

The Cayman Islands National Curriculum 2008

Mathematics Programme of study and attainment targets Key Stage 3

Acknowledgements

The overview document sets out the guiding philosophy and principles of the new Cayman Islands curriculum. It guides all the subject documents and approaches to teaching and learning in the revised curriculum.

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The aims of mathematics

Learning mathematics contributes to the achievement of the curriculum aims for all young people (the 'educated Caymanian') to become numerate, a good communicator and good at finding solutions to problems. The mathematics curriculum aims to develop these skills in our children and young people.

The mathematics curriculum encompasses many skills that help students function effectively, personally, academically and vocationally. Mathematics, where possible, needs to be developed in contexts that are meaningful to real life situations. Even when it appears to be abstract, the mathematics curriculum should explicitly develop students' problem-solving, logical thinking and reasoning skills – which are all crucial in the modern workplace.

In order for our young people to leave school numerate and competent in solving problems, the mathematics curriculum actively develops students' mathematical thinking.

Mathematical thinking is about:

- Understanding the idea of process, not just learning techniques
- Stopping to think - being logical and systematic

- Taking a larger problem and breaking it down into smaller ones
- Solving a smaller problem to apply to a larger one
- Being precise and systematic
- Being able to see the next question
- Asking interesting questions
- Predicting based on experience
- Developing mathematical language to make explanations more precise
- Being able to share mathematics and mathematical thinking
- Developing new challenges - asking 'what if?' and 'what if not?' questions

Overview

Mathematics is an integral part of our existence. It is a powerful form of communication that enables us to represent, to interpret, to explain and to predict.

The study of mathematics involves a search for patterns and relationships through which we are able to explore, explain and interpret the world around us. We all require a fundamental knowledge of numbers, measurement, spatial relationships and statistics in our daily lives. At the same time, more sophisticated understanding of these areas form the basis of a myriad of vital activities in science, technology, the humanities and the arts. Beyond this specific value, the study of mathematics develops logical

reasoning and problem solving skills, and provides a powerful means of communication in the global society.

Mathematics is exciting, challenging and satisfying. It holds an inherent interest for children, which can be maintained throughout their schooling through effective and engaging teaching.

What is numeracy?

Numeracy is a proficiency that involves confidence and competence with numbers and measures. It requires an understanding of the number system, a repertoire of computational skills and an inclination and ability to solve number problems in a variety of contexts. Numeracy also demands practical understanding of the ways in which information is gathered by counting and measuring, and of how it is presented in graphs, diagrams, charts and tables.

How teachers should use the programme of study and attainment targets

Introduction

Key Stage 2 and Key Stage 3 should be seen as a continuum. Students will come to Key Stage 3 with a range of mathematical abilities and attainment. Whatever organisation of groups of students is adopted, each student should work at tasks suited to his or her individual ability, attainment and maturity.

Throughout Key Stage 3, students should be given opportunities to develop their skills in estimation and approximation and encouraged to make and test predictions and generalizations in all areas of mathematics.

The sections of the programme of study interrelate. Processes in mathematics should pervade the entire mathematics programme. Students should use and apply mathematics in practical tasks, in real-life situations and within mathematics itself.

The programme of study identifies the experiences and opportunities that students must be given to enable them to gain the knowledge, skills and understanding specified in the attainment targets.

The programme of study for mathematics is divided into four strands:

- i. Using and applying mathematics
- ii. Number and algebra
- iii. Measurement and geometry
- iv. Statistics

The first strand, using and applying mathematics, incorporates problem-solving, communicating and reasoning and is assessed through the other three strands.

This division into strands is a convenient way of emphasizing the outcomes for students learning mathematics. Learning in each strand should not happen independently. Teachers' planning should make explicit the links between strands.

Mathematical activities

Activities should:

- Involve students in different modes of learning, including playing, exploring and investigating, doing and observing, speaking and listening, discussing and asking questions
- Match the stage of development and abilities of the students

- Include opportunities for both cooperative and independent learning.
- Bring together different areas of mathematics
- Develop skills in mental arithmetic
- Use, where appropriate, students' own interests, experiences or questions, either as a starting point or as further lines of development
- Be balanced between activities that develop knowledge, skills and understanding and those that develop the ability to solve problems
- Be balanced between those that are closed and short in duration and those that are open-ended and have scope for development over a longer period of time

Attainment targets

The attainment targets specify the knowledge, skills and understanding that students should acquire through the key stage. Levels 3 through 8 have been included in this document although most students in Key Stage 3 will be working between levels 4 and 7. Further details about the attainment targets are given in appendix 1.

