



**BRIEF**

**ON THE CHANGES TO THE**

**NEW NATIONAL MATHS CURRICULUM**

**FROM SEPTEMBER 2014**

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- **TIMELINE FOR IMPLEMENTATION OF NEW NATIONAL MATHS CURRICULUM**

- The **new national curriculum will begin to be implemented in September 2014**
- This is the new curriculum that will be taught in all maintained primary and secondary schools from September 2014
- **The exceptions to this are:**
  - **Pupils in year 2 and year 6 in 2014/15, in English, mathematics and science**, will follow the old national curriculum (2006). This is because these pupils will be the last cohort to sit the current key stage 1 assessment and key stage 2 tests
  - **Pupils in years 10 and 11 in 2014/15, in English, mathematics and science**, will follow the old programmes of study (2007). The new national curriculum in English, mathematics and science will be introduced from 2015, alongside reformed GCSEs in these subjects

- **KEY TIMELINE FOR NEW NATIONAL MATHS CURRICULUM IN SECONDARY**

- **2014/2015 Year 9 will be the first students to sit the new GCSEs under the new National Curriculum**

2013/14	2014/15	2015/16	2016/27
Year 7	Year 7	Year 7	Year 7
Year 8	Year 8	Year 8	Year 8
Year 9	Year 9	Year 9	Year 9
Year 10	Year 10	Year 10	Year 10
Year 11 - sit old GCSE	Year 11 - sit old GCSE	Year 11 - sit old GCSE	Year 11 - sit new GCSE

- **PRIMARY – GENERAL AND DETAILED CHANGES TO THE NEW NATIONAL MATHS CURRICULUM**

- **General changes to the new national maths curriculum:**
  - *There is higher expectation overall – **pupils will be benchmarked against age-related expectations in other nations (same in Secondary)***
  - There are **fewer things in more depth in primary**, so data has less prominence and **probability will not be introduced till Key Stage 3**
  - **Conceptual development of number has been addressed in detail, especially in relation to arithmetic and proportionality**
  - All pupils will be expected to **build firm foundations and not be accelerated to content** expected in secondary school
  - **Progression shown year-by-year** – but it will be for teachers to set out their year-by-year approach in their school curriculum
- **Detailed changes to the new national maths curriculum:**
  - There are **earlier and more challenging requirements for multiplication tables, which have been increased to 12x12**
  - The curriculum has **clear expectations around written methods in addition to mental methods**
  - There is an **earlier and more challenging requirement for fractions and decimals**
  - There is an **increased requirement for pupils to use formulae for volume and to calculate the area of shapes other than squares and rectangles**
  - **Probability has been removed** from the primary curriculum
  - There is an **increased requirement for understanding of proportional reasoning** – for example **through volume and calculations with fractions**
  - **Financial education has been reinforced, with a renewed emphasis on essential numeracy skills, using money and working with percentages (similar in Secondary)**
  - The curriculum has a strong steer that the **use of calculators should be restricted until the later years of primary**
  - There is a **greater emphasis on the use of large numbers, algebra, ratio and proportion at an earlier age** than in the current documentation. Expectations for learning ratio and proportion have been accelerated since the initial draft.
  - **Roman numerals have been introduced in the Year 3 curriculum**
  - There is a **focus on counting beyond whole numbers, eg, decimals, fractions**
  - **Abstract symbols have been introduced in Year 1**

- **Data handling has decreased**, but the curriculum makes **more reference to interpretation of data**
- **To understand expectations in Years 5 and 6, equivalent objectives in the primary framework would need to be drawn from Years 7, 8 and 9**
- New national maths curriculum programme of study for KS1-KS3:  
<https://www.gov.uk/government/publications/national-curriculum-in-england-mathematics-programmes-of-study/national-curriculum-in-england-mathematics-programmes-of-study>

- **SECONDARY - GENERAL AND DETAILED CHANGES TO THE NEW NATIONAL MATHS CURRICULUM**
  - **General changes to the new national maths curriculum:**
    - *There is a higher expectation overall – **pupils will be benchmarked against age-related expectations in other nations (same in Primary)***
    - **Mathematics is set out in more detail than the current National Curriculum, albeit with less specification of generic skills**
    - **Probability and statistics are treated as two separate topics**
    - There is a **focus on consolidating understanding**: Key Stage 3 builds on Key Stage 2
    - The **aim of the new curriculum is to prepare young people for further study post-16, as well as for work and personal life**
  - **Detailed changes to the new national maths curriculum:**
    - There is **an increased level of challenge around the theory of number – achieved by introducing prime numbers and surds in KS3**
    - You'll find **increased requirements for algebra, geometry and measures and ratios, proportion and rates of change – the three pillars for calculus at post-16 level**
    - There are **raised expectations for achievement in probability**
    - **Financial education** has been reinforced with **a focus on solving problems involving percentage increases and decreases, simple interest and repeated growth (similar in Primary)**



- **ASSESSMENT IN EYFS/PRIMARY – GENERAL AND DETAILED CHANGES TO THE NEW NATIONAL CURRICULUM**
  - **General changes to the new national curriculum:**
    - **Assessment levels have been removed** from the national curriculum and will not be replaced because the levels have become too abstract, do not give parents meaningful information about how their child is performing, nor give pupils information about how to improve (**same in Secondary**)
      - **Schools have the freedom to develop their own means of assessing pupils' progress towards end of key stage expectations providing they suit the new national curriculum**
    - **The first new key stage 2 tests in English, mathematics and science**, based on the new national curriculum, will be sat by pupils for the first time **in the summer of 2016**
  - **Detailed changes to the new national curriculum:**
    - New assessments will reflect the more challenging national curriculum. Specifically:
      - **introduce more challenging tests** that will **report a scaled score at the end of the key stages rather than a level (same in Secondary)**
      - **make detailed performance descriptors available** to inform teacher assessment **at the end of key stage 1 and key stage 2**. These will be **directly linked to the content of the new curriculum** and improve the moderation regime to ensure that teacher assessments are more consistent
      - We will have **national assessments at key points in children's primary education**. These have **two aims** – to **provide standard information to parents** and to give a **picture of school performance**
      - There will be **different approaches to assessment through a child's education and development**, using the most appropriate approach for capturing children's learning at each stage and to complement on-going teacher assessment:
        - **the existing statutory two-year-old progress check undertaken in early years settings**
        - **a short reception baseline** that will sit within the assessments that teachers make of children **during reception**
        - **a phonics check near the end of year 1**
        - **a teacher assessment at the end of key stage 1 in mathematics; reading; and, writing, informed by pupils' scores in externally-set but internally-marked tests** (writing will be partly

informed by the grammar, punctuation and spelling test); and teacher assessment of speaking and listening and science

- **national tests at the end of key stage 2 in: mathematics; reading; grammar, punctuation and spelling; and a teacher assessment of mathematics, reading, writing, and science**
- [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/297595/Primary\\_Accountability\\_and\\_Assessment\\_Consultation\\_Response.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/297595/Primary_Accountability_and_Assessment_Consultation_Response.pdf)

- **ASSESSMENT IN SECONDARY – GENERAL AND DETAILED CHANGES TO THE NEW NATIONAL CURRICULUM**
  - **General changes to the new national curriculum:**
    - **Assessment levels have been removed** from the national curriculum and will not be replaced because the levels have become too abstract, do not give parents meaningful information about how their child is performing, nor give pupils information about how to improve **(same in Primary)**
      - **Schools have the freedom to develop their own means of assessing pupils' progress towards end of key stage expectations providing they suit the new national curriculum**
    - Pupils will sit **the first exams for new GCSEs in English language, English literature and mathematics in summer 2017**
  - **Detailed changes to the new national curriculum:**
    - New assessments will reflect the more challenging national curriculum. Specifically:
      - **introduce more challenging tests** that will **report a scaled score at the end of the key stages rather than a level (same in Primary)**

- **COMPARING AIMS IN PRIMARY (KS1 & KS2) – THE NEW MATHS NATIONAL CURRICULUM**

- The national curriculum for mathematics aims to ensure that all pupils:
  - **become fluent in the fundamentals of mathematics**, including through varied and frequent practice with increasingly complex problems over time, so that pupils:
    - develop conceptual understanding
    - develop the ability to recall and apply knowledge rapidly and accurately
  - **reason mathematically** by
    - following a line of enquiry
    - conjecturing relationships and generalisations
    - developing an argument, justification or proof using mathematical language
  - can **solve problems** by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication including
    - breaking down problems into a series of simpler steps
    - persevering in seeking solutions

### **COMPARED TO:**

- **BREADTH OF STUDY IN PRIMARY (KS1) – 2006 MATHS NATIONAL CURRICULUM**
  - **Knowledge, skills and understanding** through
    - practical activity, exploration and discussion
    - using mathematical ideas in practical activities, then recording these using objects, pictures, diagrams, words, numbers and symbols
    - using mental images of numbers and their relationships to support the development of mental calculation strategies
    - estimating, drawing and measuring in a range of practical contexts
    - drawing inferences from data in practical activities
    - exploring and using a variety of resources and materials, including ICT g. activities that encourage them to make connections between number work and other aspects of their work in mathematics

### **AND**

- **BREADTH OF STUDY IN PRIMARY (KS2) – 2006 MATHS NATIONAL CURRICULUM**
  - **Knowledge, skills and understanding** through
    - activities that extend their understanding of the number system to include integers, fractions and decimals
    - approximating and estimating more systematically in their work in mathematics
    - using patterns and relationships to explore simple algebraic ideas
    - applying their measuring skills in a range of contexts
    - drawing inferences from data in practical activities, and recognising the difference between meaningful and misleading representations of data
    - exploring and using a variety of resources and materials, including ICT
    - activities in which pupils decide when the use of calculators is appropriate and then use them effectively
    - using mathematics in their work in other subjects

- **COMPARING AIMS IN SECONDARY (KS3) – THE NEW MATHS NATIONAL CURRICULUM**

- Through the mathematics content, pupils should be taught to:

- **Develop fluency**

- consolidate their numerical and mathematical capability from key stage 2 and extend their understanding of the number system and place value to include decimals, fractions, powers and roots
- select and use appropriate calculation strategies to solve increasingly complex problems
- use algebra to generalise the structure of arithmetic, including to formulate mathematical relationships
- substitute values in expressions, rearrange and simplify expressions, and solve equations
- move freely between different numerical, algebraic, graphical and diagrammatic representations [for example, equivalent fractions, fractions and decimals, and equations and graphs]
- develop algebraic and graphical fluency, including understanding linear and simple quadratic functions
- use language and properties precisely to analyse numbers, algebraic expressions, 2-D and 3-D shapes, probability and statistics

- **Reason mathematically**

- extend their understanding of the number system; make connections between number relationships, and their algebraic and graphical representations
- extend and formalise their knowledge of ratio and proportion in working with measures and geometry, and in formulating proportional relations algebraically
- identify variables and express relations between variables algebraically and graphically
- make and test conjectures about patterns and relationships; look for proofs or counter-examples
- begin to reason deductively in geometry, number and algebra, including using geometrical constructions
- interpret when the structure of a numerical problem requires additive, multiplicative or proportional reasoning

- explore what can and cannot be inferred in statistical and probabilistic settings, and begin to express their arguments formally
- **Solve problems**
  - develop their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems
  - develop their use of formal mathematical knowledge to interpret and solve problems, including in financial mathematics
  - begin to model situations mathematically and express the results using a range of formal mathematical representations
  - select appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems

## **AND**

### • **COMPARING AIMS IN SECONDARY (KS4) – THE NEW MATHS NATIONAL CURRICULUM**

- Through the mathematics content pupils should be taught to:
  - **Develop fluency**
    - consolidate their numerical and mathematical capability from key stage 3 and extend their understanding of the number system to include powers, roots {and fractional indices}
    - select and use appropriate calculation strategies to solve increasingly complex problems, including exact calculations involving multiples of  $\pi$  {and surds}, use of standard form and application and interpretation of limits of accuracy
    - consolidate their algebraic capability from key stage 3 and extend their understanding of algebraic simplification and manipulation to include quadratic expressions, {and expressions involving surds and algebraic fractions}
    - extend fluency with expressions and equations from key stage 3, to include quadratic equations, simultaneous equations and inequalities
    - move freely between different numerical, algebraic, graphical and diagrammatic representations, including of linear, quadratic, reciprocal, {exponential and trigonometric} functions
    - use mathematical language and properties precisely
  - **Reason mathematically**
    - extend and formalise their knowledge of ratio and proportion, including trigonometric ratios, in working with measures and geometry, and in working with proportional relations algebraically and graphically
    - extend their ability to identify variables and express relations between variables algebraically and graphically
    - make and test conjectures about the generalisations that underlie patterns and relationships; look for proofs or counter-examples; begin to use algebra to support and construct arguments {and proofs}
    - reason deductively in geometry, number and algebra, including using geometrical constructions
    - interpret when the structure of a numerical problem requires additive, multiplicative or proportional reasoning



- explore what can and cannot be inferred in statistical and probabilistic settings, and express their arguments formally
- assess the validity of an argument and the accuracy of a given way of presenting information
- **Solve problems**
  - develop their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems
  - develop their use of formal mathematical knowledge to interpret and solve problems, including in financial contexts
  - make and use connections between different parts of mathematics to solve problems
  - model situations mathematically and express the results using a range of formal mathematical representations, reflecting on how their solutions may have been affected by any modelling assumptions
  - select appropriate concepts, methods and techniques to apply to unfamiliar

## **COMPARED TO:**

- **MATHEMATICAL PROCESSES AND APPLICATION IN SECONDARY (KS3 & KS4) – 2007 MATHS NATIONAL CURRICULUM**
  - **Aims**
    - Successful learners
    - Confident individuals
    - Responsible citizens
  - **Key Concepts**
    - Competence
    - Creativity
    - Application and implication of Maths
    - Critical understanding
  - **Key Processes** representing analysing using:
    - Mathematical reasoning
    - Appropriate mathematical procedures
    - Interpreting and evaluating
    - Communicating and reflecting
      - **Level 1** - Pupils use mathematics as an integral part of classroom activities. They represent their work with objects or pictures and discuss it. They recognise and use a simple pattern or relationship
      - **Level 2** - Pupils select the mathematics they use in some classroom activities. They discuss their work using mathematical language and are beginning to represent it using symbols and simple diagrams. They explain why an answer is correct
      - **Level 3** - Pupils try different approaches and find ways of overcoming difficulties that arise when they are solving problems. They are beginning to organise their work and check results. Pupils discuss their mathematical work and are beginning to explain their thinking. They use and interpret mathematical symbols and diagrams. Pupils show that they understand a general statement by finding particular examples that match it
      - **Level 4** - Pupils develop their own strategies for solving problems and use these strategies both in working within mathematics and in applying mathematics to practical contexts. When solving problems, with or without a calculator, they check their results are reasonable by considering the context or the size of the numbers. 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
      - **Level 5** - In order to explore mathematical situations, carry out tasks or tackle problems, pupils identify the

mathematical aspects and obtain necessary information. They calculate accurately, using ICT where 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 explain their reasoning

- **Level 6** - Pupils carry out 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. Their written and spoken language explains and informs their use of diagrams. They begin to give mathematical justifications, making connections between the current situation and situations they have encountered before
- **Level 7** - Starting from problems or contexts that have been presented to them, pupils 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 reasons 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
- **Level 8** - Pupils 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 generalisations or solutions reached in an activity and make further progress in the activity as a result. They comment constructively on the reasoning and logic, the process employed and the results obtained

- **Exceptional performance** - Pupils critically examine the strategies adopted when investigating within mathematics itself or when using mathematics to analyse tasks. They explain why different strategies were used, considering the elegance and efficiency of alternative lines of enquiry or procedures. They apply the mathematics they know in a wide range of familiar and unfamiliar contexts. They use mathematical language and symbols effectively in presenting a convincing, reasoned argument. Their reports include mathematical justifications, distinguishing between evidence and proof and explaining their solutions to problems involving a number of features or variables

- **YEAR 1 (KS1) NEW NATIONAL MATHS CURRICULUM PROGRAMME OF STUDY**
  - **At a glance changes to the Maths Curriculum: Year 1**
    - **What's gone**
      - **Data handling/Statistics is removed from Y1**
      - **No specific requirement to describe patterns**
      - **No specific requirements to describe ways of solving problems or explain choices**
    - **What's been added**
      - **Counting & writing numerals to 100**
      - **Write numbers in words up to 20**
      - **Number bonds secured to 20**
      - **Use of vocabulary such as equal, more than, less than, fewer, etc.**
  - **Number**
    - **Number and place value**
      - count to and across 100, forwards and backwards, beginning with 0 or 1, or from any given number
      - **count, read and write numbers to 100 in numerals;** count in multiples of 2s, 5s and 10s
      - given a number, identify 1 more and 1 less
      - identify and represent numbers using objects and pictorial representations including the number line, and **use the language of: equal to, more than, less than (fewer), most, least**
      - **read and write numbers from 1 to 20 in numerals and words**
    - **Number - addition and subtraction**
      - read, write and interpret mathematical statements involving addition (+), subtraction (−) and equals (=) signs
      - **represent and use number bonds and related subtraction facts within 20**
      - add and subtract one-digit and two-digit numbers to 20, including 0
      - solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as  $7 = ? - 9$
    - **Number - multiplication and division**
      - solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher

- **Number - fractions**
  - recognise, find and name a half as 1 of 2 equal parts of an object, shape or quantity
  - recognise, find and name a quarter as 1 of 4 equal parts of an object, shape or quantity
  
- **Measurement**
  - compare, describe and solve practical problems for: lengths and heights [for example, long/short, longer/shorter, tall/short, double/half]
  - mass/weight [for example, heavy/light, heavier than, lighter than]
  - capacity and volume [for example, full/empty, more than, less than, half, half full, quarter]
  - time [for example, quicker, slower, earlier, later]
  - measure and begin to record the following: lengths and heights
  - mass/weight
  - capacity and volume
  - time (hours, minutes, seconds)
  - recognise and know the value of different denominations of coins and notes
  - sequence events in chronological order using language [for example, before and after, next, first, today, yesterday, tomorrow, morning, afternoon and evening]
  - recognise and use language relating to dates, including days of the week, weeks, months and years
  - tell the time to the hour and half past the hour and draw the hands on a clock face to show these times
  
- **Geometry**
  - **Geometry - properties of shapes**
    - recognise and name common 2-D and 3-D shapes, including: 2-D shapes [for example, rectangles (including squares), circles and triangles]
    - 3-D shapes [for example, cuboids (including cubes), pyramids and spheres]
  - **Geometry - position and direction**
    - describe position, direction and movement, including whole, half, quarter and three-quarter turns

- **YEAR 2 (KS1) NEW NATIONAL MATHS CURRICULUM PROGRAMME OF STUDY**

- **At a glance changes to the Maths Curriculum: Year 2**

- **What's gone**

- Rounding two-digit numbers to the nearest 10
- Halving/doubling no longer explicitly required
- Using lists/tables/diagrams to sort objects

- **What's been added**

- Solving problems with subtraction
- Finding/writing fractions of quantities (and lengths)
- Adding two 2-digit numbers
- Adding three 1-digit numbers
- Demonstrating commutativity of addition & multiplication
- Describing properties of shape (e.g. edges, vertices)
- Measuring temperature in °C
- Tell time to nearest 5 minutes
- Make comparisons using  $<$   $>$   $=$  symbols
- Recognise £ p symbols and solve simple money problems

- **Number**

- **Number and place value**

- count in steps of 2, 3, and 5 from 0, and in 10s from any number, forward and backward
- recognise the place value of each digit in a two-digit number (10s, 1s)
- identify, represent and estimate numbers using different representations, including the number line
- compare and order numbers from 0 up to 100; **use  $<$ ,  $>$  and  $=$  signs**
- read and write numbers to at least 100 in numerals and in words
- use place value and number facts to solve problems

- **Number - addition and subtraction**

- **solve problems with** addition and **subtraction**: using concrete objects and pictorial representations, including those involving numbers, quantities and measures
- applying their increasing knowledge of mental and written methods
- recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100
- add and subtract numbers using concrete objects, pictorial representations, and mentally, including:
  - a two-digit number and 1s
- **a two-digit number** and 10s

- 2 two-digit numbers
- **adding 3 one-digit numbers**
- **show that addition of 2 numbers can be done in any order (commutative) and subtraction of 1 number from another cannot**
- recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems
- **Number - multiplication and division**
  - solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher
  - recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers
  - calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication ( $\times$ ), division ( $\div$ ) and equals (=) signs
  - **show that multiplication of 2 numbers can be done in any order (commutative) and division of 1 number by another cannot**
  - solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts
- **Number - fractions**
  - recognise, **find, name and write fractions**  $\frac{1}{3}$ ,  $\frac{1}{4}$ ,  $\frac{2}{4}$  and  $\frac{3}{4}$  of a **length**, shape, set **of** objects or **quantity**
  - write simple fractions, for example  $\frac{1}{2}$  of  $6 = 3$  and recognise the equivalence of  $\frac{2}{4}$  and  $\frac{1}{2}$
- **Measurement**
  - choose and use appropriate standard units to estimate and **measure** length/height in any direction (m/cm); mass (kg/g); **temperature ( $^{\circ}\text{C}$ )**; capacity (litres/ml) to the nearest appropriate unit, using rulers, scales, thermometers and measuring vessels
  - compare and order lengths, mass, volume/capacity and record the results using  $>$ ,  $<$  and  $=$
  - **recognise and use symbols for pounds ( $\pounds$ ) and pence (p)**; combine amounts to make a particular value
  - find different combinations of coins that equal the same amounts of money



- solve simple problems in a practical context involving addition and subtraction of money of the same unit, including giving change
  - compare and sequence intervals of time
  - **tell** and write **the time to five minutes**, including quarter past/to the hour and draw the hands on a clock face to show these times
  - know the number of minutes in an hour and the number of hours in a day
- **Geometry**
- **Geometry - properties of shapes**
    - identify and describe the properties of 2-D shapes, including the number of sides, and line symmetry in a vertical line
    - identify and **describe the properties of 3-D shapes, including the number of edges, vertices and faces**
    - identify 2-D shapes on the surface of 3-D shapes, [for example, a circle on a cylinder and a triangle on a pyramid]
    - compare and sort common 2-D and 3-D shapes and everyday objects
  - **Geometry - position and direction**
    - order and arrange combinations of mathematical objects in patterns and sequences
    - use mathematical vocabulary to describe position, direction and movement, including movement in a straight line and distinguishing between rotation as a turn and in terms of right angles for quarter, half and three-quarter turns (clockwise and anti-clockwise)
- **Statistics**
- interpret and construct simple pictograms, tally charts, block diagrams and tables
  - ask and answer simple questions by counting the number of objects in each category and sorting the categories by quantity
  - ask-and-answer questions about totalling and comparing categorical data

