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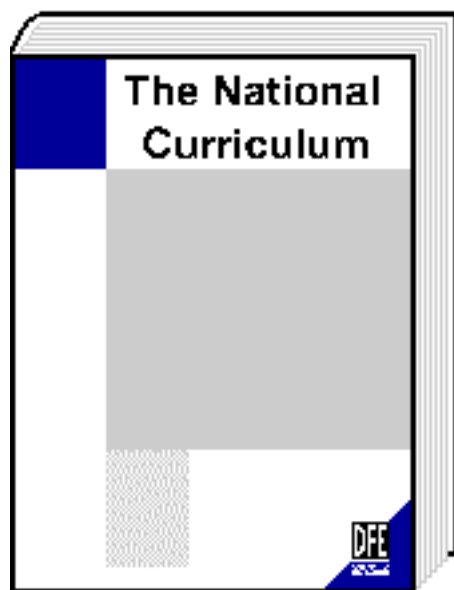


Department for
Education and Employment

The National Curriculum

These Web pages bring together the complete revised National curriculum for 5 to 16 year olds for all the required subjects in England. Published in January 1995, The National Curriculum for each subject is available in printed form as a [Stationery Office Publication](#), either in one complete volume or as separate subject orders.

CONTENTS



English
Mathematics
Science
Design and Technology
Information Technology
History
Geography
Modern Foreign Languages
Art
Music
Physical Education

[DfEE Educational Information](#)

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THE NATIONAL CURRICULUM



FOR MATHS

PROGRAMMES OF STUDY

Key Stage 1 Programme of Study

- * Using and Applying Mathematics
- * Number
- * Shape, Space and Measures

Key Stage 2 Programme of Study

- * Using and Applying Mathematics
- * Number
- * Shape, Space and Measures
- * Handling Data

Key Stages 3 and 4 Programme of Study

- * Using and Applying Mathematics
 - * Number
 - * Algebra
 - * Shape, Space and Measures
 - * Handling Data
 - * Key Stage 4: Further Material
-

ATTAINMENT TARGETS

Level Descriptions

- * Attainment Target 1: Using and Applying Mathematics
 - * Attainment Target 2: Number and Algebra
 - * Attainment Target 3: Shape, Space and Measures
 - * Attainment Target 4: Handling Data
-

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COMMON REQUIREMENTS

Access

The programme of study for each key stage should be taught to the great majority of pupils in the key stage, in ways appropriate to their abilities.

For the small number of pupils who may need the provision, material may be selected from earlier or later key stages where this is necessary to enable individual pupils to progress and demonstrate achievement. Such material should be presented in contexts suitable to the pupil's age.

Appropriate provision should be made for pupils who need to use:

- * means of communication other than speech, including computers, technological aids, signing, symbols or lip-reading;
- * non-sighted methods of reading, such as Braille, or non-visual or non-aural ways of acquiring information;
- * technological aids in practical and written work;
- * aids or adapted equipment to allow access to practical activities within and beyond school.

Judgements made in relation to the level descriptions should allow for the provision above, where appropriate.

Use of language

Pupils should be taught to express themselves clearly in both speech and writing and to develop their reading skills. They should be taught to use grammatically correct sentences and to spell and punctuate accurately in order to communicate effectively in written English or, when the medium is Welsh, in written Welsh.

Information technology

Pupils should be given opportunities, where appropriate, to develop and apply their information technology (IT) capability in their study of mathematics.

The Curriculum Cymreig

In Wales, pupils should be given opportunities, where appropriate, in their study of mathematics, to develop and apply their knowledge and understanding of the cultural, economic, environmental, historical and linguistic characteristics of Wales.

Referencing

The numbers and letters throughout the programmes of study are for referencing purposes only and do not necessarily indicate a particular teaching sequence or hierarchy of knowledge, understanding and skills.

Examples

Examples printed in italics are non-statutory.

KEY STAGES 3 & 4

PROGRAMME OF STUDY

In each of Key Stage 3 and Key Stage 4, pupils should be taught mathematics drawn from all the numbered sections of the joint programme of study. In addition, where appropriate, pupils in Key Stage 4 should be taught the [further material](#) specified.

The sections of the programme of study interrelate. Using mathematics, communicating mathematically and reasoning should be set in the context of the other areas of mathematics. Measurement should be taught in relation to number as well as to handling data and geometry. Ratio and proportion should be linked to probability, geometry and to solving numerical problems. Key concepts such as variable, equivalence, order and inverse, should be developed in number, algebra and geometry.

