

Interacting with mathematics in Year 9:

key messages

This leaflet is for mathematics teachers who were unable to attend the national training. It summarises the main points and is best used in conjunction with the school file for *Interacting with mathematics in Key Stage 3* (ref: DfES 0216/2002).

Aims and purpose of the materials

The materials supplement those produced in the 2002 summer term: *Interacting with mathematics in Year 8*. Both sets of materials have been developed to support mathematics departments in:

- planning for teaching that engages and challenges pupils;
- developing mathematical reasoning in pupils.

The materials provide guidance and support for:

- planning for mathematics teaching as a whole department;
- discussing key aspects of mathematics in the department;
- trying out innovative ideas in teaching and evaluating them as a department.

The materials centre on two Year 9 units of work, the first on [geometrical reasoning](#), the second on [proportional reasoning](#). For each of these units, there is a mini-pack containing:

- the teaching objectives;
- a detailed plan for the unit;
- resources to support the teaching of the unit.

Structured [notes for departmental meetings](#) are provided to support you and other teachers in the mathematics department in exploring the mathematics and the suggested teaching approaches.

Geometrical reasoning mini-pack: key messages

The 2000 revision of the National Curriculum gives a stronger emphasis to geometry in Key Stages 3 and 4. This unit aims to support you and your colleagues in developing the teaching and learning of geometrical reasoning, particularly where this is a new focus.

Many Key Stage 3 pupils have difficulty understanding the notion of geometrical proof. They often cannot see the point of proving something that is obvious to them. Visualisation skills – being able to construct and control mind pictures – are often underdeveloped. This mini-pack offers an innovative approach to teaching geometrical reasoning, including the development of deductive reasoning and proof.

Teaching approaches include:

- using visualisation exercises to help pupils create and talk about mental images using precise mathematical language;
- effective use of teacher modelling/demonstration to stimulate pupils' own reconstructions;
- using discussion with and between pupils to evaluate understanding;
- exploring strategies to solve geometrical problems, including the development of formal written solutions.

Geometrical reasoning audio tracks

The CD-ROM includes two sequences of pupils discussing their work on geometrical reasoning. The first (audio track 9) is a group of pupils proving that the angles in a triangle add to 180° , with a second group acting as 'doubters' questioning each stage of the proof. The second (audio track 10) is a group of pupils discussing a visualisation exercise while their teacher listens. When working with this audio track, discuss:

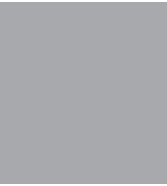
- *How can an open discussion usefully reveal areas for further work, such as the need to develop language or resolve misconceptions?*
- *What is the value of working dynamically with mental images and sharing perceptions with others, in order to develop geometrical reasoning?*

Proportional reasoning mini-pack: key messages

Many Key Stage 3 pupils have difficulty in using and understanding proportional relationships, yet such relationships are at the heart of mathematical thinking. This mini-pack builds on the unit developed in the Year 8 materials, on multiplicative relationships. It provides an opportunity to revise, consolidate and extend the ideas introduced in Year 8 and to make links to other mathematical strands, particularly shape and space.

The teaching approaches developed include:

- using visual images in the context of enlargement and similarity to develop pupils' awareness and understanding of proportional relationships;
- using problem-solving contexts to revise and extend pupils' strategies.



The problem-solving strategies taught in this unit are:

- translating a problem into a form that helps with the solution, e.g. extracting appropriate data and putting the data into tabular form;
- estimating the answer by using knowledge of the effect of multiplying or dividing by numbers greater than or less than 1;
- considering scaling methods by finding a multiplier between two relevant items of data.

Problems drawn from a range of mathematical contexts are included in the mini-pack.

Multiplicative relationships video

This video includes two sequences from a lesson on multiplicative relationships. The focus is on developing the precursors to multiplicative thinking. After watching the video, discuss:

- *How do the precursors enable pupils to engage with the main teaching about scale factors?*
- *What strategies are used by the teacher to emphasise the importance of mathematical language?*

How might you use these materials?

Following the training in the 2003 spring term, heads of department and key teachers will be asked to choose one of the mini-packs as a basis for collaborative planning and discussion in the department. Some departments may choose to work on both units over time, and then perhaps extend to other units.

The notes for meetings can be used flexibly. You and your colleagues may prefer to focus on one section of a unit, for example visualisations in geometrical reasoning. When using the materials in this way, it is a good idea to start by using the identified sections in the notes for your departmental discussion, agreeing what will be tried with teaching groups, then coming back to discuss outcomes and implications for future work.

What's included in the materials?

Your head of department or the teacher who attended the course will have received a school pack (ref: DfES 0588/2002), which contains a range of supporting materials for use in schools:

- two copies of the Year 9 pack (see below), to be inserted into the *Interacting with mathematics in Key Stage 3* school file;
- a video;
- a CD-ROM of text and audio files;
- five additional copies of each of the mini-packs for geometrical reasoning and proportional reasoning.

Each **Year 9 pack** contains:

- guide to the Year 9 pack;
- a mini-pack on geometrical reasoning;
- a mini-pack on proportional reasoning;
- notes for two departmental meetings on each mini-pack;
- resource sheets for each mini-pack.

The contents of the school file and Word versions of each of the unit plans can be found on the Key Stage 3 Strategy website at www.standards.dfes.gov.uk/keystage3