

# Levels of Progression in USING MATHEMATICS across the curriculum: Key Stage 3

The colours used in this document provide a means by which progression in the Requirements may be tracked across the levels.

For First Use 2012/13

## Requirements for Using Mathematics

Across the curriculum, at a level appropriate to their ability, pupils should be enabled to:

- choose the appropriate materials, equipment and mathematics to use in a particular situation;
- use mathematical knowledge and concepts accurately;
- work systematically and check their work;
- use mathematics to solve problems and make decisions;
- develop methods and strategies, including mental mathematics;
- explore ideas, make and test predictions and think creatively;
- identify and collect information;
- read, interpret, organise and present information in mathematical formats;
- use mathematical understanding and language to ask and answer questions, talk about and discuss ideas and explain ways of working;
- develop financial capability;
- use ICT to solve problems and/or present their work;

using their Knowledge and Understanding of:

### Number and Algebra

- use, estimate, add and subtract numbers up to at least 10;
- understand conservation of number;
- create and describe repeating patterns using objects, numbers or pictures;
- recognise and use coins;

### Shape, Space and Measures

- use everyday language associated with length, 'weight', capacity and area to describe, compare and order three objects;
- sequence familiar events;
- know the days of the week and their sequence;
- recognise 'special' times on the clock;
- sort 2-D and 3-D shapes and make and describe 2-D and 3-D constructions;
- use language and follow instructions, in practical situations, for position and movement;

### Handling Data

- sort and classify real objects for one criterion and re-sort for a different criterion, using Venn, Carroll and Tree diagrams;
- collect information and record using real objects or drawings.

## Level 1

In structured activities, in familiar and accessible contexts, pupils can:

- talk about and use the materials and equipment provided to carry out an activity;
- use some mathematical notation;
- show some organisation in their practical work;
- talk about ways to solve simple everyday problems;
- use counting strategies when carrying out activities;
- look for and talk about patterns;
- talk about and collect information required;
- represent their work using pictures and objects;
- use appropriate mathematical language to respond to questions about their work;

## Level 2

In structured activities, in familiar and accessible contexts, pupils can:

- talk about how to approach an activity;
- select and use the materials, equipment and mathematics required;
- use appropriate mathematical notation;
- organise their practical work and check what they have done;
- use mental strategies to carry out calculations when solving problems/carrying out activities;
- recognise patterns and relationships and make predictions;
- discuss the information required and how it can be collected;
- present the information appropriately and talk about their findings;
- use appropriate mathematical language to talk about their work and respond to questions;

- read, write and order whole numbers up to at least 100;
- understand that the place of the digit indicates its value;
- use quick recall of number facts up to 10;
- add and subtract within 20 mentally and in written form;
- use addition and subtraction patterns within 20 to explore the relationship between addition and subtraction;
- understand that addition is commutative and subtraction is not;
- add and subtract within 100;
- understand the use of a symbol to stand for an unknown number;
- understand and use halves and quarters;
- understand relationships between all coins up to £1 and use this knowledge to carry out shopping activities;

- identify and use non-standard units to measure length, 'weight', capacity and area;
- understand the need for standard units and know the most commonly used units in length, 'weight', capacity and time;
- name and order days of the week, months of the year and seasons;
- read simple digital and analogue clock displays;
- recognise and name common 2-D and 3-D shapes;
- sort 2-D and 3-D shapes, giving reasons for sorting;
- use language and follow instructions, in practical situations, for turning movements;

- sort and classify objects for two criteria using Venn, Carroll and Tree diagrams;
- collect information and record results using simple tables, block graphs, simple pictograms and diagrams;
- discuss and interpret information.

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## Level 3

In structured activities, in familiar and accessible contexts, pupils can:

- suggest different ways an activity might be approached;
- select and use the appropriate materials, equipment and mathematics required;
- use a range of appropriate mathematical notation;
- organise their work and know how to check its accuracy;
- use mathematics to solve simple two-stage problems;
- use a range of mental calculation strategies;
- identify and explain patterns and relationships and make predictions;
- identify, collect and record the information required;
- present their findings clearly using a range of appropriate mathematical formats;
- explain their findings;
- use appropriate mathematical language to discuss and describe their way of working and respond to questions;

- understand, use, add and subtract whole numbers up to at least 1000;
- understand and use the concept of place value in whole numbers;
- use quick recall of number facts up to 20;
- add and subtract mentally two 2-digit numbers within 100;
- approximate to the nearest 10 or 100;
- identify and describe simple number patterns within the 100 square;
- know 2, 3, 4, 5 and 10 multiplication facts;
- understand that multiplication is commutative;
- explore and use division in practical situations;
- understand and use simple fractions in context;
- use number skills in the context of money up to £10;

