Kenn C of E Primary Curriculum Design for Maths

Kenn C of E Primary School

Maths INTENT

Here at Kenn C of E Primary School, we take a maths mastery approach to teaching and learning mathematics. This means that maths lessons are taught as a whole year group with a 'back and forth' interaction between teacher and pupils; all the children work on the same maths with the aim of a deep understanding for all. Each lesson consists of small steps of learning; there will also be questioning, demonstration, short tasks, peer to peer maths chat, pupils feeding back using whole sentences with specific mathematical vocabulary, repetition of stem sentences and the use of manipulatives to model structure .

We teach the National Curriculum, supported by a clear skills and knowledge progression starting in EYFS, centred around the EYFS Statutory Framework and Development Matters (2020). Our EYFS and Years 1-6 maths progressions are, by necessity, organised into apparently distinct domains, but pupils should make rich connections across mathematical ideas to develop fluency, mathematical reasoning and competence in solving increasingly sophisticated problems.

We believe that all children can be successful in the study of mathematics. Our intent is for every child to gain mastery of the primary maths curriculum and for children to become confident, resilient mathematicians; well equipped to become successful in their future adventures. We aim to prepare them for a successful working life.

Maths IMPLEMENTATION

Learning is coherently sequenced in order for children to progress through their mathematical journey.

Our mastery approach ensures that children spend far longer on fewer key mathematical concepts whilst working at greater depth. We have a creative and flexible approach to teaching mathematics which may change each academic year depending on class set up, year groups and teacher skill. This year, the school morning has been organized so that only one year group will be in the classroom for their mastery maths lesson.

The large majority of children progress through the curriculum at the same pace. However, we do adapt these plans to suit the needs of our individual children and year groups (including SEND and more able). Interventions, pre and post teaching ensure children are equipped to make the most of class teaching. Power Maths, White Rose and Nrich resources are used to support maths teaching. DfE/Ncetm KS1 and 2 Ready to Progress Criteria are mostly used to assess and inform planning.

Maths lessons are taught regularly, according to the needs of their year group. Formative assessment plays an important role in ensuring that all children are exposed to the right level of mathematics, with opportunities to go 'deeper' into a concept for those who have grasped the initial structure of a concept, including by use of questioning to probe deeper understanding.

Staff ensure teaching promotes a growth mindset and enables all children to achieve in and enjoy mathematics.

Formative assessment takes place in every lesson and is an integral component to our mastery approach. Staff utilise carefully crafted questions to assess and challenge our children. Prerequisite and summative assessments take place at key points in the year within our school's monitoring and evaluating cycle. Staff use Target Tracker to ensure all maths objectives are being covered.

Maths IMPACT

Pupils have a curiosity and a 'can do' attitude to achieve and enjoy mathematics.

Children show confidence and believe they can learn about a new maths area and apply the knowledge and skills they already have.

Knowledge and skills - Pupils know how and why maths is used in the outside world and in the workplace. They know about different ways that maths can be used to support their future potential.

Mathematical concepts or skills are mastered when a child can show it in multiple ways, using the mathematical language to explain their ideas, and can independently apply the concept to new problems in unfamiliar situations.

Our pupils are able to show mastery; that they really understand a mathematical concept, idea or technique when they can:

- describe it in their own words
- represent it in a variety of ways (e.g. using concrete materials, pictures and symbols)
- explain it to someone else
- generalise
- make up their own examples (and non-examples) of it
- see connections between it and other facts and ideas
- recognise it in new situations and contexts
- make use of it in various ways, including in new situations

- demonstrate a quick recall of facts and procedures, including the recollection of times tables

Subject leaders monitor impact through conferencing with children. Through discussion and feedback with children, children talk enthusiastically about their maths lessons and speak about how they love learning about maths. They can articulate the context in which maths is being taught and relate this to real life purposes. Subject leaders also monitor through lesson observations, book scrutinies and data analysis.

Ultimately, we ask our children to be mathematical rather than to simply do mathematics.

SEND & disadvantaged pupils

We plan to ensure that ALL children will develop a secure and deep understanding of the mathematics they are learning so that future mathematical learning is built on solid foundations. We encourage our children to have a positive mind-set and advocate that ALL children are able to succeed in mathematics, regardless of their prior attainment or starting point.

In embracing a mastery approach, we engage our children in reasoning and the development of mathematical thinking and plan to include:

Coherent, carefully structured small learning steps
Conceptual variation: the mathematical concept is presented in a variety of ways so children are able to discern the essential features.
Multiple representations: a variety of manipulative and pictorial representations are used to explain the mathematical concept.
Procedural variation: questions are chosen with care to demonstrate a particular concept, ensuring that calculations are more than simply finding an answer, but about understanding patterns and concepts too.
Depth for all: every child in the lesson has the opportunity to apply their key learning through extension, application, reasoning or problem solving (or a combination).
Scaffolding: support is available for those who need it (this could be by providing additional concrete resources; further peer or adult support where necessary; pre teaching/consolidation interventions).

