Interactive number patterns 1

Ready-made spreadsheets to explore mathematical ideas

Prerequisite knowledge
- Use of symbols to represent unknown or varying values
- Use of algebraic expressions to represent relationships

Why do this unit?

This interactive environment allows pupils to explore number sequences and their algebraic representation. 'Interactive number patterns 2' extends the work here to quadratics.

Time

One lesson

Resources

CD-ROM: spreadsheet
NRICH website (optional):
www.nrich.maths.org, September 2007,
'Interactive number patterns 1'

Interactive number patterns 1: Display
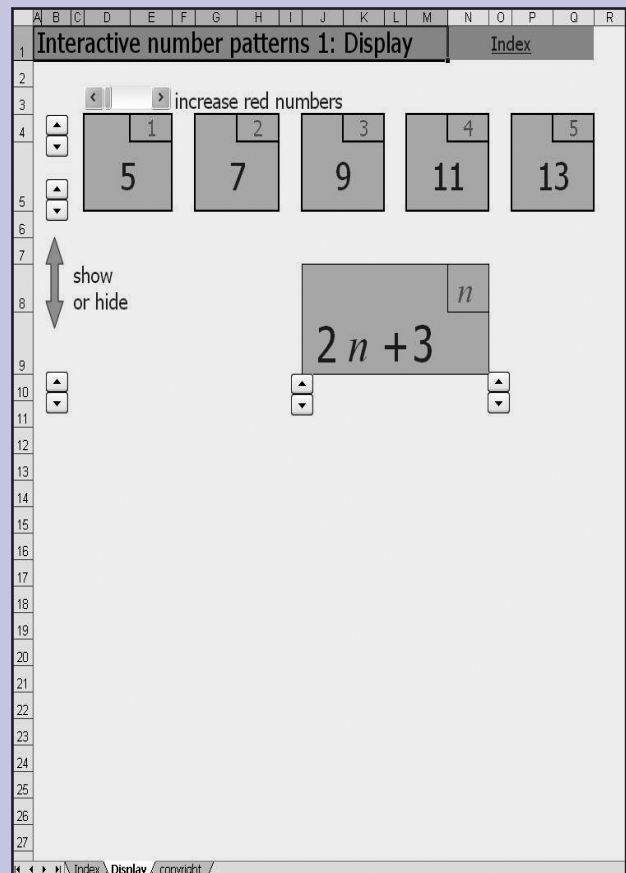
Introducing the unit

Open the spreadsheet and familiarise the group with it. Check that pupils understand:

- the slider at the top changes the red numbers;
- the spinner buttons on the edge of the formula box change the numbers in the formula;
- the three spinner buttons on the left of the screen hide or show parts of the display.

The purpose of this part of the activity is to familiarise pupils with substituting values into given formulae and to predict the sequence of blue numbers.

Set the formula to $2n+3$ and set the red numbers to read 1 to 5.

- Why is the first blue number 5? [Substituting $n=1$ in the formula gives $2 \times 1 + 3 = 5$.]
- Why are the other blue numbers 7, 9, 11 and

13? [similar substitutions of 2, 3, 4 and 5 into the formula]

Hide the blue numbers and invite pupils to suggest changes to the formula. Ask pupils to predict the hidden blue values and record their answers. Repeat this process with different formulae, keeping the red values 1 to 5. Have pupils propose formulae, predict the blue values and then check. Extend the activity by changing the red values using the slider but keep the calculations easily within the ability of the group so that their focus remains on the algebra not the calculation.

Continue this activity but hide the red values instead of the blue.

Pupils will be solving equations mentally, though they probably will not think of it like that, and now is a good opportunity to invite pupils to share their methods.

Make sure that these two processes of substituting and solving to find unknown or hidden values are well practised before moving to the main activity.

Main part of the unit

The purpose in this part of the activity is for pupils to arrive at a method for determining the formula which has been used to generate the terms within a displayed sequence. There are a number of ways that the spreadsheet can help. Here are two approaches.

Open investigation

Ask pupils to work in pairs to devise a method that can successfully predict the hidden formula. The method is then shared with the group and the presenters are asked to explain why their method works. If a justification is not possible for the presenters, other pupils may be asked if they can see and explain why that method works. Invite the group to explain how the offered methods compare. Ask pupils to say which method they like best and why.

Whole group

Set the red numbers to start at 1 and set the formula box to $2n$.

- Do you notice any pattern in the blue numbers? [They go up by 2.]

Discuss how the $2n$ makes this happen and then look at $3n$, $4n$ and $5n$ similarly. Some pupils might use phrases like '$2n$ is the algebra for the two times table'.

Return the formula box to $2n$, drawing attention to the blue values ascending by 2, and change the formula to $2n + 1$. Point out that the blue numbers still increase by 2 as before but with every value getting a 'bonus 1' from the $+1$ in the formula. Extend this to cover any constant between -10 and 10.

If time allows, pupils can work in pairs to test each other's understanding by taking turns to hide various elements of the spreadsheet for the partner to complete, before checking.

Plenary

Working with the whole class, ask pupils to 'look away' while one pupil changes the formula and then hides it so that the red and blue values are all that show.

Model to the group how you would determine the formula. For example: 'First I notice the step size – the increase between blue values – that tells me the value of the number of n in the formula. Next I think what it would be if it was that many n and nothing else (like a times table). I compare that with the actual blue number and that tells me how much bonus or loss every term is getting.'

Invite pupils to 'look away' with you each time. Offer your model initially but move towards pupils offering their own descriptions of the process.

Ensure that a good range of red values is used.