

Section 1: The National Curriculum programme of study for mathematics

This section focuses on:

- 1.1 How the mathematics National Curriculum (NC) is structured;
- 1.2 The general requirements;
- 1.3 The essential characteristics of the mathematics for each key stage;
- 1.4 The mathematics that must be taught at each key stage;
- 1.5 How the mathematics NC informs the planning of teaching programmes;
- 1.6 How to use attainment target (AT) level descriptors to help you assess children's achievement.

1.1 HOW IS THE MATHEMATICS NATIONAL CURRICULUM (NC) STRUCTURED?

www.nc.uk.net

The NC programmes of study (PoS) for mathematics indicate the knowledge, skills and processes that are statutory and must be taught at each key stage. They also set out the breadth of study required, that is, the contexts, areas of study and range of experiences through which the mathematics should be taught.

Each PoS is split into sections:

- Ma2 (Number at key stage 1 and Number and Algebra at key stage 2. Data Handling is also embedded into Ma2 at key stage 1);
- Ma3 (Shape, space and measures);
- Ma4 (Handling data) at key stage 2.

There is no longer a separate section Ma1 (Using and applying mathematics) as the teaching requirements relating to this are included within the other sections. Additional guidance, examples and suggestions, especially for links with other subjects, are included in the NC documents in grey type. These are for illustration and are not statutory.

Attainment targets (ATs) complement the PoS and provide a basis for judging the performance of children at the end of each key stage. They show the mathematical *'knowledge, skills and understanding that children of different abilities and maturities are expected to have by the end of each key stage'*. Each AT corresponds to a separate section of the PoS, with the exception of the first AT Ma1 (Using and applying mathematics). ATs are broken down into levels ranging from 1 to 8, although primary children are expected to perform within levels 1 to 5, with a few exceptional children reaching level 6 (see table 1 on page 71). At each level, a brief description indicates the type and range of performance that is characteristic of children working at that level.

Education Act 1996, section 353a

Table 1: Attainment targets related to each primary key stage

Key stage	Range of levels at which most children are expected to work	Attainment level most children are expected to achieve
1	1–3	2
2	2–5	4

1.2 WHAT ARE THE GENERAL REQUIREMENTS?



Reading

To find out what your responsibilities are in relation to the requirements, read *National Curriculum Handbook for primary teachers in England (1999)* pp30–39.

When planning mathematics teaching, you should take account of the general teaching requirements that apply to all subjects. These set out your responsibilities for providing:

- effective learning opportunities for all children (inclusion);
- opportunities for children to develop, consolidate and apply language skills in mathematics;
- opportunities for children to develop and apply their information and communication technology (ICT) capability and to use ICT to support their learning in mathematics.

1.3 WHAT ARE THE ESSENTIAL CHARACTERISTICS OF EACH KEY STAGE?



Reading

Find out the details of the mathematics you must teach at each key stage by reading the *National Curriculum Handbook for primary teachers in England: key stage 1 (pp62–66)* and *key stage 2 (pp67–74)*.

At key stage 1, children learn about shape and space through practical activities and are encouraged to explore and discuss mathematical ideas. They should be encouraged to develop mental calculation strategies and to reinforce their mathematical ideas and understanding of mathematical language by talking about their work.

At key stage 2, the emphasis is on gaining fluency in efficient calculation strategies with all four number operations, continuing to acquire and use a broad range of mental strategies and develop an understanding of measuring, shape and space and data handling. They should apply their knowledge, skills and understanding in a wider range of contexts. Children need to cultivate more formal written methods in all aspects of their mathematical work. They will be involved in solving increasingly complex problems, and will be able to discuss and present their methods and reasoning using a wider range of mathematical vocabulary and with the aid of charts and diagrams.

1.4 WHAT MATHEMATICS DO I HAVE TO TEACH AT EACH KEY STAGE?

The knowledge, skills and understanding that you should teach children are grouped under headings in each section of the PoS. These are shown in table 2 (on page 72). The breadth of study, which is included at the end of the PoS for each key stage, shows what children should have opportunities to do in order to gain the knowledge, skills and understanding required.

Table 2: Programme of study related to each primary key stage

Programme of study	
Key stage 1	Key stage 2
<p>Ma2 Number: Using and applying number Numbers and the number system Calculations Solving numerical problems Processing, representing and interpreting data</p>	<p>Ma2 Number: Using and applying number Numbers and the number system Calculations Solving numerical problems</p>
<p>Ma3 Shape, space and measures: Using and applying shape, space and measures Understanding patterns and properties of shape Understanding properties of position and movement Understanding measures</p>	<p>Ma3 Shape, space and measures: Using and applying shape, space and measures Understanding properties of shape Understanding properties of position and movement Understanding measures</p>
	<p>Ma4 Handling data: Using and applying handling data Processing, representing and interpreting data</p>

1.5 HOW DOES THE MATHEMATICS NC AFFECT MY TEACHING PLANS?

For more information, see
Chapter 5: Section 7: Planning
mathematics lessons

In most cases, schools will be able to provide you with a copy of their medium-term plans (half-termly or termly), which are based on the *Framework for teaching mathematics from Reception to Year 6* and satisfy the National Curriculum requirements. This will help you plan a series of lessons on a weekly or lesson-by-lesson basis, depending on the school. In addition at both key stages, the NC requires children to be given opportunities, on the one hand, to develop their ICT capability through mathematics, and on the other, to use ICT, including calculators, to support their mathematics work. In the *National Curriculum Handbook for primary teachers in England* (1999), margin notes in grey type will help you to identify suitable opportunities for using ICT.

For more information, see
Chapter 5: Section 2: The National
Numeracy Strategy

1.6 HOW CAN ATTAINMENT TARGETS HELP MY JUDGEMENTS?

The ATs provide descriptions of children's performance at different levels. These indicate the range and type of performance that typically characterise children working at each level. These level descriptors should be used on a 'best fit' basis to judge children's levels of achievement. They are designed to enable you to judge children's attainment at the end of each key stage, but can be useful for gaining an interim overview of performance in the various aspects of mathematics covered by the PoS. Table 1 on page 71 shows how the levels relate to each key stage.