Spiritual, moral, social and cultural development though mathematics.

Spiritual development in Mathematics - The study of mathematics enables children to make sense of the world around them and we strive to enable each of our children to explore the connections between their mathematics skills and every-day life. Developing deep thinking and an ability to question the way in which the world works promotes the spiritual growth of children.

Moral development in Mathematics - The moral development of children is an important thread running through the mathematics curriculum. Children are provided with opportunities to use their maths skills in real life contexts, applying and exploring the skills required in solving various problems. All children are made aware of the fact that the choices they make lead to various consequences. They must then make a choice that relates to the result they are looking for. The logical aspect of this relates strongly to the right/wrong responses in mathematics.

Social development in Mathematics - Problem solving skills and teamwork are fundamental to mathematics through creative thinking, discussion, explaining and presenting ideas. Children are always encouraged to explain concepts to each other and support each other in their learning. In this manner, children realise their own strengths and feel a sense of achievement, which often boosts confidence. Over time, they become more independent and resilient learners.

Year 1-6 Curriculum Map (yearly overviews) 2022-23

	Unit	Unit name
Autumn 1	1	Previous Reception experiences and counting within 100
Autumn 2	2	Comparison of quantities and part–whole relationships
	3	Numbers 0 to 5
Spring 1	4	Recognise, compose, decompose and manipulate 2D and 3D shapes
	5	Numbers 0 to 10
Spring 2	6	Additive structures
	7	Addition and subtraction facts within 10
Summer 1	8	Numbers 0 to 20
Summer 2	9	Unitising and coin recognition
	10	Position and direction
	11	Time

- Number and place value
- Number facts
- Addition and subtraction
- Geometry
- Other

Year 1

Curriculum map

NCETM
NATIONAL CENTRE for EXCELLENCE in the TEACHING of MATHEMATICS

June 2021

	Unit	Unit name
Autumn 1	1	Numbers 10 to 100
	2	Calculations within 20
Autumn 2	3	Fluently add and subtract within 10
	4	Addition and subtraction of two-digit numbers (1)
Spring 1	5	Introduction to multiplication
	6	Introduction to division structures
Spring 2	7	Shape
	8	Addition and subtraction of two-digit numbers (2)
Summer 1	9	Money
	10	Fractions
	11	Time
	12	Position and direction
Summer 2	13	Multiplication and division – doubling, halving, quotitive and partitive division
	14	Sense of measure – capacity, volume, mass

- Number and place value
- Number facts
- Addition and subtraction
- Multiplication and division
- Geometry
- Other

Year 2

Curriculum map

NCETM

NATIONAL CENTRE for EXCELLENCE in the TEACHING of MATHEMATICS

June 2021

	Unit	Unit name
Autumn 1	1	Adding and subtracting across 10
	2	Numbers to 1,000
Autumn 2		
Spring 1	3	Right angles
	4	Manipulating the additive relationship and securing mental calculation
Spring 2	5	Column addition
	6	2, 4, 8 times tables
	7	Column subtraction
Summer 1	8	Unit fractions
Summer 2	9	Non-unit fractions
	10	Parallel and perpendicular sides in polygons
	11	Time

- Number and place value
- Number facts
- Addition and subtraction
- Multiplication and division
- Fractions
- Geometry
- Other

Year 3

Curriculum map

NCETM
NATIONAL CENTRE FOR EXCELLENCE IN THE TEACHING OF MATHEMATICS

June 2021

	Unit	Unit name
Autumn 1	1	Review of column addition and subtraction
	2	Numbers to 10,000
Autumn 2	3	Perimeter
	4	3, 6, 9 times tables
Spring 1	5	7 times table and patterns
	6	Understanding and manipulating multiplicative relationships
Spring 2	7	Coordinates
	8	Review of fractions
Summer 1	9	Fractions greater than 1
	10	Symmetry in 2D shapes
	11	Time
Summer 2	12	Division with remainders

- Number and place value
- Number facts
- Addition and subtraction
- Multiplication and division
- Fractions
- Geometry
- Other

Year 4

Curriculum map

NCETM

NATIONAL CENTRE for EXCELLENCE in the TEACHING of MATHEMATICS

June 2021

	Unit	Unit name
Autumn 1	1	Decimal fractions
	2	Money
Autumn 2	3	Negative numbers
	4	Short multiplication and short division
Spring 1	5	Area and scaling
Spring 2	6	Calculating with decimal fractions
	7	Factors, multiples and primes
Summer 1	8	Fractions
Summer 2	9	Converting units
	10	Angles

