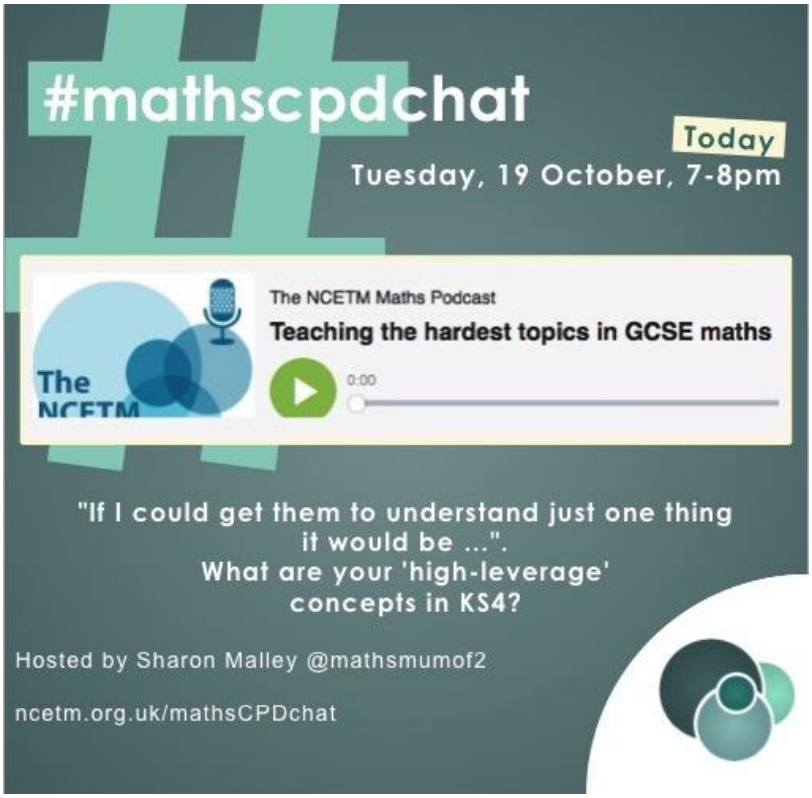
#mathscpdchat 19 October 2021

"If I could get them to understand just one thing it would be …". What are your 'high leverage' concepts in KS4?
Hosted by Sharon Malley

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



The links shared during this discussion were:

Transformational spiders which is one of Don Steward's resources. The tasks can help students 'appreciate that multiplying and dividing have a different effect on an expression than adding or subtracting'. It was shared by Sharon Malley

English to algebra, equations which is another Don Steward resource. Most of the tasks require students to solve 'think-of-a-number' problems by expressing them as equations. But the first task is taken from Robert Recorde's 'Whetstone of Witte' (1556). It was shared by Sam Blatherwick

Boxes resources which is also a Don Steward resource. In each task students are given three numbers ‘A’, ‘B’ and ‘C’, each placed in a cell of a 2-by-2 ‘box’ of cells. Students have to find the fourth number ‘D’, when ‘A’ and ‘B’ are related multiplicatively in the same way as ‘C’ and ‘D’, and ‘A’ and ‘C’ are related multiplicatively in the same way as ‘B’ and ‘D’. It was shared by Sam Blatherwick

Teaching Mathematics at Secondary Level which is a book by Tony Gardiner. It focuses on central principles and concepts of school mathematics, and so provides food for thought for all mathematics teachers. This is the link to a free downloadable PDF version of the book (which can also be purchased as a physical book). It was shared by Mary Pardoe

Algebradabra - Developing a better feel for school algebra which is a printed book and downloadable slides from the ATM by Dietmar Küchemann. It is a collection of twenty sets of five related tasks designed to help students develop a better feel for school algebra, and is based on an acclaimed blog by the author. It was shared by Mary Pardoe

Algeburble - Encounters with early algebra which is also a printed book and downloadable slides from the ATM by Dietmar Küchemann. It is a collection of twenty sets of five related tasks designed to help pupils engage with early or pre-algebra, and is a prequel to *Algebradabra*. It was shared by Mary Pardoe

The screenshots below, of chains of tweets posted during the chat, show six conversations about the finding that many KS4 students are unable to form equations to represent relationships presented non-algebraically. This applies both to those who are working towards Foundation level and Higher level GCSE. **Click on any of these screenshots-of-a-tweet to go to that actual tweet on Twitter, or in some cases the link that the tweet provided.**
The first three conversations were generated by this tweet from Sharon Malley:

Sharon Malley @mathsmumof2 · 19h

Ready for **#mathsCPDchat** I had a look at the @AQAMaths June 2019 examiners report and found a theme in questions that students generally did badly on. This is Q17 from Foundation P1. Any thoughts on why part b was done so poorly?

