



Planning, teaching and assessing the curriculum for pupils with learning difficulties

# Mathematics



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## Introduction

### What is the purpose of this guidance?

This guidance supports the planning, development and implementation of the curriculum for pupils with learning difficulties. It draws on effective practice across a range of schools and can be used in mainstream and special primary and secondary schools, specialised units and independent schools. It also provides support to the range of services that work with these schools.

The guidance can be used with the school's own material, the national curriculum and the frameworks for teaching literacy and mathematics to:

- confirm the statutory entitlement to learning for all pupils and build on the principles of inclusion set out in the national curriculum
- help schools develop an inclusive curriculum by:
  - setting suitable learning challenges
  - responding to pupils' diverse learning needs
  - including all learners by overcoming potential barriers to learning and assessment
- provide a stimulus to revisit and revise existing schemes of work or a basis to develop new ones.

### Who are the pupils?

The guidance relates to all pupils aged between 5 and 16 who have learning difficulties, regardless of factors such as their ethnicity, culture, religion, home language, family background or gender, or the extent of their other difficulties. This includes pupils who are unlikely to achieve above level 2 at key stage 4. (These pupils are usually described as having severe or profound and multiple learning difficulties.) This also includes pupils with learning difficulties who may be working at age-related expectations in some subjects but are well below this in others. (These pupils, along with those with other significant difficulties, are often described as having moderate learning difficulties.)

### Who is the guidance for?

The guidance supports the work of a range of adults who are concerned with meeting the needs of pupils with learning difficulties. This includes class teachers, subject coordinators, special educational needs coordinators (SENCOs), senior managers, teaching assistants, parents,

carers, governors, therapists, local authority and advisory support services, and professionals from health, social services and the voluntary sector. Throughout these materials, the term 'staff' is used to refer to all those concerned with the education of these pupils.

## What is in the guidance?

The guidance contains:

- support on developing and planning the curriculum
- support on developing skills across the curriculum
- subject materials on planning and teaching and assessing each national curriculum subject; religious education (RE); and personal, social and health education (PSHE) and citizenship. These include descriptions of pupils' attainment showing progress up to level 1 of the national curriculum, which can be used to recognise attainment and structure teaching.

## What are the subject materials?

The subject materials support staff in planning appropriate learning opportunities. The materials do not represent a separate curriculum for pupils with learning difficulties or an alternative to the national curriculum. They demonstrate a process for developing access to the national curriculum and support staff in developing their own curriculum to respond to the needs of their pupils at each key stage. The materials offer one approach to meeting this challenge. Schools may already have effective structures or may wish to adopt different approaches.

The materials identify learning opportunities relevant to each subject. They demonstrate appropriate learning across the scope of the national curriculum from the earliest levels. They are intended to increase schools' confidence in their capacity to provide appropriate access to the national curriculum.

A common framework for these materials has been used. In each subject, appropriate learning for pupils with diverse needs at each key stage has been identified. Those aspects of the programmes of study that may create particular difficulties are also discussed, as well as aspects that may be unsuitable at a particular key stage. The suggested activities can be used to develop ideas for relevant, accessible and challenging experiences in curriculum plans.

## Responding to pupils' needs when teaching mathematics

### The importance of mathematics to pupils with learning difficulties

Mathematics can provide pupils with powerful ways of exploring, investigating and understanding the world. The potential to apply the skills of making comparisons, identifying differences, investigating relationships and establishing connections reflects the importance of the subject across the curriculum during the school years. Mathematics is vital in everyday life as it encourages logical reasoning and the ability to think in abstract ways. At the earliest stages of development, where thinking centres around concrete situations and events, pupils strive to make sense of experiences and sensations that involve changes in pattern, quantity, space and time. Such experiences help them approach problem situations flexibly, to move from random to trial and improvement responses, and on to anticipate and predict. Increasingly, pupils will plan and reflect and come to recognise and evaluate alternative solutions. In this way, mathematical skills and understanding build on the earliest perceptual and cognitive learning.

In particular, mathematics offers pupils with learning difficulties opportunities to:

- build on their awareness of events and actions to recognise changes in pattern, quantity and space in their immediate environment and in the wider world
- use their developing awareness to anticipate and predict changes
- use their awareness and developing understanding of pattern, space, shape and number, to develop problem-solving skills that contribute to making choices, taking decisions and gaining control over their immediate environment
- extend mathematical skills, experiences and understanding which allows them to visualise, compare and estimate. For some pupils this will be achieved in abstract as well as concrete contexts
- begin to think about the strategies they use and explain them to others
- develop a powerful set of thinking tools to help them increase their knowledge and understanding of the world and, during the school years, to learn effectively in different subjects across the curriculum.

In response to these opportunities, pupils can make progress in mathematics by:

- increasing the breadth of their mathematical experience
- moving from an awareness of mathematical properties through using such information to anticipate and predict and then actively solve problems
- developing the ability to form mental representations of increasingly complex and detailed mathematical information
- communicating their understanding to others with increasing clarity
- using mathematical information to make choices and decisions in an increasing range of contexts.

### Modifying the mathematics programmes of study

The statutory inclusion statement of the national curriculum requires staff to modify the programmes of study to give all pupils relevant and appropriately challenging work at each key stage. Staff should teach knowledge, skills and understanding in ways that match and challenge their pupils' abilities.