- Number and place value
- Number facts
- Multiplication and division
- Fractions
- Geometry
- Other

Year 5

Curriculum map

NCETM
NATIONAL CENTRE for EXCELLENCE in the TEACHING of MATHEMATICS

Summer 2021

	Unit	Unit name
Autumn 1	1	Calculating using knowledge of structures (1)
	2	Multiples of 1,000
Autumn 2	3	Numbers up to 10,000,000
	4	Draw, compose and decompose shapes
Spring 1	5	Multiplication and division
	6	Area, perimeter, position and direction
Spring 2	7	Fractions and percentages
	8	Statistics
Summer 1		KS2 tests
Summer 2	9	Ratio and proportion
	10	Calculating using knowledge of structures (2)
	11	Solving problems with two unknowns
	12	Order of operations
	13	Mean average

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

Year 6

Curriculum map

NCETM
NATIONAL CENTRE FOR EXCELLENCE IN THE TEACHING OF MATHEMATICS

June 2021

Mastering Number curriculum map (Reception, Year 1 and Year 2) 2022-23

Mastering Number.

Children in EYFS, Year 1 and Year 2 follow the Mastering number programme by NCTEM to develop their understanding and knowledge of how numbers are made up. This is taught alongside the KS1 mastery programme materials.

Mastering Number: Overview of content – Reception

Strand/ Half-term	Subitising	Cardinality, ordinality and counting	Composition	Comparison
1 **Children will:**	• perceptually subitise within 3 • identify sub-groups in larger arrangements • create their own patterns for numbers within 4 • practise using their fingers to represent quantities which they can subitise • experience subitising in a range of contexts, including temporal patterns made by sounds.	• relate the counting sequence to cardinality, seeing that the last number spoken gives the number in the entire set • have a wide range of opportunities to develop their knowledge of the counting sequence, including through rhyme and song • have a wide range of opportunities to develop 1:1 correspondence, including by coordinating movement and counting • have opportunities to develop an understanding that anything can be counted, including actions and sounds • explore a range of strategies which support accurate counting.	• see that all numbers can be made of 1s • compose their own collections within 4.	• understand that sets can be compared according to a range of attributes, including by their numerosity use the • language of comparison, including 'more than' and 'fewer than' compare sets • 'just by looking'.

2 **Children will:**	• continue from first half-term • subitise within 5, perceptually and conceptually, depending on the arrangements.	• continue to develop their counting skills • explore the cardinality of 5, linking this to dice patterns and 5 fingers on 1 hand • begin to count beyond 5 • begin to recognise numerals, relating these to quantities they can subitise and count.	• explore the concept of 'wholes' and 'parts' by looking at a range of objects that are composed of parts, some of which can be taken apart and some of which cannot • explore the composition of numbers within 5.	• compare sets using a variety of strategies, including 'just by looking', by subitising and by matching • compare sets by matching, seeing that when every object in a set can be matched to one in the other set, they contain the same number and are equal amounts.
3 **Children will:**	• increase confidence in subitising by continuing to explore patterns within 5, including structured and random arrangements	• continue to develop verbal counting to 20 and beyond • continue to develop object counting skills, using a range of strategies to develop accuracy	• continue to explore the composition of 5 and practise recalling 'missing' or 'hidden' parts for 5	• continue to compare sets using the language of comparison, and play games which involve comparing sets

	• explore a range of patterns made by some numbers greater than 5, including structured patterns in which 5 is a clear part • experience patterns which show a small group and '1 more' • continue to match arrangements to finger patterns.	• continue to link counting to cardinality, including using their fingers to represent quantities between 5 and 10 • order numbers, linking cardinal and ordinal representations of number.	• explore the composition of 6, linking this to familiar patterns, including symmetrical patterns • begin to see that numbers within 10 can be composed of '5 and a bit'.	• continue to compare sets by matching, identifying when sets are equal • explore ways of making unequal sets equal.
4 **Children will:**	• explore symmetrical patterns, in which each side is a familiar pattern, linking this to 'doubles'.	• continue to consolidate their understanding of cardinality, working with larger numbers within 10 • become more familiar with the counting pattern beyond 20.	• explore the composition of odd and even numbers, looking at the 'shape' of these numbers • begin to link even numbers to doubles • begin to explore the composition of numbers within 10.	• compare numbers, reasoning about which is more, using both an understanding of the 'howmanyness' of a number, and its position in the number system.

