

# Overcoming barriers in mathematics – helping children move from level 4 to level 5



Minimum specification		
	PC	Mac
CPU	Pentium III or greater	PowerPC G4 (867MHz or faster)
RAM	128 MB	512 MB
Hard drive	100 MB space	100 MB space
CD drive	24 x speed	24 x speed
SVGA graphics card	16 bit colour	16 bit colour
Minimum screen resolution	800 x 600	800 x 600
Sound card, speakers, or headphones	16 bit	Standard
Keyboard and mouse	Yes (Microsoft compatible)	Yes
Operating system	Windows 2000 or later	Mac OS X or later

### Instructions for running the CD-ROM

Insert the CD-ROM into your CD-ROM tray. Your computer may automatically run the program if you have a feature called Auto run enabled. If it does not automatically run, try the following steps.

- For PC users, double click on My Computer to open it, and then double click on the CD-ROM icon to open the CD-ROM.
- For Mac users, double click on the CD-ROM icon on your desktop to open the CD-ROM.
- Double click on the file '**index.html**'

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## **Disclaimer**

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The websites referred to in these materials existed at the time of going to print.

Please check all website references carefully to see if they have changed and substitute other references where appropriate.

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## Introduction

Welcome to this CD-ROM-based resource. These materials are designed to help you build on the success in increasing the numbers of children who achieve level 5 in mathematics by the end of Key Stage 2. Some children still meet barriers in their learning that slow or block their progress but, with additional support, they could achieve level 5. The materials on the CD-ROM provide teaching resources and ideas upon which you can draw when planning additional support for these children. This CD-ROM is one of a set of focused materials that have been developed for mathematics. Materials to support moving children from level 1 to level 2, level 2 to level 3 and from level 3 to level 4 are already available (Refs: 00021-2009CDO-EN, 00149-2008PCK-EN and 00695-2007PCK-EN). We hope that you will find these materials useful when planning your teaching to help children working around the level 4 to level 5 border to make good progress.

## What mathematics appears on the CD-ROM?

The materials address key areas of mathematics that children working at level 4 often find challenging. While the CD-ROM includes all the Year 6 and Year 6 progression to Year 7 learning objectives for mathematics, not all these objectives have materials to support them, only those that have been identified as the most common barriers to progress.

## How were these areas of mathematics identified?

The decision about which areas of mathematics to include on the CD-ROM was informed by a scrutiny of work by children whose attainment was just below or only just above the level 4 to 5 boundary at the end of Key Stage 2. This analysis was further supported by evidence from QCA reports, research evidence and feedback from teachers and consultants. This evidence pointed to a number of common barriers in mathematics that often prevent children from making progress. These are the areas of mathematics that appear on the CD-ROM – the areas of mathematics children find difficult to learn, which are often those that are more difficult to teach.

## How do I access the materials?

The materials on the CD-ROM are accessed through the learning objectives for mathematics as set out in the Primary Framework. The objectives are organised into the seven strands of the Framework to help you match them to the Unit of work you are currently teaching. At the back of this booklet there is a sequence of charts that make links between level descriptions, common barriers to progress, the associated Year 6 and Year 6 progression to Year 7 objectives, and materials on the CD-ROM, with reference to the Blocks and Units in the Primary Framework. This provides an at-a-glance guide to support you in identifying key barriers in moving children from level 4 to level 5, pinpointing where children are having difficulties and how to move them on. The CD-ROM draws on existing materials, some of which can be found on the Primary Framework site at [www.standards.dcsf.gov.uk/nationalstrategies](http://www.standards.dcsf.gov.uk/nationalstrategies) and provides extra support and guidance on teaching approaches designed to support children in overcoming identified barriers to progress.

## Who are these materials aimed at?

The materials are designed to be used flexibly and as appropriate for your planning and teaching context. There are aspects that require intervention by you, as the teacher, drawing on your knowledge of children's progress in mathematics, for example, when using the 'Can I...?' prompts and review questions to pinpoint barriers to progress. After the barriers to learning have been identified, other elements might be used by a teaching assistant or by additional adults to support learning, or might

provide a focus for targeted intervention. These materials could be used with an individual child or with a group of children who share similar barriers to progress.

The materials are designed to be used with children who are at risk of not making the necessary progress to move from level 4 to level 5 and therefore not reaching the attainment level of which they are capable.

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## How do the materials link to the Primary Framework?

