest town is 40 km away from the church. How many centimetres will this be on the map?

e) Bennie walks along a path that is 4 km long. How many centimetres will this be on the map?

? Bennie can walk at a pace of 6 km per hour. How long will it take him to walk each of the routes in parts b) to e)?

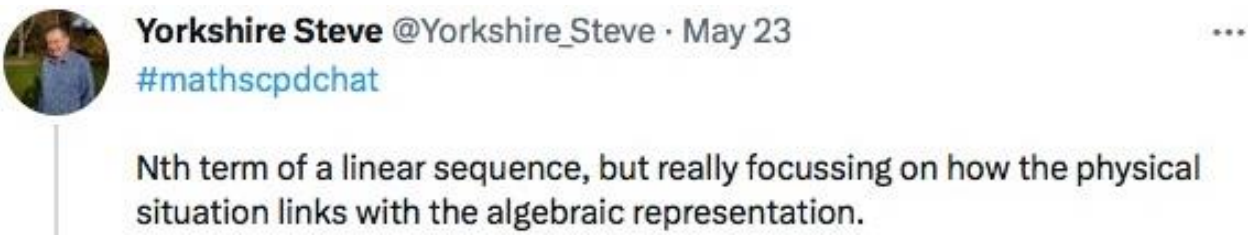
Checkpoint 6: Guidance

Adaptations	Assessing understanding
Support Model the double number line on squared paper (with 5 squares between 0 and 1) to help students use counting up to understand the connection between the values. Labelling the printable version of the line may also help. **Challenge** The further thinking question introduces speed – a r multiplicative relationship. Ask students to re Bennie's speed to a different speed. **Representations** The double number line here is used in the context of a map, rather than as a standalone representation. The values are straightforward in case students are unfamiliar; an editable printable version is also available.	This checkpoint explores whether students can complete and use a double number line, to support future planning and gauge how readily students might be able to use them for multiplicative reasoning. (Students should have experience of maps from geography, although scales are not specifically mentioned in the national curriculum.) From part b onwards, students use the double number line to reason about distances on the map and in real life. These questions build from using the markings on the double number line, to values beyond the number line, and finally to values that are between the markings on the number line. Pay attention to whether students use the line to support their reasoning, or if they have a different strategy. Students may notice that they can work between questions – for example, that their answer to part e needs to be ten times smaller than their answer to part d. This indicates a greater depth of understanding.
Additional resources • Within Primary Mastery Professional Development | NCETM, Teaching Point 3 of Scale factors, ratio and proportional reasoning | NCETM explores using scales for maps; Key Idea 3.1.2.1 Representing multiplicative relationships using double number lines gives more on double number lines. • An example of a map scale can be found in the Key Stage 2 SATs papers: 2017 Paper 2 (reasoning) question 21. Past papers can readily be found online.	



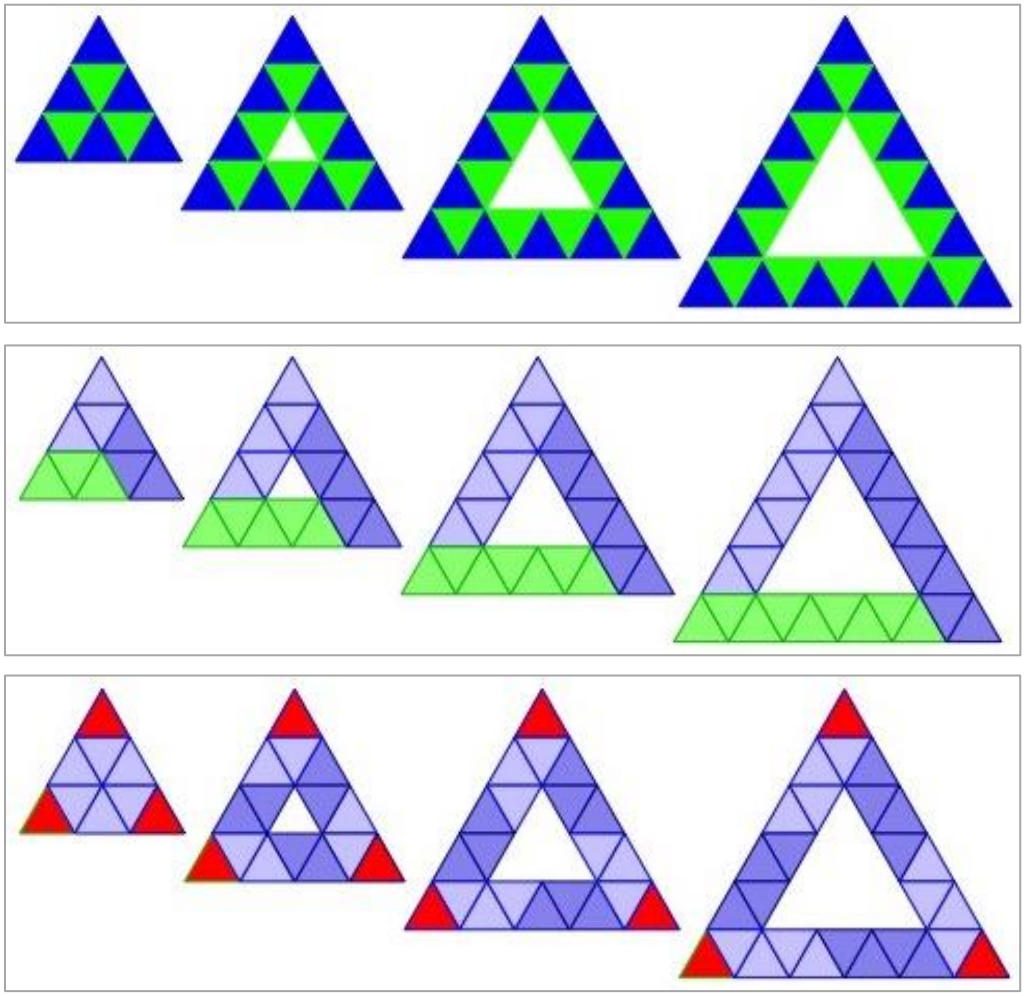
(This link is provided at the start of the summary.)