Mathematics programme of study for Key Stage 3

Throughout Key Stage 3, teachers should provide opportunities for students to develop a range of skills, knowledge and understanding within the four strands for mathematics through well-planned activities.

The following skills, knowledge and understanding should be taught at a level which is appropriate to the needs and abilities of students in Key Stage 3.

Using and applying mathematics

Students should be given opportunities to:

- Gather information for a task, initially with help; progress to identifying and obtaining information needed to pursue a line of enquiry, *for example, complete a data collection sheet*
 - Take increasing responsibility for selecting and using appropriate resources and mathematics
 - Plan and organise their work, learning to work systematically
 - Outline steps to be taken to carry out a task; progress to giving reasons for the order of steps
 - 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
 - Review progress in the course of their work; check their results and evaluate their solutions; consider whether these are reasonable
- Develop a range of mathematical strategies for solving problems, *for example, simplify the task, use trial and improvement methods, work backwards, make organised lists, look for patterns*
 - Explain, interpret and discuss their mathematics as they work; compare their ideas and methods with others; understand and use appropriate mathematical language and notation
 - Present their work and results clearly, initially with help, using writing and symbolic notation, *for example, diagrams, graphs and symbols*; choose the most appropriate format and use it to present information and results clearly, *for example, record results in tabular form to assist in identifying patterns*; explain the reasons for the choice of presentation
 - Comment on results; summarise and explain the main findings, *for example, indicating trends*, presenting these in an appropriate format
 - Examine critically, improve and justify their choice of mathematical presentation
 - Recognise important variables; progress to controlling these variables, *for example, in considering the area of rectangles, vary length of one side while keeping the other constant*
- Use patterns and relationships arising from their work to make and test predictions; understand general statements; understand, make and test generalisations, initially in words, later translating these into symbolic form where appropriate; appreciate the difference between mathematical explanation and experimental evidence; use counter examples in disproving
 - Ask and respond to open-ended questions
 - Use mathematical reasoning, *for example, if ... then; what would happen if ...*, initially when explaining, and then when following a line of argument, recognizing inconsistencies
 - Synthesise information which is in a variety of mathematical forms
 - Justify how they arrived at a conclusion or solution to a problem

Number and algebra

Understanding number and number notation

Students should be given opportunities to:

- Understand and use the language of number, *for example, whole, decimal, fraction, percentage, prime, square, cube, root, factor, multiple, positive and negative, integer, natural, sum, difference, product, numerator, denominator, equivalent*
- Read, write and order whole numbers up to 1000; progress to work with numbers with up to three decimal places, initially in the context of measurement; understand and use the concept of place value in whole numbers and decimals and use this to multiply and divide numbers by 10, 100 and 1000
- Approximate numbers to the nearest 10 or 100; estimate within calculations, initially with numbers within 100 and extending to all whole numbers; estimate and approximate to gain a feeling for the size of a solution to a problem, *for example, understand that 32.45×9.75 is approximately 30×10* ; approximate to specified degrees of accuracy including a given number of decimal places and significant figures; use trial and improvement methods; in the context of a problem, select an appropriate degree of accuracy
- Understand and use the conventional way of recording money
- Understand the four operations and the relationships between them
- Understand and use fractions, decimals, percentages and ratios in

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context; understand and use the relationship between fractions, decimals, ratios and percentages, square and square root, cube and cube root

- Understand and use index notation

Number operations and applications

Students should be given opportunities to:

- Consolidate knowledge of number facts, including multiplication to 10×10 ; use this knowledge to find facts that they cannot recall
- Add, subtract, multiply and divide, initially with whole numbers and progressing to numbers with up to three decimal places; understand the effects of operations on numbers of any size; apply order of precedence, first without brackets and then with brackets
- Solve problems requiring application of order of precedence; check calculations including the use of inverse operations
- Calculate with fractions mainly in context, including fractions of quantities and fractional change; initially using simple percentages, calculate percentages of quantities and percentage change; express one number as a percentage of another; understand and use repeated proportional change including the calculation of compound interest restricted to a maximum of three iterations; use unitary ratios and calculate with ratios in a variety of situations
- Understand and use directed numbers starting with interpreting negative