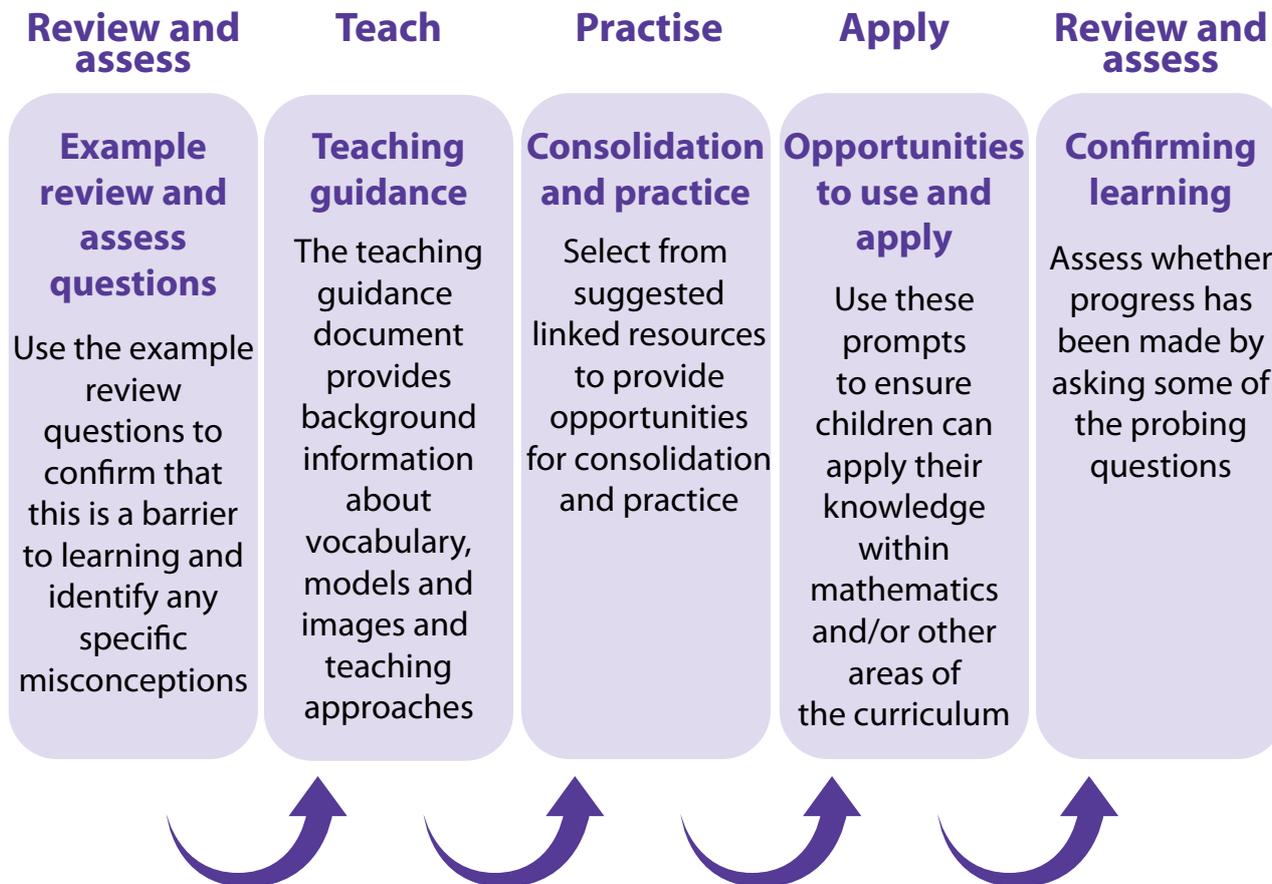
The structure of the CD-ROM follows that of the Primary Framework, with the strands and objectives providing the way into the 'Can I...?' questions and related teaching materials and resources. The grids at the end of this booklet show how these objectives fit into the Blocks and Units structure of the Framework, where further materials including 'I can...' targets and assessment for learning prompts can be found. The Assessment section of the Framework will help you to identify areas of mathematics that require additional focus with children working at the level 4 to 5 border, and the materials on this CD-ROM could then be used to help address these areas.

## How are the CD-ROM materials structured?

The entry point to access the materials has been aligned to six of the seven strands of mathematics used in the Primary Framework. The Using and applying mathematics strand is embedded throughout the materials with two specific "Can I...?" questions linked from the Counting and understanding number strand. This is to place the use and application of mathematics at the heart of the teaching and learning cycle to ensure that children have sufficient opportunity to apply their learning – and that the learning is sufficiently secure to enable them to use their mathematics in new contexts and make connections across their learning.

The materials on the CD-ROM support the cycle that underpins the Primary Framework: review and assess–teach–practise–apply–review and assess. Each stage is supported by prompts and linked materials.

The cycle is set out in more detail below to show how it informs the structure of the materials on the CD-ROM.