A long conversation was generated by this next response to Charlotte's second main question:



Mary Pardoe @PardoeMary · May 23

Yes ... me too! Eg when what they say shows that they're getting there in different ways ... they can learn so much from seeing/discussing each other's ways!
#mathscpdchat Eg ...

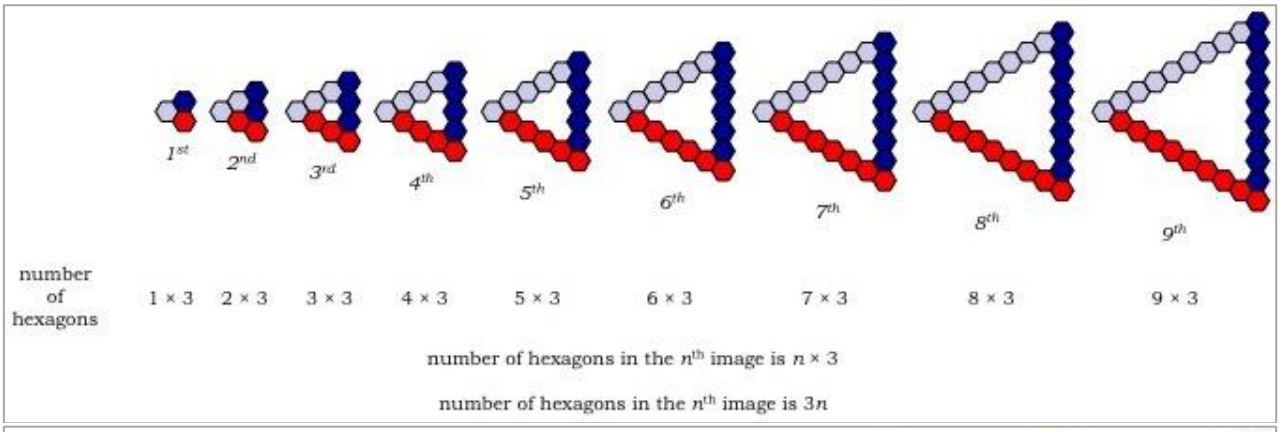


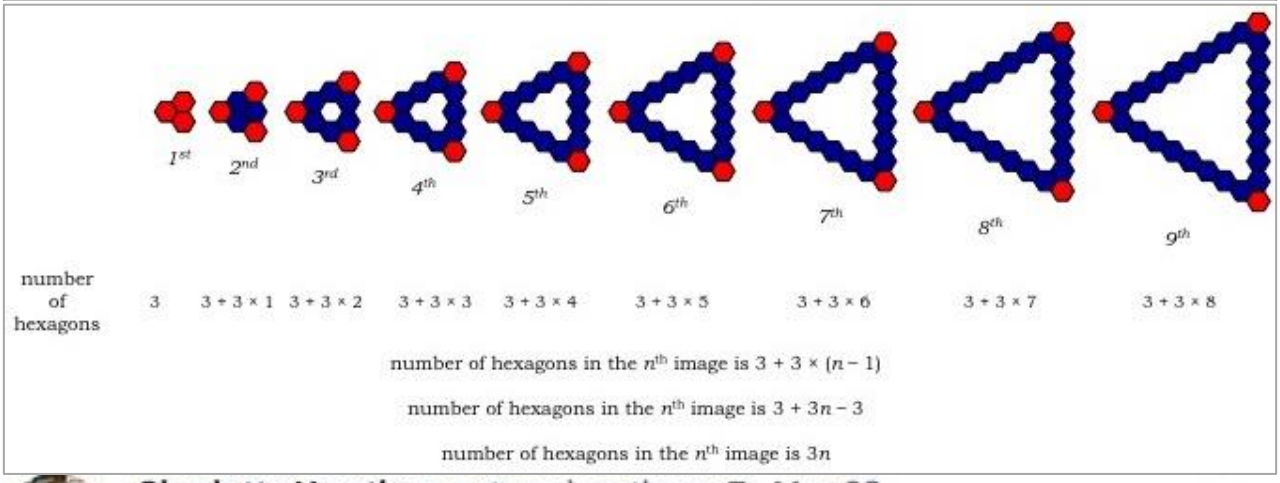
Yorkshire Steve @Yorkshire_Steve · May 23

And then seeing *why* different formulations are equivalent is always nice.

Mary Pardoe @PardoeMary · May 23

Yes! I love it when they can use algebra to show equivalences ... e.g. as in the second pic below ... #mathscpdchat





Charlotte Hawthorne @mrshawthorne7 · May 23

There was an @nrichmaths task that I remember which has students describing the different ways they grow/build a pattern using sticks. It's lovely to show how these are equivalent expressions eventually

Mr Mattock FCCT NPQSL @MrMattock · May 23

That would be the brilliant "Seven Squares" #mathscpdchat

nrich.maths.org

Seven Squares

Watch these videos to see how Phoebe, Alice and Luke chose to draw 7 squares. How would they draw 100?

Yorkshire Steve @Yorkshire_Steve · May 23

I recall an old gcse coursework task - I really am that old! - making 'loops' out of regular polygons and finding formula for the number of internal and external walls given the frequency of each polygon used to make the loop.

Lots of different ways of 'seeing' the problem.

Peter Gates @petergates3 · May 23

Have you tried drawing n-sided polygons using the formula for internal angle:
180°-360°/n
Where n is not an integer (but is rational)

Mr Mattock FCCT NPQSL @MrMattock · May 23

Was that the Ponds one? I too am (just) old enough to remember coursework at GCSE and A-Level

Yorkshire Steve @Yorkshire_Steve · May 23

No. But I remember that one too! It might have been an 'in-house' one. Back in the days you could write your own task or go with board set one!

(Info for the benefit of those whipper-snappers on here!)

Yorkshire Steve @Yorkshire_Steve · May 23

We did A level F Maths and one who unit (of the 6 making up further maths) could be coursework. All dud diffetent things. Had to go beyond the syllabus of units they were studying as part of maths or further maths.

Yorkshire Steve @Yorkshire_Steve · May 23

We gave each pupil a 'supervisor' (teacher) they met fortnightly for an hour. They discussed progress and next steps. Some pupils needed more support/guidance than others. This cost them marks but allowed them to make progress. About 4-5 months on it in total.