Key Stage 3 and 4 - [Using and Applying Mathematics](#)

Key Stage 3 and 4 - [Number](#)

Key Stage 3 and 4 - [Algebra](#)

Key Stage 3 and 4 - [Shape, Space and Measures](#)

Key Stage 3 and 4 - [Handling Data](#)

Key Stage 4 - [Further Materials](#)

Using and Applying Mathematics

1. Pupils should be given opportunities to:

- a** use and apply mathematics in practical tasks, in real-life problems and within mathematics itself;
- b** work on problems that pose a challenge;
- c** encounter and consider different lines of mathematical argument.

2. Making and monitoring decisions to solve problems

Pupils should be taught to:

- a** find ways of overcoming difficulties that arise; develop and use their own strategies;
- b** select, trial and evaluate a variety of possible approaches; identify what further information may be required in order to pursue a particular line of enquiry; break complex problems into a series of tasks;
- c** select and organise mathematics and resources; extend their work to related tasks; select, follow and reflect on alternative approaches of their own;
- d** review progress whilst engaging in work, and check and evaluate solutions.

3. Communicating mathematically

- a** understand and use mathematical language and notation;
- b** use mathematical forms of communication, including diagrams, tables, graphs and computer print-outs;
- c** present work clearly, using diagrams, graphs and symbols appropriately, to convey meaning;
- d** interpret mathematics presented in a variety of forms; evaluate forms of presentation;
- e** examine critically, improve and justify their choice of mathematical presentation.

4. Developing skills of mathematical reasoning

Pupils should be taught to:

a explain and justify how they arrived at a conclusion or solution to a problem;

b make conjectures and hypotheses, designing methods to test them, and analysing results to see whether they are valid;

c understand general statements, leading to making and testing generalisations; recognise particular examples, and appreciate the difference between mathematical explanation and experimental evidence;

d appreciate and use 'if... then...' lines of argument in number, algebra and geometry, and draw inferences from statistics;

e use mathematical reasoning, initially when explaining, and then when following a line of argument, recognising inconsistencies.

NUMBER

1. Pupils should be given opportunities to:

a use calculators and computer software, *eg spreadsheets*;

b develop and use flexibly a range of methods of computation, and apply these to a range of problems.

2. Understanding place value and extending the number system

Pupils should be taught to:

a understand and use the concept of place value in whole numbers and decimals, relating this to computation and the metric system of measurement;

b understand and use decimals, ratios, fractions and percentages, and the interrelationships between them; understand and use negative numbers;

c understand and use index notation, leading to standard form.

3. Understanding and using relationships between numbers and developing methods of computation

a consolidate knowledge of number facts, including multiplication to 10210, developing use of methods for finding quickly from known facts those that they cannot recall; use some common properties of numbers, including multiples, factors and primes, leading to powers and roots;

b extend mental methods of computation, to consolidate a range of non-calculator methods of addition and subtraction of whole numbers, and multiplication and division of whole numbers by whole numbers, understanding and using accurately the methods that they choose;

c calculate with negative numbers, decimals, fractions, percentages and ratio, understanding the effects of operations, *eg squaring, multiplying and dividing by numbers between 0 and 1*, and selecting an appropriate non-calculator or calculator method;

d understand when and how to use fractions and percentages to make proportional comparisons;

e understand and use the facilities of a calculator, including the use of the constant function, memory and brackets, to plan a calculation and evaluate expressions;

f mentally estimate and approximate solutions to numerical calculations, leading to multiplication and division with numbers of any size rounded to one significant figure.

4. Solving numerical problems

Pupils should be taught to:

a develop an understanding of the four operations and the relationship between them, and apply them to solving problems, including those that involve ratios, proportions and compound measures, using metric or common Imperial units where appropriate;

b select suitable sequences of operations and methods of computation, including trial-and-improvement methods, to solve problems involving integers, decimals, fractions, ratios and percentages, *eg using a spreadsheet to consider sets of numbers that have a given sum and find the set that has the maximum product*;

c use a variety of checking strategies and apply them appropriately to calculations; use estimation and inverse operations, and confirm that results are of the right order of magnitude;

d give solutions in the context of the problem, selecting an appropriate degree of accuracy, interpreting the display on a calculator, and recognising limitations on the accuracy of data and measurements.