- **YEAR 1 & 2 (KS1) 2006 MATHS NATIONAL CURRICULUM PROGRAMME OF STUDY**

- **Ma2 Number**

- **Using and applying number**

- **Problem solving**

- approach problems involving number, and data presented in a variety of forms, in order to identify what they need to do
- develop flexible approaches to problem solving and look for ways to overcome difficulties
- make decisions about which operations and problem-solving strategies to use
- organise and check their work

- **Communicating**

- use the correct language, symbols and vocabulary associated with number and data
- communicate in spoken, pictorial and written form, at first using informal language and recording, then mathematical language and symbols

- **Reasoning**

- present results in an organised way
- understand a general statement and investigate whether particular cases match it
- explain their methods and reasoning when solving problems involving number and data

- **Numbers and the number system**

- **Counting**

- count reliably up to 20 objects at first and recognise that if the objects are rearranged the number stays the same; be familiar with the numbers 11 to 20; gradually extend counting to 100 and beyond

- **Number patterns and sequences**

- create and describe number patterns; explore and record patterns related to addition and subtraction, and then patterns of multiples of 2, 5 and 10 explaining the patterns and using them to make predictions; recognise sequences, including odd and even numbers to 30 then beyond; recognise the relationship between halving and doubling

- **The number system**

- read and write numbers to 20 at first and then to 100 or beyond; understand and use the

vocabulary of comparing and ordering these numbers; recognise that the position of a digit gives its value and know what each digit represents, including zero as a place-holder; order a set of one and two-digit numbers and position them on a number line and hundred-square; round any two-digit number to the nearest 10

▪ **Calculations**

• ***Number operations and the relationships between them***

- understand addition and use related vocabulary; recognise that addition can be done in any order; understand subtraction as both 'take away' and 'difference' and use the related vocabulary; recognise that subtraction is the inverse of addition; give the subtraction corresponding to an addition and vice versa; use the symbol '=' to represent equality; solve simple missing number problems [for example,  $6 = 2 + ?$  ]
- understand multiplication as repeated addition; understand that halving is the inverse of doubling and find one half and one quarter of shapes and small numbers of objects; begin to understand division as grouping (repeated subtraction); use vocabulary associated with multiplication and division

• ***Mental methods***

- develop rapid recall of number facts: know addition and subtraction facts to 10 and use these to derive facts with totals to 20, know multiplication facts for the x2 and x10 multiplication tables and derive corresponding division facts, know doubles of numbers to 10 and halves of even numbers to 20
- develop a range of mental methods for finding, from known facts, those that they cannot recall, including adding 10 to any single-digit number, then adding and subtracting a multiple of 10 to or from a two-digit number; develop a variety of methods for adding and subtracting, including making use of the facts that addition can be done in any order and that subtraction is the inverse of addition e. carry out simple calculations of the

form  $40 + 30 = ?$ ,  $40 + ? = 100$ ,  $56 - ? = 10$ ;  
record calculations in a number sentence,  
using the symbols  $+$ ,  $-$ ,  $\times$ ,  $\div$  and  $=$  correctly [for  
example,  $7 + 2 = 9$ ]

- **Solving numerical problems**
  - choose sensible calculation methods to solve whole-number problems (including problems involving money or measures), drawing on their understanding of the operations
  - check that their answers are reasonable and explain their methods or reasoning
- **Processing, representing and interpreting data**
  - Pupils should be taught to: a. solve a relevant problem by using simple lists, tables and charts to sort, classify and organise information
  - discuss what they have done and explain their results
- **Ma3 Shape, space and measures**
  - **Using and applying shape, space and measures**
    - **Problem solving**
      - try different approaches and find ways of overcoming difficulties when solving shape and space problems
      - select and use appropriate mathematical equipment when solving problems involving measures or measurement
      - select and use appropriate equipment and materials when solving shape and space problems
    - **Communicating**
      - use the correct language and vocabulary for shape, space and measures
    - **Reasoning**
      - recognise simple spatial patterns and relationships and make predictions about them
      - use mathematical communication and explanation skills
  - **Understanding patterns and properties of shape**
    - describe properties of shapes that they can see or visualise using the related vocabulary
    - observe, handle and describe common 2D and 3-shapes; name and describe the mathematical features of common 2D and 3D shapes, including triangles of various kinds, rectangles including

- squares, circles, cubes, cuboids, then hexagons, pentagons, cylinders, pyramids, cones and spheres
- create 2D shapes and 3D shapes d. recognise reflective symmetry in familiar 2D shapes and patterns
  - **Understanding properties of position and movement**
    - observe, visualise and describe positions, directions and movements using common 9 words
    - recognise movements in a straight line (translations) and rotations, and combine them in simple ways [for example, give instructions to get to the headteacher's office or for rotating a programmable toy]
    - recognise right angles
  - **Understanding measures**
    - estimate the size of objects and order them by direct comparison using appropriate language; put familiar events in chronological order; compare and measure objects using uniform non-standard units [for example, a straw, wooden cubes], then with a standard unit of length (cm, m), weight (kg), capacity (l) [for example, 'longer or shorter than a metre rule', 'three-and-a-bit litre jugs']; compare the durations of events using a standard unit of time
    - understand angle as a measure of turn using whole turns, half-turns and quarter-turns c. estimate, measure and weigh objects; choose and use simple measuring instruments, reading and interpreting numbers, and scales to the nearest labelled division

- **COMPARING YEAR 1 & YEAR 2 (KS1) NEW NATIONAL MATHS CURRICULUM PROGRAMME OF STUDY**
  - **KS1**
    - **Year 1**
      - **Number**
        - Number and place value
        - Addition and subtraction
        - Multiplication and division
        - Fractions
      - **Measurement**
      - **Geometry**
        - Properties of shapes
        - Position and direction
    - **Year 2 (same as Year 1 but with the addition of Statistics)**
      - **Number**
        - Number and place value
        - Addition and subtraction
        - Multiplication and division
        - Fractions
      - **Measurement**
      - **Geometry**
        - Properties of shapes
        - Position and direction
      - **Statistics**

**COMPARED TO:**

• **YEAR 1 & 2 (KS1) 2006 MATHS NATIONAL CURRICULUM PROGRAMME OF STUDY**

- **KS1**
  - **Year 1 & Year 2**
    - **Ma2 Number**
      - **Using and applying number**
        - Problem solving
        - Communicating
        - Reasoning
      - **Number and the Number System**
        - Counting
        - Number patterns and sequences
        - Number system
      - **Calculations**
        - Number operations and the relationships between them
        - Mental methods
      - **Solving numerical problems**
      - **Processing, representing and interpreting data**
    - **Ma3 Shape, space and measures**
      - **Using and applying shape, space and measures**
        - Problem solving
        - Communicating
        - Reasoning
      - **Understanding patterns and properties of shape**
      - **Understanding properties of position and movement**
      - **Understanding measures**

- **YEAR 3 (Lower KS2) NEW NATIONAL MATHS CURRICULUM PROGRAMME OF STUDY**
  - **At a glance changes to the Maths Curriculum: Year 3**
    - **What's gone**
      - Specific detail of problem-solving strategies (although the requirement to solve problems remains)
      - Rounding to nearest 10/100 moves to Year 4
      - Reflective symmetry moves to Year 4
      - Converting between metric units moves to Year 4
      - No requirement to use Carroll/Venn diagrams
    - **What's been added**
      - Adding tens or hundreds to 3-digit numbers
      - Formal written methods for addition/subtraction
      - 8 times tables replaces 6 times tables (!)
      - Counting in tenths
      - Comparing, ordering, adding & subtracting fractions with common denominators
      - Identifying angles larger than/smaller than right angles
      - Identify horizontal, vertical, parallel and perpendicular lines
      - Tell time to the nearest minute, including 24-hour clock and using Roman numerals
      - Know the number of seconds in a minute and the number of days in each month, year and leap year
  - **Number**
    - **Number and place value**
      - count from 0 in multiples of 4, 8, 50 and 100; find 10 or 100 more or less than a given number
      - recognise the place value of each digit in a 3-digit number (100s, 10s, 1s)
      - compare and order numbers up to 1,000
      - identify, represent and estimate numbers using different representations
      - read and write numbers up to 1,000 in numerals and in words
      - solve number problems and practical problems involving these ideas
    - **Number - addition and subtraction**
      - add and subtract numbers mentally, including: a three-digit number and 1s
      - **a three-digit number and 10s**
      - **a three-digit number and 100s**



- add and subtract numbers with up to 3 digits, using **formal written methods of columnar addition and subtraction**
- estimate the answer to a calculation and use inverse operations to check answers
- solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction
- **Number - multiplication and division**
  - recall and use multiplication and division facts for the 3, 4 and **8 multiplication tables**
  - write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods
  - solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects
- **Number - fractions**
  - **count up and down in tenths**; recognise that tenths arise from dividing an object into 10 equal parts and in dividing one-digit numbers or quantities by 10
  - recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators
  - recognise and use fractions as numbers: unit fractions and non-unit fractions with small denominators
  - recognise and show, using diagrams, equivalent fractions with small denominators
  - **add and subtract fractions with the same denominator** within one whole [for example,  $5/7 + 1/7 = 6/7$  ]
  - **compare and order unit fractions, and fractions with the same denominators**
  - solve problems that involve all of the above
- **Measurement**
  - measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)
  - measure the perimeter of simple 2-D shapes
  - add and subtract amounts of money to give change, using both £ and p in practical contexts

- **tell and write the time from an analogue clock, including using Roman numerals from I to XII, and 12-hour and 24-hour clocks**
- estimate and read time with increasing accuracy to the nearest minute; record and compare time in terms of seconds, minutes and hours; use vocabulary such as o'clock, am/pm, morning, afternoon, noon and midnight
- **know the number of seconds in a minute and the number of days in each month, year and leap year**
- compare durations of events [for example, to calculate the time taken by particular events or tasks]
  
- **Geometry - properties of shapes**
  - draw 2-D shapes and make 3-D shapes using modelling materials; recognise 3-D shapes in different orientations and describe them
  - recognise angles as a property of shape or a description of a turn
  
- **Geometry – position and direction**
  - identify right angles, recognise that 2 right angles make a half-turn, 3 make three-quarters of a turn and 4 a complete turn; **identify whether angles are greater than or less than a right angle**
  - **identify horizontal and vertical lines and pairs of perpendicular and parallel lines**
  
- **Statistics**
  - interpret and present data using bar charts, pictograms and tables
  - solve one-step and two-step questions [for example 'How many more?' and 'How many fewer?'] using information presented in scaled bar charts and pictograms and tables

