IDEA 14

NETWORKS

This idea is one I have used several times and first came across in *Points of Departure 2*, one of many excellent ATM publications. The idea is an adaptation from *POD2* and requires square-dot grid paper and works as follows.

Consider the following 'sequences':

- Start 2, 1, 2, 2, 1, 2 Finish
- Start 3, 1, 3, 2, 2, 3, 1, 3 Finish
- Start 4, 1, 4, 2, 3, 3, 2, 4, 1, 4 Finish
- Start 5, 1, 5, 2, 4, 3, 3, 4, 2, 5, 1, 5 Finish

What will the next few sequences be?

Now draw each sequence on a square-dot grid as follows:

- Choose a start point and draw the first length as a horizontal line from right to left.
- Next turn 'right' through an internal angle of 90° (or an external angle of 270°) and draw the next length.
- Keep turning right and draw each line until you reach the 'Finish'.

Once you have drawn each of the four sequences above try drawing each one of them as fast as you can. Now try drawing the next few diagrams at speed. The idea here is to produce a rhythm to enable the artist to 'feel' how the pattern works.

For each diagram the following questions can be explored with the possibility of students trying to produce general results:

- How many instructions are there are for each sequence?
- What is the total length of each sequence?
- What is the enclosed area for each sequence?
- How many 4-node points are there on each diagram?
- How many 3-node points are there on each diagram?
- How many 3- and 4-node points are there on each diagram?

IDEA 15

PALINDROMES

This is a simple-to-pose problem holding hidden complexities and is, therefore, useful for offering to students of different ages and attainments.

Choose a two-digit number and write it down,

for example	39
Reverse it	93
Add	132 (stage 1)
Reverse it	231
Add	363 (stage 2)

Stop here because the answer, 363, is palindromic

The number 39 can now be classified as a 2-stage number.

How many stages do other numbers take?

Challenges such as finding 4-stage and 6-stage numbers will provide a class with plenty to work on.

If different stages are colour coded, students might make use of a 100 square and colour in every number according to how many stages each takes. There will, of course, be several zero-stage numbers that are already palindromic such as 11, 22, 33, etc. Students might be encouraged to explore why palindromic answers produced in this way are all multiples of 11. Trying to explain why this is the case will provide students with an interesting challenge.

A harder problem is to consider palindromic multiplication when two two-digit numbers are used, for example: $96 \times 23 = 32 \times 69$.

The smallest palindromic product of two two-digit numbers that some PGCE students found was 504, proving me wrong when I had thought 806 was the smallest product!

- What is the palindromic multiplication to make 504?
- Is there a smaller palindromic product?
- What palindromic multiplication gives 806?

Asking students to generate more examples, explore the underlying structure of the process and, ultimately, to try to prove the result will provide worthy challenges.