Staff can modify the mathematics programmes of study for pupils with learning difficulties by:

- choosing material from earlier key stages
- maintaining, reinforcing, consolidating and generalising previous learning, as well as introducing new knowledge, skills and understanding
- focusing on one aspect, or a limited number of aspects of the age-related programmes of study, in depth
- using everyday activities, shared routines and events, which capture and hold pupils' attention and interest, as the starting point for mathematics
- integrating aspects of mathematical understanding into the development of skills and understanding that form part of accredited awards and schemes at later key stages.

This guidance complements the mathematics national curriculum programmes of study and the work of the National Numeracy Strategy (NNS). It also draws on the *Practice guidance for the early years foundation stage* (DCSF00266-2008BKT-EN) and the early learning goals for problem solving, reasoning and numeracy. The learning objectives of



the frameworks for teaching numeracy and mathematics in the Primary and Secondary National Strategies can also be used to support planning. These materials, together with the national curriculum breadth of study, provide the context for coverage and the development of skills at an appropriate level for each pupil.

## Number

In modifying the sections of the programmes of study for number, the main focus will be to build on pupils' earliest perceptual awareness of quantity. Before they develop counting skills, pupils use this awareness to anticipate, to predict and to modify their actions. The contexts that will reinforce this early awareness and may help pupils to progress involve one, two or three items, events or sensations. These contexts change as staff add or subtract items and increase or decrease the number of events. For some pupils, the contexts include contrasting one and lots of objects. Introducing a formal system of counting, when relevant, will support pupils' increasing awareness of number. This development, in turn, may be supported by appropriate activities that involve manipulating numbers in concrete situations at first, then mentally and symbolically. The language used to support the development of number skills should be focused on essential vocabulary.

Teaching number across the key stages can help pupils to:

- develop awareness of number and differences in number and use this awareness to refine their responses
- acquire the skill of counting as an important tool in everyday situations
- use counting and numbers to plan and make decisions
- begin to solve number problems practically and mentally
- become familiar with numerical symbols and manipulate numbers in concrete and abstract situations.

## Algebra

The thinking skills and understanding that algebra is based on involve seeing relationships, making connections and deducing rules. A modified programme will build on familiar, practical situations that enable pupils to predict what will come next, and what action or response will lead to a familiar outcome. It will provide opportunities to make connections between symbols and events, *for example, pupils may use relevant photographs or symbols to represent a sequence of classroom events to*



help them find a particular location, such as the hall for assembly. To develop their recognition of patterns and relationships, there will be an emphasis on supporting pupils' predictions at appropriate levels. Opportunities to explore and investigate existing situations may help pupils move towards creating their own patterns and rules. A clear focus on key mathematical language and opportunities to use invented signs and symbols may help them to share their perceptions.

Teaching algebra across the key stages can help pupils to:

- develop awareness of patterns in their immediate environment in response to visual, auditory, or tactile sensations
- explore patterns and make predictions
- create patterns and communicate them to others
- deduce or suggest rules that govern a sequence.

### Shape, space, geometry and measures

In modifying the sections of the programmes of study for shape, space, geometry and measures, the main focus will be to build on the way pupils respond to similarities and differences, *for example, in position, movement, size, weight, duration and temperature.* (In the international system of units, kilogram is the unit of mass. In practice, mass is measured by weighing; scales measure or compare a force. In the national curriculum for key stages 1 and 2, it is considered acceptable to treat weight as synonymous with mass.) Relevant experiences and opportunities for exploration, and investigation move from simple activities, in which pupils might respond by trial and improvement, to more complex situations to a more precise response. *For example, pupils move from altering their reach to grasp a new and desirable item to arranging shapes or solving spatial problems in a more focused way.* Such experiences within shape, space, geometry and measures can help pupils to organise and classify their environment in a meaningful way.

Teaching shape, space, geometry and measures across the key stages can help pupils to:

- develop their awareness of position, distance, movement and direction, and use their awareness to refine their responses
- develop their awareness of shape, size and weight and begin to use their understanding to recognise similarities and differences

- develop their awareness of time, duration and the sequence of everyday events
- use simple criteria to classify objects in their environment, measure by direct comparison and, later, use standard measures to help them plan or make decisions
- acquire mathematical language associated with shape, space and measures and use directional symbols.

### Handling data and statistics

In modifying the sections of the programmes of study for handling data and statistics, the main focus will be to build on familiar and routine activities to provide new ways of thinking about them. At the earliest stages, contexts will include representing a situation by arranging the real objects involved in a way that makes information about them clearer. A modified programme will involve connecting photographs and objects to people and events. The emphasis in interpreting data will be on similarities and differences, and may move towards drawing conclusions about changes and trends.

Teaching handling data across the key stages can help pupils to:

- associate an object, and later a symbol, with a real event, person or item
- use symbols to represent events, people and items
- represent information or data in a variety of forms and describe them to others
- select information that is of particular relevance or interest to be represented and, once collected, draw conclusions from the outcome.