Chapter 5: Section 2: The National Numeracy Strategy

This section focuses on:

- 2.1 What the National Numeracy Strategy (NNS) is and to whom it applies;
- 2.2 How it relates to the National Curriculum (NC) and the foundation stage;
- 2.3 How the NNS affects the teaching of mathematics;
- 2.4 How the NNS supports lesson planning.

2.1 WHAT IS THE NATIONAL NUMERACY STRATEGY (NNS)?



Reading

Read the *Framework*, pp4–5, to find out more about numeracy and factors that promote high standards.

www.standards.dfes.gov.uk/numeracy/teaching_resources/?sec=0

Introduction

Key objectives

Yearly teaching programmes and planning grids

Supplements of examples

The NNS was launched to raise standards in mathematics in primary schools. It is based on the principles that effective learning takes place when teaching is interactive, differentiation is manageable within the class and the foundations of mental calculation and recall of number facts are well established before formal written methods are introduced. The NNS promotes the teaching of mathematics through structured lessons.

The *Framework for teaching mathematics from Reception to Year 6* provides guidance and support on implementing the strategy and is available to all teachers free of charge. It consists of:

- key features of numeracy and factors that promote high standards;
- approaches to teaching mathematics and school and class organisation;
- managing assessment;
- planning mathematics teaching;
- the teaching objectives that should be given priority in each year group in Reception to Year 6;
- objectives and example teaching plans for each year group;
- Reception is treated separately, then Years 1, 2 and 3 and Years 4, 5 and 6;
- illustrations of outcomes, ie. what children should know and be able to do by the end of the year.

The *Framework* covers all the mathematics required by the NC. It has five strands. The first three link directly to the NC programme of study (PoS) for number, the fourth strand links to shape, space and measures and the fifth to handling data. Using and applying mathematics is integrated throughout all strands. The five strands are:

- numbers and the number system;
- calculations;
- solving problems;
- measures, shape and space;
- handling data.

Although it is not statutory, schools are expected to adopt the NNS unless they have very good reason for doing otherwise. If you are to teach mathematics, you will almost certainly be expected to teach in accordance with the NNS.



Optional Task

To gain an overview of the *Framework*, read the introduction on pages 6 and 7 and the information on the structure of the *Framework* on pages 38 to 40.

2.2 HOW DOES THE NNS RELATE TO NC AND FOUNDATION STAGE MATHEMATICS REQUIREMENTS?



Reading

To find out how the *Framework* relates to the NC level descriptions, read the *Framework*, p42.

The NC and the *Curriculum guidance for the foundation stage* indicate **what** should be taught and the standards most children are expected to achieve by the end of each key stage. The *Framework* supplements these with guidance and exemplars illustrating **how** the mathematics can be planned and taught in each year group from Reception to Year 6. The objectives in the yearly teaching programmes cover all aspects of the mathematics NC at key stages 1 and 2. The key objectives should be given priority as they are central to children's achievement in relation to the NC level descriptions. The Reception teaching programme links to the early learning goals for mathematics set out in *Curriculum guidance for the foundation stage*.

2.3 IN WHAT WAYS DOES IT AFFECT HOW I TEACH MATHEMATICS?



Reading

To find out about the approach to teaching recommended by the NNS, read the *Framework*, pp11–17.

For advice about putting the strategy into practice in your teaching, read the *Framework*, pp18–32, and *The National Numeracy Strategy: Mathematical Vocabulary* (1999) pp1–6.

The DfES produce Guidance on the organisation of the daily mathematics lesson in Reception classes. Copies can be obtained from DfES Publications Tel. 0845 60 222 60.

Class teachers are expected to provide a daily lesson dedicated to the teaching of mathematics lasting about 45 minutes at key stage 1 and 50–60 minutes at key stage 2. In addition, you should plan time in other subjects for children to develop and apply their mathematical skills and time for discussing progress with individual children.

There are three elements to the typical mathematics lesson from Reception to Year 6. These are:

- oral and mental work;
- the main teaching activity;
- a plenary.

The emphasis throughout the mathematics lesson is on direct teaching and questioning. This may be with the whole class, a group of children or individuals. The *Framework* recommends organising whole-class work for a significant proportion of the time in order to maximise children's contact time with their teacher. This allows them to benefit from sustained periods of direct teaching and interaction.

The introductory section of the *Framework* includes much practical advice to help you implement the strategy. Advice is included on organisational issues – for example, dealing with mixed-age classes and small schools, and organising children within the classroom. Guidance and suggestions are also given on catering for children with different needs, using adult helpers, selecting and using resources and ICT. A separate booklet, *Mathematical Vocabulary*, includes a helpful introductory section on asking questions and using oral techniques to develop children’s understanding of mathematical vocabulary.

2.4 HOW SHOULD I PLAN THE MATHEMATICS I TEACH?

www.standards.dfes.gov.uk/numeracy/teaching_resources/?sec=1&up_id=216&top_id318&atcl_id=1815&ovrsz=0

The mathematics you teach will be that which is set out for each key stage in the NC. However, the *Framework* provides teaching programmes for each year group which summarise the teaching objectives and identify those ‘key objectives’ to which you should give priority. Planning grids related to each teaching programme indicate topics to be taught in units of work and the number of daily lessons recommended for each unit. These are offered as a guide and will assist your medium-term planning, but check with the school first, as it might already have prepared detailed plans to guide your teaching.

You will find a wealth of material on the DfES numeracy website that will help you plan, teach and assess children’s work. You will find the *Framework for teaching mathematics from Reception to Year 6* on the web and also details of how to obtain a printed copy. The use of common mathematical strands and the layout of the *Framework* make it easy to see how learning can be developed progressively within and across year groups. Use it to help you to build on what your children already know and can do and to extend the learning of higher-ability children.

Understanding mathematical vocabulary is a key factor in enabling children to make good progress. To help you identify the vocabulary needed at different stages, checklists of words relating to the five strands of mathematics and those commonly used when giving instructions are provided for each year group. Take account of these when planning and teaching your lessons. You will need to check which words children understand and which are new words that you will need to explain and encourage children to use.



Optional Task

Gain an overview of how the development of mathematical vocabulary progresses across the year groups by following through, from Reception to Year 6, the list of words for one strand in the book *Mathematical Vocabulary*.