17 In a bag there are 10p coins, 20p coins and 50p coins.

There are two **fewer** 20p coins than 10p coins.

There are five **more** 50p coins than 10p coins.

17 (a) Complete the table.

[1 mark]

Coin	Number of coins
10p	n
20p	$n - 2$
50p	

17 (b) Altogether, there are 60 coins.

Work out the total **value** of the 20p coins.

[4 marks]

Question 17:

Almost 70% of students completed the table in part (a) with a correct expression. However, few students could successfully use the expressions from the table to form and solve an equation, with only around 30% of students getting any credit in part (b). Most of those who attempted an algebraic approach in part (b) went on to achieve all four available marks.

and included these from Mary Pardoe, Sharon Malley, Catherine Edwards, Ruby Judge and Atul Rana:

Mary Pardoe @PardoeMary · 19h

Replying to @mathsmumof2 and @AQAMaths

Do students have enough practice at representing ordinary-language statements algebraically … and vice-versa?

#mathsCPDchat

Sharon Malley @mathsmumof2 · 19h

Mary you are reading my mind - 😉#mathscpdchat

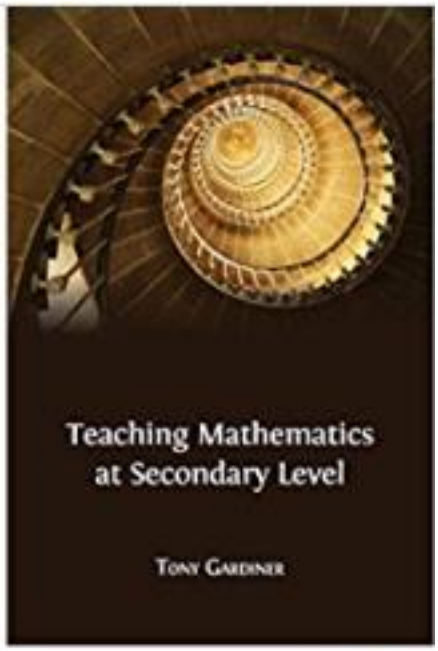
Catherine Edwards @Edwards08C · 19h

@StudyMaths maths bot has a good starter activity turning statements into expressions

Mary Pardoe @PardoeMary · Oct 19

Replying to @mathsmumof2 and @AQAMaths

Tony Gardiner wrote a lot of useful/helpful advice about this in here ...
amazon.co.uk/Teaching-Mathe..
(Used to be able to downline a free copy ... I'll try to find link later)
#mathsCPDchat



Ruby Judge @RubyJudge · Oct 19

This is a great book he really tackles the problems and it resonated so well with me.

Atul Rana @atulrana · 19h

Replying to @PardoeMary @mathsmumof2 and @AQAMaths

I've been trialing out numberless word problems with tutees after the fab workshop on this topic by @VikkiPriddle There's also the idea of forming expressions using cuieanaire rods, algebra tiles, pattern blocks etc. too
#MathsCPDchat

these from Sam Blatherwick, Sharon Malley, Catherine Edwards and MrHawesMaths:

Sam Blatherwick @blatherwick_sam · 19h

Replying to @mathsmumof2 and @AQAMaths

I think many responses will be blank, it's an unfamiliar question and students are used to setting up and solving equations only in familiar contexts. A lesson for me would be to include setting up equations as a skill through the course.