## How should I use the materials on the CD-ROM?

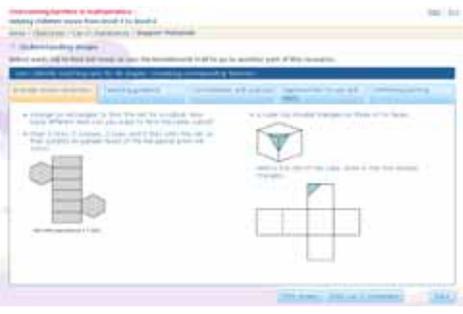
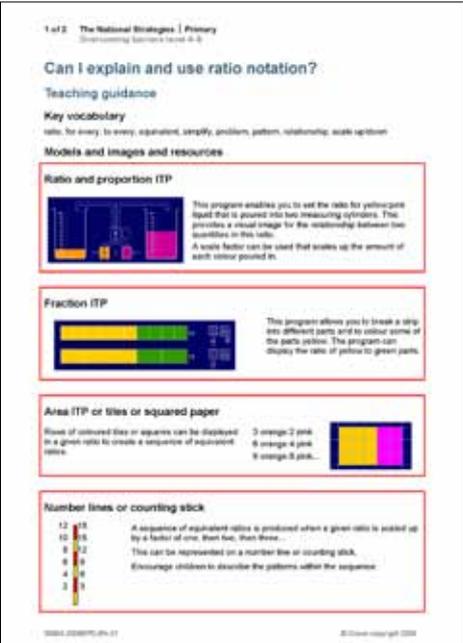
The first step in using the CD-ROM is to carry out an assessment of the children's learning to identify where support is needed. The Assessment section of the Primary Framework provides materials to support you with this. Select the objective linked to an identified barrier to learning for an individual or group of children. Then select the relevant 'Can I...?' question linked to this barrier. The tables on the next few pages explain the structure of screens on the CD-ROM and the linked resources.

## How can I make use of these materials if I am a Year 7 teacher?

While the materials are closely aligned to the Primary Framework, the Year 6 progression to Year 7 objectives were written in order to help children address some of the mathematics that is normally taught in Year 7. This means that the structure on the CD-ROM can easily be linked to the objectives identified in the Secondary Framework. When using the materials to plan Year 7 mathematics lessons start with assessment as identified above and relate the Year 6 progression to Year 7 objectives to your planned teaching objectives.



## Contents of the CD-ROM

	<p>From your tracking of children's progress and ongoing assessment you will have identified potential barriers to learning. The <b>Example review questions</b> provide support for confirming that this area is a barrier to learning for children and identifying any specific misconceptions.</p> <p>The questions might be used as starting points for discussion with small groups or individuals.</p> <p>Depending upon the area of mathematics, suggestions for closed and open-ended questions are included, and also questions requiring reasoning and discussion.</p>
	<p>The <b>Teaching guidance</b> provides background information about appropriate vocabulary, models, images and resources and teaching approaches. The list of vocabulary is a useful reference point for key vocabulary that children need to be able to use and explain. The models, images and practical materials are drawn from a variety of sources, including the interactive teaching programs, and often include some suggestions for their use. The Teaching tips section provides a few starting points for tackling the area of mathematics with children, ways of linking concepts with other areas of the curriculum, or ways of overcoming misconceptions.</p>
	<p>The <b>Consolidation and practice</b> pages provide links to a variety of existing resources that can be used by children in guided or independent work.</p> <p>The ICT resources include interactive teaching programs (ITPs) and spreadsheets. Where the ITP guide symbol appears, this links to a guidance document to support the use of ITPs.</p> <p>Further ITPs can be accessed via the mathematics subject area at <a href="http://www.standards.dcsf.gov.uk/nationalstrategies">www.standards.dcsf.gov.uk/nationalstrategies</a></p>
	<p>The <b>Opportunities to use and apply</b> pages provide suggestions for how children might make use of a specific area of mathematics. This includes three key areas: applying understanding in a reasoning context, for example investigating a general statement; applying in other areas of mathematics, for example using the ability to locate numbers on a number line to read scales in measures; and, finally, using and applying mathematics across the curriculum.</p>



The **Confirming learning** section for each 'Can I...?' question provides questions, prompts and activities to probe children's understanding. These can be adapted to be used as assessment activities for individuals or small groups in order to assess whether progress has been made in this area of mathematics.

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## What is available to help me build the materials into my planning?

On the next few pages is a set of at-a-glance charts to help you to carry out your assessments and to plan appropriate learning and teaching. The level 4 and level 5 descriptions for the Number and algebra, Shape, space and measures and Handling data attainment targets are listed, together with the difficulties that the range of analyses has identified as most common in limiting children's progress from level 4 to level 5. After the level descriptions for each attainment target there are charts with the learning objectives for Year 6 and Year 6 progression to Year 7 taken from the relevant strands that can be used to inform your planning. These have the appropriate 'Can I...?' questions that appear on the CD-ROM aligned to the objectives. The 'Can I...?' questions might be shared with children as part of the assessment process, inviting them to identify the mathematics they can do in the context of the question and what they still find difficult. They might also be turned into 'I can...' statements to generate curricular targets, using the materials on the CD-ROM and the Primary Framework to draw together success criteria to share and discuss with children. The final set of charts indicate where each of the objectives for Year 6 and Year 6 progression to Year 7 appear in the Blocks and Units structure of the Primary Framework. When teaching Year 7 children these may need to be cross-referenced to the Secondary Framework for mathematics.