- choose and use appropriate standard units to estimate, measure and record length, capacity, volume, 'weight', time and temperature;
- read simple measuring instruments with an appropriate degree of accuracy;
- find the area of shapes by counting whole and half squares;
- read and interpret a calendar;
- read digital and analogue clock displays;
- recognise, name and describe common 2-D and 3-D shapes;
- recognise one line of symmetry in common 2-D shapes;
- recognise tessellations through practical activities;
- recognise right angles in the environment and understand angle as a measurement of turn;
- use grid references in practical situations;

- collect and record relevant data for a given activity;
- draw and label pictograms and bar charts;
- read and interpret information from tables, pictograms, diagrams, lists, bar charts, simple pie charts and databases.

## Level 4

In activities with some structure, in familiar and some unfamiliar contexts and situations, pupils can:

- decide how an activity might be approached and compare their approaches with others;
- identify and use appropriately the materials, equipment and mathematics required;
- use a range of appropriate mathematical techniques and notation;
- organise their own work and work systematically;
- review their work and check for accuracy;
- use a range of problem-solving strategies;
- use a range of efficient mental calculation strategies;
- investigate patterns and relationships, using their findings to make predictions;
- investigate general statements to see if they are true;
- find, organise and interpret relevant information;
- present information clearly;
- compare methods of presentation;
- use appropriate mathematical language to discuss their work and explain their thinking;

- read, write and order whole numbers within 10 000;
- use knowledge of place value to multiply and divide whole numbers by 10 and 100;
- understand place value to two decimal places;
- approximate within 10 000 to the nearest 10, 100 and 1000;
- estimate answers to calculations and approximate by rounding;
- add, subtract, multiply and divide whole numbers using a range of mental, written and calculator methods;
- add and subtract numbers with up to two decimal places;
- use the relationship between addition and subtraction to check calculations;
- know multiplication facts up to  $10 \times 10$  and derive associated division facts;
- understand and use multiples and factors;
- use fractions to describe quantities;
- perform simple calculations involving unitary fractions;
- understand equivalence of fractions;
- understand and use simple percentages;
- interpret and apply simple rules expressed in words;
- interpret a calculator display when solving money problems;
- make choices about spending and value for money;
- know different ways in which payments for goods can be made;

- estimate and measure length, 'weight'/mass, time and temperature, working to an appropriate degree of accuracy;
- understand the relationship between metric units;
- add and subtract common measures;
- estimate area and volume of shapes by counting squares/cubes;
- work out perimeters of simple shapes;
- understand and use digital and analogue clock displays, using am, pm and 24-hour notation;
- explore the properties of common 2-D and 3-D shapes;
- explore the relationship between 2-D and 3-D shapes;
- recognise and draw lines of symmetry in a variety of 2-D shapes;
- know the eight points of the compass;
- understand and use the language of line, angle and location;
- use coordinates in the first quadrant;

- collect, group, record and present data with given class intervals;
- present and interpret data using a range of graphs, tables, diagrams, spreadsheets and databases;
- understand and use the language of probability.

## Level 5

In activities with some structure, in familiar and some unfamiliar contexts and situations, pupils can:

- plan and decide how an activity might be approached;
- identify and use efficiently the materials, equipment, mathematics and strategies required;
- use a range of appropriate mathematical techniques and notation;
- plan and work systematically and efficiently;
- review their work, considering if their findings are reasonable and making changes where appropriate;
- use a range of problem-solving strategies, suggesting and trying out different approaches when difficulties arise;
- make and test predictions;
- make general statements based on findings and test using new examples;
- summarise their findings;
- identify, obtain, process and interpret information appropriate and sufficient for the activity;
- present information accurately and appropriately including the use of mathematical language, symbols and diagrams;
- use appropriate mathematical language to express and communicate ideas accurately;

- read, write and order whole numbers of any size;
- use knowledge of place value to multiply and divide numbers by 10, 100 and 1000;
- understand place value to three decimal places;
- round decimals to the nearest whole number;
- multiply and divide numbers with up to two decimal places by a whole number;
- check calculations by applying inverse operations;
- understand and use negative numbers in practical contexts;
- understand and use square, cube and prime numbers;
- understand the relationship between common fractions, decimals and percentages;
- calculate fractions and percentages of quantities, including money;
- use understanding of equivalence to add and subtract fractions;
- devise and use rules for generating sequences in words and/or symbolic form;
- express and use formulae in words and/or symbolic form;
- make informed choices about personal budgeting and spending;

- convert from one metric unit to another;
- use the four operations to solve problems related to measures;
- calculate areas of squares, rectangles and right-angled triangles and volumes of cubes and cuboids;
- calculate perimeters of a range of shapes;
- understand and use scale in the context of simple maps and drawings;
- read and interpret timetables;
- describe the properties of regular and irregular 2-D shapes in terms of sides, angles, symmetry and tessellations;
- reflect 2-D shapes in a line;
- describe the properties of 3-D shapes in terms of faces, edges and vertices;
- draw nets of 3-D shapes;
- estimate, measure, draw and label angles up to 360 degrees;

- collect, organise, record and represent data;
- design and use a data collection sheet;
- construct, label and interpret a range of graphs, tables, diagrams, spreadsheets and databases;
- understand, calculate and use mean and range;
- place events in order of likelihood.