#mathscpdchat

Sharon Malley @mathsmumof2 · 19h

Replying to @blatherwick_sam and @AQAMaths

What I got from this was that we need to be setting up and solving equations from as early in their mathematical journey as possible and throughout the curriculum so they see it in lots of different contexts. #mathsCPDchat

Catherine Edwards @Edwards08C · 19h

And explaining why it's useful and easier than T&I. I think it does flow naturally from using bar model representations though. #mathscpdchat

MrHawesMaths @HawesMaths · 19h

Replying to @mathsmumof2 @blatherwick_sam and @AQAMaths

I tend to do this when I cover area and perimeter of rectangles and triangles. Putting unknowns in to find the missing lengths. #mathscpdchat

Catherine Edwards @Edwards08C · 19h

The Pearson Edexcel course really emphasises setting up and solving equations in unfamiliar situations especially ones that students would attempt to brute force #mathscpdchat

Sam Blatherwick @blatherwick_sam · 19h

Replying to @blatherwick_sam @mathsmumof2 and @AQAMaths

In addition,I reckon a lot of answers will have been £16 (10p x20, 20p x20, 50p x20), we don't show things split unevenly enough and so students see division where there isn't division #mathscpdchat

these from Waqar, Catherine Edwards, Sharon Malley, Mary Pardoe and Ruby Judge:

Waqar @W_A_QAR · 19h

Replying to @mathsmumof2 and @AQAMaths

Foundation paper, are many lower ability foundation classes even taught how to form algebraic equations? #mathscpdchat

Catherine Edwards @Edwards08C · 19h

I spend a long time on it with my grade2/3 classes, it's something they can do really successfully if they are guided and practice. It's also , if we are looking to the future for them, a good transferable skill. Thinking algebraically even if they don't write it #mathscpdchat

Sharon Malley @mathsmumof2 · 19h

Replying to @Edwards08C @W_A_QAR and @AQAMaths

One of the biggest transferable skills especially if they will ever have to do any work with excel #mathsCPDchat

Waqar @W_A_QAR · 19h

If the class struggles with rearranging or solving would you then teach them how to form algebraic equations, I mean wouldn't that confuse them further?

Catherine Edwards @Edwards08C · 19h

I would say that forming equations is really complementary to solving equations. It transforms letter and number soup into something with concrete meaning. It stops a lot of the random procedural practices you see. I am talking about grade 2/3 here not entry level #mathscpdchat

Sharon Malley @mathsmumof2 · Oct 19

Replying to @W_A_QAR @Edwards08C and @AQAMaths

They first encounter forming simple equations in y6. I would hope it helped them understand the 'what' of what they are rearranging and solving but as it is the transformation of one mathematical idea into another form it is an area a lot of students struggle with **#mathsCPDchat**

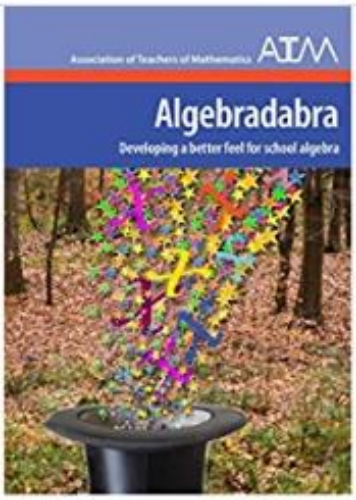
Mary Pardoe @PardoeMary · Oct 19

Replying to @mathsmumof2 @W_A_QAR and 2 others

Are teachers using the best resources?

Such as ... amazon.co.uk/Algebradabra-D...

#mathsCPDchat

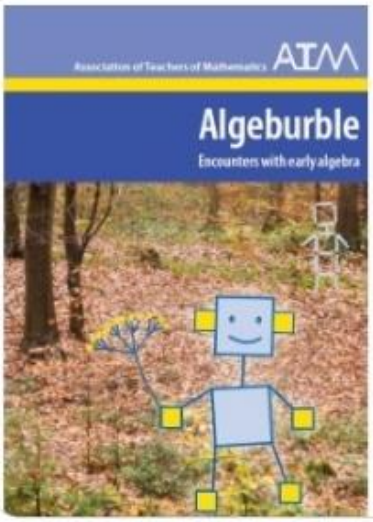


Algebradabra - Developing a better feel for school algebra, book & PDF slides

Algebradabra - Developing a better feel for school algebra, printed book & downloadable slides, by Dietmar Küchemann

Mary Pardoe @PardoeMary · Oct 19

... and recently ... Algeburble ...
atm.org.uk/shop/New-Produ..
#mathsCPDchat



Algeburble - Encounters with early algebra Book and PDF Slides

Algeburble - Encounters with early algebra Book and PDF Slides, by Dietmar Küchemann. A collection of twenty sets of five related tasks, to help pupils engage with early or pre-algebra.

