LESSON 4 : THE ESCAPE

BOWLAND MATHS

Narrative

The teacher who has been captured is being held in the mother ship. From her cell, the teacher can see the massive brain that controls all the Aliens and the vast triangular communicator that sends signals to the Aliens in the city. The teacher thinks that the communicator uses a code based on patterns. If she could get out of her cell and crack the code to the communicator, she could send a false communication to the Aliens to entice them back to their ships.

Problems

- What is the code that will unlock the cell?
- What is the code for the patterns used by the communicator?

Mathematics Content Objectives

- Generate integer sequences (levels 4 and 5)
- Find and describe the *n*th term of a sequence (level 6)
- Formulate and solve linear equations (level 6)

Learning points

- Terms in a linear sequence increase or decrease by the same amount each time.
- The formula for the *n*th term is the position-to-term rule for the sequence.
- You can generate the terms of a sequence by substituting values of *n* into the formula for the *n*th term.

Alien invasion resources

4.1 Slides: Sequences for analysis

4.2 Video clip: film of scared captured teacher giving the background to the Alien communicator and explaining what is required in the lesson (3 minutes)

4.3 A4 resource sheets of the problems of the Alien communicator and the switches (print one set per pupil)

4.4 Optional A4 resource sheet with a supplementary problem for groups that finish quickly

4.5 Optional video clip: Breaking news about overseas developments (4 minutes)

For pupils: calculators.

BOWLAND MATHS

Main activity

Either before or at the start of the lesson, practise generating sequences of numbers given a formula for the *n*th term such as $5n - 2$, or 3^n. Also show or remind pupils how to find the nth term of a sequence based on patterns of shapes. Either display the sequences on **Resource 4.1**, **slides 1 and 2**, or use your own materials. Use prompts such as:

- Could you represent this sequence of shapes in a table? What number patterns can you see in the table? Explain why the number patterns arise.
- What do you think the 20th shape in the sequence will be like. How can you test your prediction?
- What formula would describe what you have discovered?

Introduce the last stage of the invasion. From her cell next to the communicator, the captured teacher can reach its keypad. Play **Resource 4.2**, a 3-minute video clip of the teacher's message. Her suggestion is that she should try to send out a message to entice the Aliens back to their ships. She needs to know how the communicator works and send the message.

Give out copies of **Resource 4.3** for groups to work on the problems. In order to gain a sense of achievement, all pupils need to crack the final part of the coded message that will lure away the Aliens. *If time is short, some or all pupils could omit problems e and f on Resource 4.3 and go straight to problem g.*

If time allows, groups could try the supplementary problem on Resource 4.4 to help the teacher to escape. If they get stuck, you could prompt them with:

- *Would it help to list the multiples of the numbers on the keypad?*

They can then look for combinations of multiples that sum to the required total.

Differentiation

Some pupils may be interested in looking further into the patterns in Pascal's triangle, e.g. the patterns of triangular numbers and of Fibonacci numbers (see **Useful websites** in the introductory notes). Pupils could also explore the 'routes' that can be taken on Pascal's triangle and the links with probability.

Review

Take feedback on solutions to the problems and strategies for solving them.

You could explain that the triangle of numbers on the communicator is named in the English-speaking world after the Frenchman Blaise Pascal (1623–1662), although mathematicians in Iran, China, India, and Italy discovered it years before.

Also ask:

- Why do you think that are we working in this way in maths lessons?

Draw out the mathematical theme linking the lessons in this unit: that maths plays a vital part in communications, not only through maps, diagrams and graphs but also through formulae and codes. Explain that the exciting real mathematics involved in many jobs requires working in teams to solve real problems, just as would happen if there really were an alien invasion.

*If time allows, finish by playing **Resource 4.5**, a 4-minute video. Globe news reports that the captured teacher has rejoined the class and everyone has been lifted out by the Army's helicopter. The Aliens seem to have gone but there are new reports of four large shadows over Sydney in Australia and of a strange signal coming from a Russian satellite … A research unit has been set up. Anyone who has experience of dealing successfully with the Aliens should contact the unit on 0801 242424.*

BOWLAND MATHS

Assessment and homework

You could list the objectives for the unit in pupil-friendly wording so that pupils can make their own assessment of their progress, perhaps using a traffic-light system.

The Key Stage 3 test questions listed below relate to the topics touched on in this unit. You could choose some of the questions to suit the groups of pupils in your class, either to try as homework or in a further lesson.

Level 5
2003 Paper A1 q. 17
2001 Paper A2 q. 12
2000 Paper A2 q. 16
2000 Paper A1 q. 13
1997 Paper A2 q. 12
1995 Paper A1 q. 9

Level 6
2006 Paper D1 q. 2
2006 Paper D2 q. 4
2005 Paper D1 q. 8
2001 Paper B2 q. 12
2000 Paper B2 q. 12
1996 Paper C2 q. 7

Level 7
2006 Paper D2 q. 9
2003 Paper D1 q. 9
1997 Paper B1 q. 10
1997 Paper D2 q. 9