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numbers in familiar contexts, *for example, temperature*; progress to addition, subtraction, multiplication and division of negative numbers in context

- Use square and cube numbers, and square and cube roots; express a positive integer as a product of primes; calculate using integer indices; express numbers in standard index form using integer powers of 10; express all powers and roots in index notation; calculate with numbers in standard index form using integer powers of 10
- Calculate with money; solve problems in the context of finance, *for example, currency exchange rates, profit and loss, discount, loans, school bank accounts, current and deposit accounts, cheques, statements, deposits and withdrawals*
- Multiply and divide mentally single-digit multiples of any power of 10, and realise that, with a number less than 1, multiplication has a decreasing effect and division has an increasing effect

Patterns, relationships, sequences and generalizations

Students should be given opportunities to:

- Explore, explain and generalise number patterns; predict and check subsequent numbers; generalise, mainly in words, patterns that arise in various situations; *for example, through spatial arrangement*; follow sets of instructions to generate sequences and determine possible rules; use symbolic notation to express rules of sequences (mainly linear and simple quadratic)

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Algebraic conventions and manipulations

Students should be given opportunities to:

- Understand key concepts and terms, *for example, substitute, simplify, like terms, expand, factorise, subject, expression, equation, rule, generalisation, sequence, nth term, index/indices, power, reciprocal, inequation*
- Understand and use conventional notations of algebra, *for example: 1a is written as a; a x b x 2 is written as 2ab; b + b + b is written as 3b, y x y is written as y²; 3c + 4c is written as 7c; 2x² + 3x² is written as 5x²; 7x – 2x + y is written as 5x + y; a ÷ b is written as a/b*
- Formulate, interpret and evaluate algebraic expressions; manipulate simple expressions, simplifying, removing brackets and factorising as appropriate; use the rules of indices for integral and fractional values

Functions, formulae, equations and inequalities

Students should be given opportunities to:

- Appreciate the use of letters to represent variables
- Use simple function machines where appropriate; understand and work with simple functions arising in a variety of situations; express a function in words,

in tabular form, graphically and symbolically; interpret graphs that describe real-life situations including conversion graphs

- Explore the properties of standard mathematical functions including linear, simple quadratic, *for example $f(x) = x^2 + c$ where c is an integer*, and simple reciprocal functions; make tables of such functions, sketch and interpret their graphs using graphical calculators and computers to understand their behaviour; appreciate the use of letters to represent unknowns
- Understand, construct and evaluate formulae related to mathematics or other subjects or real-life situations; change the subject of formulae where the subject appears in one term only
- Formulate, use, solve and draw graphs of linear equations; use algebraic and graphical methods to solve simultaneous linear equations in two unknowns; solve polynomial equations, *for example, $x^2 + x = 5$, by 'trial and improvement'*
- Solve inequalities on a number line; use straight line graphs to locate regions representing linear inequalities

Measurement and geometry

Exploration of shape

Students should be given opportunities to:

- Explore shape through drawing and practical work using a wide range of materials; recognise and describe 2-D

and 3-D shapes, including squares, rectangles, triangles, hexagons, pentagons, circles, cubes, cuboids, cylinders, spheres, cones, triangular prisms, pyramids; recognise right-angled corners in 2-D and 3-D shapes; investigate tessellation of 2-D shapes, *for example, equal angles in diagrams and tessellations*

- Explore and investigate lines and angles, using appropriate language and notation including vertical, horizontal, perpendicular, parallel, acute, obtuse, right, reflex, vertically opposite, adjacent, alternate and corresponding angles
- Classify and define types of triangles including scalene, right angle, equilateral and isosceles; classify and define types of quadrilaterals including square, rectangle, parallelogram, rhombus, kite and trapezium; use the properties of triangles and quadrilaterals
- Know and use language associated with circles, including circumference, radius, diameter, arc and chord
- Understand and apply Pythagoras' Theorem and apply sine, cosine and tangent to right angled triangles
- Explore a range of regular and irregular 2-D and 3-D shapes; make 2-D and 3-D shapes from given information including 2-D representation of 3-D objects; use associated language including edge, face and vertex; draw nets; estimate, measure and calculate angles; construct triangles and simple scale drawings using protractor, ruler and compasses, as appropriate
- Understand the concepts of congruence and mathematical similarity