Yorkshire Steve @Yorkshire_Steve · May 23

Replying to @Yorkshire_Steve @MrMattock and 2 others

It was most excellent. Of course a very different accountability framework. I think 20% of the unit grade was on how independent a pupil was in their work. No way anyone could 'check up' that you'd given the right mark for that bit.

Yorkshire Steve @Yorkshire_Steve · May 23

We had predator-prey cycles, 3d calculus, modelling spread of infectious diseases (bird flu was topical), "is just after you have scored really the most dangerous time to concede in football?", modelling a free throw in basketball... all sorts.

Yorkshire Steve @Yorkshire_Steve · May 23

So good was it that even some single mathmos did it just for fun (and their UCAS forms no doubt). Aggregation rules at time meant it was an FM only unit.

Charlotte Hawthorne @mrshawthorne7 · May 23

That sounds lovely! So many of the old coursework tasks make for a lovely series of lessons #mathscpdchat

MrHawesMaths @HawesMaths · May 23

I would love to get my hands on the big A3 versions of Mayfield data for GCSE stats coursework. #mathscpdchat also loved the t totals investigation.

Yorkshire Steve @Yorkshire_Steve · May 23

We built a reaction time tester where the screen changed colour and it timed your reaction. Got whole year group to do it. Left hand, right hand, different colours, with background music ... all sorts of stuff. Pupils then put into master spreadsheet .. with inevitable errors!

Charlotte Hawthorne @mrshawthorne7 · May 23

Oh my goodness! I remember the Mayfield data! #mathsCPDchat

Karen @karenshancock · May 23

I still use it in my GCSE Stats lessons. I have a cleaning data lesson based on it.:-) #mathscpdchat

Karen @karenshancock · May 23

You know the spreadsheet is still out there... It's linked in the Pearson GCSE Statistics textbook.
#mathscpdchat

StubbsMaths @StubbsMaths · May 23

What's coursework 😜

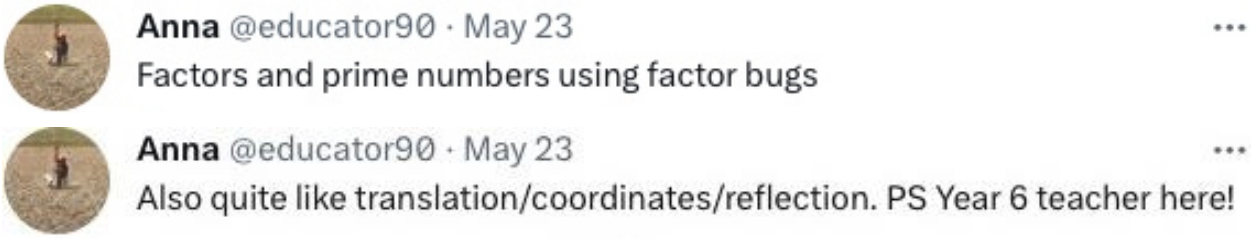
StubbsMaths @StubbsMaths · May 23

In all seriousness as a pupil I did painted cubes and remember really enjoying it, teaching t-totals not so much or the stats one

Charlotte's second main question …

> …what's your favourite (or top three if you can't pick one) bit of maths from Early years through to KS3?

… also prompted this short thread …



… another long branching discussion:

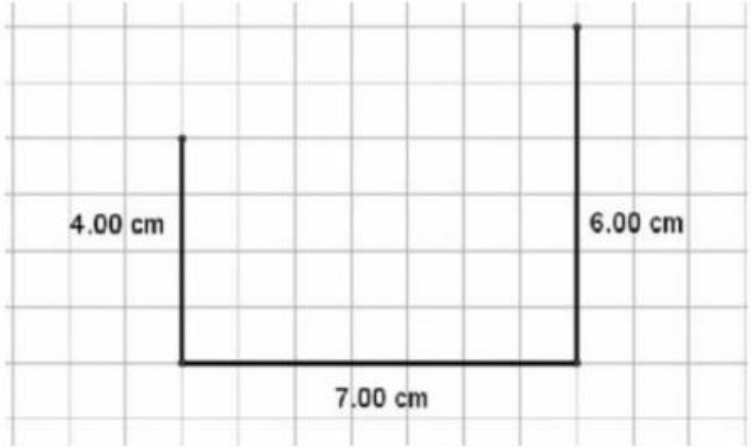
Jay Timotheus @jaytimotheus · May 23

All depends on where you start...
#mathscpdchat

Jay Timotheus @jaytimotheus · May 23

... From a piece I wrote back in 2009 in MT213

There are a number of computer software applications in which geometric figures can be constructed and manipulated. In this example I use *Geometers' Sketchpad*. However, when working with students on constructing triangles I often begin by giving my students three side lengths (for example 7cm, 6cm and 4cm) and then ask them to draw the triangle described in their exercise books. The next ten minutes or so are spent with the students busily drawing triangles with their pencils and rulers, and finding, in most cases, that it is quite difficult to achieve three sides all with the required lengths. There is soon a sense in the room that 'this is actually harder than we thought.' It is at this point that a sense of 'need' has been created to find a better way.



This figure is then constructed by drawing three line segments that 'snap' to the grid..

The teacher can then use the 4cm and 6cm lines as radii and construct two circles as shown. Two further radii are then drawn which are rotated by dragging until a triangle is formed.

There is something about the construction of this image that is powerful in a way that cannot be conveyed on the printed page. As the two radii are dragged towards the intersection of the circles, the triangle is suddenly apparent and I have found that this always provokes an excited response from many students in the room. Suddenly they see that these (round) circles have in fact allowed us to rotate the lengths and to make the very same triangle (with straight sides!) that seemed so difficult to construct earlier with a (straight) ruler and a pencil. I find it helpful to try and channel the generated excitement at this point by asking further questions.

- Is this the triangle we wanted?
- How do we know?
- Is there another triangle that will also have the same side lengths?
- Why did we draw circles?
- . . . ?