5 **Children will:**	• continue to practise increasingly familiar subitising arrangements, including those which expose '1 more' or 'doubles' patterns • use subitising skills to enable them to identify when patterns show the same number but in a different arrangement, or when patterns are similar but have a different number • subitise structured and unstructured patterns, including those which show numbers within 10, in relation to 5 and 10 • be encouraged to identify when it is appropriate to count and when groups can be subitised.	• continue to develop verbal counting to 20 and beyond, including counting from different starting numbers • continue to develop confidence and accuracy in both verbal and object counting.	• explore the composition of 10.	• order sets of objects, linking this to their understanding of the ordinal number system.
6	In this half-term, the children will consolidate their understanding of concepts previously taught through working in a variety of contexts and with different numbers.			

EYFS children also follow the adventures of block characters in Numberland, with the number of blocks **determining which numeral they embody**. A black floating number, called a Numberling, appears above their heads to show how many blocks they are made of.

Number Blocks Episodes

Mastering Number: Overview of content – Year 1

Strand/ Half-term	Subitising	Cardinality, ordinality and counting	Composition	Comparison	Addition and subtraction/ Number facts
1 Children will:	• revisit subitising within 5 using perceptual subitising • practise conceptual subitising of bigger numbers as they become more familiar with patterns made by the numbers 5–10.	• explore the linear number system within 10, looking at a range of ordinal representations • explore the link between the 'staircase' pattern and a number track.	• focus on the composition of numbers within 10, with a particular emphasis on the composition of numbers 6, 7, 8 and 9 as '5 and a bit', as well as exploring the composition of numbers 5 and 6 in-depth • explore the composition of odd and even numbers, identifying that even numbers are made of 2s and odd numbers have 'an extra 1' – they will link this to the 'shape' of these numbers.		Although children will not be looking at number bonds expressed as equations, their work on the composition of numbers within 10 will be developing their knowledge of number bonds.
2 Children will:	• continue to practise conceptually subitising numbers they have already explored the composition of.	• review the linear number system to 10 as they compare numbers.	• continue to explore the composition of the numbers 7–9 in-depth, linking this to their understanding of odd and even numbers • explore the composition of 10, developing a systematic approach to finding pairs that sum to 10.	• revisit what is meant by 'comparing' and see that quantities can be compared according to different attributes, including numerosity.	As above.
3 Children will:	• continue to practise conceptually subitising numbers they have already explored the composition of.		• review the composition of numbers within 10, linking these to part-part-whole representations • practise recalling missing parts for numbers within 10.	• compare numbers within 10, linking this to their understanding of the linear system • use the inequality symbol to create expressions, e.g. 7 > 2, and use the language of 'greater than' and 'less than'	• develop their recall of number bonds within 10, through the use of exercises which use written numerals but not the symbols +, –, or =.

Mastering Number: Overview of content – Year 2

Strand/ Half-term	Subitising	Cardinality, ordinality and counting	Composition	Comparison	Addition and subtraction/ Number facts
1 Children will:	• develop conceptual subitising skills as they become more familiar with patterns made by numbers within 10 and understand their composition • use perceptual and conceptual subitising when using a rekenrek.	• explore the linear number system within 10, looking at a range of representations • compare number tracks and number lines and explore the use of 'midpoints' to enable them to identify the location of other numbers.	• focus on the composition of numbers within 10, with a particular emphasis on the composition of numbers 6, 7, 8 and 9 as '5 and a bit', as well as exploring the composition of numbers 5 and 6 in-depth • explore the composition of odd and even numbers, identifying that even numbers are made of 2s and odd numbers have 'an extra 1' – they will link this to the 'shape' of these numbers.		• link their growing understanding of the composition of numbers within 10 to the related additive facts, including adding 2 to an odd or even number • practise recalling facts in a variety of ways, including through solving simple picture problems and completing equations with a missing sum or addend,
2 Children will:	• continue to practise conceptually subitising numbers they have already explored the composition of.	• review the linear number system as they compare numbers.	• continue to explore the composition of the numbers 7–9 in-depth, linking this to their understanding of odd and even numbers	• compare numbers within 10, linking this to their understanding of the linear number system • use the inequality symbols to create expressions, e.g. $7 > 2$, and use the language of 'greater than' and 'less than' • draw on their knowledge of number bonds to answer questions in the form: True or false? $5 + 3 > 7$	• continue to practise recalling additive facts for numbers within 10, using a range of equations, games and picture problems.

