Module 10: Classroom approaches to algebra

Description   This module is for an individual teacher or group of teachers in secondary schools who have been considering their teaching of algebra. It discusses ways of approaching the teaching of algebra in the classroom.

Its purpose is to conclude and help teachers to reflect on a sequence of one or more algebra modules which have been studied either earlier in the day or on a previous occasion. Hence it cannot be studied on its own, although it may be used on more than one occasion by the same teacher or group of teachers. Since it involves consideration of what has just been worked through, it will result in different conclusions and decisions each time it is used.

For example, Module 10 could be used to follow:

- Module 5: Collecting like terms
- Module 7: Applying algebraic reasoning

or:

- Module 8: Generalising from sequences
- Module 9: Linking sequences, functions and graphs

Study time   From 20 to 30 minutes

Resources   Each teacher will need a personal notepad.

Each teacher or pair of teachers working together will need:

- copies of the questions on **Resources 10a and 10b** at the end of this module;
- a copy of the algebra strand of the *Revised learning objectives for mathematics* for Key Stages 3 and 4 produced by the Secondary National Strategy (2010), which you can download from:

  nationalstrategies.standards.dcsf.gov.uk/secondary/framework/maths/fwsm/mlo

It would also be helpful to have available for reference a copy of *Teaching and learning algebra pre-19*, a joint report from the Royal Society and the Joint Mathematical Council, which you can download from:

  www2.royalsociety.org/document.asp?id=1910

Classroom approaches to algebra

1   The National Curriculum 2007 for algebra in **Key Stage 3** involves:

- algebra as generalised arithmetic
- linear equations, formulae, expressions and identities
- analytical, graphical and numerical methods for solving equations
- polynomial graphs, sequences and functions

In **Key Stage 4**, the National Curriculum involves:

- linear, quadratic and other expressions and equations

- graphs of exponential and trigonometric functions

- transformation of functions

- graphs of simple loci

Some guiding principles on the teaching of algebra are:

- developing pupils' understanding that algebra is a way of generalising, either from arithmetic, or from particular cases or from patterns and sequences;

- providing regular opportunities to construct algebraic expressions and formulae and to transform one expression into another – for example, by collecting like terms, taking out common factors, working with inverses or solving equations;

- using opportunities to represent a problem and its solution in tabular, graphical or symbolic form, using a graph plotter, graphical calculator or a spreadsheet where appropriate, and to relate solutions to the context of the problem;

- developing algebraic reasoning, including an appreciation that while a number pattern may suggest a general result, a proof is derived from the structure of the situation being considered.

Now consider this question.

- Which of these principles apply to the activities for pupils that you have considered in the last few sessions?

2   In a moment you will be asked to consider some questions.

If you are working alone, jot down answers to the questions on your notepad. When you have finished, review and modify your answers.

If you are working with colleagues, discuss the questions as a group, and reach a consensus on the answers. If the group is large, you could first discuss the questions in a pair or small group before discussing them with the whole group. Make notes to record your answers on a flip chart or whiteboard.

Now find the questions on **Resource 10a, Questions for consideration 1**.

3   Look back over the notes you have made during your study. Have you identified the most important things that you may need to consider and adopt in your planning and teaching of algebra?

Think about the questions on **Resource 10b, Questions for consideration 2** and jot down some reminders.

4   If you are interested in learning more about the teaching of algebra in secondary schools, read *Teaching and learning algebra pre-19*, a joint report from the Royal Society and the Joint Mathematical Council, which you can download from www2.royalsociety.org/document.asp?id=1910

Resource 10a: Questions for consideration 1

Consider the examples of activities for pupils that you have tried out and considered while you were thinking about aspects of algebra in Key Stages 3 and 4.

1 What learning objectives for pupils, and for which year groups, did these activities address?

2 What other activities could you incorporate in lessons to teach these objectives?

3 How could you adapt or extend these activities for other Key Stage 3 or 4 classes?

4 Consider the questions or prompts that guided you through the activities and helped you to reflect on them. Look back and identify the questions or prompts that you could incorporate into your questioning of pupils and make a note of them.

5 How would you introduce activities like these into your classroom? What modifications, if any, would you need to make to your planning, questioning styles or classroom organisation?

Resource 10b: Questions for consideration 2

1 What actions will you now take? Make a note, then decide on the two or three things to do first.

2 Do you need to consider deadlines for getting things done? If so, what are they?

3 Are there any issues you would like to follow up in further study?

4 Are there any issues that you need to discuss with colleagues who have not been involved in your study?