ALGEBRA

1. Pupils should be given opportunities to:

- a** explore a variety of situations that lead to the expression of relationships;
- b** consider how relationships between number operations underpin the techniques for manipulating algebraic expressions;
- c** consider how algebra can be used to model real-life situations and solve problems.

2. Understanding and using functional relationships

Pupils should be taught to:

- a** appreciate the use of letters to represent variables;
- b** explore number patterns arising from a variety of situations, using computers where appropriate; interpret, generalise and use simple relationships, and generate rules for number sequences; express simple functions initially in words and then symbolically, representing them in graphical or tabular form;
- c** interpret graphs that describe real-life situations;
- d** explore the properties of standard mathematical functions, including linear and square, reciprocal and other polynomial functions; make and interpret tables and graphs of functions, sketch their graphs, and use graphical calculators and computers to understand their behaviour.

3. Understanding and using equations and formulae

- a** appreciate the use of letters to represent unknowns;
- b** construct, interpret and evaluate formulae and expressions, given in words or symbols, related to mathematics or other subjects, or real-life situations, using computers and calculators where appropriate;
- c** manipulate algebraic expressions; form and manipulate equations or inequalities in order to solve problems;
- d** solve a range of linear equations, simple linear simultaneous equations, inequalities, and quadratic and higher-order polynomial equations, selecting the most appropriate method for the problem concerned, including trial-and-improvement methods.

SHAPE, SPACE AND MEASURES

1. Pupils should be given opportunities to:

- a** use a variety of different representations;
- b** explore shape and space through drawing and practical work using a wide range of materials;
- c** use computers to generate and transform graphic images and to solve problems.

2. Understanding and using properties shape

Pupils should be taught to:

- a** visualise, describe and represent shapes, including 2-D representations of 3-D objects, using geometrical language with increasing precision;
- b** construct 2-D and 3-D shapes from given information; understand the congruence of simple shapes, and classify triangles, quadrilaterals, polygons and other shapes, knowing and using their properties;
- c** understand the symmetry properties of 2-D and 3-D shapes and use these to solve problems in two and three dimensions;
- d** measure angles, and use the language associated with them; explain and use the angle properties of polygons and other 2-D configurations, including those associated with parallel and intersecting lines;
- e** understand and use Pythagoras' theorem;
- f** understand the trigonometrical relationships in right-angled triangles, and use these to solve problems, including those involving bearings.

3. Understanding & using of position, movement & transformation

- a** use co-ordinate systems to specify location, initially using rectangular Cartesian co-ordinates in the first quadrant;
- b** recognise and visualise the transformations of translation, reflection, rotation and enlargement, and their combination in two dimensions; understand the notations used to describe them;

- c** understand and use the properties of transformations to create and analyse patterns, to investigate the properties of shapes, and to derive results, including congruence;
- d** develop an understanding of scale, including using and interpreting maps and drawings, and enlarging shapes by different scale factors; develop an understanding of and use mathematical similarity;
- e** determine the locus of an object moving according to a given rule, including, where appropriate, using practical methods and the devising of instructions for a computer to produce desired shapes and paths.

4. Understanding and using measures

Pupils should be taught to:

- a** choose appropriate instruments and standard units of length, mass, capacity and time, and make sensible estimates in everyday situations, extending to less familiar contexts; develop an understanding of the relationship between units, converting one metric unit to another; know Imperial units in daily use and their approximate metric equivalents;
- b** develop an understanding of the difference between discrete and continuous measures; read and interpret scales, including decimal scales, and understand the degree of accuracy that is possible, or appropriate, for a given purpose;
- c** understand and use compound measures, including speed and density;
- d** find perimeters, areas and volumes of common shapes, including circles and cylinders, by counting and dissection methods, progressing to the derivation and use of standard formulae; distinguish between formulae by considering dimensions, *eg recognise that $\frac{3}{4}\pi r^2$ cannot represent the volume of a sphere.*

HANDLING DATA

1. Pupils should be given opportunities to:

a formulate questions that can be considered using statistical methods;

b undertake purposeful enquiries based on data analysis;

c use computers as a source of large samples, a tool for exploring graphical representations, and as a means to simulate events;

d engage in practical and experimental work in order to appreciate some of the principles which govern random events;

e look critically at some of the ways in which representations of data can be misleading and conclusions can be uncertain.