Kenn C of E Primary School Progression maps

Number: Number and Place Value

National Centre for Excellence in the Teaching of Mathematics

COUNTING					
Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
count to and across 100, forwards and backwards, beginning with 0 or 1, or from any given number			count backwards through zero to include negative numbers	interpret negative numbers in context, count forwards and backwards with positive and negative whole numbers, including through zero	use negative numbers in context, and calculate intervals across zero
count, read and write numbers to 100 in numerals; count in multiples of twos, fives and tens	count in steps of 2, 3, and 5 from 0, and in tens from any number, forward or backward	count from 0 in multiples of 4, 8, 50 and 100;	count in multiples of 6, 7, 9, 25 and 1000	count forwards or backwards in steps of powers of 10 for any given number up to 1000 000	
given a number, identify one more and one less		find 10 or 100 more or less than a given number	find 1000 more or less than a given number		
COMPARING NUMBERS					
use the language of: equal to, more than, less than (fewer), most, least	compare and order numbers from 0 up to 100; use <, > and = signs	compare and order numbers up to 1000	order and compare numbers beyond 1000 *compare numbers with the same number of decimal places up to two decimal places* (copied from Fractions)	read, write, order and compare numbers to at least 1 000 000 and determine the value of each digit (appears also in Reading and Writing Numbers)	read, write, order and compare numbers up to 10 000 000 and determine the value of each digit (appears also in Reading and Writing Numbers)
IDENTIFYING, REPRESENTING AND ESTIMATING NUMBERS					
identify and represent numbers using objects and pictorial representations including the number line	identify, represent and estimate numbers using different representations, including the number line	identify, represent and estimate numbers using different representations	identify, represent and estimate numbers using different representations		

Number: Number and Place Value

National Centre for Excellence in the Teaching of Mathematics

READING AND WRITING NUMBERS (including Roman Numerals)					
Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
read and write numbers from 1 to 20 in numerals and words.	read and write numbers to at least 100 in numerals and in words	read and write numbers up to 1000 in numerals and in words		read, write, order and compare numbers to at least 1 000 000 and determine the value of each digit (appears also in Comparing Numbers)	read, write, order and compare numbers up to 10 000 000 and determine the value of each digit (appears also in Understanding Place Value)
		tell and write the time from an analogue clock, including using Roman numerals from I to XII, and 12-hour and 24-hour clocks (copied from Measurement)	read Roman numerals to 100 (I to C) and know that over time, the numeral system changed to include the concept of zero and place value.	read Roman numerals to 1000 (M) and recognise years written in Roman numerals.	
UNDERSTANDING PLACE VALUE					
	recognise the place value of each digit in a two-digit number (tens, ones)	recognise the place value of each digit in a three-digit number (hundreds, tens, ones)	recognise the place value of each digit in a four-digit number (thousands, hundreds, tens, and ones)	read, write, order and compare numbers to at least 1 000 000 and determine the value of each digit (appears also in Reading and Writing Numbers)	read, write, order and compare numbers up to 10 000 000 and determine the value of each digit (appears also in Reading and Writing Numbers)
			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 units, tenths and hundredths (copied from Fractions)	*recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents* (copied from Fractions)	*identify the value of each digit to three decimal places and multiply and divide numbers by 10, 100 and 1000 where the answers are up to three decimal places* (copied from Fractions)

Number: Number and Place Value

National Centre for Excellence in the Teaching of Mathematics

ROUNDING					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
			round any number to the nearest 10, 100 or 1 000	round any number up to 1 000 000 to the nearest 10, 100, 1 000, 10 000 and 100 000	round any whole number to a required degree of accuracy
			round decimals with one decimal place to the nearest whole number (copied from Fractions)	*round decimals with two decimal places to the nearest whole number and to one decimal place* (copied from Fractions)	*solve problems which require answers to be rounded to specified degrees of accuracy* (copied from Fractions)
PROBLEM SOLVING					
	use place value and number facts to solve problems	solve number problems and practical problems involving these ideas.	solve number and practical problems that involve all of the above and with increasingly large positive numbers	solve number problems and practical problems that involve all of the above	solve number and practical problems that involve all of the above

Number: Addition and Subtraction

National Centre for Excellence in the Teaching of Mathematics

NUMBER BONDS					
Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
represent and use number bonds and related subtraction facts within 20	recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100				
MENTAL CALCULATION					
add and subtract one-digit and two-digit numbers to 20, including zero	add and subtract numbers using concrete objects, pictorial representations, and mentally, including: * a two-digit number and ones * a two-digit number and tens * two two-digit numbers * adding three one-digit numbers	add and subtract numbers mentally, including: * a three-digit number and ones * a three-digit number and tens * a three-digit number and hundreds		add and subtract numbers mentally with increasingly large numbers	perform mental calculations, including with mixed operations and large numbers
read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs (appears also in Written Methods)	show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot				use their knowledge of the order of operations to carry out calculations involving the four operations

Number: Addition and Subtraction

National Centre for Excellence in the Teaching of Mathematics

WRITTEN METHODS					
Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs (appears also in Mental Calculation)		add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction	add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate	add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)	
INVERSE OPERATIONS, ESTIMATING AND CHECKING ANSWERS					
	recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.	estimate the answer to a calculation and use inverse operations to check answers	estimate and use inverse operations to check answers to a calculation	use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy	use estimation to check answers to calculations and determine, in the context of a problem, levels of accuracy.