### Improving access to the mathematics curriculum

Staff can make mathematics more accessible by:

- presenting materials, activities, and resources that pupils can experience and understand through sight, sound, touch, taste or smell
- modelling how the materials can be used in a mathematical context
- using alternative and augmentative communication modes to support understanding
- using visual imagery, *for example, fingers and tally marks*, to help develop an understanding of more abstract symbols

- using events and objects that are relevant and motivating for pupils, *for example, where changes make an impact on them*
- using everyday events and games that are well-established, as well as new activities, to give opportunities for noticing changes and differences in quantity, pattern, space, and time
- emphasising mathematical language and modelling its use in concrete situations, *for example, using consistent and relevant cues*
- encouraging pupils to visualise and form mental images, *for example, where items are partially obscured or hidden*
- introducing new skills and concepts by building on those that are well-established and using small numbers of items or events which reduce the load on memory and other information processing skills
- recognising potentially motivating contexts and using them to support the consolidation and extension of learned skills.

Mathematics can help pupils to develop their broader communication and literacy skills through encouraging interaction with other pupils as well as staff. With some pupils, communication and literacy skills will develop through using a range of visual, written and tactile materials, *for example, large print, symbols and symbol text*. These skills also develop as pupils use information and communication technology (ICT) and other technological aids. Other pupils' skills develop as they use alternative and augmentative communication, *for example, body movements, eye gaze, facial expressions and gestures including pointing and signing*.

## Opportunities and activities at key stage 1

Much of the mathematics programme of study at key stage 1 is relevant to pupils with learning difficulties. With modification, it can provide stimulating and challenging learning opportunities.

The focus of teaching mathematics at key stage 1 may be on giving pupils opportunities to:

- explore their environment to get first hand experience of differences in space, shape and quantity
- develop an awareness of simple patterns and relationships
- use this awareness to anticipate and predict within routines or familiar situations
- develop a system for communicating this awareness and, where appropriate, start to acquire specific mathematical language (including number words) in familiar or everyday practical contexts
- take part in activities that involve counting.

Given these opportunities in mathematics at key stage 1:

<p><b>all</b> pupils with learning difficulties (including those with the most profound disabilities)</p>	<p>have opportunities to develop their awareness of events in their immediate world through experience or exploration. They may develop awareness of pattern and quantities (1, 2, 3 and lots) in sequences of sounds or other sensations.</p>
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<p><b>most</b> pupils with learning difficulties (including those with severe difficulties in learning) who will develop further skills, knowledge and understanding in most aspects of the subject</p>	<p>respond to mathematical information including position, shape and small quantities in active exploration, investigation and play. They begin to make connections, <i>for example, in a short, familiar sequence they connect an event with the one that usually follows.</i> They begin to share in aspects of counting tasks in concrete situations.</p>
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a few pupils with learning difficulties who will develop further aspects of knowledge, skills and understanding in the subject count small numbers in everyday contexts and use their knowledge of the sequence of numbers to develop early reasoning in mathematical situations. They start to use mathematical language and to use their counting skills when they solve simple, practical problems. They can be helped to develop a system for recording, *for example, a tally system*. They make simple measurements by direct comparison.

Some parts of the key stage 1 programme of study may be too demanding for some pupils. Staff will need to use their judgement, together with knowledge of each pupil's attainment and pace of learning, before making decisions about the application of particular parts of the subject. Such parts may become less demanding as pupils get older, but it may not be appropriate to teach these parts to some pupils during this key stage. It may be more appropriate to draw on materials from *Practice guidance for the early years foundation stage* (DCSF00266-2008BKT-EN).

Pupils at key stage 1 are encouraged to explore and to investigate using both familiar, preferred contexts as well as new events designed to attract their interest and curiosity. The following opportunities and activities should complement the planning guidance in the framework for teaching mathematics from reception to year 6 and focus on supporting the earliest stages of the development of mathematical skills and understanding.

### Number patterns

*Pupils develop an awareness of number patterns in number activities*

They may:

- experience number patterns in a variety of contexts: visual, auditory, kinaesthetic and tactile, *for example, they feel beats of one and two on a resonance board, they see another child jumping one, two and three times, they hear two short rings of the school bell to indicate that it is dinner time*. With repetition, they show signs of anticipation by waiting or becoming still

- shift their attention between one, two or three less familiar or new events or items, *for example, look briefly at the first and then the second, or even third, puppet as it appears noisily before them, and then look back at the first*
- observe two items being hidden, *for example, in sand, water or bubbles, and search for both of them or indicate an awareness that there is another by looking towards its location*
- make identical simple patterns, *for example, taking turns to shake maracas twice, to put two marks on each picture of a ladybird, to knock two towers down.*

### Number skills

*Pupils develop a knowledge of some of the skill elements of counting in number activities*

They may:

- respond to familiar counting rhymes and demonstrate an understanding of the distinct context, *for example, making appropriate gestures or actions*
- share in some aspects of the counting task, *for example, through pointing or tagging as each item is counted or communicating the sequence of number words.*

### Understanding of space

*Pupils develop an understanding of space, position and movement in work on shape, space and measures*

They may:

- locate sources of sensation, *for example, turning towards lights or sounds*
- locate familiar items or people in the usual places
- communicate where an item is missing or not in an expected location
- follow a sequence of stepping stones between each activity.

### Understanding of shape

*Pupils build up their knowledge of the properties of shape in work on shape, space and measures*

They may:

- explore the properties of shapes, *for example, feeling outlines, straight lines, angles or curves, and demonstrate an awareness of these features by choosing to group items with straight or curved edges together*
- choose shapes to build the highest tower
- adjust their grasp to fill a jar with handfuls of smaller items, *for example, butter beans or sand*
- locate the posting hole for shapes and select the shapes that fit into it.