Waqar @W_A_QAR · Oct 19

Replying to @mathsmumof2 @Edwards08C and @AQAMaths

I could be wrong but when they encounter forming equations in year 6, aren't those equations based on images. I've noticed when we use images kids tend to form the equations easier but the second it is in writing they can't comprehend what's being asked of them

Ruby Judge @RubyJudge · Oct 19

Children should be taught using all these methods pictorial, concrete, abstract but then they should be able to solve equations without any images or manipulatives if they have solid understanding.

Sharon Malley @mathsmumof2 · Oct 19

#mathsCPDchat how do scaffolds used in the classroom transfer to use in the exam?

Catherine Edwards @Edwards08C · Oct 19

Replying to @mathsmumof2

I encourage them to draw it out. It's really satisfying when you mark their papers and see little sketches of manipulatives (and they get it right!) . Often the sketch is only of the first stage but it helps them parse the question. #mathscpdchat

Ruby Judge @RubyJudge · Oct 19

Absolutely

Ruby Judge @RubyJudge · Oct 19

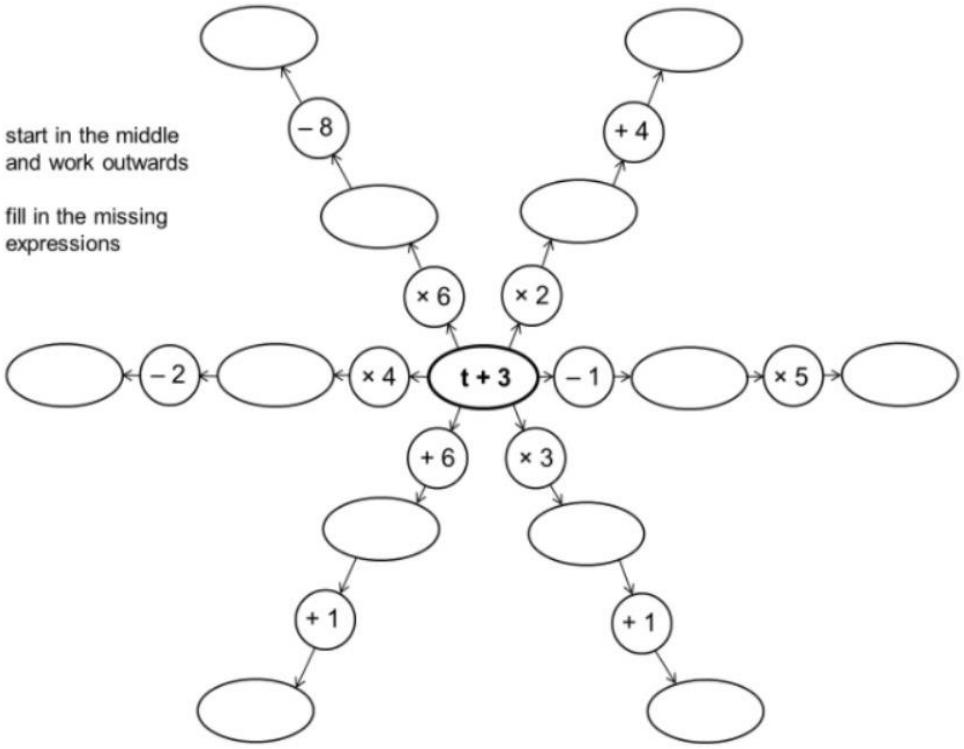
Replying to @mathsmumof2

1: Practice using worded problems and that's when they get more familiar after using and knowing all the building blocks in my opinion.

The next conversation was generated by this tweet from Sharon Malley:

Sharon Malley @mathsmumof2 · Oct 19

This is another lovely Done Steward task for thinking about how expressions are formed as it is not just the language which has caused issues but also use of brackets and order of operations #mathsCPDchat



and included these from K Bentley and RHMaths:

K Bentley @MrsB874 · Oct 20

Replying to @mathsmumof2

This is a good one! Could generate some interesting responses from students. Where did you download the sheet from?

Sharon Malley @mathsmumof2 · Oct 20

The link is here donsteward.blogspot.com/2015/01/transf... #mathscpdchat

RHMaths @MathsRh · Oct 19

Replying to @mathsmumof2

Thank you for reminding me of this one! So simple yet requires a good understanding of manipulating expressions.