Number: Addition and Subtraction

National Centre for Excellence in the Teaching of Mathematics

PROBLEM SOLVING					
Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = □ - 9	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	solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction	solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why	solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why	solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why
	solve simple problems in a practical context involving addition and subtraction of money of the same unit, including giving change (copied from Measurement)				Solve problems involving addition, subtraction, multiplication and division

Number: Multiplication and Division

National Centre for Excellence in the Teaching of Mathematics

MULTIPLICATION & DIVISION FACTS					
Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
count in multiples of twos, fives and tens (copied from Number and Place Value)	*count in steps of 2, 3, and 5 from 0, and in tens from any number, forward or backward* (copied from Number and Place Value)	*count from 0 in multiples of 4, 8, 50 and 100* (copied from Number and Place Value)	*count in multiples of 6, 7, 9, 25 and 1 000* (copied from Number and Place Value)	*count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000* (copied from Number and Place Value)	
	recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers	recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables	recall multiplication and division facts for multiplication tables up to 12 × 12		
MENTAL CALCULATION					
		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 (appears also in Written Methods)	use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers	multiply and divide numbers mentally drawing upon known facts	perform mental calculations, including with mixed operations and large numbers
	show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot		recognise and use factor pairs and commutativity in mental calculations (appears also in Properties of Numbers)	multiply and divide whole numbers and those involving decimals by 10, 100 and 1000	*associate a fraction with division and calculate decimal fraction equivalents (e.g. 0.375) for a simple fraction (e.g. $^{3}/_{8}$)* (copied from Fractions)

Number: Multiplication and Division

National Centre for Excellence in the Teaching of Mathematics

WRITTEN CALCULATION					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs	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 (appears also in Mental Methods)	multiply two-digit and three-digit numbers by a one-digit number using formal written layout	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 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 one-digit number using the formal written method of short division and interpret remainders appropriately for the context	divide numbers up to 4-digits by a two-digit whole number using the formal written method of short division where appropriate for the context 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
					use written division methods in cases where the answer has up to two decimal places (copied from Fractions (including decimals))

Number: Multiplication and Division

National Centre for Excellence in the Teaching of Mathematics

PROPERTIES OF NUMBERS: MULTIPLES, FACTORS, PRIMES, SQUARE AND CUBE NUMBERS					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
			recognise and use factor pairs and commutativity in mental calculations (repeated)	identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers.	identify common factors, common multiples and prime numbers
				know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers	*use common factors to simplify fractions; use common multiples to express fractions in the same denomination* (copied from Fractions)
				establish whether a number up to 100 is prime and recall prime numbers up to 19	
				recognise and use square numbers and cube numbers, and the notation for squared (^{2}) and cubed (^{3})	*calculate, estimate and compare volume of cubes and cuboids using standard units, including centimetre cubed (cm^3) and cubic metres (m^3), and extending to other units such as mm^3 and km^3* (copied from Measures)

Number: Multiplication and Division

National Centre for Excellence in the Teaching of Mathematics

ORDER OF OPERATIONS					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
					use their knowledge of the order of operations to carry out calculations involving the four operations
INVERSE OPERATIONS, ESTIMATING AND CHECKING ANSWERS					
		estimate the answer to a calculation and use inverse operations to check answers (copied from Addition and Subtraction)	*estimate and use inverse operations to check answers to a calculation* (copied from Addition and Subtraction)		use estimation to check answers to calculations and determine, in the context of a problem, levels of accuracy

Number: Multiplication and Division

National Centre for Excellence in the Teaching of Mathematics

PROBLEM SOLVING					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
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	solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts	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	solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects	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
				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	*solve problems involving similar shapes where the scale factor is known or can be found* (copied from Ratio and Proportion)

Number: Fractions (including Decimals and Percentages)

National Centre for Excellence in the Teaching of Mathematics

COUNTING IN FRACTIONAL STEPS					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	Pupils should count in fractions up to 10, starting from any number and using the1/2 and 2/4 equivalence on the number line (Non Statutory Guidance)	count up and down in tenths	count up and down in hundredths		
RECOGNISING FRACTIONS					
recognise, find and name a half as one of two equal parts of an object, shape or quantity	recognise, find, name and write fractions $^{1}/_{3}$, $^{1}/_{4}$, $^{2}/_{4}$ and $^{3}/_{4}$ of a length, shape, set of objects or quantity	recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators	recognise that hundredths arise when dividing an object by one hundred and dividing tenths by ten	recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents (appears also in Equivalence)	
		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 name a quarter as one of four equal parts of an object, shape or quantity		recognise and use fractions as numbers: unit fractions and non-unit fractions with small denominators			
COMPARING FRACTIONS					
		compare and order unit fractions, and fractions with the same denominators		compare and order fractions whose denominators are all multiples of the same number	compare and order fractions, including fractions >1