- **YEAR 4 (Lower KS2) NEW NATIONAL MATHS CURRICULUM PROGRAMME OF STUDY**
  - **At a glance changes to the Maths Curriculum: Year 4**
    - **What's gone**
      - Using mixed numbers (moved to Y5)
      - Most ratio work moved to Y6
      - Written division methods (moved to Y5)
      - All calculator skills removed from KS2 PoS
      - Measuring angles in degrees (moved to Y5)
    - **What's been added**
      - Specific detail on lines of enquiry, representing problems and find strategies to solve problems and explaining methods (i.e. largely from old Ma1)
      - Solving problems with fractions and decimals to two decimal places
      - Rounding decimals to whole numbers
      - Roman numerals to 100
      - Recognising equivalent fractions
      - Knowing equivalent decimals to common fractions
      - Dividing by 10 and 100 (incl. with decimal answers)
      - Using factor pairs
      - Translation of shapes
      - Finding perimeter/area of compound shapes
  - **Number**
    - **Number - number and place value**
      - count in multiples of 6, 7, 9, 25 and 1,000
      - find 1,000 more or less than a given number
      - count backwards through 0 to include negative numbers
      - recognise the place value of each digit in a four-digit number (1,000s, 100s, 10s, and 1s)
      - order and compare numbers beyond 1,000
      - identify, represent and estimate numbers using different representations
      - round any number to the nearest 10, 100 or 1,000
      - **solve number and practical problems that involve all of the above** and with increasingly large positive numbers
      - **read Roman numerals to 100** (I to C) and know that over time, the numeral system changed to include the concept of 0 and place value
    - **Number - addition and subtraction**
      - add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate
      - estimate and use inverse operations to check answers to a calculation

- solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why
- **Number - multiplication and division**
  - recall multiplication and division facts for multiplication tables up to  $12 \times 12$
  - use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together 3 numbers
  - recognise and **use factor pairs** and commutativity in mental calculations
  - multiply two-digit and three-digit numbers by a one-digit number using formal written layout
  - solve problems involving multiplying and adding, including using the distributive law to multiply two-digit numbers by 1 digit, integer scaling problems and harder correspondence problems such as  $n$  objects are connected to  $m$  objects
- **Number - fractions (including decimals)**
  - **recognise** and show, using diagrams, families of common **equivalent fractions**
  - count up and down in hundredths; recognise that hundredths arise when dividing an object by 100 and dividing tenths by 10
  - solve problems involving increasingly harder fractions to calculate quantities, and fractions to divide quantities, including non-unit fractions where the answer is a whole number
  - add and subtract fractions with the same denominator
  - recognise and write decimal equivalents of any number of tenths or hundreds
  - **recognise and write decimal equivalents to  $1/4$ ,  $1/2$ ,  $3/4$**
  - **find the effect of dividing a one- or two-digit number by 10 and 100**, identifying the value of the digits in the answer as ones, tenths and hundredths
  - **round decimals with 1 decimal place to the nearest whole number**
  - compare numbers with the same number of decimal places up to 2 decimal places
  - **solve simple measure and money problems involving fractions and decimals to 2 decimal places**

- **Measurement**
  - convert between different units of measure [for example, kilometre to metre; hour to minute]
  - **measure and calculate the perimeter of a rectilinear figure (including squares) in centimetres and metres**
  - **find the area of rectilinear shapes by counting squares**
  - estimate, compare and calculate different measures, including money in pounds and pence
  - read, write and convert time between analogue and digital 12- and 24-hour clocks
  - solve problems involving converting from hours to minutes, minutes to seconds, years to months, weeks to days
  
- **Geometry**
  - **Geometry - properties of shapes**
    - compare and classify geometric shapes, including quadrilaterals and triangles, based on their properties and sizes
    - identify acute and obtuse angles and compare and order angles up to 2 right angles by size
    - identify lines of symmetry in 2-D shapes presented in different orientations
    - complete a simple symmetric figure with respect to a specific line of symmetry
  - **Geometry - position and direction**
    - describe positions on a 2-D grid as coordinates in the first quadrant
    - **describe movements between positions as translations of a given unit to the left/right and up/down**
    - plot specified points and draw sides to complete a given polygon
  -
  
- **Statistics**
  - interpret and present discrete and continuous data using appropriate graphical methods, including bar charts and time graphs
  - solve comparison, sum and difference problems using information presented in bar charts, pictograms, tables and other graphs

- **YEAR 5 (Upper KS2) NEW NATIONAL MATHS CURRICULUM PROGRAMME OF STUDY**
  - **At a glance changes to the Maths Curriculum: Year 5**
    - **What's gone**
      - Detail of problem-solving process and data handling cycle no longer required
      - Calculator skills moved to KS3
      - Probability moves to KS3
      - Several elements are now expected to be covered in lower KS2, e.g. decimals/fractions knowledge, points in the first quadrant; parallel/perpendicular lines
    - **What's been added**
      - Understand & use decimals to 3dp
      - Solve problems using up to 3dp, and fractions
      - Write %ages as fractions; fractions as decimals
      - Use vocabulary of primes, prime factors, composite numbers, etc.
      - Know prime numbers to 20
      - Understand square and cube numbers
      - Use standard multiplication & division methods for up to 4 digits
      - add and subtract fractions with the same denominator
      - multiply proper fractions and mixed numbers by whole numbers
      - deduce facts based on shape knowledge
      - distinguish regular and irregular polygons
      - calculate the mean average
  - **Number**
    - **Number - number and place value**
      - read, write, order and compare numbers to at least 1,000,000 and determine the value of each digit
      - count forwards or backwards in steps of powers of 10 for any given number up to 1,000,000
      - interpret negative numbers in context, count forwards and backwards with positive and negative whole numbers, including through 0
      - round any number up to 1,000,000 to the nearest 10, 100, 1,000, 10,000 and 100,000
      - solve number problems and practical problems that involve all of the above
      - read Roman numerals to 1,000 (M) and recognise years written in Roman numerals

- **Number - addition and subtraction**
  - add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)
  - add and subtract numbers mentally with **increasingly large numbers**
  - use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
  - solve addition and subtraction multi-step problems in contexts, deciding which operations and methods **to use and why**
- **Number - multiplication and division**
  - identify multiples and factors, including finding all factor pairs of a number, and common factors of 2 numbers
  - **know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers**
  - establish whether a number up to 100 is prime and **recall prime numbers up to 19**
  - **multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers**
  - multiply and divide numbers mentally, drawing upon known facts
  - **divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context**
  - multiply and divide whole numbers and those involving decimals by 10, 100 and 1,000
  - **recognise and use square numbers and cube numbers, and the notation for squared (<sup>2</sup>) and cubed (<sup>3</sup>)**
  - solve problems involving multiplication and division, including using their knowledge of factors and multiples, squares and cubes
  - solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign
  - solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates

- **Number - fractions (including decimals and percentages)**
  - compare and order fractions whose denominators are all multiples of the same number
  - identify, name and write equivalent fractions of a given fraction, represented visually, including tenths and hundredths
  - recognise mixed numbers and improper fractions and convert from one form to the other and write mathematical statements  $> 1$  as a mixed number [for example,  $2/5 + 4/5 = 6/5 = 1 \frac{1}{5}$ ]
  - **add and subtract fractions with the same denominator**, and denominators that are multiples of the same number
  - **multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams**
  - read and write decimal numbers as fractions [for example,  $0.71 = 71/100$ ]
  - recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents
  - round decimals with 2 decimal places to the nearest whole number and to 1 decimal place
  - **read, write, order and compare numbers with up to 3 decimal places**
  - **solve problems involving number up to 3 decimal places**
  - **recognise the per cent symbol (%) and understand that per cent relates to 'number of parts per 100', and write percentages as a fraction with denominator 100, and as a decimal fraction**
  - solve problems which require knowing percentage and decimal equivalents of  $1/2$ ,  $1/4$ ,  $1/5$ ,  $2/5$ ,  $4/5$  and those fractions with a denominator of a multiple of 10 or 25
  
- **Measurement**
  - convert between different units of metric measure [for example, kilometre and metre; centimetre and metre; centimetre and millimetre; gram and kilogram; litre and millilitre]
  - understand and use approximate equivalences between metric units and common imperial units such as inches, pounds and pints
  - measure and calculate the perimeter of composite rectilinear shapes in centimetres and metres



- calculate and compare the area of rectangles (including squares), including using standard units, square centimetres ( $\text{cm}^2$ ) and square metres ( $\text{m}^2$ ), and estimate the area of irregular shapes
  - estimate volume [for example, using  $1 \text{ cm}^3$  blocks to build cuboids (including cubes)] and capacity [for example, using water]
  - solve problems involving converting between units of time
  - use all four operations to solve problems involving measure [for example, length, mass, volume, money] using decimal notation, including scaling
- **Geometry**
    - **Geometry - properties of shapes**
      - **identify 3-D shapes, including cubes and other cuboids, from 2-D representations**
      - know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles
      - draw given angles, and measure them in degrees ( $^\circ$ )
      - identify: • angles at a point and 1 whole turn (total  $360^\circ$ )
      - angles at a point on a straight line and half a turn (total  $180^\circ$ )
      - other multiples of  $90^\circ$
      - use the properties of rectangles to deduce related facts and find missing lengths and angles
      - **distinguish between regular and irregular polygons based on reasoning about equal sides and angles**
    - **Geometry - position and direction**
      - identify, describe and represent the position of a shape following a reflection or translation, using the appropriate language, and know that the shape has not changed
  - **Statistics**
    - solve comparison, sum and difference problems using information presented in a line graph
    - complete, read and interpret information in tables, including timetables

- **YEAR 6 (Upper KS2) NEW NATIONAL MATHS CURRICULUM PROGRAMME OF STUDY**
  - **At a glance changes to the Maths Curriculum: Year 6**
    - **What's gone**
      - Detail of problem-solving processes no longer explicit
      - Divisibility tests
      - Calculator skills move to KS3 PoS
      - Rotation moves to KS3
      - Probability moves to KS3
      - Median/Mode/Range no longer required
    - **What's been added**
      - Compare and ordering fractions greater than 1
      - Long division
      - 4 operations with fractions
      - Calculate decimal equivalent of fractions
      - Understand & use order of operations
      - Plot points in all 4 quadrants
      - Convert between miles and kilometres
      - Name radius/diameter and know relationship
      - Use formulae for area/volume of shapes
      - Calculate area of triangles & parallelograms
      - Calculate volume of 3-d shapes
      - Use letters to represent unknowns (algebra)
      - Generate and describe linear sequences
      - Find solutions to unknowns in problems
  - **Number**
    - **Number - number and place value**
      - read, write, order and compare numbers up to 10,000,000 and determine the value of each digit
      - round any whole number to a required degree of accuracy
      - use negative numbers in context, and calculate intervals across 0
      - **solve number and practical problems that involve all of the above**
    - **Number - addition, subtraction, multiplication and division**
      - multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication
      - **divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division**, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context

- divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context
- perform mental calculations, including with mixed operations and large numbers
- identify common factors, common multiples and prime numbers
- **use their knowledge of the order of operations to carry out calculations involving the 4 operations**
- solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why
- solve problems involving addition, subtraction, multiplication and division
- use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy
- **Number - Fractions (including decimals and percentages)**
  - use common factors to simplify fractions; use common multiples to express fractions in the same denomination
  - **compare and order fractions, including fractions >1**
  - **add and subtract fractions with** different denominators and mixed numbers, using the concept of equivalent fractions
  - **multiply** simple pairs of proper **fractions**, writing the answer in its simplest form [for example,  $1/4 \times 1/2 = 1/8$  ]
  - **divide** proper **fractions** by whole numbers [for example,  $1/3 \div 2 = 1/6$  ]
  - associate a fraction with division and **calculate decimal fraction equivalents [for example, 0.375] for a simple fraction [for example, 3/8 ]**
  - identify the value of each digit in numbers given to 3 decimal places and multiply and divide numbers by 10, 100 and 1,000 giving answers up to 3 decimal places
  - multiply one-digit numbers with up to 2 decimal places by whole numbers
  - use written division methods in cases where the answer has up to 2 decimal places
  - solve problems which require answers to be rounded to specified degrees of accuracy
  - recall and use equivalences between simple fractions, decimals and percentages, including in different contexts

- **Ratio and proportion**
  - solve problems involving the relative sizes of 2 quantities where missing values can be found by using integer multiplication and division facts
  - solve problems involving the calculation of percentages [for example, of measures and such as 15% of 360] and the use of percentages for comparison
  - solve problems involving similar shapes where the scale factor is known or can be found
  - solve problems involving unequal sharing and grouping using knowledge of fractions and multiples
  
- **Algebra**
  - use simple formulae
  - **generate and describe linear number sequences**
  - **express missing number problems algebraically**
  - **find pairs of numbers that satisfy an equation with 2 unknowns**
  - enumerate possibilities of combinations of 2 variables
  
- **Measurement**
  - solve problems involving the calculation and conversion of units of measure, using decimal notation up to 3 decimal places where appropriate
  - use, read, write and convert between standard units, converting measurements of length, mass, volume and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to up to 3 decimal places
  - **convert between miles and kilometres**
  - recognise that shapes with the same areas can have different perimeters and vice versa
  - **recognise when it is possible to use formulae for area and volume of shapes**
  - **calculate the area of parallelograms and triangles**
  - **calculate, estimate and compare volume of cubes and cuboids using standard units, including cubic centimetres (cm<sup>3</sup>) and cubic metres (m<sup>3</sup>), and extending to other units [for example, mm<sup>3</sup> and km<sup>3</sup>]**
  
- **Geometry**
  - **Geometry - properties of shapes**
    - draw 2-D shapes using given dimensions and angles
    - recognise, describe and build simple 3-D shapes, including making nets

- compare and classify geometric shapes based on their properties and sizes and find unknown angles in any triangles, quadrilaterals, and regular polygons
- illustrate and **name parts of circles, including radius, diameter and circumference** and know that the diameter is twice the radius
- recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles
- **Geometry - position and direction**
  - **describe positions on the full coordinate grid (all 4 quadrants)**
  - draw and translate simple shapes on the coordinate plane, and reflect them in the axes
- **Statistics**
  - interpret and construct pie charts and line graphs and use these to solve problems
  - calculate and interpret the mean as an average

- **YEAR 3, 4, 5 & 6 (KS2) 2006 MATHS NATIONAL CURRICULUM PROGRAMME OF STUDY**

- **Ma2 Number and algebra**
  - **Using and applying number**
    - **Problem solving**
      - make connections in mathematics and appreciate the need to use numerical skills and knowledge when solving problems in other parts of the mathematics curriculum
      - break down a more complex problem or calculation into simpler steps before attempting a solution; identify the information needed to carry out the tasks
      - select and use appropriate mathematical equipment, including ICT
      - find different ways of approaching a problem in order to overcome any difficulties
      - make mental estimates of the answers to calculations; check results
      - Communicating
      - organise work and refine ways of recording
      - use notation diagrams and symbols correctly within a given problem
      - present and interpret solutions in the context of the problem
      - communicate mathematically, including the use of precise mathematical language
    - **Reasoning**
      - understand and investigate general statements [for example, 'there are four prime numbers less than 10', 'wrist size is half neck size']
      - search for pattern in their results; develop logical thinking and explain their reasoning
  - **Numbers and the number system**
    - **Counting**
      - count on and back in tens or hundreds from any two- or three-digit number; recognise and continue number sequences formed by counting on or back in steps of constant size from any integer, extending to negative integers when counting back
    - **Number patterns and sequences**
      - recognise and describe number patterns, including two- and three-digit multiples of 2, 5 or 10, recognising their patterns and using

these to make predictions; make general statements, using words to describe a functional relationship, and test these; recognise prime numbers to 20 and square numbers up to  $10 \times 10$ ; find factor pairs and all the prime factors of any two-digit integer

- **Integers**

- read, write and order whole numbers, recognising that the position of a digit gives its value; use correctly the symbols  $<$ ,  $>$ ,  $=$ ; multiply and divide any integer by 10 or 100 then extend to multiplying and dividing by 1000; round integers to the nearest 10 or 100 and then 1000; order a set of negative integers, explaining methods and reasoning; multiply and divide decimals by 10 or 100

- **Fractions, percentages and ratio**

- understand unit fractions [for example, one-third or one-eighth] then fractions that are several parts of one whole [for example, two-thirds or five-eighths], locate them on a number line and use them to find fractions of shapes and quantities
- understand simple equivalent fractions and simplify fractions by cancelling common factors; compare and order simple fractions by converting them to fractions with a common denominator, explaining their methods and reasoning
- recognise the equivalence between the decimal and fraction forms of one half, quarters, tenths and hundredths; understand that 'percentage' means the 'number of parts per 100' and that it can be used for comparisons; find percentages of whole number quantities, using a calculator where appropriate
- recognise approximate proportions of a whole and use simple fractions and percentages to describe them, explaining their methods and reasoning
- solve simple problems involving ratio and direct proportion

- **Decimals**

- understand and use decimal notation for tenths and hundredths in context [for example, order amounts of money, round a

sum of money to the nearest £, convert a length such as 1.36 metres to centimetres and vice versa]; locate on a number line, and order, a set of numbers or measurements; then recognise thousandths (only in metric measurements)

- round a number with one or two decimal places to the nearest integer or tenth; convert between centimetres and millimetres or metres, then between millimetres and metres, and metres and kilometres, explaining methods and reasoning

▪ **Calculations**

• ***Number operations and the relationships between them***

- develop further their understanding of the four number operations and the relationships between them including inverses; use the related vocabulary; choose suitable number operations to solve a given problem, and recognise similar problems to which they apply
- find remainders after division, then express a quotient as a fraction or decimal; round up or down after division, depending on the context
- understand the use of brackets to determine the order of operations; understand why the commutative, associative and distributive laws apply to addition and multiplication and how they can be used to do mental and written calculations more efficiently

• ***Mental methods***

- recall all addition and subtraction facts for each number to 20
- work out what they need to add to any two-digit number to make 100, then add or subtract any pair of two-digit whole numbers; handle particular cases of three-digit and four-digit additions and subtractions by using compensation or other methods [for example,  $3000 - 1997$ ,  $4560 + 998$ ]
- recall multiplication facts to  $10 \times 10$  and use them to derive quickly the corresponding division facts
- double and halve any two-digit number
- multiply and divide, at first in the range 1 to 100 [for example,  $27 \times 3$ ,  $65 \div 5$ ], then for



particular cases of larger numbers by using factors, distribution or other methods

- **Written methods**
  - use written methods to add and subtract positive integers less than 1000, then up to 10000, then add and subtract numbers involving decimals; use approximations and other strategies to check that their answers are reasonable
  - use written methods for short multiplication and division by a single-digit integer of two-digit then three-digit then four-digit integers, then of numbers with decimals; then use long multiplication, at first for two-digit by two-digit integer calculations, then for three-digit by two-digit calculations; extend division to informal methods of dividing by a two-digit divisor [for example,  $64 \div 16$ ]; use approximations and other strategies to check that their answers are reasonable
- **Calculator methods**
  - use a calculator for calculations involving several digits, including decimals; use a calculator to solve number problems [for example,  $47 \times 7 = 343$ ]; know how to enter and interpret money calculations and fractions; know how to select the correct key sequence for calculations with more than one operation [for example,  $56 \times (87 - 48)$ ]
- **Solving numerical problems**
  - choose, use and combine any of the four number operations to solve word problems involving numbers in 'real life', money or measures of length, mass, capacity or time, then perimeter and area
  - choose and use an appropriate way to calculate and explain their methods and reasoning
  - estimate answers by approximating and checking that their results are reasonable by thinking about the context of the problem, and where necessary checking accuracy [for example, by using the inverse operation, by repeating the calculation in a different order]
  - recognise, represent and interpret simple number relationships, constructing and using formulae in words then symbols [for example,  $c = 15n$  is the cost, in pence, of  $n$  articles at 15p each] e. read and plot coordinates in the first quadrant, then in all four

quadrants [for example, plot the vertices of a rectangle, or a graph of the multiples of 3]

- **MA3 Shape, space and measures**
  - **Using and applying shape, space and measures**
    - **Problem solving**
      - recognise the need for standard units of measurement
      - select and use appropriate calculation skills to solve geometrical problems
      - approach spatial problems flexibly, including trying alternative approaches to overcome difficulties
      - use checking procedures to confirm that their results of geometrical problems are reasonable
    - **Communicating**
      - organise work and record or represent it in a variety of ways when presenting solutions to geometrical problems
      - use geometrical notation and symbols correctly
      - present and interpret solutions to problems
      - Reasoning
      - use mathematical reasoning to explain features of shape and space
  - **Understanding properties of shape**
    - recognise right angles, perpendicular and parallel lines; know that angles are measured in degrees and that one whole turn is 360 degrees and angles at a point total 360 degrees, then recognise that angles at a point on a straight line total 180 degrees; know that the sum of the angles of a triangle is 180 degrees
    - visualise and describe 2D and 3D shapes and the way they behave, making more precise use of geometrical language, especially that of triangles, quadrilaterals, and prisms and pyramids of various kinds; recognise when shapes are identical
    - make and draw with increasing accuracy 2D and 3D shapes and patterns; recognise reflective symmetry in regular polygons; recognise their geometrical features and properties including angles, faces, pairs of parallel lines and symmetry, and use these to classify shapes and solve problems
    - visualise 3D shapes from 2D drawings

- **Understanding properties of position and movement**
  - visualise and describe movements using appropriate language
  - transform objects in practical situations; transform images using ICT; visualise and predict the position of a shape following a rotation, reflection or translation
  - identify and draw 2D shapes in different orientations on grids; locate and draw shapes using coordinates in the first quadrant, then in all four quadrants [for example, use coordinates to locate position in a computer game]
- **Understanding measures**
  - recognise the need for standard units of length, mass and capacity, choose which ones are suitable for a task, and use them to make sensible estimates in everyday situations; convert one metric unit to another [for example, convert 3.17kg to 3170g] ; know the rough metric equivalents of imperial units still in daily use
  - recognise that measurement is approximate; choose and use suitable measuring instruments for a task; interpret numbers and read scales with increasing accuracy; record measurements using decimal notation
  - recognise angles as greater or less than a right angle or half-turn, estimate their size and order them; measure and draw acute, obtuse and right angles to the nearest degree
  - read the time from analogue and digital 12- and 24-hour clocks; use units of time - seconds, minutes, hours, days, weeks - and know the relationship between them
  - find perimeters of simple shapes; find areas of rectangles using the formula, understanding its connection to counting squares and how it extends this approach; calculate the perimeter and area of shapes composed of rectangles
- **Ma4 Handling data**
  - **Using and applying handling data**
    - **Problem solving**
      - select and use handling data skills when solving problems in other areas of the curriculum, in particular science