The theme continued, prompted by this tweet from Sharon Malley:

Sharon Malley @mathsmumof2 · 19h

So many are not surprised at foundation students struggling with forming and solving equations but it was also an area where higher students are falling down @AQAMaths June 2019 H P1 Q17 #mathsCPDchat

17 Toby is forming and solving equations.

17 (a)

> The product of half of a number and three more than the number
> is the same as
> the square of the number

Toby uses y to represent the number.

Write an equation that Toby could form.

[2 marks]

Question 17:

Part (a) proved to be one of the most difficult questions on this paper. Most students were not able to convert the description in words into an equation, with many confusing 'product' with 'sum' and others omitting the required brackets around '$y + 3$'.

Students were more successful in part (b), although many thought that the error was in giving a negative solution. Those who understood where the error had occurred could usually explain it satisfactorily.

and included these from Catherine Edwards and Sam Blatherwick:

Catherine Edwards @Edwards08C · 19h

Replying to @mathsmumof2 and @AQAMaths

Oooh, that's a hard one! Lots of language to decode and a fair way into the exam so they are fatigued. Interesting that that is explicitly set up and equation , so not quite the same mistakes as the foundation #mathscpdchat

Sam Blatherwick @blatherwick_sam · 19h

Replying to @mathsmumof2 and @AQAMaths

Language, absolute classic blind spot.

There's a brilliant donsteward task on this.

Sharon Malley @mathsmumof2 · 19h

Please share a link Sam, I am yet to find a Don Steward task that can not be preceded with the word brilliant #mathsCPDchat

Sam Blatherwick @blatherwick_sam · 19h

Replying to @blatherwick_sam @mathsmumof2 and @AQAMaths

donsteward.blogspot.com/2014/01/englis...

#mathscpdchat

Sharon Malley @mathsmumof2 · 19h

Replying to @mathsmumof2

part b of Q17 for those that are interested, this looks more like something most people will do in lessons #mathsCPDchat

17 (b) Toby forms another equation.

$$x = \frac{9}{8x}$$

He wants to work out the values of x.

Here is his working.

$$x = \frac{9}{8x}$$

$$8x^2 = 9$$

$$8x = 3 \text{ or } 8x = -3$$

$$x = \frac{3}{8} \text{ or } x = -\frac{3}{8}$$

What error has he made in his working?

[1 mark]

Catherine Edwards @Edwards08C · Oct 19

Replying to @mathsmumof2

Can I change my 10 magic lessons answer to order of operations ! #mathscpdchat

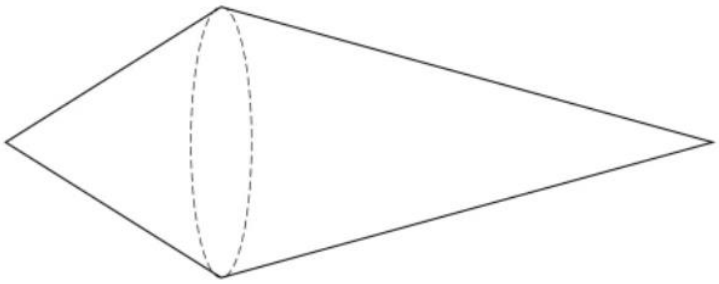
these from Sharon Malley and Catherine Edwards:

Sharon Malley @mathsmumof2 · Oct 19

So the theme I found in the @AQAMaths June 2019 papers continued Q21 H P2. This one really surprised me **#mathsCPDchat**

21 A solid shape is made by joining two cones.

Each cone has the same radius.



One cone has slant height = 2 × radius

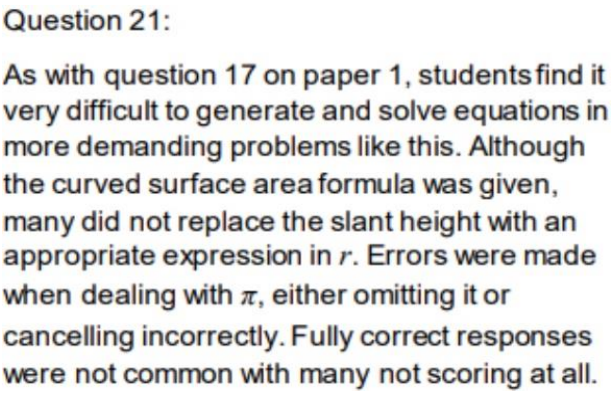
The other cone has slant height = 3 × radius

The total surface area of the shape is 57.8π cm^2

Curved surface area of a cone = πrl where r is the radius and l is the slant height

Work out the radius.