Number: Fractions (including Decimals and Percentages)

National Centre for Excellence in the Teaching of Mathematics

COMPARING DECIMALS					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
			compare numbers with the same number of decimal places up to two decimal places	read, write, order and compare numbers with up to three decimal places	identify the value of each digit in numbers given to three decimal places
ROUNDING INCLUDING DECIMALS					
			round decimals with one decimal place to the nearest whole number	round decimals with two decimal places to the nearest whole number and to one decimal place	solve problems which require answers to be rounded to specified degrees of accuracy
EQUIVALENCE (INCLUDING FRACTIONS, DECIMALS AND PERCENTAGES)					
	write simple fractions e.g. $^1/_2$ of 6 = 3 and recognise the equivalence of $^2/_4$ and $^1/_2$.	recognise and show, using diagrams, equivalent fractions with small denominators	recognise and show, using diagrams, families of common equivalent fractions	identify, name and write equivalent fractions of a given fraction, represented visually, including tenths and hundredths	use common factors to simplify fractions; use common multiples to express fractions in the same denomination
			recognise and write decimal equivalents of any number of tenths or hundredths	read and write decimal numbers as fractions (e.g. 0.71 = $^{71}/_{100}$) recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents	associate a fraction with division and calculate decimal fraction equivalents (e.g. 0.375) for a simple fraction (e.g. $^3/_8$)
			recognise and write decimal equivalents to $^1/_4$; $^1/_2$; $^3/_4$	recognise the per cent symbol (%) and understand that per cent relates to "number of parts per hundred", and write percentages as a fraction with denominator 100 as a decimal fraction	recall and use equivalences between simple fractions, decimals and percentages, including in different contexts.

Number: Fractions (including Decimals and Percentages)

National Centre for Excellence in the Teaching of Mathematics

ADDITION AND SUBTRACTION OF FRACTIONS					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
		add and subtract fractions with the same denominator within one whole (e.g. $^{5}/_{7} + {}^{1}/_{7} = {}^{6}/_{7}$)	add and subtract fractions with the same denominator	add and subtract fractions with the same denominator and multiples of the same number	add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions
				recognise mixed numbers and improper fractions and convert from one form to the other and write mathematical statements > 1 as a mixed number (e.g. $^{2}/_{5} + {}^{4}/_{5} = {}^{6}/_{5} = 1\,{}^{1}/_{5}$)	
MULTIPLICATION AND DIVISION OF FRACTIONS					
				multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams	multiply simple pairs of proper fractions, writing the answer in its simplest form (e.g. $^{1}/_{4} \times {}^{1}/_{2} = {}^{1}/_{8}$)
					multiply one-digit numbers with up to two decimal places by whole numbers
					divide proper fractions by whole numbers (e.g. $^{1}/_{3} \div 2 = {}^{1}/_{6}$)

Number: Fractions (including Decimals and Percentages)

National Centre for Excellence in the Teaching of Mathematics

MULTIPLICATION AND DIVISION OF DECIMALS					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
					multiply one-digit numbers with up to two decimal places by whole numbers
			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		multiply and divide numbers by 10, 100 and 1000 where the answers are up to three decimal places
					identify the value of each digit to three decimal places and multiply and divide numbers by 10, 100 and 1000 where the answers are up to three decimal places
					associate a fraction with division and calculate decimal fraction equivalents (e.g. 0.375) for a simple fraction (e.g. $^{3}/_{8}$)
					use written division methods in cases where the answer has up to two decimal places

Number: Fractions (including Decimals and Percentages)

National Centre for Excellence in the Teaching of Mathematics

PROBLEM SOLVING					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
		solve problems that involve all of the above	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	solve problems involving numbers up to three decimal places	
			solve simple measure and money problems involving fractions and decimals to two decimal places.	solve problems which require knowing percentage and decimal equivalents of $^{1}/_{2}$, $^{1}/_{4}$, $^{1}/_{5}$, $^{2}/_{5}$, $^{4}/_{5}$ and those with a denominator of a multiple of 10 or 25.	