- approach problems flexibly, including trying alternative approaches to overcome any difficulties
- identify the data necessary to solve a given problem
- select and use appropriate calculation skills to solve problems involving data
- check results and ensure that solutions are reasonable in the context of the problem
- **Communicating**
  - decide how best to organise and present findings
  - use the precise mathematical language and vocabulary for handling data
- **Reasoning**
  - explain and justify their methods and reasoning
- **Processing, representing and interpreting data**
  - solve problems involving data
  - interpret tables, lists and charts used in everyday life; construct and interpret frequency tables, including tables for grouped discrete data
  - represent and interpret discrete data using graphs and diagrams, including pictograms, bar charts and line graphs, then interpret a wider range of graphs and diagrams, using ICT where appropriate
  - know that mode is a measure of average and that range is a measure of spread, and to use both ideas to describe data sets
  - recognise the difference between discrete and continuous data
  - draw conclusions from statistics and graphs and recognise when information is presented in a misleading way; explore doubt and certainty and develop an understanding of probability through classroom situations; discuss events using a vocabulary that includes the words 'equally likely', 'fair', 'unfair', 'certain'

- **COMPARING KS2 NEW NATIONAL MATHS CURRICULUM PROGRAMME OF STUDY**

- **KS2**

- **Year 3 (same as Year 2)**

- **Number**

- Number and place value
- Addition and subtraction
- Multiplication and division
- Fractions

- **Measurement**

- **Geometry**

- Properties of shapes
- Position and direction

- **Statistics**

- **Year 4**

- **Number (Same as Year 3 but with the addition of decimals)**

- Number and place value
- Addition and subtraction
- Multiplication and division
- Fractions including decimals

- **Measurement**

- **Geometry**

- Properties of shapes
- Position and direction

- **Statistics**

- **Year 5**
  - **Number (Same as Year 4 but with the addition of percentages)**
    - Number and place value
    - Addition and subtraction
    - Multiplication and division
    - Fractions including decimals and percentages
  - **Measurement**
  - **Geometry**
    - Properties of shapes
    - Position and direction
  - **Statistics**
- **Year 6 (Same as Year 5 but with the addition of Ratio & Proportion and Algebra)**
  - **Number (Same as Year 5 but Addition and Subtraction not separate from Multiplication and Division)**
    - Number and place value
    - Addition, Subtraction, Multiplication and Division
    - Fractions including decimals and percentages
  - **Ratio and Proportion**
  - **Algebra**
  - **Measurement**
  - **Geometry**
    - Properties of shapes
    - Position and direction
  - **Statistics**

**COMPARED TO:**

**• YEAR 3,4,5 & 6 (KS2) 2006 MATHS NATIONAL CURRICULUM PROGRAMMED OF STUDY**

○ **KS2**

▪ **Year 3, 4, 5 & Year 6**

**• Ma2 Number (same as KS1 but no processing, representing and interpreting data)**

○ **Using and applying number (same as KS1 but no communicating)**

- Problem solving
- Reasoning

○ **Number and the Number System (same as KS1 but no Number System and with the addition of Integers & Fractions, Percentages and Ratio & Decimals)**

- Counting
- Number patterns and sequences
- Integers
- Fractions, Percentages and Ratio
- Decimals

○ **Calculations (same as KS1 but with the addition of Written methods and Calculator methods)**

- Number operations and the relationships between them
- Mental methods
- Written methods
- Calculator methods

○ **Solving numerical problems**

**• MA3 Shape, space and measures**

○ **Using and applying shape, space and measures (same as KS1 but no reasoning)**

- Problem solving
- Communicating

○ **Understanding properties of shape (same as KS1 but no understanding of patterns)**

○ **Understanding properties of position and movement**

○ **Understanding measures**

- **Ma4 Handling data (not taught in KS1)**
  - **Using and applying handling data**
    - Problem solving
    - Communicating
  - **Processing, representing and interpreting data**



- **YEAR 7, 8 & 9 (KS3) NEW NATIONAL MATHS CURRICULUM PROGRAMME OF STUDY**
  - **Number**
    - understand and use place value for decimals, measures and integers of any size
    - order positive and negative integers, decimals and fractions; use the number line as a model for ordering of the real numbers; use the symbols =, ≠, <, >, ≤, ≥
    - use the concepts and vocabulary of prime numbers, factors (or divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple, prime factorisation, including using product notation and the unique factorisation property
    - use the four operations, including formal written methods, applied to integers, decimals, proper and improper fractions, and mixed numbers, all both positive and negative
    - use conventional notation for the priority of operations, including brackets, powers, roots and reciprocals
    - recognise and use relationships between operations including inverse operations
    - use integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5 and distinguish between exact representations of roots and their decimal approximations
    - interpret and compare numbers in standard form  $A \times 10^n$   $1 \leq A < 10$ , where  $n$  is a positive or negative integer or zero
    - work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and  $\frac{7}{2}$  or 0.375 and  $\frac{3}{8}$ )
    - define percentage as 'number of parts per hundred', interpret percentages and percentage changes as a fraction or a decimal, interpret these multiplicatively, express one quantity as a percentage of another, compare two quantities using percentages, and work with percentages greater than 100%
    - interpret fractions and percentages as operators
    - use standard units of mass, length, time, money and other measures, including with decimal quantities
    - round numbers and measures to an appropriate degree of accuracy [for example, to a number of decimal places or significant figures]
    - use approximation through rounding to estimate answers and calculate possible resulting errors expressed using inequality notation  $a < x \leq b$

- use a calculator and other technologies to calculate results accurately and then interpret them appropriately
- appreciate the infinite nature of the sets of integers, real and rational numbers
- **Algebra**
  - use and interpret algebraic notation, including:
    - $ab$  in place of  $a \times b$
    - $3y$  in place of  $y + y + y$  and  $3 \times y$
    - $a^2$  in place of  $a \times a$ ,  $a^3$  in place of  $a \times a \times a$ ;  $a^2b$  in place of  $a \times a \times b \times b$
    - $a$  in place of  $a \div b$
    - coefficients written as fractions rather than as decimals
    - brackets
    - substitute numerical values into formulae and expressions, including scientific formulae
    - understand and use the concepts and vocabulary of expressions, equations, inequalities, terms and factors
    - simplify and manipulate algebraic expressions to maintain equivalence by:
      - collecting like terms
      - multiplying a single term over a bracket
      - taking out common factors
      - expanding products of two or more binomials
    - understand and use standard mathematical formulae; rearrange formulae to change the subject
    - model situations or procedures by translating them into algebraic expressions or formulae and by using graphs
    - use algebraic methods to solve linear equations in one variable (including all forms that require rearrangement)
    - work with coordinates in all four quadrants
    - recognise, sketch and produce graphs of linear and quadratic functions of one variable with appropriate scaling, using equations in  $x$  and  $y$  and the Cartesian plane
    - interpret mathematical relationships both algebraically and graphically
    - reduce a given linear equation in two variables to the standard form  $y = mx + c$ ; calculate and interpret gradients and intercepts of graphs of such linear equations numerically, graphically and algebraically
    - use linear and quadratic graphs to estimate values of  $y$  for given values of  $x$  and vice versa and to find approximate solutions of simultaneous linear equations
    - find approximate solutions to contextual problems from given graphs of a variety of functions, including piece-wise linear, exponential and reciprocal graphs

- generate terms of a sequence from either a term-to-term or a position-to-term rule
  - recognise arithmetic sequences and find the  $n$ th term
  - recognise geometric sequences and appreciate other sequences that arise
- **Ratio, proportion and rates of change**
- change freely between related standard units [for example time, length, area, volume/capacity, mass]
  - use scale factors, scale diagrams and maps
  - express one quantity as a fraction of another, where the fraction is less than 1 and greater than 1
  - use ratio notation, including reduction to simplest form
  - divide a given quantity into two parts in a given part:part or part:whole ratio; express the division of a quantity into two parts as a ratio
  - understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction
  - relate the language of ratios and the associated calculations to the arithmetic of fractions and to linear functions
  - solve problems involving percentage change, including: percentage increase, decrease and original value problems and simple interest in financial mathematics
  - solve problems involving direct and inverse proportion, including graphical and algebraic representations
  - use compound units such as speed, unit pricing and density to solve problems
- **Geometry and measures**
- derive and apply formulae to calculate and solve problems involving: perimeter and area of triangles, parallelograms, trapezia, volume of cuboids (including cubes) and other prisms (including cylinders)
  - calculate and solve problems involving: perimeters of 2-D shapes (including circles), areas of circles and composite shapes
  - draw and measure line segments and angles in geometric figures, including interpreting scale drawings
  - derive and use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a perpendicular to a given line from/at a given point, bisecting a given angle); recognise and use the perpendicular distance from a point to a line as the shortest distance to the line

- describe, sketch and draw using conventional terms and notations: points, lines, parallel lines, perpendicular lines, right angles, regular polygons, and other polygons that are reflectively and rotationally symmetric
  - use the standard conventions for labelling the sides and angles of triangle ABC, and know and use the criteria for congruence of triangles
  - derive and illustrate properties of triangles, quadrilaterals, circles, and other plane figures [for example, equal lengths and angles] using appropriate language and technologies
  - identify properties of, and describe the results of, translations, rotations and reflections applied to given figures
  - identify and construct congruent triangles, and construct similar shapes by enlargement, with and without coordinate grids
  - apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles
  - understand and use the relationship between parallel lines and alternate and corresponding angles
  - derive and use the sum of angles in a triangle and use it to deduce the angle sum in any polygon, and to derive properties of regular polygons
  - apply angle facts, triangle congruence, similarity and properties of quadrilaterals to derive results about angles and sides, including Pythagoras' Theorem, and use known results to obtain simple proofs
  - use Pythagoras' Theorem and trigonometric ratios in similar triangles to solve problems involving right-angled triangles
  - use the properties of faces, surfaces, edges and vertices of cubes, cuboids, prisms, cylinders, pyramids, cones and spheres to solve problems in 3-D
  - interpret mathematical relationships both algebraically and geometrically
- **Probability**
- record, describe and analyse the frequency of outcomes of simple probability experiments involving randomness, fairness, equally and unequally likely outcomes, using appropriate language and the 0-1 probability scale
  - understand that the probabilities of all possible outcomes sum to 1
  - enumerate sets and unions/intersections of sets systematically, using tables, grids and Venn diagrams

- generate theoretical sample spaces for single and combined events with equally likely, mutually exclusive outcomes and use these to calculate theoretical probabilities
- **Statistics (used to fall under data and was taught with probability)**
  - describe, interpret and compare observed distributions of a single variable through: appropriate graphical representation involving discrete, continuous and grouped data; and appropriate measures of central tendency (mean, mode, median) and spread (range, consideration of outliers)
  - construct and interpret appropriate tables, charts, and diagrams, including frequency tables, bar charts, pie charts, and pictograms for categorical data, and vertical line (or bar) charts for ungrouped and grouped numerical data
  - describe simple mathematical relationships between two variables (bivariate data) in observational and experimental contexts and illustrate using scatter graphs