Chapter 5: Section 3: Mathematical development at the foundation stage

This section focuses on:

- 3.1 What the foundation stage is;
- 3.2 The mathematics requirements at the foundation stage;
- 3.3 What children should know by the end of the foundation stage;
- 3.4 How foundation stage mathematics and the National Numeracy Strategy (NNS) are linked;
- 3.5 The approaches to take when teaching mathematics to very young children.

3.1 WHAT IS THE FOUNDATION STAGE?



Reading

To find out about the mathematical development of children at this stage, read *Curriculum guidance for the foundation stage* (2000) pp68–71.

The foundation stage precedes the National Curriculum (NC) key stage 1. It begins when children reach the age of three and ends at the end of the Reception Year. There are six areas of learning at this stage, one of which is mathematical development. You will need to take account of these if you teach children in a Nursery or Reception class or a combined Reception/Year 1 class. The DfES Guidance on the organisation of the daily mathematics lesson in Reception classes will support your planning and teaching.

3.2 WHAT MATHEMATICS SHOULD I TEACH AT THE FOUNDATION STAGE?

The focus of mathematical development at the foundation stage is on children learning and using key skills competently. These include counting, seeing patterns and working with numbers, shapes, spaces and measures and are set out as a progressive series of 'Stepping Stones' in the curriculum guidance. It is important that children should enjoy their early experiences of mathematics so you should develop their understanding through stories, songs, games and imaginative play. Use the Reception checklists in the *National Numeracy Strategy: Mathematical Vocabulary* to help you identify the mathematical language that should be taught and consolidated at this stage.

www.qca.org.uk/pdf.asp?/cal/foundation/elg/mathematics.pdf

3.3 WHAT SHOULD CHILDREN KNOW BY THE END OF THE FOUNDATION STAGE?

The foundation stage is dealt with in more detail in 'Filling the Gaps' in this series

For more information, see Chapter 5: Section 1: The National Curriculum programme of study for mathematics

Early learning goals are related to each area of learning. The goals for mathematics are shown in grey in the Stepping Stones section of *Curriculum guidance for the foundation stage: mathematical development*. They indicate what most children are expected to achieve by the end of the foundation stage. Illustrative examples included in the document will help you to interpret the goals in practice.

The early learning goals introduce ideas pitched around level 1 of the NC and they form the objectives of Reception in the *Framework*. By the end of the foundation stage, children should be developing a sound understanding of numbers to 10, being able to recognise, name, count and compare them. They should be beginning to relate addition to combining objects and subtraction to taking away objects.

Children should be acquiring and using mathematical language to describe objects, patterns, shapes and operations, such as addition and subtraction, and to make comparisons. They should be able to recognise and recreate simple patterns.

3.4 DOES THE FRAMEWORK FOR TEACHING MATHEMATICS FROM RECEPTION TO YEAR 6 APPLY AT THE FOUNDATION STAGE?

The *Framework* applies to children in Reception classes so it does apply to older children at the foundation stage. The guidance given in the *Framework* is aligned with the early learning goals for mathematical development and can help you to plan lessons.

If you are teaching a Reception class for more than a few days, you will need to be flexible in the way you apply the *Framework* when planning teaching programmes. This is because children enter the Reception class at different times in the year and have a broad range of experiences and competencies. Check whether the Reception teacher has already assessed children and drawn up a teaching plan to cater for their needs and the demands of the curriculum. If so, obtain a copy to guide your day-to-day planning. Bear in mind that the aim is for children to be familiar with the daily mathematics lesson structure; therefore elements need to be introduced in the early part of the year, and by the end of the Reception Year a daily mathematics lesson should be in place.

For more information, see Chapter 5: Section 2: The National Numeracy Strategy



Optional Task

Compare the Stepping Stones with the teaching programme for Reception in Section 3 of the *Framework*.

3.5 WHAT APPROACHES SHOULD I TAKE WHEN TEACHING MATHEMATICS TO VERY YOUNG CHILDREN?

It is important that children should find mathematics enjoyable as this will help to sustain their interest and confidence as they grow older. Providing play activities and encouraging children to talk about these are vitally important in developing mathematical ideas and vocabulary. Aim to provide a variety of first-hand experiences in a range of contexts. When you intervene, make sure that your focus is on extending and developing mathematical learning and that you model the use of mathematical vocabulary. For example, '*How did you work out that the next shape would be a circle?*' and '*Suppose I have six. Will you have more than me or fewer than me?*'

See Chapter 3: Other adults in the classroom

You will probably have at least one other adult to assist you in the classroom, often a trained nursery nurse or experienced teaching assistant. When you plan your teaching, think about how to use this person to develop and extend children's learning and make sure that you discuss this with them before the lesson.



Optional Task

Read the guidance on teaching mathematics in *Curriculum guidance for the foundation stage*, pages 71–73 and in the Stepping Stones section on pages 74–81.

Chapter 5: Section 4: Key stage 1 mathematics

This section focuses on:

- 4.1 What mathematics should be taught at key stage 1 and how the *Framework for teaching mathematics from Reception to Year 6* and the National Curriculum (NC) are linked;
- 4.2 The key mathematical concepts taught at this key stage and where to find help with understanding and teaching the basic mathematical concepts;
- 4.3 How to pitch work at an appropriate level for the age and ability of the children;
- 4.4 What children should be expected to do and understand.

4.1 WHAT MATHEMATICS SHOULD I TEACH AT KEY STAGE 1?



Reading

To check the requirements of the mathematics curriculum at key stage 1, read the *National Curriculum Handbook for primary school teachers in England (1999)* pp62–66.

www.nc.uk.net/servlets/Subjects?Subject=Ma

[www.standards.dfes.gov.uk/numeracy/teaching_resources/?y=0&t=\)&f=1](http://www.standards.dfes.gov.uk/numeracy/teaching_resources/?y=0&t=)&f=1)

For more information, see Chapter 5: Section 7: Planning mathematics lessons

The NC for mathematics sets out what must be taught at key stage 1 and you should be fully conversant with the requirements if you are to teach at this key stage. You will also need to be familiar with the *Framework*, which sets out key objectives for each year group. The guidance it contains will help you to identify the specific mathematics that is relevant to the year group, or groups, you are to teach. Table 1 overleaf summarises the content of the curriculum and gives examples related to the *Framework* key objectives.