## Number and algebra

Attainment target 2: Number and algebra		
Level 4	Level 5	Commonly encountered difficulties
<p>Pupils use their understanding of place value to multiply and divide whole numbers by 10 or 100. In solving number problems, pupils use a range of mental methods of computation with the four operations, including mental recall of multiplication facts up to <math>10 \times 10</math> and quick derivation of corresponding division facts. They use efficient written methods of addition and subtraction and of short multiplication and division. They add and subtract decimals to two places and order decimals to three places. In solving problems with or without a calculator, pupils check the reasonableness of their results by reference to their knowledge of the context or to the size of the numbers. They recognise approximate proportions of a whole and use simple fractions and percentages to describe these. Pupils recognise and describe number patterns, and relationships including multiple, factor and square. They begin to use simple formulae expressed in words. Pupils use and interpret coordinates in the first quadrant.</p>	<p>Pupils use their understanding of place value to multiply and divide whole numbers and decimals by 10, 100 and 1000. They order, add and subtract negative numbers in context. They use all four operations with decimals to two places. They reduce a fraction to its simplest form by cancelling common factors and solve simple problems involving ratio and direct proportion. They calculate fractional or percentage parts of quantities and measurements, using a calculator where appropriate. Pupils understand and use an appropriate non-calculator method for solving problems that involve multiplying and dividing any three-digit number by any two-digit number. They check their solutions by applying inverse operations or estimating using approximations. They construct, express in symbolic form, and use simple formulae involving one or two operations. They use brackets appropriately. Pupils use and interpret coordinates in all four quadrants.</p>	<p>Unable to identify the whole when given part information, e.g. <math>\frac{4}{5}</math> costs £20.</p> <p>Misinterpreting the values of digits and changing values when multiplying or dividing a decimal number by an integer.</p> <p>Multiplying a two-digit integer by a number with one decimal place using a written method.</p> <p>Dividing a three-digit integer by a two-digit integer using a written method.</p> <p>Applying ratio notation when scaling up or down.</p> <p>Interpreting simple problems that involve ratio and proportion.</p> <p>Understanding when the use of a calculator is appropriate, and how to use it efficiently, interpreting the display in the context of the problem.</p> <p>Keeping track of the steps in a multi-step problem when using a calculator in order to explain the method used.</p> <p>Recognising the inverse operation needed, and how it can be used, to solve problems.</p> <p>Interpreting and manipulating fractions and percentages when presented with multi-step problems.</p> <p>Checking solutions are correct using methods that involve approximation and estimation.</p> <p>Understanding the relationship between factors and multiples and finding the common factors and multiples for given numbers.</p> <p>Describing the relationship between terms in a sequence in order to generalise and decide if given numbers belong to a sequence or not.</p> <p>Constructing simple algebraic expressions to describe a relationship.</p>

Counting and understanding number strand and associated objectives		
Year 6 objectives	Year 6 progression to Year 7 objectives	Overcoming barriers sequence
Find the difference between a positive and a negative integer, or two negative integers, in context		
Use decimal notation for tenths, hundredths and thousandths; partition, round and order decimals with up to three places, and position them on the number line	Compare and order integers and decimals in different contexts	
Express a larger whole number as a fraction of a smaller one (e.g. recognise that 8 slices of a 5-slice pizza represents $\frac{8}{5}$ or $1\frac{3}{5}$ pizzas); simplify fractions by cancelling common factors; order a set of fractions by converting them to fractions with a common denominator	Order a set of fractions by converting them to decimals	<ul style="list-style-type: none"> <li>Can I work out the whole, having been given the fraction?</li> </ul>
Express one quantity as a percentage of another (e.g. express £400 as a percentage of £1000); find equivalent percentages, decimals and fractions	Recognise approximate proportions of a whole and use fractions and percentages to describe and compare them, for example when interpreting pie charts	
Solve simple problems involving direct proportion by scaling quantities up or down	Use ratio notation; reduce a ratio to its simplest form and divide a quantity into two parts in a given ratio; solve simple problems involving ratio and direct proportion (e.g. identify the quantities needed to make a fruit drink by mixing water and juice in a given ratio)	<ul style="list-style-type: none"> <li>Can I understand and explain the relationships between two or more parts of a whole and describe them using the language and notation of ratio?</li> <li>Can I solve simple problems involving ratio and proportion?</li> </ul>
Represent and interpret sequences, patterns and relationships involving numbers and shapes; suggest and test hypotheses; construct and use simple expressions and formulae in words then symbols (e.g. the cost of $c$ pens at 15 pence each is $15c$ pence)	Generate sequences and describe the general term; use letters and symbols to represent unknown numbers or variables; represent simple relationships as graphs	<ul style="list-style-type: none"> <li>Can I make generalisations about sequences and explain why given numbers do or do not belong to the given sequence?</li> <li>Can I create an algebraic expression that describes a simple relationship?</li> </ul>