- **YEAR 7, 8, & 9 (KS3) 2007 MATHS NATIONAL CURRICULUM PROGRAMME OF STUDY AND ATTAINMENT TARGETS**
  - **Number and algebra**
    - rational numbers, their properties and their different representations
    - rules of arithmetic applied to calculations and manipulations with rational numbers
    - applications of ratio and proportion
    - accuracy and rounding
    - algebra as generalised arithmetic
    - linear equations, formulae, expressions and identities
    - analytical, graphical and numerical methods for solving equations
    - polynomial graphs, sequences and functions
      - **Level 1** - Pupils count, order, add and subtract numbers when solving problems involving up to 10 objects. They read and write the numbers involved
      - **Level 2** - Pupils 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 choose the appropriate operation when solving addition and subtraction problems. They use the knowledge that subtraction is the inverse of addition. They use mental calculation strategies to solve number problems involving money and measures. They recognise sequences of numbers, including odd and even numbers
      - **Level 3** - Pupils show understanding of place value in numbers up to 1000 and use this to make approximations. They begin to use decimal notation and to recognise negative numbers, in contexts such as money and temperature. Pupils 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 numbers with three digits using 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 or division, including those that give rise to remainders. They use simple fractions that are several parts of a whole and recognise when two simple fractions are equivalent

- **Level 4** - Pupils use their understanding of place value to multiply and divide whole numbers by 10 or 100. When solving number problems, they use a range of mental methods of computation with the four operations, including mental recall of multiplication facts up to  $10 \times 10$  and quick derivation of corresponding division facts. They use efficient written methods of addition and subtraction and of short multiplication and division. They recognise approximate proportions of a whole and use simple fractions and percentages to describe these. They begin to use simple formulae expressed in words
- **Level 5** - Pupils 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. They use and interpret coordinates in all four quadrants
- **Level 6** - Pupils order and approximate decimals when solving numerical problems and equations, using trial and improvement methods. They 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 by writing them with a common denominator. They find and describe in words the rule for the next term or  $n$ th term of a sequence where the rule is linear. They formulate and solve linear equations with whole-number coefficients. They represent mappings expressed algebraically, and use Cartesian coordinates for graphical representation interpreting general features.
- **Level 7** - When making estimates, pupils round to one significant figure and multiply and divide mentally. They understand the effects of multiplying and dividing by numbers between 0 and 1. They solve numerical problems involving multiplication and division with numbers of any size, using a calculator efficiently and appropriately. They



understand and use proportional changes, calculating the result of any proportional change using only multiplicative methods. They find and describe in symbols the next term or  $n$ th term of a sequence where the rule is quadratic. They use algebraic and graphical methods to solve simultaneous linear equations in two variables.

- **Level 8** - Pupils solve problems that involve 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
  - **Exceptional performance** - Pupils understand and use rational and irrational numbers. They determine the bounds of intervals. They understand and use direct and inverse proportion. In simplifying algebraic expressions, they use rules of indices for negative and fractional values. In finding formulae that approximately connect data, they express general laws in symbolic form. They solve simultaneous equations in two variables where one equation is linear and the other is quadratic. They solve problems using intersections and gradients of graphs
- **Geometry and measures**
    - properties of 2D and 3D shapes
    - constructions, loci and bearings
    - Pythagoras' theorem
    - transformations
    - similarity, including the use of scale
    - points, lines and shapes in 2D coordinate systems
    - units, compound measures and conversions
    - perimeters, areas, surface areas and volumes



- **Level 1** - When working with 2D and 3D shapes, pupils use everyday language to describe properties and positions. They measure and order objects using direct comparison, and order events
- **Level 2** - Pupils 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 non-standard and standard units to measure length and mass
- **Level 3** - Pupils classify 3D and 2D shapes in various ways using mathematical properties such as reflective symmetry for 2D shapes. They use non-standard units, standard metric units of length, capacity and mass, and standard units of time, in a range of contexts
- **Level 4** - Pupils make 3D mathematical models by linking given faces or edges, and 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, with appropriate accuracy, numbers on a range of measuring instruments. They find perimeters of simple shapes and find areas by counting squares
- **Level 5** - When constructing models and drawing or using shapes, pupils measure and draw angles to the nearest degree and use language associated with angles. They know the angle sum of a triangle and that of angles at a point. They identify all the symmetries of 2D shapes. 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
- **Level 6** - Pupils recognise and use common 2D representations of 3D objects. They 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 devise instructions for a computer to generate and transform shapes and paths. They understand and use appropriate formulae for finding circumferences and areas of circles, areas of plane rectilinear figures and volumes of cuboids when solving problems

- **Level 7** - Pupils 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 a fractional 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
  - **Level 8** - Pupils understand and use congruence and mathematical similarity. They use sine, cosine and tangent in right-angled triangles when solving problems in two dimensions
  - **Exceptional performance** - Pupils sketch the graphs of sine, cosine and tangent functions for any angle, and generate and interpret graphs based on these functions. They use sine, cosine and tangent of angles of any size, and Pythagoras' theorem when solving problems in two and three dimensions. They construct formal geometric proofs. They calculate lengths of circular arcs and areas of sectors, and calculate the surface area of cylinders and volumes of cones and spheres. They appreciate the continuous nature of scales that are used to make measurements
- **Statistics**
- the handling data cycle
  - presentation and analysis of grouped and ungrouped data, including time series and lines of best fit
  - measures of central tendency and spread
  - experimental and theoretical probabilities, including those based on equally likely outcomes
    - **Level 1** - Pupils sort objects and classify them, demonstrating the criterion they have used
    - **Level 2** - Pupils sort objects and classify them using more than one criterion. When they have gathered information, pupils record results in simple lists, tables and block graphs, in order to communicate their findings

- **Level 3** - Pupils 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 to them in these forms
- **Level 4** - 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 in equal class intervals where appropriate, represent collected data in frequency diagrams and interpret such diagrams. They construct and interpret simple line graphs
- **Level 5** - 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. They 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 different outcomes may result from repeating an experiment
- **Level 6** - Pupils collect and record continuous data, choosing appropriate equal class intervals over a sensible range to create frequency tables. They construct and interpret frequency diagrams. They construct pie charts. They draw conclusions from scatter diagrams, and have a basic understanding of correlation. When dealing with a combination of two experiments, they identify all the outcomes. When solving problems, they use their knowledge that the total probability of all the mutually exclusive outcomes of an experiment is 1
- **Level 7** - Pupils 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 polygons, 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

- **Level 8** - Pupils interpret and construct cumulative frequency tables and diagrams. They estimate the median and interquartile 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
- **Exceptional performance** - Pupils interpret and construct histograms. They understand how different methods of sampling and different sample sizes may affect the reliability of conclusions drawn. They select and justify a sample and method to investigate a population. They recognise when and how to work with probabilities associated with independent, mutually exclusive events

- **COMPARING YEAR 7,8,& 9 (KS3) NEW NATIONAL MATHS CURRICULUM PROGRAMME OF STUDY**
  - **KS3**
    - **Year 7, 8 & 9**
      - **Number**
      - **Algebra**
      - **Ratio, proportion and rates of change**
      - **Geometry and measures**
      - **Probability**
      - **Statistics**

**COMPARED TO:**

- **YEAR 7,8, & 9 (KS3) 2007 MATHS NATIONAL CURRICULUM PROGRAMME OF STUDY**
  - **KS3**
    - **Year 7, 8 & 9**
      - **Number and Algebra**
      - **Geometry and Measure**
      - **Statistics**

- **YEAR 10 & 11 (KS4) NEW NATIONAL MATHS CURRICULUM PROGRAMME OF STUDY - additional mathematical content to be taught to more highly attaining pupils, in braces { }**
  - **Number** - in addition to consolidating subject content from key stage 3, pupils should be taught to:
    - apply systematic listing strategies, {including use of the product rule for counting}
    - {estimate powers and roots of any given positive number}
    - calculate with roots, and with integer {and fractional} indices
    - calculate exactly with fractions, {surds} and multiples of  $\pi$  {simplify surd expressions involving squares [for example  $\sqrt{12} = \sqrt{4 \times 3} = \sqrt{4} \times \sqrt{3} = 2\sqrt{3}$ ] and rationalise denominators}
    - calculate with numbers in standard form  $A \times 10^n$ , where  $1 \leq A < 10$  and  $n$  is an integer
    - {change recurring decimals into their corresponding fractions and vice versa}
    - identify and work with fractions in ratio problems
    - apply and interpret limits of accuracy when rounding or truncating, {including upper and lower bounds}
  - **Algebra** - in addition to consolidating subject content from key stage 3, pupils should be taught to:
    - simplify and manipulate algebraic expressions (including those involving surds {and algebraic fractions}) by: factorising quadratic expressions of the form  $x^2 + bx + c$ , including the difference of 2 squares; {factorising quadratic expressions of the form  $ax^2 + bx + c$ }
    - simplifying expressions involving sums, products and powers, including the laws of indices
    - know the difference between an equation and an identity; argue mathematically to show algebraic expressions are equivalent, and use algebra to support and construct arguments {and proofs}
    - where appropriate, interpret simple expressions as functions with inputs and outputs; {interpret the reverse process as the 'inverse function'; interpret the succession of 2 functions as a 'composite function'}
    - use the form  $y = mx + c$  to identify parallel {and perpendicular} lines; find the equation of the line through 2 given points, or through 1 point with a given gradient
    - identify and interpret roots, intercepts and turning points of quadratic functions graphically; deduce roots algebraically {and turning points by completing the square}

- recognise, sketch and interpret graphs of linear functions, quadratic functions, simple cubic functions, the reciprocal function  $y = 1/x$  with  $x \neq 0$ , {the exponential function  $y = kx$  for positive values of  $k$ , and the trigonometric functions (with arguments in degrees)  $y = \sin x$ ,  $y = \cos x$  and  $y = \tan x$  for angles of any size}
- {sketch translations and reflections of the graph of a given function}
- plot and interpret graphs (including reciprocal graphs {and exponential graphs}) and graphs of non-standard functions in real contexts, to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration
- {calculate or estimate gradients of graphs and areas under graphs (including quadratic and other non-linear graphs), and interpret results in cases such as distance-time graphs, velocity-time graphs and graphs in financial contexts}
- {recognise and use the equation of a circle with centre at the origin; find the equation of a tangent to a circle at a given point}
- solve quadratic equations {including those that require rearrangement} algebraically by factorising, {by completing the square and by using the quadratic formula}; find approximate solutions using a graph
- solve 2 simultaneous equations in 2 variables (linear/linear {or linear/quadratic}) algebraically; find approximate solutions using a graph
- {find approximate solutions to equations numerically using iteration}
- translate simple situations or procedures into algebraic expressions or formulae; derive an equation (or 2 simultaneous equations), solve the equation(s) and interpret the solution
- solve linear inequalities in 1 {or 2} variable {s}, {and quadratic inequalities in 1 variable}; represent the solution set on a number line, {using set notation and on a graph}
- recognise and use sequences of triangular, square and cube numbers, simple arithmetic progressions, Fibonacci type sequences, quadratic sequences, and simple geometric progressions ( $rn$  where  $n$  is an integer, and  $r$  is a positive rational number {or a surd}) {and other sequences}
- deduce expressions to calculate the  $n$ th term of linear {and quadratic} sequences