Remember that you are also required to provide opportunities for children to develop and apply their ICT capability and to use ICT, including calculators, to support their learning. Non-statutory guidance (grey type) within the margins of the PoS highlights suitable opportunities in mathematics. Further guidance on using ICT to support mathematics is available in a free training pack (see page 92).

You will need to find out how the school has organised the teaching of mathematics and which year groups are represented in the class you will teach. How the school groups the children will affect your planning and teaching. If possible, find out from the mathematics co-ordinator or head teacher the topic on which the class is working and what they have done already. Check whether detailed medium-term and short-term plans are available that you can use to guide your teaching. If not, use the teaching programmes and supplement of examples appropriate to the age of the children from the *Framework* to develop your own plans.

Table 1: Summary of the key stage 1 mathematics curriculum

	National Curriculum programme of study (PoS)	Related <i>Framework</i> key objectives for Year 2
Number	Using and applying number: <ul style="list-style-type: none"> • problem solving • communicating • reasoning 	<ul style="list-style-type: none"> • Choose and use appropriate operation. • Use efficient calculation strategies to solve problems. • Choose and explain how a problem is solved.
	Numbers and the number system: <ul style="list-style-type: none"> • counting • number patterns and sequences • the number system 	<ul style="list-style-type: none"> • Describe and extend simple number sequences: count on or back in ones or tens, starting from any two-digit number. • Recognise odd and even numbers ... • Read and write whole numbers to at least 100 ... • Know what each digit in a two-digit number represents, including 0 as a place holder ... • Order whole numbers to at least 100 ...
	Calculations: <ul style="list-style-type: none"> • number operations and the relationships between them • mental methods 	<ul style="list-style-type: none"> • Understand that subtraction is the inverse of addition ... • Know by heart all addition and subtraction facts for each number at least to 10; multiplication facts for the 2 and 10 times tables. • Use knowledge that addition can be done in any order to do mental calculations more efficiently. • State subtraction corresponding to a given addition, and vice versa. • Understand the operation of multiplication as repeated addition or as describing an array ... • Know and use halving as the inverse of doubling.
	Solving numerical problems	<ul style="list-style-type: none"> • Choose and use appropriate operations and efficient calculation strategies to solve problems. • Explain how a problem was solved.
	Processing, representing and interpreting data	<ul style="list-style-type: none"> • State the subtraction corresponding to a given addition and vice versa.
Shape, space and measures	Using and applying shape, space and measures: <ul style="list-style-type: none"> • problem solving • communicating 	<ul style="list-style-type: none"> • Choose and use appropriate operations to solve problems. • Sort shapes and describe some of their features.
	Understanding patterns and properties of shape	<ul style="list-style-type: none"> • Use the mathematical names for common 3-D and 2-D shapes ... • Sort shapes and describe some of their features ... • Use mathematical vocabulary to describe position, direction and movement ...
	Understanding properties of position and movement	
	Understanding measures	<ul style="list-style-type: none"> • Estimate, measure and compare lengths, masses and capacities, using standard units and equipment ... • Read a simple scale to the nearest labelled division ...

4.2 WHAT ARE THE KEY MATHEMATICAL CONCEPTS I NEED TO UNDERSTAND IN ORDER TO TEACH CHILDREN IN KEY STAGE 1?

You will need a good understanding of the key concepts that underpin the children's curriculum at key stage 1 so that you:

- are able to give clear explanations to children;
- know how to develop and extend their learning;
- ensure that their learning is relevant and progressive by making relevant links between areas of mathematics.

The summary of the NC mathematics given in table 1 outlines the main conceptual areas you need to understand. These are reflected in the *Framework's* five strands.

You may not have regular experience of teaching all these mathematical concepts but may be required to do so, possibly at short notice. If you feel you need to refresh or gain further knowledge of the mathematics required, some resources that will help you are listed at the end of this chapter.



Reading

For a succinct diagrammatic summary of the key mathematical concepts and their relationship to the five strands used for planning teaching, read p40 of the *Framework for teaching mathematics from Reception to Year 6* (1998).

4.3 HOW DO I KNOW AT WHAT LEVEL TO PITCH MY TEACHING TO MATCH THE AGE OF THE CHILDREN IN MY CLASS?

For more information, see
Chapter 5: Sections 1, 2, 6 and 7

All schools should have detailed medium-term teaching plans that show what mathematics you should teach. These will help you to pitch your work accurately. If these are not available, follow the guidance in the *Framework*. Its yearly teaching programmes identify the mathematical concepts that should be taught in each year group at key stage 1. The supplement of examples covering this key stage illustrates the outcomes you can expect for each year group. You will, of course, also have to take account of the range of ability in the class. As a starting point, ask the school for information about the children that you are to teach. Once you have taught them, you will be able to make your own assessments to guide your planning and teaching.

4.4 WHAT SHOULD I EXPECT CHILDREN TO BE ABLE TO DO AND UNDERSTAND?



Reading

Mathematics attainment targets are detailed in the fold-out end section of the *National Curriculum Handbook for primary teachers in England* (1999) pp8–15.

www.nc.uk.net/servlets/NCFrame?subject=Ma&KeyStage=1

www.nc.uk.net/servlets/NCFrame?subject=Ma&KeyStage=2

The *Framework* key objectives and the supplement of examples give you indications of what children should be able to do and understand and can be used as on-going assessment throughout the year, at the end of a unit of work, at the end of the half-term or end of term/year. The NC level descriptions are meant for end of key stage assessment only. Further help is available in the Qualifications and Curriculum Authority's (QCA) documents:

- *Teaching mental calculation strategies: guidance for teachers at key stages 1 and 2* (1999);
- *Teaching written calculation strategies: guidance for teachers at key stages 1 and 2* (1999);
- *Standards in mathematics: exemplification of key learning objectives from Reception to Year 6* (1999).