### Communicating

*Pupils communicate about their mathematical experiences*

They may:

- record that they have taken part in an activity, *for example, by using symbols*
- respond to mathematical language by demonstrating that they recognise simple shape and space vocabulary, *for example, round, flat, top, bottom, inside.*



## Opportunities and activities at key stage 2

Much of the mathematics programme of study at key stage 2 is relevant to pupils with learning difficulties. With modification, it can provide stimulating and challenging learning opportunities.

The focus of teaching mathematics at key stage 2 may be on giving pupils opportunities to:

- use their awareness of space, shape and quantity in responding to the environment
- compare, contrast and be aware of similarities and differences in shape, space and aspects of measurement
- match and sort, selecting their own criteria
- learn to count and use counting to find out 'how many?'
- add and subtract in practical contexts
- use numerals to represent amounts and respond appropriately to mathematical symbols
- represent mathematical information in different forms and be able to make simple deductions.

Given these opportunities in mathematics at key stage 2:

<p>all pupils with learning difficulties (including those with the most profound disabilities)</p>	<p>encounter mathematical information relating to space, shape and quantity, and anticipate events and actions. Their emerging awareness informs their actions and they may modify their responses to achieve desired objects or events. With help, they respond to patterns, <i>such as sounds or tactile cues</i>, with anticipation. Their reactions show their awareness of changes and differences in position or location and the relationship between objects in the environment.</p>
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**most** pupils with learning difficulties (including those with severe difficulties in learning) who will develop further skills, knowledge and understanding in most aspects of the subject use mathematical information to anticipate events, predict outcomes and to solve simple problems. They begin to recognise relationships and use information about objects to sort and match. The development of mathematical language and understanding helps them apply labels to small quantities, recognise and describe shapes by name, and describe positions in space. Increases in their attention span and confidence help to extend their counting skills and their ability to represent data by recording numbers.

**a few** pupils with learning difficulties who will develop further aspects of knowledge, skills and understanding in the subject count reliably and solve simple number problems in more abstract situations. They begin to understand the rules or principles of counting and use their knowledge for checking. They develop confidence in the sequence of numbers and understand 'more' and 'less'. They carry out simple additions and subtractions. With encouragement, they use mathematical language to communicate position, and to compare, *for example, differences in size, weight or quantity*. Mathematical language and understanding helps pupils solve simple spatial problems. Pupils begin to present data in different formats. With help, they interpret this data and make simple deductions.

Some parts of the key stage 2 programme of study may be too demanding for some pupils. Such parts may become less demanding as pupils get older, but it may not be appropriate to teach these parts to some pupils during this key stage. It may be more appropriate to teach the more demanding parts of the programme of study for key stage 1. Throughout key stage 2, staff can maintain and reinforce the knowledge, skills and understanding introduced during key stage 1 by applying these in different areas, and introduce new learning.

Pupils at key stage 2 are encouraged to respond to concrete, practical activities and to form mental images and communicate about these either

indirectly through their actions or directly through language. Activities need to capture and hold pupils' attention. Asking pupils to estimate and make predictions encourages mental representation. As with key stage 1, the following opportunities and activities complement the planning guidance in the framework for teaching mathematics from reception to year 6 and support the earlier stages of developing mathematical skills and understanding.

### Developing counting

*Pupils consolidate their understanding of number, including their counting skills, and use counting as a tool when they work on number activities*

They may:

- recognise sequences of sensation or movement and anticipate the next occurrence in sequence, *for example, '1, 2, 3, go'*
- use their knowledge of number to anticipate an event, *for example, when simple play routines have been established, such as variations of 'two bears diving into the water' or 'two mice appearing from their hole'*
- count reliably to 10 and recognise that 'one more' is the next number in the sequence and 'one less', the number before
- represent numbers using fingers, their own tally system of marks and then conventional numerals, *for example, keep a note of how many items are in the box, how many goals have been scored, how many pennies are in the purse*
- estimate the number of items and use counting to confirm the result, *for example, when watching items being put into a tin*
- use their perception to estimate and then count to find out which group is larger or smaller.

### Shape, space and measures

*Pupils make direct comparisons between everyday objects in their environment as they work on shape, space and measures*

They may:

- shift their gaze between items and respond selectively to them, *for example, smiling at preferred events, reaching out for an item nearby*
- compare and make choices on the basis of length, weight, height, *for example, in circuit training or carrying shopping*
- devise their own criteria to sort and match items and guess what criteria others have used
- recognise a time sequence of activities, begin to use a symbolic diary to understand the order of their day, and know times at which key events occur
- make and follow a mathematics trail to find a particular location, *for example, where the 'treasure' is hidden*
- devise and use a non-standard measure for comparing two different things, *for example, use the length of their reach.*

### Handling data

*Pupils represent information and communicate it to others in work on handling data*

They may:

- recognise that a symbol is associated with an event, person or object, *for example, show anticipation of an event, look for the person whose photograph is in the set, 'in class today'*
- use a list, sorting circles, tally or simple block graph to represent data
- interpret data, *for example, to find which set has more, less or most.*

## Opportunities and activities at key stage 3

The broad areas of the mathematics programme of study at key stage 3 are relevant to pupils with learning difficulties. Modification will involve selecting content from the corresponding areas of the programmes of study for earlier key stages and presenting it in age-appropriate contexts to provide stimulating and challenging learning opportunities.