Position, movement and direction

Students should be given opportunities to:

- Understand the notion of angle in the context of turning; give and understand instructions for moving through $1/4$, $1/2$ and $3/4$ turns
- Locate position; use clockwise and anticlockwise; use the 8 points of the compass; specify location by means of co-ordinates in the first and then the four quadrants; understand and use 3-figure bearings to define direction
- Recognise symmetry properties in a variety of shapes in two dimensions; recognise line symmetry; draw the axes of symmetry; reflect shapes in a mirror line; recognise rotational symmetry, its order and centre; know and use symmetry properties of triangles, quadrilaterals and other polygons; recognise planes of symmetry in practical situations
- Understand transformation of shapes; reflect shapes in a line, *for example*, $x = 1$; rotate shapes about a given centre; translate shapes; enlarge a shape through a given centre of enlargement, initially by a whole number scale factor and then a positive fractional scale factor; use transformations to create and analyse spatial patterns

Measurement

Students should be given opportunities to:

- Understand and use metric units of length, area, capacity and 'weight'/mass; understand the relationship between units; convert from one metric unit to another
- Choose and use appropriate metric units and measuring instruments in a variety of situations, interpreting numbers on a range of measuring instruments
- Make sensible estimates of length, area, capacity, mass, weight and time
- Understand and use compound measures, including speed
- Know Imperial measures still in common use, including foot, yard, mile, pound and pint and their approximate metric equivalents
- Read digital and analogue displays; use a calendar; understand and use the twelve and twenty four hour clock; use timetables involving the twenty four hour clock; interpret and display information on travel graphs
- Understand and use scale in the context of maps and drawings, *for example*, *calculate the actual distance as the crow flies between two places on a map*
- Develop an understanding of the continuous nature of measure and the approximate nature of measurement
- Understand the concept of perimeter; calculate the perimeters of squares, rectangles, triangles and other straight-edged figures and circles

- Understand the concepts of area and volume; find areas and volumes, *for example*, *by counting and dissection methods*; progress to the derivation and use of standard formulae; calculate the areas of squares, rectangles, triangles, parallelograms, rhombuses, kites, trapezia, circles calculate the surface areas of cubes and cuboids; calculate the volumes of cubes, cuboids, cylinders and other simple right prisms

Statistics

Collect and record data

Students should be given opportunities to:

- Formulate questions that can be considered using statistical methods and undertake purposeful enquiries based on data analysis
- Access and retrieve data from a variety of sources and understand the purpose for which the data is required; collect, organise and record data by using and designing recording sheets, using tallying methods, where appropriate, initially with given class intervals leading to choosing suitable class intervals; design and use an appropriate questionnaire to explore an issue; use a given decision tree diagram to sort a collection of items

Represent, analyse and interpret data

Students should be given opportunities to:

- Interpret and display information in a variety of ways, including:
 - bar charts with and without a given scale
 - pictograms, using whole symbols only to represent one or more than one item
 - frequency tables and diagrams for ungrouped discrete data, grouped discrete data and continuous data
 - line graphs, understand that intermediate values may or may not have a meaning

- pie charts
- scatter graphs including line of best fit by inspection
- Interpret information in flow diagrams and two-way tables

- Interrogate data in a database, which may be a computer database, initially using one criterion; use the facilities of the database to represent information graphically
- Extract and use information from tables and lists; answer straightforward questions, then draw more general inferences for a single distribution; calculate or estimate and use the mean and range of sets of discrete data; distinguish between and be able to find the mean, median and mode of discrete data; find the mean and the modal class of grouped data; consider the suitability of the mean, mode or median in different circumstances; compare sets of data by making appropriate use of mean, mode, median and range

Probability

Students should have opportunities to:

- Understand possible outcomes of random trials or experiments; understand that there is a degree of uncertainty about the occurrence of some events and that others are certain or impossible; place events in order of 'likelihood' and use appropriate words to identify chance; know that when repeating the same experiment, different outcomes may result and that the possible outcomes

may not be equally likely; understand and use 0 and 1 as the limits of the probability scale; know that, for equally likely outcomes, the probability of an event is the number of desirable outcomes divided by the number of possible outcomes

- Recognise situations where probabilities can be based on equally likely outcomes and others where estimates must be based on sufficient experimental evidence and make these estimates; understand and use relative frequency as an estimate of probability
- Identify all the outcomes when dealing with a combination of two independent events, using diagrams or tables and use these to find probabilities; know that if there are several possible outcomes of an event (exhaustive and mutually exclusive), the total of these probabilities is 1; understand that the probability of something happening is 1 minus the probability of it not happening; understand and apply the addition of probabilities for mutually exclusive events

Appendix 1 Attainment targets

The learning outcomes or attainment targets are expressed at eight levels of increasing difficulty. These levels are the same for all key stages and are not age or year-group-dependent, which will make it easier to see how a student progresses as he/she moves up the year groups and from primary to secondary school.