Knowing and using number facts strand		
Year 6 objectives	Year 6 progression to Year 7 objectives	Overcoming barriers sequence
Use knowledge of place value and multiplication facts to $10 \times 10$ to derive related multiplication and division facts involving decimals (e.g. $0.8 \times 7$ , $4.8 \div 6$ )	Consolidate rapid recall of number facts, including multiplication facts to $10 \times 10$ and the associated division facts	
Use knowledge of multiplication facts to derive quickly squares of numbers to $12 \times 12$ and the corresponding squares of multiples of 10	Recognise the square roots of perfect squares to $12 \times 12$	
Recognise that prime numbers have only two factors and identify prime numbers less than 100; find the prime factors of two-digit numbers	Recognise and use multiples, factors, divisors, common factors, highest common factors and lowest common multiples in simple cases	<ul style="list-style-type: none"> <li>• Can I use knowledge of factors and multiples?</li> </ul>
Use approximations, inverse operations and tests of divisibility to estimate and check results	Make and justify estimates and approximations to calculations	<ul style="list-style-type: none"> <li>• Can I explain how I use approximations to help estimate the answer to a calculation?</li> </ul>

Calculating strand		
Year 6 objectives	Year 6 progression to Year 7 objectives	Overcoming barriers sequence
Calculate mentally with integers and decimals: $U.t \pm U.t$ , $TU \times U$ , $TU \div U$ , $U.t \times U$ , $U.t \div U$	Consolidate and extend mental methods of calculation to include decimals, fractions and percentages	<ul style="list-style-type: none"> <li>Can I make use of my understanding of place value to explain how to mentally multiply or divide a decimal number by an integer?</li> </ul>
Use efficient written methods to add and subtract integers and decimals, to multiply and divide integers and decimals by a one-digit integer, and to multiply two-digit and three-digit integers by a two-digit integer	Use standard column procedures to add and subtract integers and decimals, and to multiply two-digit and three-digit integers by a one-digit or two-digit integer; extend division to dividing three-digit integers by a two-digit integer	<ul style="list-style-type: none"> <li>Can I use an appropriate non-calculator method for dividing a three-digit integer by a two-digit integer?</li> <li>Can I extend my written methods for multiplying whole numbers to multiplying decimals by whole numbers?</li> </ul>
Relate fractions to multiplication and division (e.g. $6 \div 2 = \frac{1}{2}$ of $6 = 6 \times \frac{1}{2}$ ); express a quotient as a fraction or decimal (e.g. $67 \div 5 = 13.4$ or $13 \frac{2}{5}$ ); find fractions and percentages of whole-number quantities (e.g. $\frac{5}{8}$ of 96, 65% of £260)	Calculate percentage increases or decreases and fractions of quantities and measurements (integer answers)	<ul style="list-style-type: none"> <li>Can I solve multi-step problems involving percentages and/or fractions?</li> </ul>
	Understand how the commutative, associative and distributive laws, and the relationships between operations, including inverse operations, can be used to calculate more efficiently; use the order of operations, including brackets	<ul style="list-style-type: none"> <li>Can I solve multi-step problems that involve using inverse operations and explain my methods?</li> </ul>
Use a calculator to solve problems involving multi-step calculations	Use bracket keys and the memory of a calculator to carry out calculations with more than one step; use the square root key	<ul style="list-style-type: none"> <li>Can I make and justify decisions about when and how to use a calculator effectively to solve problems?</li> <li>Can I explain and record my method when I use a calculator to solve a problem?</li> </ul>

## Shape, space and measures

Attainment target 3: Shape, space and measures		
Level 4	Level 5	Commonly encountered difficulties
<p>Pupils make 3-D mathematical models by linking given faces or edges, draw common 2-D shapes in different orientations on grids. They reflect simple shapes in a mirror line. They choose and use appropriate units and instruments, interpreting, with appropriate accuracy, numbers on a range of measuring instruments. They find perimeters of simple shapes and find areas by counting squares.</p>	<p>When constructing models and when drawing or using shapes, pupils measure and draw angles to the nearest degree, and use language associated with angle. Pupils know the angle sum of a triangle and that of angles at a point. They identify all the symmetries of 2-D shapes. They know the rough metric equivalents of imperial units still in daily use and convert one metric unit to another. They make sensible estimates of a range of measures in relation to everyday situations. Pupils understand and use the formula for the area of a rectangle.</p>	<p>Interpreting the 2-D representation of a 3-D shape and visualising where and how elements relate.</p> <p>Identifying and interpreting parallel and perpendicular lines and faces on 2-D and 3-D shapes.</p> <p>Calculating missing angles using known information such as the sum of angles around a point.</p> <p>Finding the image after a transformation of a shape and using the correct mathematical language to describe the transformation.</p> <p>Interpreting, comparing and calculating measures when different units are involved.</p> <p>Explaining how a scale that has partially labelled divisions can be used to measure quantities.</p>