Whereas these items are helpful on a day-to-day basis, the NC attainment targets are more useful for target setting and gauging children's performance over longer periods of time and at the end of the key stage. At key stage 1, children are expected to work within levels 1–3, with most of them reaching level 2 by the end of the key stage.

This section focuses on:

- 5.1 What mathematics should be taught at key stage 2 and how the *Framework for teaching mathematics from Reception to Year 6* and National Curriculum (NC) are linked;
- 5.2 How to pitch work at an appropriate level for the age and ability of the children;
- 5.3 What children should be able to do and understand by the end of key stage 2.

5.1 WHAT MATHEMATICS SHOULD I TEACH AT KEY STAGE 2?



Reading

To check the requirements of the mathematics curriculum at key stage 2, read the *National Curriculum Handbook for primary teachers in England (1999)* pp67–74.

www.nc.uk.net

For more information, see *Chapter 5: Section 7: Planning mathematics lessons*

The NC mathematics sets out what must be taught at key stage 2. You must be fully conversant with the requirements if you are to teach at this key stage. You will also need to be familiar with the teaching programmes for Years 3 to 6 in the *Framework for teaching mathematics from Reception to Year 6*, which sets out key objectives for each year group. The guidance it contains will help you to identify the specific mathematics that is relevant to the year group or groups you are to teach.

Remember that you are also required to provide opportunities for children to develop and apply their information and communication technology (ICT) capability and to use ICT to support their learning. Non-statutory guidance (grey type) within the margins of the PoS highlights suitable opportunities in mathematics. Further guidance on using ICT to support mathematics is available in a free training pack (see page 92).

You will need to find out how the school has organised the teaching of mathematics. For example, ask whether the school sets children in ability groups, and which year groups are represented in the class you will teach. The answers to these questions will influence what you teach. If possible, find out from the mathematics co-ordinator or head teacher the topic on which the class is working and what they have done already. Check whether detailed medium-term and short-term plans are available that you can use to guide your teaching. If not, use the teaching programmes and supplement of examples, appropriate to the age of the children, from the *Framework* to develop your own plans. You must be prepared and able to teach the whole curriculum in order to meet the demands of the school's planned mathematics programme.

5.2 HOW DO I KNOW AT WHAT LEVEL TO PITCH MY TEACHING TO MATCH THE AGE OF THE CHILDREN IN MY CLASS?

For more information, see Chapter 5: Sections 2, 5, 6 and 7

All schools should have detailed medium-term teaching plans that show what mathematics you should teach. These will help you to pitch your work at the most appropriate level. If they are not available, follow the guidance in the *NNS Framework*. Its yearly teaching programmes identify the mathematical concepts that should be taught in each year group at key stage 2. The supplement of examples covering this key stage illustrates the outcomes you can expect for each year group. You will, of course, have to take account of the range of ability in the class. As a starting point, ask the school for information about the children that you are to teach. Once you have taught them, you will be able to make your own assessments to guide your teaching.

5.3 WHAT SHOULD I EXPECT CHILDREN TO BE ABLE TO DO AND UNDERSTAND?



Reading

The mathematics attainment targets are detailed in the fold-out end section of the *National Curriculum Handbook for primary teachers in England (1999)* pp8–15.

The *Framework* key objectives and the supplement of examples give you indications of what children should be able to do and understand, and can be used as on-going assessment throughout the year, at the end of a unit of work, at the end of the half-term or end of term/year. The NC level descriptions are meant for end of key stage assessment only. Further help is available in the QCA documents:

- *Teaching mental calculation strategies: guidance for teachers at key stages 1 and 2 (1999)*;
- *Teaching written calculation strategies: guidance for teachers at key stages 1 and 2 (1999)*;
- *Standards in mathematics: exemplification of key learning Objectives from Reception to Year 6 (1999)*.

Whereas these items are helpful on a day-to-day basis, the NC attainment targets are more useful for target setting and gauging children's performance over longer periods of time and at the end of the key stage. Key stage 2 children are expected to work within levels 2–5, with most of them reaching level 4 by the end of the key stage. Exceptional children may reach level 6 by the end of the period of study.

Chapter 5: Section 6: Securing progression in children's mathematical learning

This section focuses on:

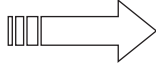

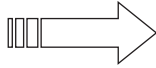
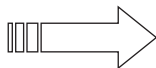
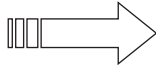
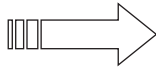
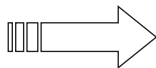
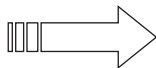
- 6.1 The stages of development in learning and applying mathematics
- 6.2 How to break down each development stage into small, progressive teaching units;
- 6.3 The key aspects of mathematics that underpin progression;
- 6.4 How to identify what children already know and can do;
- 6.5 How each successive key stage builds on the previous one and what to do when children have completed the required mathematics at their key stage;
- 6.6 What to do when children have not developed the knowledge, skills and understanding of the previous key stage.

6.1 WHAT ARE THE STAGES OF DEVELOPMENT IN MATHEMATICS THROUGH WHICH CHILDREN SHOULD PROGRESS?

Children's initial understanding of mathematics will be based on practical experiences and talking about their mathematical ideas. Effective teaching will enable them to progress towards a more abstract and precise understanding, to apply their knowledge, skills and understanding to establish general concepts and to make effective use of mental and written procedures.

The stages of development and progression in mathematics are summarised in the *Initial Teacher Training National Curriculum for Primary Mathematics*. These are represented in table 1 overleaf.