Students learn at different rates and, therefore, individual students or groups of students of the same age could be working towards different levels within and across the key stage boundaries. By the end of a key stage, **most** students should be performing at the '**expected**' level, but some will be above this level and others will be below.

The range of levels covered by the key stage and the 'expected' levels for the end of each key stage are given in the table below:

Key Stage	Year Groups	Range of levels covered by the programme of study	Expected level at end of the Key Stage
1	1 - 3	1-3	2
2	4 - 6	2-5	4
3	7 - 9	3-7	5 or 6

Teachers will be expected to make judgements about the levels attained by each of their students, particularly at the end of a key stage. In deciding on a student's level of attainment, teachers should judge which description in the attainment targets best fits the student's performance. When doing so, each description should be considered alongside those for adjacent levels. It is not necessary for a student to have satisfied the entire range of a particular level to be awarded it.

It can be helpful to divide levels into three sub-levels to support tracking of progress and target setting.

For example:

- 3a – Represents a performance that demonstrates a good understanding of all the descriptors in level 3
- 3b – Represents understanding of the majority of level 3 descriptors
- 3c– Represents understanding at level 2a (ie the full understanding of the previous level) plus an understanding of some of the descriptors at level 3

Strand i Using and applying mathematics

Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> •Students sort objects and classify them, demonstrating the criterion they have used. 	<ul style="list-style-type: none"> •Students sort and classify objects using more than one criterion. •They gather information and record results in simple lists, tables, pictograms and bar charts, in order to communicate their findings. 	<ul style="list-style-type: none"> •Students extract and interpret information presented in simple tables and lists. •They construct bar charts and pictograms, where the symbol represents a group of units, to communicate information they have gathered and they interpret information presented in these forms. 	<ul style="list-style-type: none"> •Students are developing their own strategies for solving problems and use these strategies both in working within mathematics and in applying mathematics to practical contexts. •They check their results are reasonable by considering the context or the size of the numbers when solving problems, with or without a calculator. •They look for patterns and relationships, presenting information and results in a clear and organised way. •They search for a solution by trying out ideas of their own. 	<ul style="list-style-type: none"> •Students identify the mathematical aspects and obtain the necessary information in order to explore mathematical situations, carry through tasks or tackle problems. •They calculate accurately, using ICT when appropriate • They check their working and results, considering whether these are sensible. •They show understanding of situations by describing them mathematically using symbols, words and diagrams. •They draw simple conclusions of their own and give an explanation of their reasoning.

Level 6	Level 7	Level 8
<ul style="list-style-type: none"> •Students carry through substantial tasks and solve quite complex problems by independently and systematically breaking them down into smaller, more manageable tasks. •They interpret, discuss and synthesise information presented in a variety of mathematical forms, relating findings to the original context. •Students' written and spoken language explains and informs their use of diagrams. •They are beginning to give mathematical justifications, making connections between the current situation and ones they have met before. 	<ul style="list-style-type: none"> •Starting from problems or contexts that have been presented to them, students explore the effects of varying values and look for invariance in models and representations working with and without ICT. •They progressively refine or extend the mathematics used, giving a reason for their choice of mathematical presentation and explaining features they have selected. •They justify their generalisations, arguments or solutions, looking for equivalence to different problems with similar structures. •They appreciate the difference between mathematical explanation and experimental evidence. 	<ul style="list-style-type: none"> •Students develop and follow alternative approaches. •They compare and evaluate representations of a situation, introducing and using a range of mathematical techniques. •They reflect on their own lines of enquiry when exploring mathematical tasks. •They communicate mathematical or statistical meaning to different audiences through precise and consistent use of symbols that is sustained throughout the work. •They examine generalizations or solutions reached in an activity, commenting constructively on the reasoning and logic or the process employed, or the results obtained, and make further progress in the activity as a result