- **Ratio, proportion and rates of change** - in addition to consolidating subject content from key stage 3, pupils should be taught to:
  - compare lengths, areas and volumes using ratio notation and/or scale factors; make links to similarity (including trigonometric ratios)
  - convert between related compound units (speed, rates of pay, prices, density, pressure) in numerical and algebraic contexts
  - understand that  $X$  is inversely proportional to  $Y$  is equivalent to  $X$  is proportional to  $1/Y$  ; {construct and} interpret equations that describe direct and inverse proportion
  - interpret the gradient of a straight line graph as a rate of change; recognise and interpret graphs that illustrate direct and inverse proportion
  - {interpret the gradient at a point on a curve as the instantaneous rate of change; apply the concepts of instantaneous and average rate of change (gradients of tangents and chords) in numerical, algebraic and graphical contexts}
  - set up, solve and interpret the answers in growth and decay problems, including compound interest {and work with general iterative processes}
  
- **Geometry and measures** - in addition to consolidating subject content from key stage 3, pupils should be taught to:
  - interpret and use fractional {and negative} scale factors for enlargements
  - {describe the changes and invariance achieved by combinations of rotations, reflections and translations}
  - identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference, tangent, arc, sector and segment
  - {apply and prove the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results}
  - construct and interpret plans and elevations of 3D shapes
  - interpret and use bearings
  - calculate arc lengths, angles and areas of sectors of circles
  - calculate surface areas and volumes of spheres, pyramids, cones and composite solids
  - apply the concepts of congruence and similarity, including the relationships between lengths, {areas and volumes} in similar figures

- apply Pythagoras' Theorem and trigonometric ratios to find angles and lengths in right-angled triangles {and, where possible, general triangles} in 2 {and 3} dimensional figures
  - know the exact values of  $\sin \theta$  and  $\cos \theta$  for  $\theta = 0^\circ, 30^\circ, 45^\circ, 60^\circ$  and  $90^\circ$ ; know the exact value of  $\tan \theta$  for  $\theta = 0^\circ, 30^\circ, 45^\circ, 60^\circ$
  - {know and apply the sine rule,  $a/\sin A = b/\sin B = c/\sin C$ , and cosine rule,  $a^2 = b^2 + c^2 - 2bc \cos A$ , to find unknown lengths and angles}
  - {know and apply  $\text{Area} = 1/2 ab \sin C$  to calculate the area, sides or angles of any triangle}
  - describe translations as 2D vectors
  - apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representations of vectors; {use vectors to construct geometric arguments and proofs}
- **Probability** - in addition to consolidating subject content from key stage 3, pupils should be taught to:
- apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to 1
  - use a probability model to predict the outcomes of future experiments; understand that empirical unbiased samples tend towards theoretical probability distributions, with increasing sample size
  - calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions
  - {calculate and interpret conditional probabilities through representation using expected frequencies with two-way tables, tree diagrams and Venn diagrams}
- **Statistics** - in addition to consolidating subject content from key stage 3, pupils should be taught to:
- infer properties of populations or distributions from a sample, whilst knowing the limitations of sampling
  - interpret and construct tables and line graphs for time series data
  - {construct and interpret diagrams for grouped discrete data and continuous data, ie, histograms with equal and unequal class intervals and cumulative frequency graphs, and know their appropriate use}
  - interpret, analyse and compare the distributions of data sets from univariate empirical distributions through: appropriate graphical representation involving discrete, continuous and grouped data, {including box plots}

- appropriate measures of central tendency (including modal class) and spread {including quartiles and inter-quartile range}
- apply statistics to describe a population
- use and interpret scatter graphs of bivariate data; recognise correlation and know that it does not indicate causation; draw estimated lines of best fit; make predictions; interpolate and extrapolate apparent trends whilst knowing the dangers of so doing

- **YEAR 10 & 11 (KS4) 2007 MATHS NATIONAL CURRICULUM PROGRAMME OF STUDY AND ATTAINMENT TARGETS**

- **Number and algebra**

- real numbers, their properties and their different representations
- rules of arithmetic applied to calculations and manipulations with real numbers, including standard index form and surds
- proportional reasoning, direct and inverse proportion, proportional change and exponential growth
- upper and lower bounds
- linear, quadratic and other expressions and equations
- graphs of exponential and trigonometric functions
- transformation of functions
- graphs of simple loci
  - **Level 1** - Pupils count, order, add and subtract numbers when solving problems involving up to 10 objects. They read and write the numbers involved
  - **Level 2** - Pupils 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 choose the appropriate operation when solving addition and subtraction problems. They use the knowledge that subtraction is the inverse of addition. They use mental calculation strategies to solve number problems involving money and measures. They recognise sequences of numbers, including odd and even numbers
  - **Level 3** - Pupils show understanding of place value in numbers up to 1000 and use this to make approximations. They begin to use decimal notation and to recognise negative numbers, in contexts such as money and temperature. Pupils 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 numbers with three digits using 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 or division, including those that give rise to remainders. They use simple fractions that are

several parts of a whole and recognise when two simple fractions are equivalent

- **Level 4** - Pupils use their understanding of place value to multiply and divide whole numbers by 10 or 100. When solving number problems, they use a range of mental methods of computation with the four operations, including mental recall of multiplication facts up to  $10 \times 10$  and quick derivation of corresponding division facts. They use efficient written methods of addition and subtraction and of short multiplication and division. They recognise approximate proportions of a whole and use simple fractions and percentages to describe these. They begin to use simple formulae expressed in words
- **Level 5** - Pupils 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. They use and interpret coordinates in all four quadrants
- **Level 6** - Pupils order and approximate decimals when solving numerical problems and equations, using trial and improvement methods. They 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 by writing them with a common denominator. They find and describe in words the rule for the next term or  $n$ th term of a sequence where the rule is linear. They formulate and solve linear equations with whole-number coefficients. They represent mappings expressed algebraically, and use Cartesian coordinates for graphical representation interpreting general features

- **Level 7** - When making estimates, pupils round to one significant figure and multiply and divide mentally. They understand the effects of multiplying and dividing by numbers between 0 and 1. They solve numerical problems involving multiplication and division with numbers of any size, using a calculator efficiently and appropriately. They understand and use proportional changes, calculating the result of any proportional change using only multiplicative methods. They find and describe in symbols the next term or  $n$ th term of a sequence where the rule is quadratic. They use algebraic and graphical methods to solve simultaneous linear equations in two variables
- **Level 8** - Pupils solve problems that involve 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
- **Exceptional performance** - Pupils understand and use rational and irrational numbers. They determine the bounds of intervals. They understand and use direct and inverse proportion. In simplifying algebraic expressions, they use rules of indices for negative and fractional values. In finding formulae that approximately connect data, they express general laws in symbolic form. They solve simultaneous equations in two variables where one equation is linear and the other is quadratic. They solve problems using intersections and gradients of graphs

○ **Geometry and measures**

- properties and mensuration of 2D and 3D shapes
- circle theorems
- trigonometrical relationships
- properties and combinations of transformations
- 3D coordinate systems
- vectors in two dimensions
- conversions between measures and compound measures
  - **Level 1** - When working with 2D and 3D shapes, pupils use everyday language to describe properties and positions. They measure and order objects using direct comparison, and order events
  - **Level 2** - Pupils 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 non-standard and standard units to measure length and mass
  - **Level 3** - Pupils classify 3D and 2D shapes in various ways using mathematical properties such as reflective symmetry for 2D shapes. They use non-standard units, standard metric units of length, capacity and mass, and standard units of time, in a range of contexts
  - **Level 4** - Pupils make 3D mathematical models by linking given faces or edges, and 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, with appropriate accuracy, numbers on a range of measuring instruments. They find perimeters of simple shapes and find areas by counting squares
  - **Level 5** - When constructing models and drawing or using shapes, pupils measure and draw angles to the nearest degree and use language associated with angles. They know the angle sum of a triangle and that of angles at a point. They identify all the symmetries of 2D shapes. 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
- **Level 6** - Pupils recognise and use common 2D representations of 3D objects. They 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 devise instructions for a computer to generate and transform shapes and paths. They understand and use appropriate formulae for finding circumferences and areas of circles, areas of plane rectilinear figures and volumes of cuboids when solving problems
  - **Level 7** - Pupils 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 a fractional 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
  - **Level 8** - Pupils understand and use congruence and mathematical similarity. They use sine, cosine and tangent in right-angled triangles when solving problems in two dimensions
  - **Exceptional performance** - Pupils sketch the graphs of sine, cosine and tangent functions for any angle, and generate and interpret graphs based on these functions. They use sine, cosine and tangent of angles of any size, and Pythagoras' theorem when solving problems in two and three dimensions. They construct formal geometric proofs. They calculate lengths of circular arcs and areas of sectors, and calculate the surface area of cylinders and volumes of cones and spheres. They appreciate the continuous nature of scales that are used to make measurements



○ **Statistics**

- the handling data cycle
- presentation and analysis of large sets of grouped and ungrouped data, including box plots and histograms, lines of best fit and their interpretation
- measures of central tendency and spread
- experimental and theoretical probabilities of single and combined events
- The handling data cycle: This is closely linked to the mathematical key processes and consists of: specifying the problem and planning (representing); collecting data (representing and analysing); processing and presenting the data (analysing); interpreting and discussing the results (interpreting and evaluating).  
Presentation and analysis: This includes the use of ICT.

Grouped

- **Level 1** - Pupils sort objects and classify them, demonstrating the criterion they have used
- **Level 2** - Pupils sort objects and classify them using more than one criterion. When they have gathered information, pupils record results in simple lists, tables and block graphs, in order to communicate their findings
- **Level 3** - Pupils 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 to them in these forms
- **Level 4** - 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 in equal class intervals where appropriate, represent collected data in frequency diagrams and interpret such diagrams. They construct and interpret simple line graphs
- **Level 5** - 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. They 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 different outcomes may result from repeating an experiment

- **Level 6** - Pupils collect and record continuous data, choosing appropriate equal class intervals over a sensible range to create frequency tables. They construct and interpret frequency diagrams. They construct pie charts. They draw conclusions from scatter diagrams, and have a basic understanding of correlation. When dealing with a combination of two experiments, they identify all the outcomes. When solving problems, they use their knowledge that the total probability of all the mutually exclusive outcomes of an experiment is 1
  - **Level 7** - Pupils 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 polygons, 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
  - **Level 8** - Pupils interpret and construct cumulative frequency tables and diagrams. They estimate the median and interquartile 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
  - **Exceptional performance** - Pupils interpret and construct histograms. They understand how different methods of sampling and different sample sizes may affect the reliability of conclusions drawn. They select and justify a sample and method to investigate a population. They recognise when and how to work with probabilities associated with independent, mutually exclusive events
- <http://webarchive.nationalarchives.gov.uk/20130904095205/http://www.education.gov.uk/schools/teachingandlearning/curriculum/secondary/b00199003/mathematics/ks4/attainment>

- **COMPARING YEAR 10 & 11 (KS4) NEW NATIONAL MATHS CURRICULUM PROGRAMME OF STUDY**
  - **KS4**
    - **Year 10 & 11**
      - **Number**
      - **Algebra**
      - **Ratio, proportion and rates of change**
      - **Geometry and measures**
      - **Probability**
      - **Statistics**

**COMPARED TO:**

• **YEAR 10 & 11 (KS4) 2007 MATHS NATIONAL CURRICULUM PROGRAMME OF STUDY**

○ **KS4**

▪ **Year 10 & 11**

- **Number and Algebra**
- **Geometry and Measure**
- **Statistics**