Table 1: A summary of the stages of development and progression in mathematics (based on *Initial Teacher Training National Curriculum for Primary Mathematics*, section A2b)

Progress from		To
Using informal mathematical vocabulary		Using precise, correct mathematical vocabulary, notation and symbols
Counting, ordering and sorting small whole numbers		Using and approximating numbers within the extended number system Using number operations to calculate accurately and efficiently
Guessing unknown numbers as a basis for trial and improvement Forming simple statements with unknowns		Solving simple equations using inverse operations Manipulating algebraic symbols Constructing general expressions
Sorting and classifying shapes Identifying properties		Transforming shapes Recognising invariant properties Using precise geometric language
Using simple drawings and diagrams to represent mathematical ideas		Using conventional diagrams, graphs and notation
Measuring with non-standard units		Understanding common systems of measurement Using them to measure and calculate angle, length, mass, area, volume, capacity, speed and time Giving approximate answers and estimates
Collecting discrete data by counting Recording data with simple diagrams and graphs		Handling both discrete and continuous data Classifying, representing and interpreting data, employing more sophisticated graphical forms and summary statistics

6.2 WHERE CAN I GET HELP TO BREAK THE DEVELOPMENT STAGES DOWN INTO TEACHING UNITS?

All schools will have a scheme of work for mathematics and the medium- and short-term plans for your class should provide most of the help you need to plan lessons that enable children to make progress. If any of these are not available or you need further help, use the Stepping Stones in the *Curriculum guidance for the foundation stage* (2000) or the *Framework* yearly teaching programmes and planning grids for Reception, key stage 1 and key stage 2. Ask the subject co-ordinator about the resources used in school.

6.3 ARE THERE KEY ASPECTS OF MATHEMATICS THAT INFLUENCE CHILDREN'S PROGRESS?

The following key aspects of mathematics are vitally important because they underpin progression:

- structures and operations;
- equivalence;
- classification;
- diagrammatic, graphical and algebraic representation;
- methods and applications.

6.4 HOW CAN I FIND OUT WHAT THE CHILDREN ALREADY KNOW AND UNDERSTAND?



Think About

If the tasks involve recognising and investigating number patterns, you could delay setting the parameters of the pattern until you are clearer about the complexity children could handle. Open-ended tasks will allow children to demonstrate their capability. You could ask them to establish the rule that governs the pattern and to make up and describe patterns of their own which have a similar rule, or to investigate the effect of using different starting points.

- If the class teacher's current weekly or fortnightly plan or recent lesson plans are available, they will help by reflecting the teacher's perceptions of children's existing attainment.
- Look at the children's books before the lesson to find out what work they have done to date, at which level they are working and how well they have coped with the activities set. These will also give you some clues as to the teaching methods with which they are familiar – is there evidence of investigative work, for example?
- If your appointment is at such short notice that you do not have time to look at any of these, use as your starting point the *Stepping Stones* in the *Curriculum guidance for the foundation stage* (2000).
- If the school has more than one form entry, take the opportunity to talk to the parallel class teacher.
- The oral and mental starter part of the lesson might help you to gain an overall picture of attainment in the class and to identify any particular children who might need extra support or extension work.

During the main teaching activity, plan tasks that are flexible so that, if necessary, you can vary them in the light of what you have learned from the first part of the lesson.

Once you are clear about what the children know, find this point in the *Stepping Stones* for the foundation stage and the teaching programmes and supplements of examples in the *Framework*. These documents will help you to identify the next steps that you need to teach. You may need to draw on work in programmes for younger or older children to meet the needs of children with different levels of ability. If you have advance notice of your appointment, the school may be able to provide you with assessment information that will give you an insight into what your children already know and can do. It is important to build assessment opportunities into lessons and use the information you gain to tailor your teaching more accurately to ensure that you are providing opportunities for all children to make progress.

6.5 WHAT SHOULD I DO WITH CHILDREN WHO HAVE COMPLETED ALL THE REQUIRED MATHEMATICS FOR THEIR KEY STAGE?

www.nc.uk.net/ld

For children who progress faster than others and exceed the expectations for their key stage, you should plan work for them based on the National Curriculum (NC) programme of study (PoS) for the next key stage. The foundation stage and NC key stages are carefully structured to ensure that progress is continuous; each key stage builds on the mathematics taught in the previous one. Within a year group, it may be necessary to draw on the foundation stage Stepping Stones or numeracy *Framework* teaching programmes for subsequent year groups in order to ensure that the most able children are challenged and continue to progress. You could also provide further challenge in the form of opportunities for children to apply their mathematics in different contexts.

6.6 HOW SHOULD I DEAL WITH CHILDREN WHO HAVE NOT YET DEVELOPED THE KNOWLEDGE, SKILLS AND UNDERSTANDING EXPECTED IN THE PREVIOUS KEY STAGE?

www.standards.dfee.gov.uk/numeracy
www.qca.org.uk/ca/5-14/

For more information about educational initiatives such as *Springboard* and *Booster lessons*, see 'Getting Started' in this series

Where possible, check with the Special Educational Needs Co-ordinator (SENCO) whether any special teaching programmes have been planned for children in your class and ask for help with planning to meet their needs. The QCA produces *Planning teaching and assessing the curriculum for pupils with learning difficulties: Mathematics*. The materials demonstrate a process for developing access to the NC and support staff in developing the curriculum to respond to the needs of pupils at each key stage. You may need to plan teaching that draws on the PoS from the previous key stage or year group. At key stage 1, children who have not yet attained the early learning goals need to continue with work from the foundation stage. For children at key stage 2, check what arrangements are in place for 'Booster lessons' (Year 6) or 'Springboard' (Year 5) for those who are expected to achieve level 3 in the key stage 2 National Curriculum tests. Examine the sample lesson plans for both 'Booster lessons' and 'Springboard' on the NNS site.

Chapter 5: Section 7: Planning mathematics lessons

This section focuses on:

- 7.1 How to use the foundation stage curriculum, the National Curriculum (NC) and the *Framework* to plan effective lessons appropriate to the age of the children taught;
- 7.2 What features to include in a mathematics lesson or series of lessons;
- 7.3 How to cater for a range of children's abilities and needs;
- 7.4 How to plan lessons for mixed-age classes that meet the needs of all children and the curriculum.

7.1 WHAT IS EFFECTIVE PLANNING?

Foundation stage

For more information, see Chapter 5: Section 3: *Mathematical development at the foundation stage*

Activities should be practical and oral. They should provide children with opportunities to explore key concepts in a wide range of contexts. For example:

- play;
- talk;
- observe;
- plan;
- question;
- experiment;
- test;
- respond to each other and to adults.
- chant;
- record;
- recite;
- repeat;
- recall;
- practise;
- reflect;

Your direct teaching and interventions should focus on developing and extending children's mathematical knowledge.