Strand ii Number and algebra

Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> •Students count, order, add and subtract numbers when solving problems involving up to 10 objects. •They continue a sequential pattern. 	<ul style="list-style-type: none"> •Students count sets of objects reliably and use mental recall of addition and subtraction facts to 10. •They begin to understand the place value of each digit in a number and use this to order numbers up to 100. •They understand that subtraction is the inverse of addition and use this knowledge in solving problems. •They choose the appropriate operation when solving addition and subtraction problems. •They use mental calculation strategies to solve problems involving money and measures. •They recognise sequences of numbers, including odd and even numbers. 	<ul style="list-style-type: none"> •Students show understanding of place value in numbers up to 1000 and use this to make approximations. •They begin to use decimal notation and recognise negative numbers, in contexts such as money and temperature. •They use mental recall of addition and subtraction facts to 20 in solving problems involving larger numbers. •They add and subtract numbers with two digits mentally and with three digits using appropriate written methods. •They use mental recall of the 2, 3, 4, 5 and 10 multiplication tables and derive the associated division facts. •They solve whole number problems involving multiplication and division including those that give rise to remainders. •They use simple fractions that are several parts of a whole and begin to recognise when two simple fractions are equivalent. 	<ul style="list-style-type: none"> •Students use their understanding of place value to multiply and divide whole numbers by 10 and 100. •In solving number problems, students use a range of mental methods of computation with the four operations, including mental recall of multiplication facts up to 12 x 12 and quick derivation of division facts. •They use efficient written methods of addition and subtraction and of multiplication and division. •They recognize approximate proportions of a whole and use simple fractions and percentages to describe these. •They begin to use simple formulae expressed in words. •They use and interpret coordinates •They recognize and describe relationships including multiple, factor, prime and square. 	<ul style="list-style-type: none"> •Students use their understanding of place value to multiply and divide whole numbers and decimals. •They order, add and subtract negative numbers in context. •They use all four operations with decimals to two places. •They solve simple problems involving ratio and direct proportion. •They calculate fractional or percentage parts of quantities and measurements, using a calculator where appropriate. •They construct, express in symbolic form and use simple formulae involving one or two operations. •They use brackets appropriately.

Level 6	Level 7	Level 8
<ul style="list-style-type: none"> •Students evaluate one number as a fraction or percentage of another. •They understand and use the equivalences between fractions, decimals and percentages and calculate using ratios in appropriate situations. •They add and subtract fractions. <p>They formulate and solve linear equations with whole number coefficients.</p> <ul style="list-style-type: none"> •They represent mappings expressed algebraically, and use Cartesian coordinates for graphical representation, interpreting the resulting graphs. 	<ul style="list-style-type: none"> •When making estimates, students round to one significant figure and multiply and divide mentally. •They understand and are able to multiply and divide by numbers between 0 and 1. •They solve numerical problems involving numbers of any size, using a calculator or computer software efficiently and appropriately. •They understand and use proportional changes, calculating the result of any proportional change using multiplicative methods. •They find and describe in symbols the next term or nth term of a sequence where the rule is quadratic. •They use algebraic and graphical methods to solve simultaneous linear equations in two variables. 	<ul style="list-style-type: none"> •Students solve problems involving calculating with powers, roots and numbers expressed in standard form. •They choose to use fractions or percentages to solve problems involving repeated proportional changes or the calculation of the original quantity given the result of a proportional change. •They evaluate algebraic formulae, or calculate one variable, given the others, substituting fractions, decimals and negative numbers. •They manipulate algebraic formulae, equations and expressions, finding common factors and multiplying two linear expressions. •They solve inequalities in two variables. •They sketch and interpret graphs of linear, quadratic, cubic and reciprocal functions, and graphs that model real situations.