The mathematics-with-ICT lesson presented here differs in approach from the more traditional algorithmic approach to teaching this construction. The ICT part of the lesson starts 'in the wrong place'. Rather than beginning with one length and trying to construct the other two (segment – arc – arc – segment – segment), it begins with three lengths and tries to manipulate these three lengths into the right place (segment – segment – segment – circle – circle – rotate segments into place). There is often a difference between the order in which things fit into place in mathematics and the order in which they can be best understood. Long before computers were being used in schools, Pólya wrote, *Mathematics has two faces; it is the rigorous science of Euclid but it is also something else. Mathematics presented in the Euclidean way appears a systematic, deductive science; but Mathematics in the making appears an experimental, inductive science.* (Pólya, 1945, p. xxxiii)

Yorkshire Steve @Yorkshire_Steve · May 23

Pre-visualisers or interactive whiteboards it was a VERY different topic to teach!

Jay Timotheus @jaytimotheus · May 23

It was... Although I do think that the potential of dynamic geometry software is still to be realised in the UK.

Jay Timotheus @jaytimotheus · May 23

Is it controversial to say I like teaching... constructions? #mathscpdchat

(The tweet above is repeated to indicate another thread that it started.)

Mr Mattock FCCT NPQSL @MrMattock · May 23

Not with me, wonderful links between shape properties and construction, and then equally so between inequalities in two variables and loci #mathscpdchat

Mr Mattock FCCT NPQSL @MrMattock · May 23

As well as just general graph plotting of course, always love kids seeing that the parabola is the locus of points equidistant from a point and a line, and so being able to form isosceles triangles. #mathscpdchat

Chris Shore @cjshore · May 23

And links with Pythagoras and trig, solving triangles and more. Love it too.

Mary Pardoe @PardoeMary · May 23

No, hopefully not controversial ... I agree with @MrMattock ... e.g. a student who knows the properties of a rhombus or kite can invent some of the simple constructions themselves. #mathscpdchat

Lizi Pepper @mathspeptalk · May 23

I love the history behind them since studying it at university! #mathsCPDchat

Becky Donaldson @donaldson_maths · May 24

Then you'll enjoy the new #ncetmcheckpoints out later this week! (But also - I share the constructions love! Such an under appreciated topic)

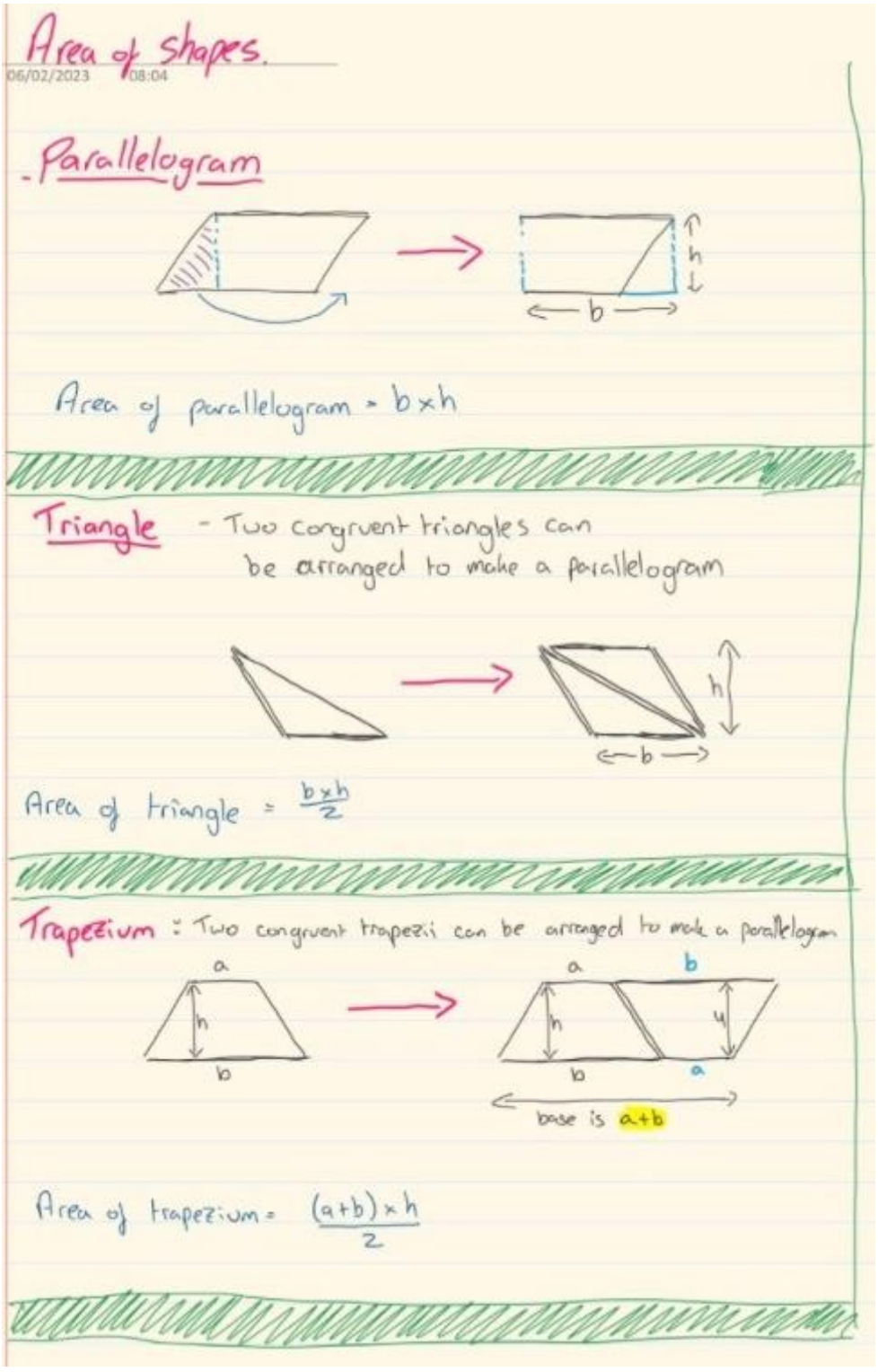
The second main question …

> …what's your favourite (or top three if you can't pick one) bit of maths from Early years through to KS3?

… also prompted an illustrated conversation about enjoying teaching students how to find areas of some simple shapes …

MrHawesMaths @HawesMaths · May 23

I love teaching area and using versions of the parallelogram to find areas of triangles rectangles and trapezium #mathscpdchat loads of discussions from this.



