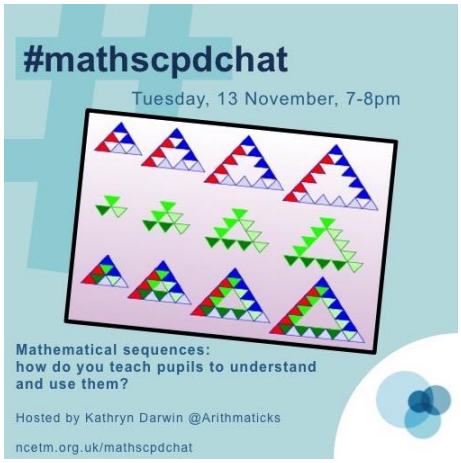
#mathscpdchat 13 November 2018

Mathematical sequences: how do you teach pupils to understand and use them?
Hosted by @Arithmaticks

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



Some of the areas where discussion focussed were:

- pupils **exploring mathematical patterns** in as wide a variety of ways as possible;
- pupils' notions of **what a sequence is** … that (how) their ideas develop over time … eg patterns made with shapes in early years, linear sequences in Y7, quadratic and geometric sequences in KS4, …;
- addressing the questions (for example about patterns made with shapes): '**what is the starting point?**' and **'what is the generating rule**?' … pupils in KS4 generalising that any arithmetic or geometric sequence has **a starting-point and a rule for finding the next term**;
- pupils **generating numerical patterns given a constraint** (eg 3rd term is 11), determining those that are/are-not sequences … then creative generative task again with condition that the pattern must be a sequence;

- **what pupils experience in KS1/2 in relation to sequences** … for example, even/odd numbers, counting-on in steps (eg 5, 10, 15, 20, 25,…), reasoning about 'values' of shapes given values of combinations of the shapes, expressing simple relationships between numbers when the relationship is exemplified using number pairs;
- **sequences of figurative patterns** … using ways of seeing the structure of figurative patterns to explain numerical relationships … finding the nth term of a numerical sequence derived from a sequence of figurative patterns;
- visual patterns the **structure of which can be seen in various different ways** … describing the structure in words … leading to using algebra to express it;
- the **first sequences that pupils explore in KS3** … eg times-tables … (how) does this build-on prior learning?
- danger of **restricting pupils' creativity** during early stages of generating their own sequences **by requiring algebraic rules**;
- **implications of GCSE requirements regarding knowledge of sequences**, eg knowledge about, and use of, geometric sequences … eg teaching Y10 students about geometric sequences in the same way as you previously taught A-level students … linking constant difference in arithmetic sequence with constant ratio in geometric sequence … students liking to use 'high level' mathematical language rather than 'things in mathematics having their names changed as you go from year to year' … students grouping sequences according to their properties;
- the **pros and cons of different ways of finding the nth term of a sequence** of numbers … discussion of this was mainly in relation to quadratic sequences;
- using sequences to **provoke particular generalisations** (such as $x^n \times x^m = x^{m+n}$);
- using **Pascal's Triangle** to generate a **Fibonacci sequence** and sequence of square numbers;
- teaching both **linear and quadratic sequences alongside graphs** … pupils seeing aspects of sequences represented in (determining) aspects of related graphs;
- exploring integer sequences using the **On-line Encyclopedia of Integer Sequences**.

An interesting 'conversation' of tweets, about exploring Pascal's Triangle and, in doing so, generating interesting sequences, followed from this tweet by Kathryn:

including this one from Esther:

Esther @MrsMathematica · 21h
At least once a fortnight my guys will have them in their starter. Either 'what sequence is this' or 'write the first x terms of *sequence*'
And we hit them ALL, currently have a competition on who can list the most prime numbers in ascending order in 1min with Y8 #mathscpdchat

these from Mike Thain and Kathryn

Mike Thain @ThainMike · 20h
Replying to @Arithmaticks
Using Pascal's Triangle is a more interesting way of doing this #mathscpdchat
1 1 1