Strand iii

Measurement and geometry

Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> •Students measure and order objects by direct comparison and order events. •They use everyday language to describe properties and positions when working with 2D and 3D shapes. 	<ul style="list-style-type: none"> •Students use mathematical names for common 3D and 2D shapes and describe their properties, including numbers of sides and corners. •They distinguish between straight and turning movements, understand angle as a measurement of turn, and recognise right angles in turns. •They begin to use everyday standard and non-standard units to measure length and mass. 	<ul style="list-style-type: none"> •Students classify 3D and 2D shapes in various ways using mathematical properties such as reflective symmetry for 2D shapes. •They use non-standard units and standard metric units of length, capacity and mass, in a range of contexts. •They know and use standard units of time and their equivalents in a range of contexts. 	<ul style="list-style-type: none"> •Students make 3D mathematical models by linking given faces or edges. •They draw common 2D shapes in different orientations on grids. •They reflect simple shapes in a mirror line. •They choose and use appropriate units and tools, interpreting numbers on a range of measuring instruments with appropriate accuracy. •They find perimeters of simple shapes and find areas by counting squares. 	<ul style="list-style-type: none"> • Students measure and draw angles to the nearest degree, and use language associated with angle when constructing models and when drawing or using shapes. • They know the angle sum of a triangle and that of angles at a point and use this knowledge to solve problems and derive other facts. •They convert one metric unit to another. •They make sensible estimates of a range of measures in relation to everyday situations. •They understand and use the formula for the area of a rectangle. •They identify all the symmetries of 2D shapes.

Level 6	Level 7	Level 8
<ul style="list-style-type: none"> •Students know and use the properties of quadrilaterals. •They solve problems using angle and symmetry properties of polygons and angle properties of intersecting and parallel lines, and explain these properties. •They understand and use appropriate formulae for finding circumferences and areas of circles when solving problems. •They understand and use appropriate formulae for finding areas of plane rectilinear figures and volumes of cuboids when solving problems. •They recognise and use common 2D representations of 3D objects. •They devise instructions for a computer to generate and transform shapes and paths. 	<ul style="list-style-type: none"> •Students understand and apply Pythagoras' theorem when solving problems in two dimensions. •They calculate lengths, areas and volumes in plane shapes and right prisms. •They enlarge shapes by any scale factor and appreciate the similarity of the resulting shapes. •They determine the locus of an object moving according to a rule. •They appreciate the imprecision of measurement and recognise that a measurement given to the nearest whole number may be inaccurate by up to one half in either direction. •They understand and use compound measures, such as speed. 	<ul style="list-style-type: none"> •Students understand and use congruence and mathematical similarity. •They use sine, cosine and tangent in right angled triangles when solving problems in two dimensions.

Strand iv

Statistics

Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> •Students sort objects and classify them, demonstrating the criterion they have used. 	<ul style="list-style-type: none"> •Students sort and classify objects using more than one criterion. •They gather information and record results in simple lists, tables, pictograms and bar charts, in order to communicate their findings. 	<ul style="list-style-type: none"> •Students extract and interpret information presented in simple tables and lists. •They construct bar charts and pictograms, where the symbol represents a group of units, to communicate information they have gathered and they interpret information presented in these forms. 	<ul style="list-style-type: none"> •Students collect discrete data and record them using a tally chart and frequency table. •They understand and use the mode and range to describe sets of discrete 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. 	<ul style="list-style-type: none"> •Students 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 frequency polygons, and draw conclusions. •They understand and use the probability scale from 0 to 1. •They find and justify probabilities and approximations to these by selecting and using methods based on equally likely outcomes and experimental evidence, as appropriate. •Students understand that different outcomes may result from repeating an experiment.

Level 6	Level 7	Level 8
<ul style="list-style-type: none"> •Students collect and record continuous data choosing appropriate equal class intervals over a sensible range to create frequency tables. •They construct and interpret frequency diagrams and pie charts. •They draw conclusions from scatter diagrams and have a basic understanding of correlation. •They identify all the outcomes in a combination of two events or experiments and find related probabilities. •They use their knowledge that the total probability of all the mutually exclusive outcomes of an experiment is 1. 	<ul style="list-style-type: none"> •Students specify hypotheses and test them by designing and using appropriate methods that take account of variability or bias. •They determine the modal class and estimate the mean, median and range of sets of grouped data, selecting the statistic most appropriate to their line of enquiry. •They use measures of average and range, with associated frequency diagrams, as appropriate, to compare distributions and make inferences. •They understand relative frequency as an estimate of probability and use this to compare outcomes of experiments. 	<ul style="list-style-type: none"> •Students interpret and construct cumulative frequency tables and diagrams. •They estimate the median and inter-quartile range and use these to compare distributions and make inferences. •They understand how to calculate the probability of a compound event and use this in solving problems.