The focus of teaching mathematics at key stage 3 may be on giving pupils opportunities to:

- form concrete and mental representations and images that help them see connections
- recognise more subtle and relative cues, that match their circumstances and maturity, involving space, shape, position, geometry and number, and develop mathematical language to support communication, *for example, describing features of shape and proportion*
- use counting in a variety of contexts and to support problem solving
- use and understand mathematical symbols in their immediate and wider environment
- use measures to support everyday activities and to explore and investigate aspects of the wider environment
- recognise the importance of strategies for checking or monitoring their mathematical solutions.

Given these opportunities in mathematics at key stage 3:

<p><b>all</b> pupils with learning difficulties (including those with the most profound disabilities)</p>	<p>have opportunities to form mental representations that relate to space, shape and quantity. Pupils may begin to develop mental representations based on concrete objects or familiar events. They may begin to respond to differences in number or size as well as location. Pupils begin to focus attention, and switch attention between attributes. Pupils encounter sequences or patterns based on appropriate cues in the environment. With help, they respond more readily to familiar sequences including those in relevant number rhymes and games, and may use anticipatory cues.</p>
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**most** pupils with learning difficulties (including those with severe difficulties in learning) who will develop further skills, knowledge and understanding in most aspects of the subject apply counting skills to making sets, adding and subtracting objects from their sets in a variety of practical contexts, including those involving money. They count up to 10 with increasing reliability and confidence. They may recognise pattern and symmetry and use this information to make predictions. They use and understand directional symbols in their immediate and wider environment. Through experience most pupils will extend their understanding of mathematical language, including the vocabulary of proportion, in everyday contexts and will reason using mathematical language, *for example, 'one fewer', 'one more' and 'half'.*

**a few** pupils with learning difficulties who will develop further aspects of knowledge, skills and understanding in the subject extend their understanding to relational or relative terms and are able to compare and contrast, to order and to sequence, *for example, they respond to mathematical terms such as 'tallest' and 'first' by selecting and placing an object in the appropriate position on a line.* They carry out more complex mathematical tasks involving repeated addition or multiplication and sharing or division and understand the relevance in practical, everyday contexts. They use symbols with more confidence and think in abstract terms about numbers. They use standard measures, including units of time, length and mass, and make comparisons.

Throughout key stage 3, staff can maintain and reinforce the knowledge, skills and understanding introduced during key stages 1 and 2, by applying them in different contexts, and introduce new learning. The following activities indicate ways in which mathematical skills and understanding can be developed.

### Solving number problems

*Pupils develop strategies to support their use of number skills to solve problems when they work on number and algebra activities*

They may:

- recognise sequences in familiar activities and contexts, *for example, the sequence of food sections in the supermarket*
- develop a consistent response to number-related vocabulary, *for example, monitor their actions to add two spoonfuls of sugar, take one biscuit, take three steps, have two people join an activity*
- monitor their own and others' counting to identify and communicate mistakes that have been made
- understand that counting can be used to make sets
- compare amounts and count on or count back to calculate how much more or less
- count on to calculate change
- appreciate when common words are used as mathematical language
- respond to and use mathematical symbols
- select a strategy or tool to make calculations, *for example, use tally marks, fingers or a calculator to add or subtract items.*



## Shape, space, geometry and measures

### *Pupils work on shape, space, geometry and measure*

They may:

- manipulate objects, explore and use different approaches to overcome difficulties when solving problems of space, shape, geometry or measure, *for example, use items as containers, turn items round to fit into a space, press air out of the item to reduce its size*
- use mathematical cues to identify an item, *for example, select an object from a set when given clues about its shape or size*
- make comparisons, estimate and use standard measures in everyday activities, *for example, to weigh ingredients, to mark out a given gardening plot*
- respond to, use and understand directional symbols, *for example, be able to follow arrows and to place them appropriately*
- recognise the time at which familiar, regular events take place, tell the time on the hour and half hour and use this information, *for example, to plan when they should start organising the tuck shop, get ready for lunch, tidy up.*

## Handling data and statistics

### *Pupils work on handling data and statistics*

They may:

- organise concrete or symbolic information so that they can understand and use it
- use numerical information to solve problems, *for example, use a clock face to work out who ran fastest*
- understand how to read and interpret a simple scale, *for example, the television display showing volume of sound, the board showing the depth of the water in the pool*
- represent data through a variety of formats that describe and enable them to compare information about important features in their lives, *for example, individual graphs about swimming performance, group graphs on youth club activities.*

## Opportunities and activities at key stage 4

The broad areas of the mathematics foundation programme of study at key stage 4 are relevant to pupils with learning difficulties. Modification will involve selecting content from the corresponding areas of the programmes of study for earlier key stages and presenting it in age-appropriate contexts to provide stimulating and challenging learning opportunities.

The focus of teaching mathematics at key stage 4 may be on giving pupils opportunities to:

- recognise symbols and mathematical representations and understand their significance in both the immediate and wider environment
- respond strategically to quantities and numerical information, from estimations, counts and measurements including time, to make choices and decisions, to plan and to anticipate outcomes
- communicate their choices to others, increasingly with explanations of their reasoning
- use mathematical knowledge and understanding to respond strategically to issues, including selecting and collecting relevant data, representing data and drawing conclusions from it.

