Can I make generalisations about sequences and explain why given numbers do or do not belong to the given sequence?

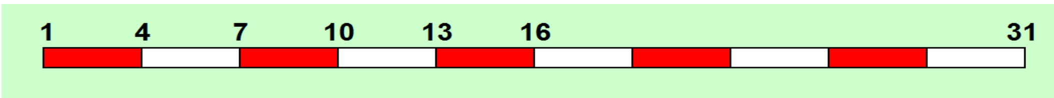
Teaching guidance

Key vocabulary

sequence, pattern, relationship, explain, reasoning, reason, rule, term, predict, prediction, generalise, generalisation, formula, multiple, consecutive

Models and images and resources

Counting stick or Counting stick with further options spreadsheet



Attach number cards onto a counting stick to create a sequence. Alternatively, use the spreadsheet Counting stick with further options to create sequences. The spreadsheet enables you to hide terms and then ask children to work out the rule, predict subsequent terms and check by revealing.

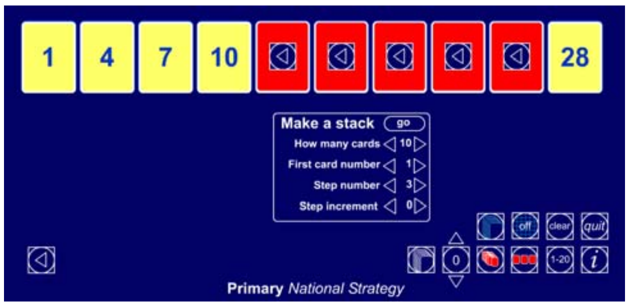
Hundred square or Number grid ITP, Increasing Number grid generator and Decreasing Number grid generator spreadsheets

Number grids create a visual image that can help children to spot patterns and predict numbers that will occur in the sequence.

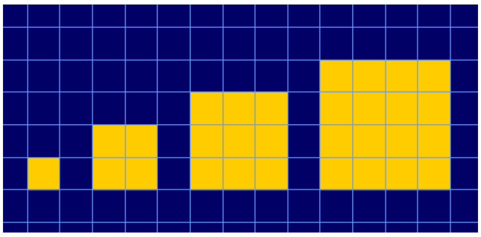
20 Cards ITP

This program allows you to create sequences. Numbers are hidden until the cards are turned over so that children can predict what they think will come next and check their ideas.

The ‘Make a stack’ function allows you and the children to create and explore a range of sequences, including those where the step itself changes incrementally.



Visual representations of number sequences



The square numbers: 1, 4, 9, 16...

Use squared paper, ICT or practical resources to provide visual representations of number sequences.

Teaching tips

- Give children experience of creating and describing spatial patterns. Ask them to explain how patterns develop, based on what they see, and to visualise and describe how to make the next diagram in a sequence. Different children may see patterns in different ways. Encourage them to describe and compare how they see the pattern developing.

- Make sure that children can create sequences with a constant step between terms:
  - Give children instructions to create particular sequences, for example: 'The start number is 100. Each term is seven less than the previous term.'
  - Ask children to create their own sequences and describe them for a partner to write down and continue.

- Show children how to find the difference between terms to identify the rule for constant step sequences. Annotate the sequences to show differences between terms. Include sequences involving decimal and negative numbers:

  1, 6, 11, 16, 21, ... 10, 7, 4, 1, –2, –5, ...

  0.25, 0.5, 0.75, 1, 1.25, ... 1.5, 1. 0.5, 0, –0.5, –1, ...

- Give children experience of finding missing terms in a sequence by identifying and using the rule for that sequence. Include some examples of sequences that do not have constant steps:

  91, 84, □ , □, 63 □, 2.8, 3.7, 4.6, □

  128, 64, 32, 16, □ , □ 1, 4, 9, 16, 25, 36, □

- Make sure that children recognise and describe sequences of multiples and start to relate other sequences to them, for example:

  4, 7, 10, 13, 16, ...

  This sequence has a constant step of three. Comparing it with the multiples 3, 6, 9, 12, 15, ... shows that this sequence contains numbers that are one greater than the multiples of three. The nth term of this sequence would therefore be 3n+1. (See 'Can I create an algebraic expression that describes a simple relationship?' for further guidance).

- In order to make generalisations, children need to look for patterns and recognise and describe common features of the terms in a sequence. Ensure that children have opportunities to compare and discuss patterns and generalisations:

Sequence	Generalisations (statements that are true for all terms)
7, 12, 17, 22, 27, ...	Units digit is 2 or 7; sequence consists of all numbers that are two more than the multiples of 5
9, 18, 27, 36, 45, ...	Digital sum to 9 (digital root is 9); sequence consists of multiples of 9
5, 9, 13, 17, 21, ...	All terms are odd; sequence consists of all numbers that are one more than the multiples of 4

- Ask children to use their generalisations to provide further numbers that will occur in the sequence. They should also decide whether given numbers will occur in a sequence or not, and should explain their reasons. For example, will the number 103 occur in the sequence 5, 9, 13, 17, 21, ...? (The sequence consists of all numbers that are one more than a multiple of 4; 100 is a multiple of 4; 103 is three more than 100, so it will not be in the sequence.)