Lizi Pepper @mathspeptalk · May 23

Replying to @HawesMaths and @mrshawthorne7

I love the ease of seeing them all as a parallelogram, but I see them as rectangles as they can all be based on rectangles too! I give them the shapes on cm squared paper, scissors and see if they can make a rectangle out of a triangle, parallelogram, trapezium #mathsCPDchat

MrHawesMaths @HawesMaths · May 23

I used it this way because of base x height. Really brought home the perpendicular height so there were no issues when all lengths were provided (even the dastardly diagonals)

Marc @marcmaths · May 23

Is that on one note?

MrHawesMaths @HawesMaths · May 23

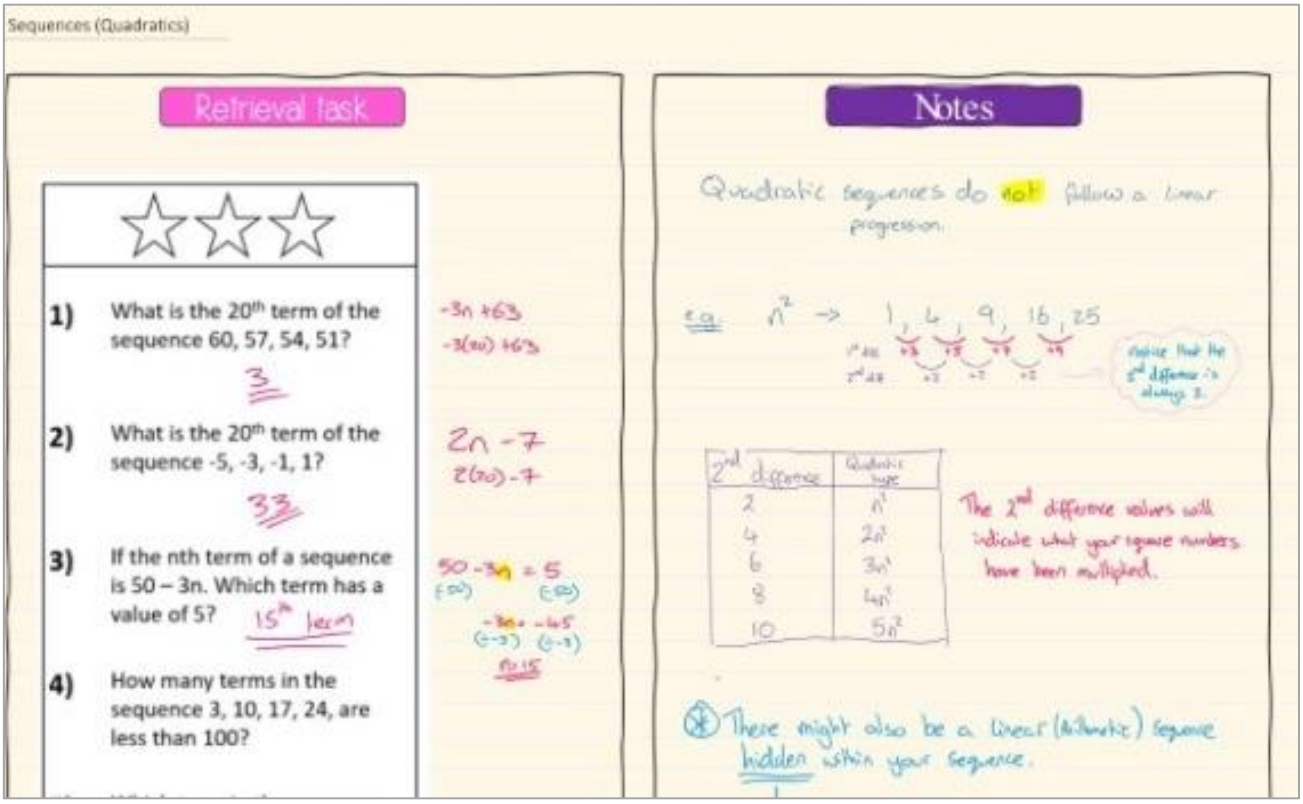
It is indeed. I love it! Got to be the best way to teach maths.

