The National Strategies
Secondary

Secondary mathematics algebra study units

Unit 10: Classroom approaches to algebra

department for
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Description

This unit is for individual teachers or groups 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 draw the other units together and to help teachers to reflect on a sequence of one or more algebra units that have been studied, either earlier on the same day or on a previous occasion. For this reason, 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, Unit 10 could be used to follow:

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

or:

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

Study time

20–30 minutes

Resources

Each teacher or pair of teachers working together will need:

- a personal notepad
- copies of **Resources 10a** and **10b** (which can be found at the end of this unit)
- a copy of the algebra pages from *The Mathematics overview and learning objectives* PDF, which you can download in A3 or A4 from the Framework for secondary mathematics at www.standards.dcsf.gov.uk/nationalstrategies. Search for the title: 'Mathematics learning objectives'.

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: www.2.royalsociety.org/document.asp?id=1910

Classroom approaches to algebra

1. The curriculum 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 algebra curriculum involves:
   - linear, quadratic, and other expressions and equations
   - graphs of exponential and trigonometric functions

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- transformation of functions
- graphs of simple loci.

Some guiding principles on the teaching of algebra include:

- 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 flipchart 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* (see Resources).

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Resource 10a: Questions for consideration 1

Review 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 such as these into your classroom? What modifications, if any, would you need to make to your planning, questioning styles, or classroom organisation?

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Resource 10b: Questions for consideration 2

1. What actions will you now take? Make a note and 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?

Audience: Local authority staff, National Strategies consultants, secondary mathematics subject leaders, secondary mathematics teachers
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