From Reception onwards

For more information, see Chapter 5: Section 2: *The National Numeracy Strategy*

Children should experience the structured lesson format recommended by the *Framework* by the end of Reception:

- special guidance is provided in the numeracy *Framework* to help teachers of Reception children;
- lessons at **key stage 1** should last about 45 minutes and 50 to 60 minutes at **key stage 2**;
- in each lesson, plan:
 - a starter activity with the whole class lasting 5 to 10 minutes to rehearse, sharpen and develop oral and mental skills;
 - a main teaching activity for 30 to 40 minutes in which you plan to teach an activity or a series of shorter activities to the whole class or a group. In this period, the children may work together as a class or in groups, pairs or as individuals. Take care to keep the number of groups and different activities manageable and ensure that all children are working on the same mathematical topic;
 - a whole-class plenary of 10 to 15 minutes at the end of the lesson to consolidate and/or extend what children have learnt in the lesson.



Reading

Guidance on points to consider when planning a mathematics lesson at the foundation stage:

Curriculum guidance for the foundation stage (2000) pp12–16

Framework for teaching mathematics from Reception to Year 6 (1999) pp26–29

www.standards.dfes.gov.uk/numeracy/teaching_resources/

Throughout the lesson, you should aim to spend as much time on the direct teaching and questioning of children as possible.

7.2 IS THERE A SET FORMAT FOR PLANNING MATHEMATICS LESSONS?



Reading

The *Framework* provides planning grids for each term, but schools are not obliged to use them. The section on planning (pp38–43) provides some general principles.

www.standards.dfes.gov.uk/numeracy/teaching_resources/

www.standards.dfes.gov.uk/numeracy/

There is no set format for planning mathematics lessons, but individual schools may have adopted a common format for all classes. Preparing written lesson plans is an important way of ensuring that you cover all the learning and teaching activities intended. For example, they can help you to keep track of the activities each group has undertaken and of the groups that have worked independently or with you or an adult helper. If you annotate your plans after the lesson, they become a record of the work covered and the issues that arose, which will help you or the class's regular teacher to plan future work.

Your lesson plans should be based on short-term (weekly or fortnightly) topic plans. These may be available from the teacher you are replacing. If you have to produce your own short-term plans, base them on the school's medium-term plans or, if these are not available, on the teaching programmes, planning grids and supplements of examples in the *Framework*. Further guidance and examples are available on the NNS website.

Lesson plans should:

- make clear what you want the children to learn. This should relate to the objectives shown in the *Framework* teaching programme for the age group you are to teach;
- note the mathematical vocabulary you need to introduce or consolidate;
- identify what the children will be doing;
- identify what you will be doing;
- identify modifications and support, such as the use of other adults, simplifications, extensions and challenges, as appropriate;
- include a note of the resources you will use;
- identify key questions to ask;
- note assessment opportunities, as these will prompt you to make sure the resources you need are available and that you allocate time for assessment and plan appropriate activities.

www.mathsyear2000.org/



Think About

Sample numeracy lesson plans covering all age groups, together with helpful tips on teaching the activities, are available on the NNS website. Many more teaching ideas, resources and lesson plans are available on the internet and the number and range are growing rapidly. Try the *Count on* website. This site is a continuation of the Maths Year 2000 site and retains the same web address.

If you have to teach a lesson at short notice, you will not have time to plan in detail. Find out as much as you can about the topic and what the children have learned so far, then note the learning objectives for the lesson and what you intend to cover in the oral/mental and main teaching sections. During the lesson, as you see how the children respond, you can decide how best to use the plenary to consolidate and develop the intended learning.

7.3 HOW DO I TAKE ACCOUNT OF CHILDREN'S DIFFERENT NEEDS WITHIN A NUMERACY LESSON?

For more information about inclusion, see 'Getting Started' in this series

Whereas the foundation stage areas of learning and NC PoS tell you what mathematics to teach during a key stage, the *Stepping Stones* and *Framework* teaching programmes and planning grids help you to plan your teaching in detail.

The NC includes helpful general guidance on providing effective learning opportunities for **all** children, based on three key principles:

1. setting suitable learning challenges;
2. responding to children's diverse learning needs;
3. overcoming potential barriers to learning and assessment for individuals and groups of children.

The three principles for inclusion are statutory. The additional non-statutory guidance and examples, in grey type, are helpful and will assist your planning.



Reading

Find out the statutory requirements for inclusion and gain an understanding of ways in which you can provide effective learning opportunities for all children by reading the *National Curriculum Handbook for primary teachers in England* (1999), pp30–37. For guidance on meeting diverse needs at the foundation stage, read *Curriculum guidance for the foundation stage* (2000) pp17–19. The *Framework* provides specific guidance on catering for a variety of needs within mathematics lessons. Find out what the *Framework* has to say about meeting different needs by reading pp19–24.

7.4 HOW DO I MAKE SURE THAT CHILDREN IN MIXED-AGE CLASSES COVER THE FULL CURRICULUM FOR THEIR KEY STAGE?

www.standards.dfes.gov.uk/numeracy/teaching_resources/

The solution is to cover the same topics but group children so that you can provide work for them at appropriate levels. The five strands used throughout the *Framework* and the layout of the supplements of examples for Reception, a mixed Reception/Year 1 class, Years 1–3 and 4–6 will help you to vary your teaching according to the age and abilities of the children. Having the same or similar structure for activities can make teaching more effective and the plenary more relevant.



Reading

Read the guidance on planning within mixed-age classes in the *Framework*, pp24–26. Further guidance and sample plans for mixed age classes can be found on the NNS website at: www.standards.dfes.gov.uk/numeracy

Chapter 5: Section 8: Using ICT to support the teaching and learning of mathematics

This section focuses on:

- 8.1 The National Curriculum information and communication technology (ICT) requirements;
- 8.2 Some ways in which ICT can support teaching and learning in mathematics;
- 8.3 Some different ways of using ICT within a lesson;
- 8.4 What you need to know and be able to do.

8.1 DO I HAVE TO USE ICT IN MATHEMATICS LESSONS?

For more information about these materials for ICT, see 'Filling the Gaps' in this series

The National Curriculum (NC) includes a general teaching requirement for children to be given opportunities to develop their ICT capability and use ICT to support their learning in all subjects. Whilst its use in some subjects is exempt or discretionary, the requirement applies to mathematics at key stages 1 and 2. This requirement also covers the use of calculators. There is no requirement to use ICT in mathematics at the foundation stage.