2. Processing and interpreting data

collecting data

Pupils should be taught to:

a design and use data collection sheets, access required information from tables, lists and computer databases, and make frequency tables for grouped data, where appropriate;

b design a questionnaire or an experiment to capture the data needed to follow lines of enquiry and to test hypotheses, taking possible bias into account;

representing and analysing data

c construct appropriate diagrams and graphs to represent discrete and continuous data, including bar charts, line graphs, pie charts, frequency polygons, scatter diagrams and cumulative frequency diagrams;

d calculate or estimate, and use appropriate measures of central tendency, ie mode, median and mean, initially with discrete data, progressing to grouped and continuous data;

e select and calculate or estimate appropriate measures of spread, including the range and interquartile range applied to discrete, grouped and continuous data;

interpreting data

f interpret a wide range of graphs and diagrams; draw inferences based on the shapes of graphs and simple statistics for a single distribution, the comparative distribution of sets of data, and the relationships between two sets of data, including correlation and lines of best fit;

g evaluate results critically, and develop an understanding of the reliability of results;

h recognise that inferences drawn from data analysis of an experiment or enquiry may suggest further questions for investigation.

3. Estimating & calculating the probabilities of events

Pupils should be taught to:

a understand and use the vocabulary of probability, through experience, experiment and theory, leading to understanding and using the probability scale from 0 to 1;

b give and justify estimates of probability to an appropriate degree of accuracy;

c understand and use relative frequency as an estimate of probability, and judge when sufficient trials have been carried out;

d recognise situations where probabilities can be based on equally likely outcomes, and others where estimates must be based on experimental evidence, and make these estimates;

e identify all the outcomes of a combination of two experiments, *eg throwing two dice*; use tabulation, tree diagrams or other diagrammatic representations of compound events;

f recognise the conditions when the addition of probabilities for mutually exclusive events, and the multiplication of probabilities for two independent events, apply, and make the appropriate calculations.

KEY STAGE 4 :

Further Material

Using mathematics, communicating mathematically and reasoning should be set in the context of the other areas of mathematics. The study of areas under graphs should apply to work on analysing data, work involving velocity and time, and probability. Trigonometric functions should be considered from the standpoint of the behaviour of functions, as well as a tool for solving problems in two & three dimensions.

1. Pupils should be given opportunities to:

a apply their knowledge, understanding and skills to solving problems of increasing complexity in a wider range of contexts.

2. Using and Applying Mathematics

Pupils should be taught to:

a explain and evaluate their choice of approach to solving problems set in contexts or areas of mathematics that are new to them;

b express mathematical ideas unambiguously through the efficient use of conventional mathematical notations;

c understand the necessary and sufficient conditions under which generalisations, inferences and solutions to problems remain valid;

d extend their mathematical reasoning into understanding and using more rigorous argument, leading to notions of proof.

3. Number

a understand and use direct and inverse proportion;

b distinguish between rational and irrational numbers, and appreciate that irrational numbers complete the real-number system;

c understand and calculate the upper and lower bounds of numerical solutions, particularly in the context of measurement;

d simplify numerical expressions involving roots; understand and use roots and reciprocals expressed in index form.

4. Algebra

- a** simplify algebraic expressions; solve equations and inequalities by algebraic and graphical methods, selecting the most appropriate method for the problem concerned;
- b** construct and use tangents to curves to estimate rates of change for non-linear functions, and use appropriate compound measures to express results;
- c** interpret the meaning of the area under a graph and apply this to the solution of numerical and statistical problems;
- d** interpret and apply the transformation of functions in the context of their graphical representation, including $y = f(x + a)$, $y = f(kx)$ and $y = f(x) + a$, applied to $y = f(x)$;
- e** select mathematical functions, *eg exponential or trigonometric functions*, to fit sets of data that model increasingly complex situations, and use them to solve problems.

5. Shape, Space and Measures

Pupils should be taught to:

- a** extend measurement, including distances and angles, to more complex plane shapes and solids, including circular arcs, cylinders, cones and spheres; understand and use relationships between similar figures and solids;
- b** apply simple vector methods to the solution of problems;
- c** extend their understanding of trigonometry to angles of any size, the graphs and behaviour of trigonometric functions, and the application of these to the solution of problems in two and three dimensions, including appropriate use of the sine and cosine rules;
- d** use angle and tangent properties of circles.

6. Handling Data

- a** use sampling methods, considering their reliability;
- b** extend skills in handling data into constructing and interpreting histograms;
- c** describe the dispersion of a set of data; find and interpret the standard deviation of a set of data;
- d** understand when and how to estimate conditional probabilities.