Understanding shape strand		
Year 6 objectives	Year 6 progression to Year 7 objectives	Overcoming barriers sequence
Make and draw shapes with increasing accuracy and apply knowledge of their properties	Construct a triangle given two sides and the included angle	<ul style="list-style-type: none"> <li>Can I identify matching nets for 3-D shapes, visualising corresponding features?</li> </ul>
	Use correctly the vocabulary, notation and labelling conventions for lines, angles and shapes	
Describe, identify and visualise parallel and perpendicular edges or faces; use these properties to classify 2-D shapes and 3-D solids	Extend knowledge of properties of triangles and quadrilaterals and use these to visualise and solve problems, explaining reasoning with diagrams	<ul style="list-style-type: none"> <li>Can I use the language of perpendicular and parallel to classify, describe and draw shapes?</li> </ul>
Estimate angles, and use a protractor to measure and draw them, on their own and in shapes; calculate angles in a triangle or around a point	Know the sum of angles on a straight line, in a triangle and at a point, and recognise vertically opposite angles	<ul style="list-style-type: none"> <li>Can I use my understanding of angles and shapes to work out missing angles?</li> </ul>
Use coordinates in the first quadrant to draw, locate and complete shapes that meet given properties	Use all four quadrants to find coordinates of points determined by geometric information	
Visualise and draw on grids of different types where a shape will be after reflection, after translations, or after rotation through $90^\circ$ or $180^\circ$ about its centre or one of its vertices	Identify all the symmetries of 2-D shapes; transform images using ICT	<ul style="list-style-type: none"> <li>Can I describe and predict transformations of shapes?</li> </ul>

Measuring strand		
Year 6 objectives	Year 6 progression to Year 7 objectives	Overcoming barriers sequence
Select and use standard metric units of measure and convert between units using decimals to two places (e.g. change 2.75 litres to 2750 ml, or vice versa)	Convert between related metric units using decimals to three places (e.g. convert 1375 mm to 1.375 m, or vice versa)	<ul style="list-style-type: none"> <li>Can I solve problems involving the conversion of units?</li> </ul>
Read and interpret scales on a range of measuring instruments, recognising that the measurement made is approximate and recording results to a required degree of accuracy; compare readings on different scales, for example when using different instruments	Solve problems by measuring, estimating and calculating; measure and calculate using imperial units still in everyday use; know their approximate metric values	<ul style="list-style-type: none"> <li>Can I read a variety of partially labelled scales and explain how I know what each unlabelled division represents?</li> </ul>
Calculate the perimeter and area of rectilinear shapes; estimate the area of an irregular shape by counting squares	Calculate the area of right-angled triangles given the lengths of the two perpendicular sides, and the volume and surface area of cubes and cuboids	

## Handling data

Attainment target 4: Handling data		
Level 4	Level 5	Commonly encountered difficulties
<p>Pupils collect discrete data and record them using a frequency table. They understand and use the mode and range to describe sets of data. They group data, where appropriate, in equal class intervals, represent collected data in frequency diagrams and interpret such diagrams. They construct and interpret simple line graphs.</p>	<p>Pupils understand and use the mean of discrete data. They compare two simple distributions, using the range and one of the mode, median or mean. They interpret graphs and diagrams, including pie charts, and draw conclusions. They understand and use the probability scale from 0 to 1. Pupils find and justify probabilities, and approximations to these, by selecting and using methods based on equally likely outcomes and experimental evidence, as appropriate. They understand that there may be different outcomes when an experiment is repeated.</p>	<p>Listing outcomes of repeated experiments and having a strategy to ensure that all possibilities are included.</p> <p>Understanding how the 0 to 1 scale is used to measure the probability of an outcome and relating this to the language of probability.</p> <p>Understanding how a line graph demonstrates a relationship between two variables, and given a value on one axis finding the corresponding value on the other.</p> <p>Understanding that two pie charts that look the same can represent very different sample sizes.</p> <p>Understanding what key features different representations of data demonstrate and how to interpret these in order to read information and to draw conclusions.</p> <p>Explaining how range, mode, median and mean are calculated and can be used to make comparisons and inform decisions.</p>

Handling data strand		
Year 6 objectives	Year 6 progression to Year 7 objectives	Overcoming barriers sequence
Describe and predict outcomes from data using the language of chance or likelihood	Understand and use the probability scale from 0 to 1; find and justify probabilities based on equally likely outcomes in simple contexts	<ul style="list-style-type: none"> <li>• Can I list all the outcomes that may result from repeating an experiment?</li> <li>• Can I use the 0 to 1 probability scale to measure the probabilities of outcomes?</li> </ul>
Solve problems by collecting, selecting, processing, presenting and interpreting data, using ICT where appropriate; draw conclusions and identify further questions to ask	Explore hypotheses by planning surveys or experiments to collect small sets of discrete or continuous data; select, process, present and interpret the data, using ICT where appropriate; identify ways to extend the survey or experiment	
Construct and interpret frequency tables, bar charts with grouped discrete data, and line graphs; interpret pie charts	Construct, interpret and compare graphs and diagrams that represent data, for example compare proportions in two pie charts that represent different totals	<ul style="list-style-type: none"> <li>• Can I interpret and explain data presented in line graphs?</li> <li>• Can I interpret sets of data with different sample sizes represented in pie charts?</li> <li>• Can I explain what different diagrams and graphs represent, read information from them and draw conclusions from this information?</li> </ul>
Describe and interpret results and solutions to problems using the mode, range, median and mean	Write a short report of a statistical enquiry and illustrate with appropriate diagrams, graphs and charts, using ICT as appropriate; justify the choice of what is presented	<ul style="list-style-type: none"> <li>• Can I explain range, mode, median and mean and use them to describe data in order to make decisions?</li> </ul>