Kathryn @Arithmaticks · 19h
Oooh please elaborate! #mathscpdchat
1

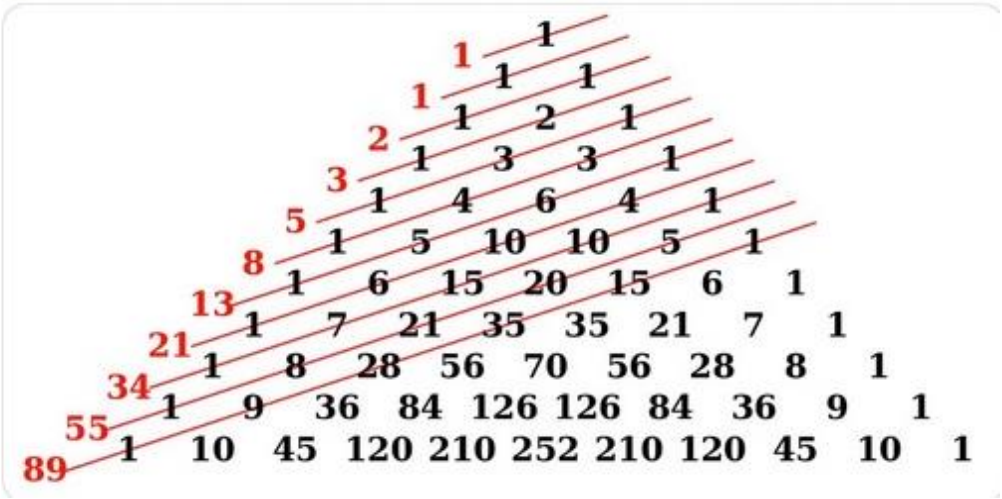
Mike Thain @ThainMike · 19h
Looking at the sum of each line gives the powers of 2, the triangle numbers are one of the diagonal lines. Can't remember where the square numbers come in though. #mathscpdchat

this from David Chart

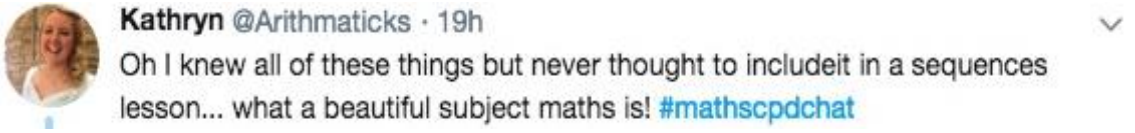
David Chart @tallerteacher · 19h
Squares are sums of triangles so just the sum of the first n entries on second diagonal. #MathsCPDChat

this from Jenny Hill-Parker:

Jenny Hill-Parker @JennyHillParker · 20h
Diagonals add up to Fibonacci sequence - I have known this for two minutes!

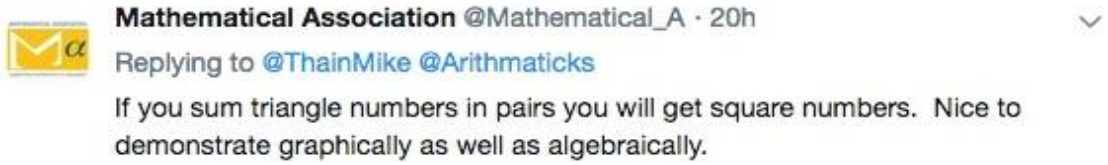


and this one from Kathryn



this from David Owens:

and this one from the Mathematical Association:



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

Among the links shared were:

Differences over Differences Methods, Pros and Cons of Different Ways of Finding the nth Term of a Sequence of Numbers, which is an article by Colin Foster in which he explains clearly different approaches to finding the nth term of a sequence of numbers, and considers advantages and disadvantages of adopting each one; this article was published in the Mathematical Association's 'Mathematics in School'; it was shared by Mary Pardoe

The On-Line Encyclopedia of Integer Sequences (OEIS) which is a fascinating website providing thousands of examples of integer sequences and much detailed information about them, shared by Mary Pardoe

Patterns and Sequences KS1 which is a collection of interesting tasks from NRICH for pupils aged 5 to 7 years, shared by Mary Pardoe

Sequences which is a part of the Underground Mathematics website providing excellent material, resources and guidance for teaching and learning about sequences beyond GCSE, shared by Mary Pardoe

Quadratic Sequences and Visual Patterns which is an article in the NCETM Secondary Magazine 141 giving examples of tasks that provide opportunities for pupils to see visual patterns in various different ways, and thereby arrive at equivalent quadratic expressions for the nth term, shared by Mary Pardoe

Using Algebra to Reconcile Different Ways of Seeing which is an entry in the NCETM Mathemapedia about learners arriving at equivalent algebraic expressions for the general term of a linear sequence by seeing the structure differently, shared by Mary Pardoe

Focus on ... Sequences which is an article in the NCETM Secondary Magazine 14 focussing sequences via algebra as that which you do and see in order to be in a position to make an algebraic statement, shared by Sue Madgwick