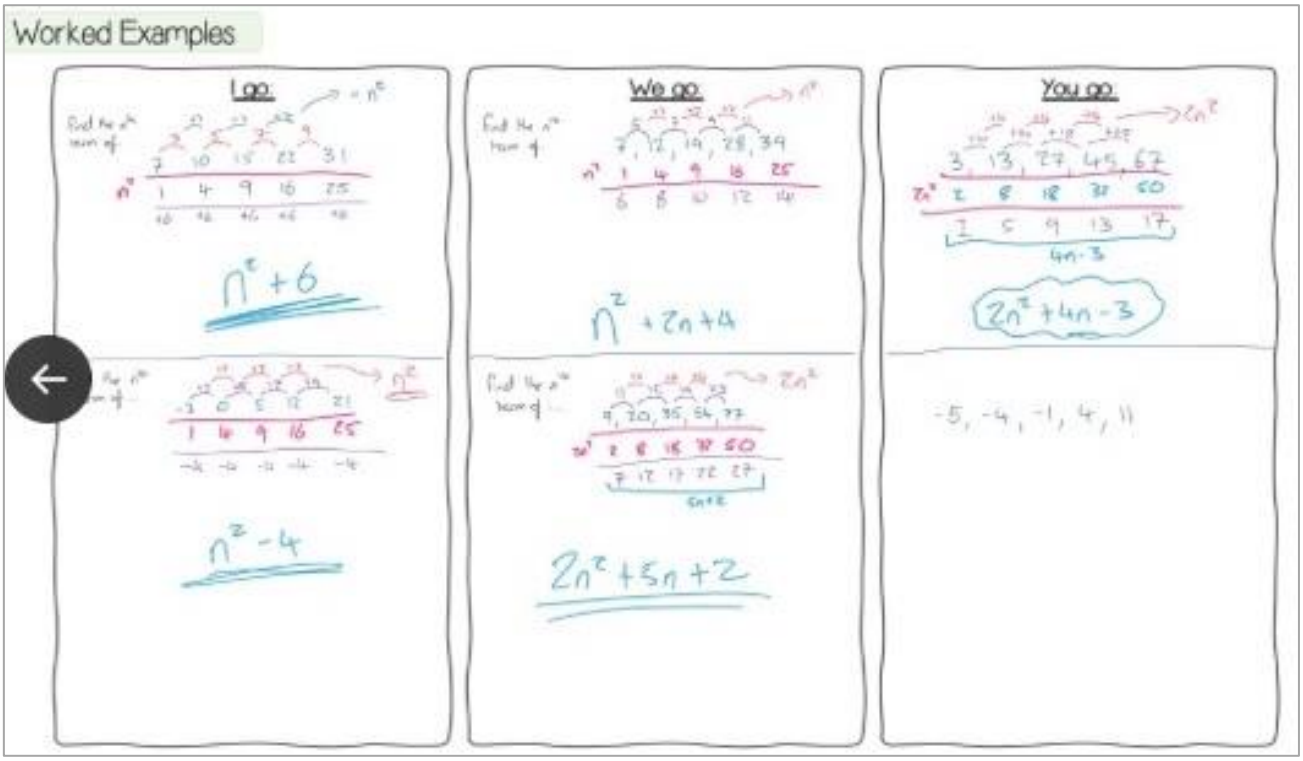
Marc @marcmaths · May 23

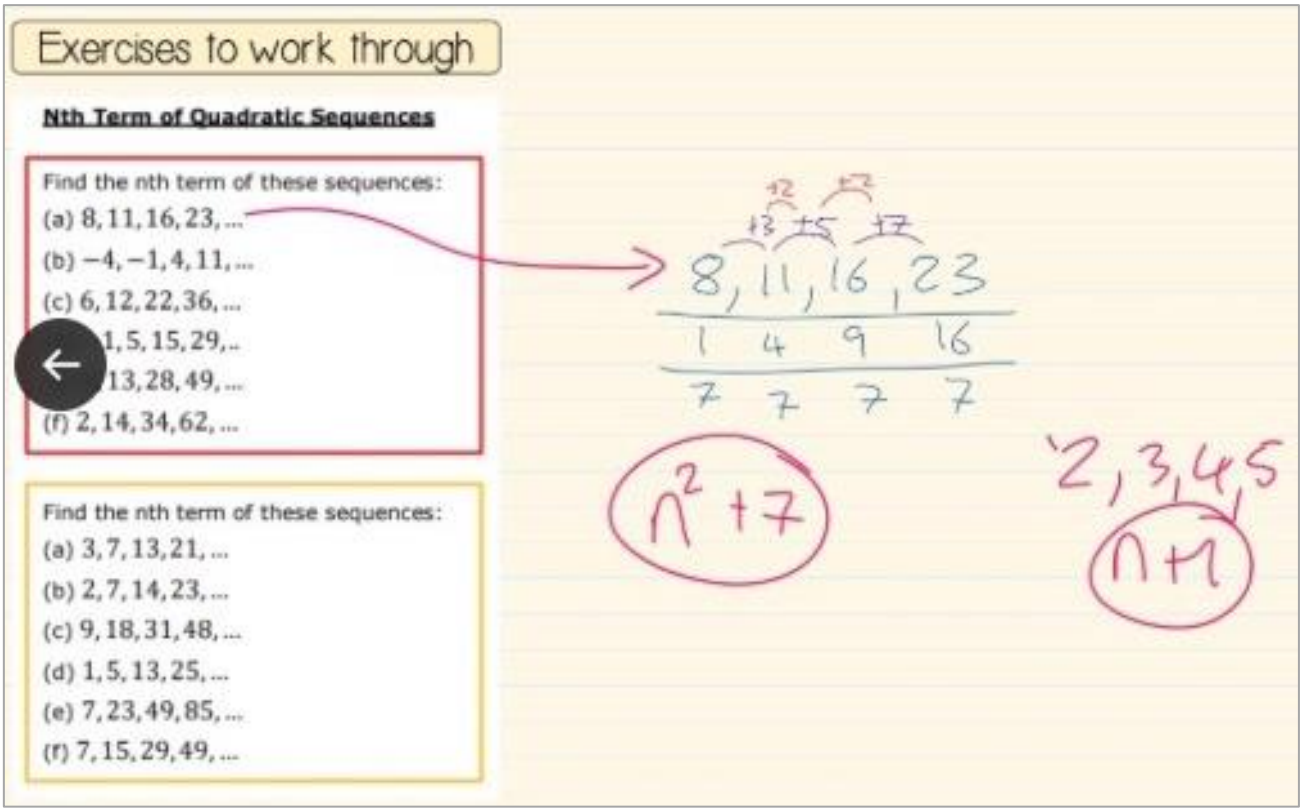
Do you use a graphics tablet?

MrHawesMaths @HawesMaths · May 23

I move around my classroom with an iPad when teaching and annotate, model and even give to students to add their workings. Plus it is a digital copy that every student has to be able to refer to.







… the next two linked comments …

Miss Konstantine @giftedHKO · May 23

Prime Factorisation

#mathsCPDchat

Isaac Howarth @Isaac_Howarth · May 23

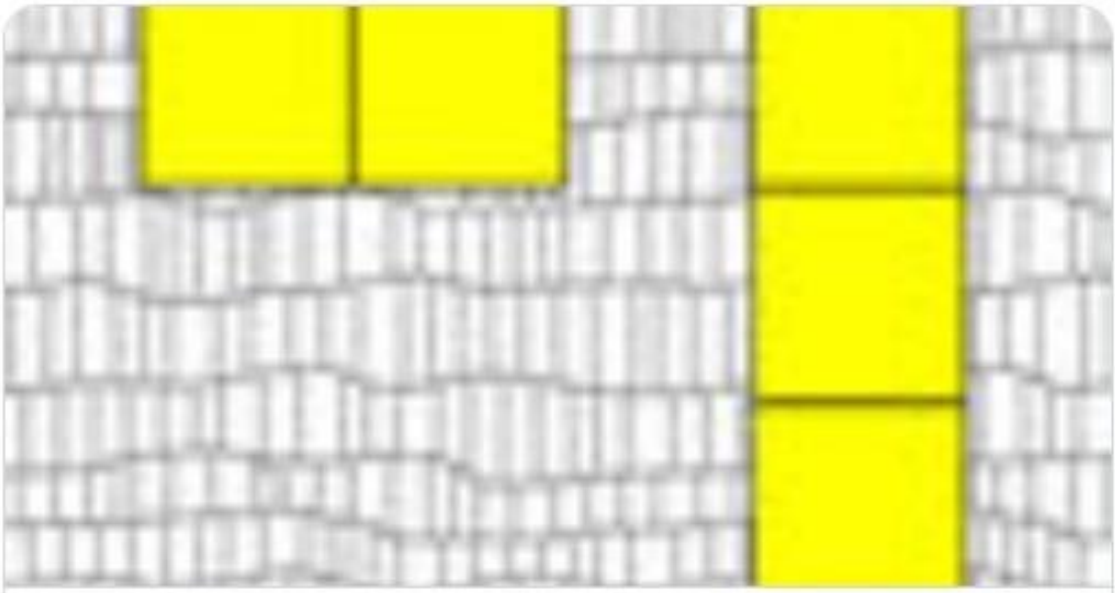
Oh yes! Leading into the Fundamental Theorem of Arithmetic to explain why 1 is not a prime. Great way to open 👀 to how mathematical ideas have evolved through history.