Given these opportunities in mathematics at key stage 4:

<b>all</b> pupils with learning difficulties (including those with the most profound disabilities)	encounter a range of mathematical representations or images in different relevant contexts relating to space, shape and quantity. They may develop mental representations or images based on concrete objects and events and respond more consistently to differences in number, size and location. Pupils may begin to use information about number, size, location and pattern or sequence in their choice of objects or actions and communicate their choice.
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**most** pupils with learning difficulties (including those with severe difficulties in learning) who will develop further skills, knowledge and understanding in most aspects of the subject use a clock, with support, to track time during the day and begin to tell the time on the hour and half-hour. They use practical experience of standard measures to plan measuring and to solve problems. As well as making individual measurements confidently, they compare measurements and extend their ability to estimate and make predictions. Numerical information has meaning in a range of contexts and pupils are able to calculate for a purpose in a variety of practical situations.

**a few** pupils with learning difficulties who will develop further aspects of knowledge, skills and understanding in the subject think strategically using mathematical knowledge and understanding, communicate their reasoning and describe their strategy. They respond to problems, selecting the practical approach and mathematics they wish to use. With encouragement, they are able to evaluate their success and reflect on whether their mathematical strategy was correct.

Throughout key stage 4, staff can maintain and reinforce knowledge, skills and understanding introduced during key stages 1, 2 and 3, by applying them in different contexts, and introduce new learning.

Particular emphasis at key stage 4 is placed on pupils using and applying their mathematical skills and knowledge to make choices and decisions. Contexts for mathematical activity will include the work pupils undertake as part of accredited schemes.

## Making choices

*Pupils apply their mathematical skills and knowledge to make choices and decisions, which helps them work individually and as part of a group*

They may:

- learn and devise new symbols, including signs that are personal to them or community signs and symbols, *for example, road signs, shop signs, symbols used in timetables including TV and travel*
- use their understanding of quantity and number, estimate, count and calculate to solve practical problems, *for example, 'Is there enough bread for lunch?', 'Do we have enough teabags?' or 'How much money do I need to buy this?'*
- use their understanding of the vocabulary of shape and space and geometry to inform their actions and those of others, *for example, selecting the large one or the packet with triangles or requesting the seat at the back*
- use their understanding of fractions and proportion, *for example, to cut a pizza into quarters, fold the paper in half, use twice as much flour as fat in a mixture*
- recognise amounts of money, displayed in different ways, and use their knowledge and understanding of money when buying items
- use measures including standard measures to inform decision making, *for example, 'How much sugar do we need?' 'Do we have enough butter to make biscuits?' 'How much should we buy?'*
- use symbolic diaries to understand the order of their day and simple timetables, *for example, to plan TV viewing or radio listening, to find the starting time of films, to know when buses, coaches and trains should arrive and depart*
- extend their understanding of duration to estimate how long the journey takes and work out the appropriate departure time from home or school
- collate group or individual data and decide how to represent it to others, and consider the implications of their decisions, *for example, presenting information appropriately for a prospective college tutor or a work experience employer.*

## Performance descriptions

These performance descriptions outline early learning and attainment before level 1 in eight levels, from P1 to P8. The performance descriptions can be used by teachers in the same way as the national curriculum level descriptions to:

- decide which description best fits a pupil's performance over a period of time and in different contexts
- develop or support more focused day-to-day approaches to ongoing teacher assessment by using the descriptions to refine and develop long-, medium- and short-term planning
- track linear progress towards attainment at national curriculum level 1
- identify lateral progress by looking for related skills at similar levels across their subjects
- record pupils' overall development and achievement, for example, at the end of a year or a key stage.

The performance descriptions for P1 to P3 are common across all subjects. They outline the types and range of general performance that pupils with learning difficulties might characteristically demonstrate. Subject-focused examples are included to illustrate some of the ways in which staff might identify attainment in different subject contexts.

Levels P4 to P8 describe pupils' performance in a way that indicates the emergence of skills, knowledge and understanding in each subject. The descriptions are characteristic of the types of attainment the learners are likely to demonstrate.

### Performance descriptions across subjects

**P1 (i)** Pupils encounter activities and experiences. They may be passive or resistant. They may show simple reflex responses, *for example, startling at sudden noises or movements*. Any participation is fully prompted.

**P1 (ii)** Pupils show emerging awareness of activities and experiences. They may have periods when they appear alert and ready to focus their attention on certain people, events, objects or parts of objects, *for example, grasping objects briefly when they are placed in their hand*. They may give intermittent reactions, *for example, sometimes showing surprise at the sudden presence or absence of an event or object*.