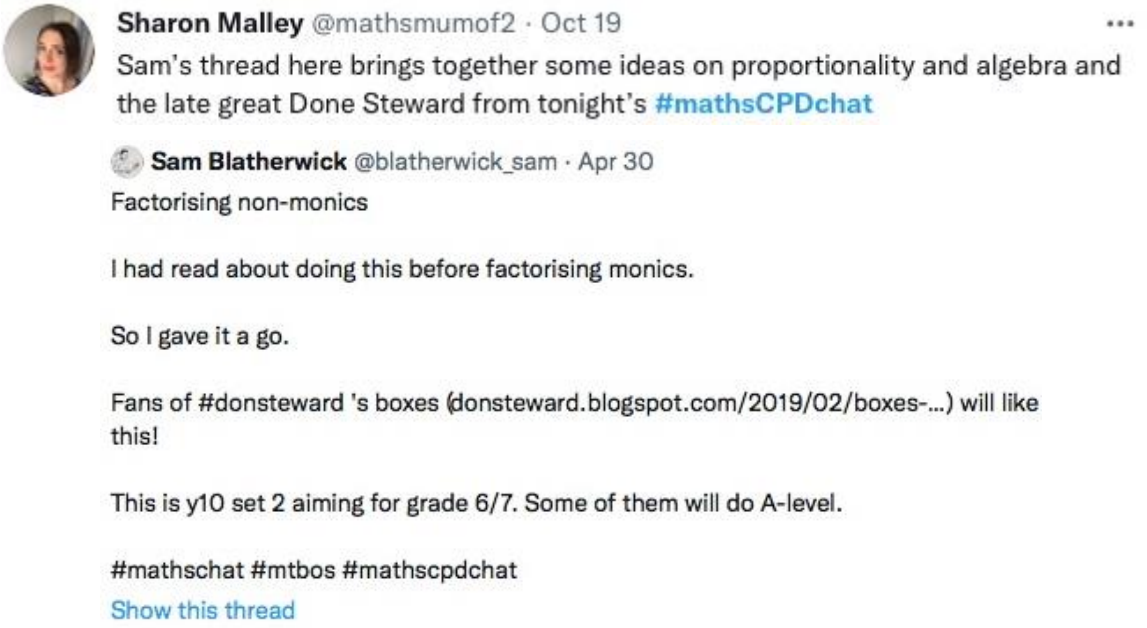
[3 marks]


Question 21:

As with question 17 on paper 1, students find it very difficult to generate and solve equations in more demanding problems like this. Although the curved surface area formula was given, many did not replace the slant height with an appropriate expression in r. Errors were made when dealing with π, either omitting it or cancelling incorrectly. Fully correct responses were not common with many not scoring at all.


Catherine Edwards @Edwards08C · Oct 19
Replying to @mathsmumof2 and @AQAMaths
I'd love to see if there was a correlation between students who annotated the diagram and students who replaced the slant height. #mathscpdchat

and finally, this from Sharon Malley (and Sam Blatherwick):


Sharon Malley @mathsmumof2 · Oct 19
Sam's thread here brings together some ideas on proportionality and algebra and the late great Done Steward from tonight's **#mathsCPDchat**

Sam Blatherwick @blatherwick_sam · Apr 30
Factorising non-monics

I had read about doing this before factorising monics.

So I gave it a go.

Fans of #donsteward 's boxes (donsteward.blogspot.com/2019/02/boxes-...) will like this!

This is y10 set 2 aiming for grade 6/7. Some of them will do A-level.

#mathschat #mtbos #mathscpdchat
Show this thread

[Sharon apologised for the auto-correct miss-spelling of Don Steward's name:]


Sharon Malley @mathsmumof2 · Oct 19
Apologies for the typo Don, donsteward.blogspot.com/2017/07/six-le...
#mathsCPDchat

]

(to read the discussion sequence generated by any tweet look at the 'replies' to that tweet)

Most of the discussion during the chat is shown in the sequences of screenshots of tweets reproduced above. But the host's first question was more general:

Sharon Malley @mathsmumof2 · 19h

Welcome to tonight's **#mathsCPDchat** lets start with a fantasy scenario where you will be given 10 extra lessons in the next half term with a year 11 class. What do you choose to focus on?