(As Helen tweeted twice during the chat that Prime Factorisation is the topic that she most enjoys teaching, we can probably assume that she feels this very strongly!)

… and the following 'single' replies:

Isaac Howarth @Isaac_Howarth · May 23

Teaching properties of numbers (odd/even, square, prime….).
@nrichmaths Numbers as Shapes can be used at many different ages for this.
nrich.maths.org/5158
Seriously, this problem is like a piece of fine art. 🎨
bit.ly/Rich-tasks-fin…



nrich.maths.org
Numbers as Shapes
Use cubes to continue making the numbers from 7 to 20. Are they sticks, rectangles or squares?

Nathan Day @nathanday314 · May 23

I find the idea of adding fractions by finding a common denominator really really satisfying.

In fact, even equivalent fractions on their own have delighted me ever since I was in primary school.

Everything I love about proportionality all within a single number.

#mathsCPDchat

Emma Turner FCCT @Emma_Turner75 · May 23

Introduction to decimals

Maths Locke @mathsmuse · May 23

Solving linear equations #mathsCPDchat

Although Charlotte's third main question …

Charlotte Hawthorne @mrshawthorne7 · May 23

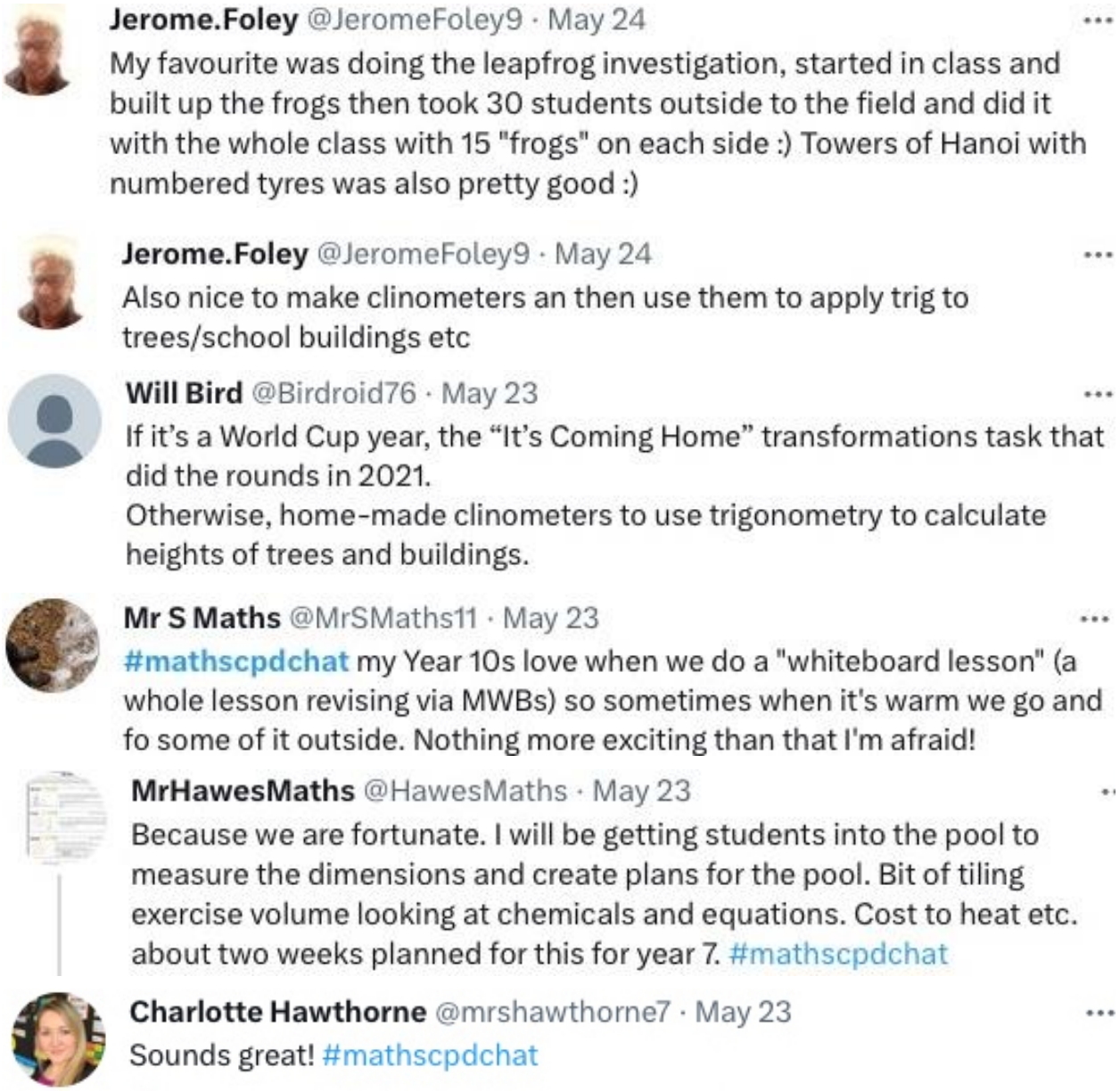
Really LOVING all the discussion on tonight's **#mathsCPDchat**

Another question for you all...