**P2 (i)** Pupils begin to respond consistently to familiar people, events and objects. They react to new activities and experiences, *for example, becoming*

*excited or alarmed when a routine is broken. They begin to show interest in people, events and objects, for example, tracking objects briefly across their field of awareness. They accept and engage in coactive exploration, for example, lifting objects briefly towards the face in shared investigations.*

**P2 (ii)** Pupils begin to be proactive in their interactions. They communicate consistent preferences and affective responses, *for example, showing a desire to hold a favourite object.* They recognise familiar people, events and objects, *for example, looking towards their own lunch box when offered a selection.* They perform actions, often by trial and improvement, and they remember learned responses over short periods of time, *for example, repeating an action with a familiar item of equipment.* They cooperate with shared exploration and supported participation, *for example, handling and feeling the texture of objects passed to them.*

**P3 (i)** Pupils begin to communicate intentionally. They seek attention through eye contact, gesture or action. They request events or activities, *for example, pushing an item of equipment towards a member of staff.* They participate in shared activities with less support. They sustain concentration for short periods. They explore materials in increasingly complex ways, *for example, banging or rubbing objects together.* They observe the results of their own actions with interest, *for example, as they throw or drop objects on to different surfaces.* They remember learned responses over more extended periods, *for example, remembering how to activate a pop-up object from a previous lesson.*

**P3 (ii)** Pupils use emerging conventional communication. They greet known people and may initiate interactions and activities, *for example, dropping objects to prompt interventions from adults.* They can remember learned responses over increasing periods of time and may anticipate known events, *for example, collecting coats and bags at the end of the school day.* They may respond to options and choices with actions or gestures, *for example, pointing to or giving one object rather than another.* They actively explore objects and events for more extended periods, *for example, manipulating objects in piles, groups or stacks.* They apply potential solutions systematically to problems, *for example, using items of equipment purposefully and appropriately.*



## Performance descriptions in mathematics

### Using and applying mathematics

**P4** Pupils are aware of cause and effects in familiar mathematical activities, *for example, knowing that in a role-play shop a coin can be exchanged for an item; hitting a mathematical shape on a concept keyboard to make it appear on the screen.* Pupils show awareness of changes in shape, position or quantity, *for example, grouping objects that have similar key features such as shape; creating very simple sequences of light or sound using switched equipment; recalling an object which has been placed out of sight.* They anticipate, follow and join in familiar activities when given a contextual clue, *for example, anticipating the next chorus or action in songs and rhymes; matching cakes to plates.*

**P5** Pupils sort or match objects or pictures by recognising similarities, *for example, matching shoes or socks by placing next to one placed by an adult; find matching pairs from a collection of pictures; collecting objects given one criterion, eg blue or big.* They make sets that have the same small number of objects in each, *for example, distributing sweets into containers so that there are one or two in each.* They solve simple problems practically, *for example, selecting appropriate containers for items of different sizes; checking there is a knife for every fork.*

**P6** Pupils sort objects and materials according to a given criteria, *for example, sorting footballs into a net and table tennis balls into a box.* They copy simple patterns or sequences, *for example, copying a drumbeat; copying a simple pattern of repeated movements; copying a pattern of large and small cups.*

**P7** Pupils complete a range of classification activities using a given criterion, *for example, sorting a pile of coins by size, colour or shape; sorting all the blue Wellington boots; sorting all the size 6 shoes.* They identify when an object is different and does not belong to a given familiar category, *for example, removing odd items from sets; collecting items into sorting boxes or drawers.* They respond appropriately to key vocabulary and questions, *for example, 'How many?'*

**P8** Pupils talk about, recognise and copy simple repeating patterns and sequences, *for example, recognising and describing simple repeating patterns on textiles or necklaces from different cultures; recognising and describing a pattern of socks on a line; joining in a pattern of hand claps; talking about and copying patterns such as beats in familiar music; shapes made by hand and feet in damp sand; sponge prints.* Pupils use their

developing mathematical understanding of counting up to ten to solve simple problems encountered in play, games or other work, *for example, using tokens or marks to tally events or scoring in games; counting in the school environment; using ordinal words to describe positions and turns.* Pupils make simple estimates, *for example, estimating the number of cubes that will fit into a box or the number of strides across a room.*

## Number

**P4** Pupils show an awareness of number activities and counting, *for example, copying some actions during number rhymes, songs and number games; following a sequence of pictures or numbers as indicated by a known person during number rhymes and songs.*

**P5** Pupils respond to and join in with familiar number rhymes, stories, songs and games, *for example, using a series of actions during the singing of a familiar song; joining in by saying, signing or indicating at least one of the numbers in a familiar number rhyme.* Pupils can indicate one or two, *for example, by using eye pointing, blinks, gestures or any other means to indicate one or two, as required.* They demonstrate that they are aware of contrasting quantities, *for example, 'one' and 'lots' by making groups of one or lots of food items on plates.*

**P6** Pupils demonstrate an understanding of one-to-one correspondence in a range of contexts, *for example: matching objects such as cups to saucers, straws to drink cartons.* Pupils join in rote counting up to five, *for example, saying or signing number names to 5 in counting activities.* They count reliably to three, make sets of up to three objects and use numbers to three in familiar activities and games, *for example, touching one, two, three items as an adult counts, counting toys or pictures, counting out sets of three, eg knife, fork and spoon.* They demonstrate an understanding the concept of 'more', *for example, indicating that more cups, counters, food items are required.* They join in with new number rhymes, songs, stories and games.