## Links between objectives and Units

Using and applying mathematics strand		
Year 6 objectives	Units	Year 6 progression to Year 7 objectives
Explain reasoning and conclusions, using words, symbols or diagrams as appropriate	6A1, 6E1, 6A2, 6E2, 6A3	Explain and justify reasoning and conclusions, using notation, symbols and diagrams; find a counter-example to disprove a conjecture; use step-by-step deductions to solve problems involving shapes
Solve multi-step problems, and problems involving fractions, decimals and percentages; choose and use appropriate calculation strategies at each stage, including calculator use	6D1, 6E1, 6A2, 6D2, 6A3, 6D3 6E3	Solve problems by breaking down complex calculations into simpler steps; choose and use operations and calculation strategies appropriate to the numbers and context; try alternative approaches to overcome difficulties; present, interpret and compare solutions
Tabulate systematically the information in a problem or puzzle; identify and record the steps or calculations needed to solve it, using symbols where appropriate; interpret solutions in the original context and check their accuracy	6E1, 6B2, 6E2, 6B3, 6E3	Represent information or unknown numbers in a problem, for example in a table, formula or equation; explain solutions in the context of the problem
Represent and interpret sequences, patterns and relationships involving numbers and shapes; suggest and test hypotheses; construct and use simple expressions and formulae in words then symbols (e.g. the cost of $c$ pens at 15 pence each is $15c$ pence)	6B1, 6B2, 6B3	Generate sequences and describe the general term; use letters and symbols to represent unknown numbers or variables; represent simple relationships as graphs
Suggest, plan and develop lines of enquiry; collect, organise and represent information, interpret results and review methods; identify and answer related questions	6C1	Develop and evaluate lines of enquiry; identify, collect, organise and analyse relevant information; decide how best to represent conclusions and what further questions to ask

Counting and understanding number strand		
Year 6 objectives	Units	Year 6 progression to Year 7 objectives
Find the difference between a positive and a negative integer, or two negative integers, in context	6A1	
Use decimal notation for tenths, hundredths and thousandths; partition, round and order decimals with up to three places, and position them on the number line	6A1, 6A2, 6A3	Compare and order integers and decimals in different contexts
Express a larger whole number as a fraction of a smaller one (e.g. recognise that 8 slices of a 5-slice pizza represents $\frac{8}{5}$ or $1\frac{3}{5}$ pizzas); simplify fractions by cancelling common factors; order a set of fractions by converting them to fractions with a common denominator	6E1, 6E2, 6E3	Order a set of fractions by converting them to decimals
Express one quantity as a percentage of another (e.g. express £400 as a percentage of £1000); find equivalent percentages, decimals and fractions	6E2, 6E3	Recognise approximate proportions of a whole and use fractions and percentages to describe and compare them, for example when interpreting pie charts
Solve simple problems involving direct proportion by scaling quantities up or down	6E1, 6E2, 6E3	Use ratio notation, reduce a ratio to its simplest form and divide a quantity into two parts in a given ratio; solve simple problems involving ratio and direct proportion (e.g. identify the quantities needed to make a fruit drink by mixing water and juice in a given ratio)

<b>Knowing and using number facts strand</b>		
<b>Year 6 objectives</b>	<b>Units</b>	<b>Year 6 progression to Year 7 objectives</b>
Use knowledge of place value and multiplication facts to $10 \times 10$ to derive related multiplication and division facts involving decimals (e.g. $0.8 \times 7$ , $4.8 \div 6$ )	6A1, 6B1, 6E1, 6A2, 6B2, 6B3, 6E3	Consolidate rapid recall of number facts, including multiplication facts to $10 \times 10$ and the associated division facts
Use knowledge of multiplication facts to derive quickly squares of numbers to $12 \times 12$ and the corresponding squares of multiples of 10	6B1, 6B2, 6B3	Recognise the square roots of perfect squares to $12 \times 12$
Recognise that prime numbers have only two factors and identify prime numbers less than 100; find the prime factors of two-digit numbers	6B1, 6B2, 6B3	Recognise and use multiples, factors, divisors, common factors, highest common factors and lowest common multiples in simple cases
Use approximations, inverse operations and tests of divisibility to estimate and check results	6A1, 6B1, 6D1, 6A2, 6B2, 6D2, 6A3, 6B3, 6D3	Make and justify estimates and approximations to calculations