8.2 HOW CAN ICT SUPPORT TEACHING AND LEARNING IN MATHEMATICS?



Reading

For more information about using ICT in mathematics lessons and some issues to consider, read the *Framework*, pp31–32.

www.standards.dfes.gov.uk/numeracy/
<http://vtc.ngfl.gov.uk/>
www.mape.org.uk
<http://curriculum.becta.org.uk/>

There are many ways in which ICT can contribute to effective teaching and learning in mathematics. Within the NC mathematics programme of study (PoS), some opportunities for using ICT are highlighted. There are also references to ICT, and examples, in the *Framework*. An NNS-produced training pack is available, *Using ICT to support mathematics in Primary schools* (2000). It is available for training co-ordinators and teachers and much of the pack is available online. It provides practical information on when/when not to use ICT, management issues, sample lessons, exemplar software and video case-studies showing ICT being used in classes. The potential contribution that ICT can make to the teaching of mathematics is explained in the *Framework* and can be summarised as follows.

ICT helps children to:

- explore, describe and explain number patterns;
- practise and consolidate number skills;
- take their first steps in mathematical modelling by exploring, interpreting and explaining patterns in data;
- estimate and compare measures (of length, angle, time etc.);
- experiment with and discuss patterns in number and shape and space;
- develop mathematical vocabulary, logical thinking and problem-solving skills.

8.3 HOW DO I USE ICT IN LESSONS?

Always start from mathematics learning objectives then decide whether ICT can support the teaching and learning. This will depend on what mathematics you want children to learn and whether ICT is the best resource to support your teaching and their learning. Does ICT enable them to learn more effectively than by using other means? You will also need to consider at what stage in the lesson the ICT should be used and by whom. Could it, for example, help you to manage differentiation? You could use it as an interactive teaching aid with the whole class or a group of children, or children could use it, either as a group, a pair or as individuals.



Optional Task

- Access the internet to find useful information and resources.
- Produce your own high-quality teaching materials and keep them on file.
- Adapt for use with groups of different ability or with another class.
- Explore the examples and case studies provided in the training pack or on the NNS website.

If children are to use ICT to support a mathematical activity, you will need to determine whether they all need to use it or whether the activity is only appropriate for a few. Some software allows you to vary the level of difficulty of the task, so you may decide, for example, that several groups or all children will undertake the task but at different levels to suit their needs. These important decisions must be made when you are planning your lesson and will have to take into account the availability of ICT resources.

For ideas of opportunities for using ICT in mathematics go to <http://curriculum.becta.org.uk/docserver.php?temid=89>, scroll down to the mathematics section and click on one of the following links:

- Primary Mathematics with IT
- Investigating Chocolate Bars (KS2)
- Junk Mail (KS2)
- People Logo (KS2)
- Cat and Mouse (KS2)
- Logo – Polygons (KS2)
- Identifying Vegetables By Their Smell (KS1)
- Running the School Tuck Shop (KS2)
- Turtle Trails (KS2)
- Snooker Table (KS2)

A further source of ideas and lesson plans relating to the use of spreadsheets, robots and Logo within mathematics can be found at www.kented.org.uk/ngfl/primary.html#Mathematics

8.4 WHAT KNOWLEDGE, SKILLS AND UNDERSTANDING DO I NEED IN ORDER TO USE ICT EFFECTIVELY IN MATHEMATICS LESSONS?

You will need to:

- understand how ICT can help to achieve your mathematics objectives;
- know how ICT can provide specific support for children with Special Educational Needs;
- be able to plan and organise its use in lessons;
- be able to evaluate and select suitable ICT resources, eg. calculators;
- know how to monitor and assess children's work when they are using ICT;
- be able to use common software, such as a word processor, database, spreadsheet and graphics software;
- know how to use ICT to support you in other non-teaching tasks, such as finding information and administration;
- know how legal and ethical issues affect the use of ICT (eg. copyright, data protection).

Useful reading and resources

DfES/TTA (2002) *Qualifying to teach: Professional Standards for Qualified Teacher Status and Requirements for Initial Teacher Training*. London: DfES.

DfEE (2000) *Using ICT to Support Mathematics in Primary Schools*. London: DfEE.

DfEE/QCA (1999) *The National Curriculum Handbook for primary teachers in England*. London: DfEE/QCA.

DfEE/QCA (1999) *The National Numeracy Strategy: Framework for teaching mathematics from Reception to Year 6*. London: DfEE/QCA.

DfEE/QCA (1999) *The National Numeracy Strategy: Mathematical Vocabulary*. London: DfEE/QCA.

QCA (1999) *Standards in mathematics: exemplification of key learning objectives from Reception to Year 6*. London: QCA.

QCA (1999) *Teaching mental calculation strategies: guidance for teachers at key stages 1 and 2*. London: QCA.

QCA (1999) *Teaching written calculations strategies: guidance for teachers at key stages 1 and 2*. London: QCA.

QCA (2000) *Curriculum guidance for the foundation stage*. London: QCA.

Websites

Please note that the websites referred to throughout the chapter have not been reproduced here. At the time of publication, the DfES is in the process of changing the stem of some of its website addresses from *www.dfee* to *www.dfes*. Should you be unsuccessful in making a connection with the address we have provided here, try typing in the alternative stem followed by the rest of the address. You may need Adobe Acrobat Reader™ to view/download any documents available on these websites.

Please note that the websites referred to throughout the chapter have not been reproduced here.

www.becta.org.uk

Becta (British Educational Communications and Technology Agency).

www.canteach.gov.uk

Information on publications for trainee teachers for developing mathematical knowledge.

www.qca.org.uk

QCA.

www.qca.org.uk/ca/5-14/age_related.asp

QCA site for curriculum planning for pupils.

www.canteach.gov.uk/community/itt/requirements/index.htm

Teaching Training Agency (Requirements for Initial Teacher Training).

www.vtc.ngfl.gov.uk/

Virtual Teachers' Centre.