**P7** Pupils join in rote counting to 10, *for example, saying or signing number names to 10 in counting activities.* They can count at least 5 objects reliably, *for example, candles on a cake, bricks in a tower.* They recognise numerals from 1 to 5 and understand that each represents a constant number or amount, *for example, putting correct number of objects (1 to 5) into containers marked with the numeral; collecting the correct number of items up to 5.* Pupils demonstrate an understanding of 'less', *for example, indicating which bottle has less water in it.* In practical

situations they respond to 'add one' to a number of objects, *for example, responding to requests such as add one pencil to the pencils in the pot, add one sweet to the dish.*

**P8** Pupils join in with rote counting to beyond 10, *for example, they say or sign number names in counting activities.* They continue to rote count onwards from a given small number, *for example, continuing the rote count onwards in a game using dice and moving counters up to 10; continuing to say, sign or indicate the count aloud when adult begins counting the first two numbers.* Pupils recognise differences in quantity, *for example, in comparing given sets of objects and saying which has more or less, which is the bigger group or smaller group.* They recognise numerals from 1 to 9 and relate them to sets of objects, *for example, labelling sets of objects with correct numerals.* In practical situations they respond to 'add one' to or 'take one away' from a number of objects, *for example, adding one more to three objects in a box and say, sign or indicate how many are now in the box; at a cake sale saying, signing or indicating how many cakes are left when one is sold.* They use ordinal numbers (first, second, third) when describing the position of objects, people or events, *for example, indicating who is first in a queue or line; who is first, second and third in a race or competition.* Pupils estimate a small number (up to 10) and check by counting, *for example, suggesting numbers that can be checked by counting, guessing then counting the number of: pupils in a group; adults in the room; cups needed at break time.*

### Shape, space and measures

**P4** Pupils search for objects that have gone out of sight, hearing or touch, demonstrating the beginning of object permanence, *for example, searching for an object or sound when it is removed.* Pupils match big objects and small objects, *for example, finding a big football to place in a net with other big footballs, matching a small model car with a similar sized model car.* They demonstrate interest in position and the relationship between objects, *for example, stacking or joining objects or using construction materials.*

**P5** Pupils search intentionally for objects in their usual place, *for example, going to the mathematics shelf for the box of shapes.* They find big and small objects on request, *for example, from a choice of two objects, identifying the 'big' and 'small'.* They compare the overall size of one object with that of another where there is a marked difference, *for example, they indicate which of two shoes is the bigger, compare objects – big boxes and small boxes.* They explore the position of objects, *for*

*example, placing objects in and out of containers, placing objects inside and outside a hoop, fitting as many objects as possible into a box.*

**P6** Pupils search for objects not found in their usual place demonstrating their understanding of object permanence, *for example, looking for cups when they are not in their usual cupboard.* They compare the overall size of one object with that of another where the difference is not great, *for example, identifying the bigger of two Russian dolls or nesting cubes.* They manipulate three-dimensional shapes, *for example, putting shapes into a shape sorter, using 3D objects to build and manipulate in role-play, rolling a tube in a race with a partner.* They show understanding of words, signs and symbols that describe positions, *for example, responding to a request to put an object in, on, under or inside another object.*

**P7** Pupils respond to 'forwards' and 'backwards', *for example, moving forwards and backwards on request, recognising when a vehicle is moving forwards or backwards, moving a counter forwards or backwards on a board game.* They pick out described shapes from a collection, *for example, picking out all the round shapes in the classroom, finding shapes with straight edges, fitting shapes into matching holes.* They use familiar words in practical situations when they compare sizes and quantities, *for example, using the words 'heavy' and 'light', 'more' and 'less', 'enough' or 'not enough' to compare objects or quantities.*

**P8** Pupils compare objects directly, focusing on one dimension such as length or height where the difference is marked and can indicate 'the long one' or 'the tall one', *for example, comparing two plants, placed side by side and indicating the tall one or comparing two zips and indicating the long one.* They show awareness of time, through some familiarity with names of the days of the week and significant times in their day, such as meal times, bed times, *for example, ordering events in their day on a visual daily timetable, understanding and using names of days of the week, 'no school on Saturday or Sunday, swimming on Wednesday'.* They respond to mathematical vocabulary such as 'straight', 'circle', 'larger' to describe the shape and size of solids and flat shapes, *for example, when shopping, pupils find boxes with straight edges to pack into the carrier bag; identify the larger circle when stacking two cans.* They describe shapes in simple models, pictures and patterns, *for example, stamping shapes in sand and describing them, using a set of flat shapes to make pictures or patterns, naming some of the shapes used, identifying specific shapes from pictures, simple models or patterns.*

## About this publication

### Who's it for?

This handbook is for all those who work with pupils with learning difficulties. This includes pupils who are often described as having severe, profound and multiple, or moderate learning difficulties. The guidance relates to all pupils aged 5 to 16 who are unlikely to achieve above level 2 at key stage 4.

### What's it about?

It provides support materials to schools for planning learning opportunities and activities in mathematics for pupils in each key stage. It includes performance descriptions of early learning and attainment in the national curriculum.

### What's it for?

It will be useful in developing an inclusive curriculum. It can be used in mainstream schools, special primary and secondary schools, specialised units and independent schools. It can also support the range of services that work with pupils with learning difficulties.

### Related material

This handbook is part of a set of guidance on planning and teaching the curriculum for pupils with learning difficulties. The entire set, which includes general guidance, guidance on developing skills and subject guidance, can be found on the QCA website at [www.qca.org.uk/ld](http://www.qca.org.uk/ld).

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