Calculating strand		
Year 6 objectives	Units	Year 6 progression to Year 7 objectives
Calculate mentally with integers and decimals: $U.t \pm U.t$ , $TU \times U$ , $TU \div U$ , $U.t \times U$ , $U.t \div U$	6A1, 6D1, 6A2, 6D2, 6A3, 6D3	Consolidate and extend mental methods of calculation to include decimals, fractions and percentages
Use efficient written methods to add and subtract integers and decimals, to multiply and divide integers and decimals by a one-digit integer, and to multiply two-digit and three-digit integers by a two-digit integer	6D1, 6E1, 6A2, 6D2, 6A3, 6D3, 6E3	Use standard column procedures to add and subtract integers and decimals, and to multiply two-digit and three-digit integers by a one-digit or two-digit integer; extend division to dividing three-digit integers by a two-digit integer
Relate fractions to multiplication and division (e.g. $6 \div 2 = \frac{1}{2}$ of $6 = 6 \times \frac{1}{2}$ ); express a quotient as a fraction or decimal (e.g. $67 \div 5 = 13.4$ or $13\frac{2}{5}$ ); find fractions and percentages of whole-number quantities (e.g. $\frac{5}{8}$ of 96, 65% of £260)	6E1, 6E2, 6E3	Calculate percentage increases or decreases and fractions of quantities and measurements (integer answers)
		Understand how the commutative, associative and distributive laws, and the relationships between operations, including inverse operations, can be used to calculate more efficiently; use the order of operations, including brackets
Use a calculator to solve problems involving multi-step calculations	6A1, 6D1, 6E1, 6A2, 6B2, 6C2, 6D2, 6E2, 6A3, 6B3, 6C3, 6D3, 6E3	Use bracket keys and the memory of a calculator to carry out calculations with more than one step; use the square root key

Understanding shape strand		
Year 6 objectives	Units	Year 6 progression to Year 7 objectives
Make and draw shapes with increasing accuracy and apply knowledge of their properties	6B1, 6B2, 6B3	Construct a triangle given two sides and the included angle
		Use correctly the vocabulary, notation and labelling conventions for lines, angles and shapes
Describe, identify and visualise parallel and perpendicular edges or faces; use these properties to classify 2-D shapes and 3-D solids	6B1, 6B2, 6B3	Extend knowledge of properties of triangles and quadrilaterals and use these to visualise and solve problems, explaining reasoning with diagrams
Estimate angles, and use a protractor to measure and draw them, on their own and in shapes; calculate angles in a triangle or around a point	6D2	Know the sum of angles on a straight line, in a triangle and at a point, and recognise vertically opposite angles
Use coordinates in the first quadrant to draw, locate and complete shapes that meet given properties	6D2	Use all four quadrants to find coordinates of points determined by geometric information
Visualise and draw on grids of different types where a shape will be after reflection, after translations, or after rotation through $90^\circ$ or $180^\circ$ about its centre or one of its vertices	6D2	Identify all the symmetries of 2-D shapes; transform images using ICT

<b>Measuring strand</b>		
<b>Year 6 objectives</b>	<b>Units</b>	<b>Year 6 progression to Year 7 objectives</b>
Select and use standard metric units of measure and convert between units using decimals to two places (e.g. change 2.75 litres to 2750 ml, or vice versa)	6C1, 6D1, 6C2, 6D2, 6C3, 6D3	Convert between related metric units using decimals to three places (e.g. convert 1375 mm to 1.375 m, or vice versa)
Read and interpret scales on a range of measuring instruments, recognising that the measurement made is approximate and recording results to a required degree of accuracy; compare readings on different scales, for example when using different instruments	6C1, 6D1, 6C2, 6C3, 6D3	Solve problems by measuring, estimating and calculating; measure and calculate using imperial units still in everyday use; know their approximate metric values
Calculate the perimeter and area of rectilinear shapes; estimate the area of an irregular shape by counting squares	6D1, 6D3	Calculate the area of right-angled triangles given the lengths of the two perpendicular sides, and the volume and surface area of cubes and cuboids

<b>Handling data strand</b>		
<b>Year 6 objectives</b>	<b>Units</b>	<b>Year 6 progression to Year 7 objectives</b>
Describe and predict outcomes from data using the language of chance or likelihood	6C2, 6C3	Understand and use the probability scale from 0 to 1; find and justify probabilities based on equally likely outcomes in simple contexts
Solve problems by collecting, selecting, processing, presenting and interpreting data, using ICT where appropriate; draw conclusions and identify further questions to ask	6C1, 6C2, 6C3	Explore hypotheses by planning surveys or experiments to collect small sets of discrete or continuous data; select, process, present and interpret the data, using ICT where appropriate; identify ways to extend the survey or experiment
Construct and interpret frequency tables, bar charts with grouped discrete data, and line graphs; interpret pie charts	6C1, 6C2, 6C3	Construct, interpret and compare graphs and diagrams that represent data, for example compare proportions in two pie charts that represent different totals
Describe and interpret results and solutions to problems using the mode, range, median and mean	6C1, 6C2, 6C3	Write a short report of a statistical enquiry and illustrate with appropriate diagrams, graphs and charts, using ICT as appropriate; justify the choice of what is presented









Audience: Key Stage 2 and 3 teachers, mathematics subject leaders, headteachers and LA consultants

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