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## Level 6

Through discussion, solving routine and non-routine problems with increasing independence in a wide range of familiar and unfamiliar contexts and situations, pupils can:

- plan for an activity by identifying and sequencing component steps;
- consider and identify a range of materials/equipment, mathematical techniques and problem-solving strategies required to meet the purpose of activities;
- use a range of appropriate mathematical techniques and notation;
- work systematically and efficiently to a given degree of accuracy;
- review their work, using appropriate checking procedures and evaluating their effectiveness at each stage;
- adapt their approach as needed;
- make and test predictions, make general statements and draw conclusions;
- obtain, process and interpret information from a range of sources;
- use a range of suitable ways to present findings, following accepted conventions;
- use appropriate mathematical language/notation to communicate and explain their work for a wider audience;

- carry out calculations with whole numbers of any size;
- add, subtract, multiply and divide decimals;
- round to a given number of decimal places;
- understand and use order of precedence in numerical calculations, including the use of brackets;
- understand and calculate square roots;
- understand, use and calculate ratio and proportion;
- add and subtract fractions, including mixed numbers;
- use equivalences between fractions, decimals and percentages to solve problems;
- calculate percentage increase and decrease in relevant contexts;
- use appropriate formulae;
- use conventional notation in algebra;
- use and interpret graphs from real situations;
- apply mathematical concepts to a range of financial situations;

- use, convert and calculate measures involving metric and, where appropriate, imperial units;
- calculate perimeters and areas of composite shapes involving squares, rectangles and triangles;
- calculate surface area and composite volumes of cubes and cuboids;
- calculate the circumference and area of circles;
- work out dimensions using scale;
- understand and use compound measures;
- recognise 2-D representations of 3-D shapes;
- use coordinates in all four quadrants;

- collect and record discrete and continuous data using a variety of methods;
- construct and interpret a variety of diagrams and graphs for discrete and continuous data;
- work out and use the median and mode;
- work out the mean, median and mode of a frequency distribution;
- use one of the measures of average to compare two sets of data;
- understand and use the probability scale from 0 to 1 to express likelihood or comparability.

## Level 7

Through discussion, solving routine and non-routine problems with increasing independence in a wide range of familiar and unfamiliar contexts and situations, pupils can:

- plan an activity, explaining their reasons for their chosen structure and approach;
- consider and identify, with some justification, the materials/equipment, mathematical techniques and problem-solving strategies required;
- use a range of appropriate mathematical techniques and notation;
- critically review to what extent they succeeded in carrying out activities, checking if the level of accuracy and their findings are appropriate and making an assessment of any limitations;
- consider alternative approaches and adapt them as required;
- make and test predictions and justify their generalisations;
- consider, identify, obtain and analyse data/information from more than one source;
- select and use the most appropriate methods to present findings, following accepted conventions;
- use appropriate mathematical language/notation to explain and justify their findings or solutions;

- use the advanced functions on a calculator to perform complex calculations;
- round to an appropriate number of decimal places and significant figures;
- use the four operations with fractions;
- calculate the original quantity given the result of a percentage change;
- calculate repeated proportional change;
- formulate linear equations;
- manipulate simple algebraic expressions, equations and formulae;
- solve two linear equations simultaneously by a graphical method;
- make informed decisions involving money;

- perform length and area calculations on a composite shape including those involving the circle;
- solve complex problems involving perimeter, surface area and volume;
- understand that measurements have an error margin of half the given unit;
- enlarge a 2-D shape by a given scale factor;
- use three figure bearings to define direction;
- understand and apply Pythagoras' Theorem;

- pursue their own lines of enquiry, using appropriate methods of data collection, and interpret and present their findings;
- construct and interpret frequency tables and diagrams for sets of continuous data;
- estimate the mean of a set of grouped data and identify the limits of the median and modal group;
- choose the most appropriate average (mean, median or mode) for a given line of enquiry;
- understand and use relative frequency as an estimate of probability and calculate expected frequency;
- apply their knowledge of the rules of probability to calculate an outcome or combination of outcomes.