Replies to that tweet showed that the mathematics that KS4 teachers would choose to be the focus of 'extra lessons' would include (each line below is copied as written in a tweet):

place value and number sense

multiplicative relationships

graphs

trigonometry

percentages, ratio and proportion

straight line graphs

ratio and proportion

proportional reasoning

Of these responses, only those indicating proportional reasoning as a concern generated a substantial discussion:

miss franklin @missfc_maths · 19h

Replying to @mathsmumof2 and @AlisonHopperMEI

Percentages, ratio and proportion #mathscpdchat

Sharon Malley @mathsmumof2 · 19h

And they could all be done together, I find that most students can cope with the 'straightforward' proportionality problems but it is getting them to spot it is there in more complex problems #mathsCPDchat

Catherine Edwards @Edwards08C · 19h

And method selection, especially the wordy questions. I like to use tables to help with this though. #mathscpdchat

Sharon Malley @mathsmumof2 · 19h

I'm trying to find all the ways that tables can be brought in the ratio table is King (and/or Queen) don't you agree @Arithmaticks #mathsCPDchat

Kathryn MCCT @Arithmaticks · 18h

Cannot believe I missed this chat. We spent so much time on this with y10 last year and it's REVOLUTIONISED maths for them. Their ability to see proportionality and solve problems using the tables has MASSIVELY impacted their mock scores

CantabKitty BSc @CantabKitty · 18h

Agree. If my students left my class knowing only one thing I'd want it to be proportional reasoning.

Also a tweet indicating that students' understandings in connection with straight-line graphs concerned one teacher prompted two more tweets:

RHMaths @MathsRh · 19h
Replying to @mathsmumof2
Straight line graphs

Sharon Malley @mathsmumof2 · 19h
Interesting do you find this is an area really holding your groups back? #mathsCPDchat

RHMaths @MathsRh · 19h
Not currently but over the years it has always been something I find many students have met previously (pre-ks4) and have a block with it - like the proverbial elastic band has snapped. #mathscpdchat

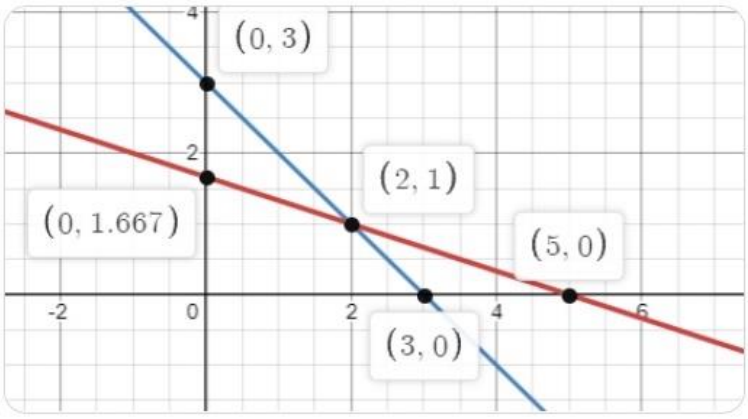
In addition to the conversations about forming algebraic expressions and equations that are shown in the main sequence of screenshots above, Sharon's first example (Q17) from the 2019 GCSE examiners' report prompted these two comments …

MrHawesMaths @HawesMaths · 19h
Replying to @mathsmumof2 and @AQAMaths
Because it was not explicit algebraic approach to collect like terms and then solve. Perhaps if it said 'using an algebraic approach or otherwise, show that ….' At least a hint will push them in the right direction. #mathscpdchat

Sharon Malley @mathsmumof2 · 19h
@danicquinn tweeted about a 'tea and coffee' simultaneous equation problem earlier that really showed how difficult it can be to transfer information into different abstract forms #mathscpdchat

… the second of which refers to this tweet (click on it to go to the thread):

Dani 🎃uinn @danicquinn · Oct 18
I am having trouble interpreting a simultaneous equations graph. If x = the price of a coffee, and y=tea, then what do the x and y intercepts mean? And the gradients? I am struggling to articulate it to myself, let alone in a kid-friendly way



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