Do you have a favourite task/activity that you like to do in the summer term? ☀️

I'm thinking Loci outside using actual trees/fences

… received these replies …

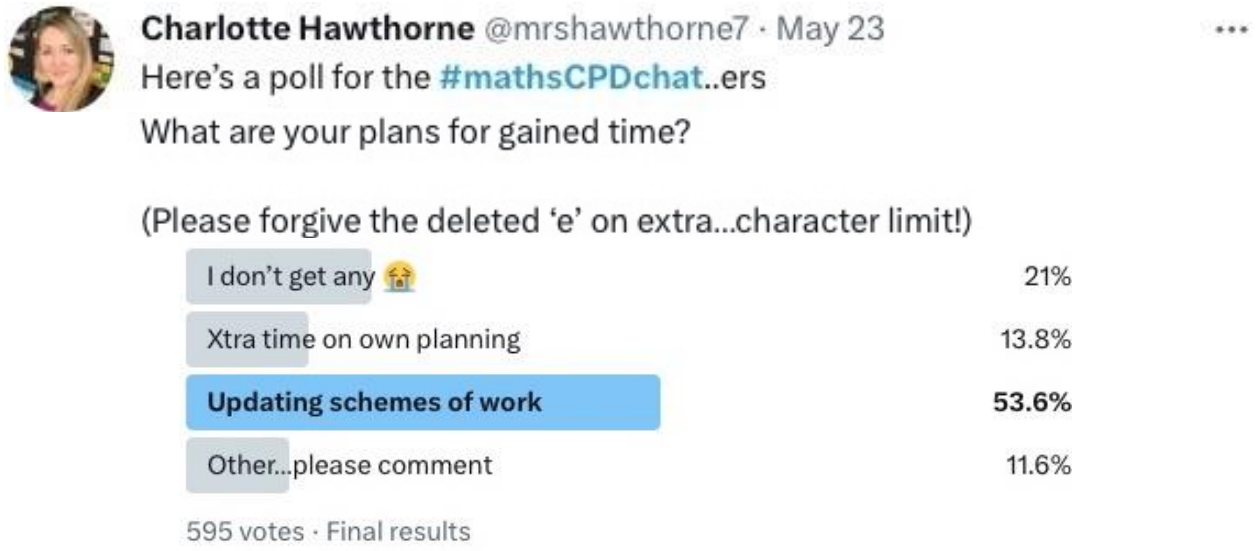


… Charlotte prompted people again towards the end of the chat …

… which generated this reply about a technically-inventive teaching enterprise:

During the mathsCPDchat the following thread (about how a teacher enjoyed working with the same problem with the same students as they matured mathematically) appeared independently of any of the host's three main questions:

In addition to her three main questions (about maths topics and ideas that people particularly enjoy teaching), Charlotte tweeted the following poll and related question …



… which generated three conversations and nine single replies. This discussion focused on collaborative planning, mentioning a 'structure' that some teachers use to support that work:

[There was no reply to Ruby's question. Below is an explanation created for teachers in one school.]

1.Start by identifying all of the key objectives in the unit for your year group (medium term planning). Sequence them, until you have an 'S' progression you are happy with (***BLACK PEN***)

2.Now, unpick the objectives to decide what the 'key ideas' needed to meet it would be (right from the beginning!) Write these on post-its first, if it helps, or sequence these straight on to the plan (***BLUE PEN***)

3.Consider 'difficult points' that you might encounter (e.g. barriers children might have to understanding, or misconceptions that crop up often or easily). Alongside these, consider teaching points / methods that might help overcome these or support pupils having difficulty (Practical? Representations? Stem sentences? Connections with other learning?) (***RED PEN)***

4.At the end, we will take a few minutes to move around and look at the other year group plans.

Charlotte Hawthorne @mrshawthorne7 · May 23

#mathsCPDchat who else is planning to do some 'S' planning over the last half term?

There were no more tweets about S planning, but lesson planning (by oneself?) was mentioned …

Mrs Hudson @MrsHuds43995523 · May 24

Planning my own CDP and plan some more Maths primary outreach (events and sessions). But I assume I will also do some more lesson planning for the year ahead. Ucas references are also on the cards

… and the activity described in this next reply includes modifying a Scheme of Work:

Karen @karenshancock · May 23

Investigating online platforms (dfm vs Sparx), recording some online CPD for the school and helping pull together an improved GCSE Stats SoW for one-to-one devices.
Given we only have 2.5 weeks of gained time left that's going to be a big ask!!! #mathsCPDchat

Anthony Shaw @ShawMaths · May 23

We've just switched to Sparx. It's a game changer! Pricey but if your school can make the money available, well worth it.

Planning one's own CPD, or that of others was a common intention …

Richard Morley @MrMorleyMaths · May 23

Department subject specific cpd (ratio tables, manipulatives, circle theorems)

Lindsay Francome @lfrancome · 15h

Updating assessments, more coaching of staff, grid algebra research project

… and teachers mentioned working on test/exam preparation and assessments:

JH @JH_Maths · May 23

Prepping end of year exams for year 10

Probably used for cover

Mr White @onechriswhite · May 24

Updating assessments.

There were other fears that teachers' time gained (because some students will have left school after taking public exams) would be used for 'covering' absent teachers' lessons …

Sally Withington @pigsdofly · May 24

Covering maths lessons

theperfectlanguage @theperfectlang1 · May 23
Resources and trying to get some trips out the door for @OutdooredTA and @CcfTorquay assuming it doesn't get taken off me.

… and some teachers would wait to see what they were directed to do …

Anne White @ALWhite09 · May 23
HOD directed

Miss Konstantine @giftedHKO · May 23
Whatever my HOD directs me to do #mathsCPDchat

Charlotte Hawthorne @mrshawthorne7 · May 23
Will you get to choose some of this though? #mathscpdchat

Miss Konstantine @giftedHKO · May 23
shrugs #mathsCPDchat

… and one teacher would no longer be using the time on maths matters:

Mr Mattock FCCT NPQSL @MrMattock · May 23
Now I am not day to day in maths I have to use my time in other areas 😪
#mathscpdchat

This was the host's closing message:

Charlotte Hawthorne @mrshawthorne7 · May 23
Wow!

Thank you all SO much for your amazing contributions & making the chat so enjoyable!

I've picked up loads of ideas myself and it's great we are so varied in our favourites too!

What a wonderful subject we teach! 🌟
#mathsCPDchat