Ratio and Proportion

National Centre for Excellence in the Teaching of Mathematics

Statements only appear in Year 6 but should be connected to previous learning, particularly fractions and multiplication and division					
					Year 6
					solve problems involving the relative sizes of two 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

National Centre for Excellence in the Teaching of Mathematics

EQUATIONS					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
*solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and **missing number problems** such as 7 = □ - 9* (copied from Addition and Subtraction)	*recognise and use the inverse relationship between addition and subtraction and use this to check calculations and **missing number** problems.* (copied from Addition and Subtraction)	solve problems, *including **missing number** problems, using number facts, place value, and more complex addition and subtraction.* (copied from Addition and Subtraction) *solve problems, including **missing number** problems, involving multiplication and division, including integer scaling* (copied from Multiplication and Division)		*use the properties of rectangles to deduce related facts and find **missing lengths and angles*** (copied from Geometry: Properties of Shapes)	express missing number problems algebraically
	recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100 (copied from Addition and Subtraction)				find pairs of numbers that satisfy number sentences involving two unknowns
represent and use number bonds and related subtraction facts within 20 (copied from Addition and Subtraction)					enumerate all possibilities of combinations of two variables

Algebra

National Centre for Excellence in the Teaching of Mathematics

FORMULAE					
Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
			Perimeter can be expressed algebraically as 2(a + b) where a and b are the dimensions in the same unit. (Copied from NSG measurement)		use simple formulae *recognise when it is possible to use formulae for area and volume of shapes* (copied from Measurement)
SEQUENCES					
sequence events in chronological order using language such as: before and after, next, first, today, yesterday, tomorrow, morning, afternoon and evening (copied from Measurement)	*compare and sequence intervals of time* (copied from Measurement) *order and arrange combinations of mathematical objects in patterns* (copied from Geometry: position and direction)				generate and describe linear number sequences

Measurement

National Centre for Excellence in the Teaching of Mathematics

COMPARING AND ESTIMATING					
Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
compare, describe and solve practical problems for: * lengths and heights [e.g. long/short, longer/shorter, tall/short, double/half] * mass/weight [e.g. heavy/light, heavier than, lighter than] * capacity and volume [e.g. full/empty, more than, less than, half, half full, quarter] * time [e.g. quicker, slower, earlier, later]	compare and order lengths, mass, volume/capacity and record the results using >, < and =		estimate, compare and calculate different measures, including money in pounds and pence (also included in Measuring)	calculate and compare the area of squares and rectangles including using standard units, square centimetres (cm^2) and square metres (m^2) and estimate the area of irregular shapes (also included in measuring) estimate volume (e.g. using 1 cm^3 blocks to build cubes and cuboids) and capacity (e.g. using water)	calculate, estimate and compare volume of cubes and cuboids using standard units, including centimetre cubed (cm^3) and cubic metres (m^3), and extending to other units such as mm^3 and km^3.
sequence events in chronological order using language [e.g. before and after, next, first, today, yesterday, tomorrow, morning, afternoon and evening]	compare and sequence intervals of time	compare durations of events, for example to calculate the time taken by particular events or tasks			
		estimate and read time with increasing accuracy to the nearest minute; record and compare time in terms of seconds, minutes, hours and o'clock; use vocabulary such as a.m./p.m., morning, afternoon, noon and midnight (appears also in Telling the Time)			

Measurement

National Centre for Excellence in the Teaching of Mathematics

MEASURING and CALCULATING					
Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
measure and begin to record the following: * **lengths and heights** * **mass/weight** * **capacity and volume** * **time** (hours, minutes, seconds)	choose and use appropriate standard units to estimate and measure **length/height** in any direction (m/cm); **mass** (kg/g); **temperature** (°C); **capacity** (litres/ml) to the nearest appropriate unit, using rulers, scales, thermometers and measuring vessels	measure, compare, add and subtract: **lengths** (m/cm/mm); **mass** (kg/g); **volume/capacity** (l/ml)	estimate, compare and calculate **different measures,** including **money in pounds and pence** (appears also in Comparing)	use all four operations to solve problems involving measure (e.g. **length, mass, volume, money**) using decimal notation including scaling.	solve problems involving the calculation and conversion of **units of measure**, using decimal notation up to three decimal places where appropriate (appears also in Converting)
		measure the **perimeter** of simple 2-D shapes	measure and calculate the **perimeter** of a rectilinear figure (including squares) in centimetres and metres	measure and calculate the **perimeter** of composite rectilinear shapes in centimetres and metres	recognise that shapes with the same areas can have different **perimeters** and vice versa

Measurement

National Centre for Excellence in the Teaching of Mathematics

MEASURING and CALCULATING					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
recognise and know the value of different denominations of **coins and notes**	recognise and use symbols for pounds **(£) and pence (p)**; combine amounts to make a particular value	add and subtract amounts of **money** to give change, using both £ and p in practical contexts			
	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				
			find the area of rectilinear shapes by counting squares	calculate and compare the area of squares and rectangles including using standard units, square centimetres (cm^2) and square metres (m^2) and estimate the area of irregular shapes *recognise and use square numbers and cube numbers, and the notation for squared (^{2}) and cubed (^{3})* (copied from Multiplication and Division)	calculate the area of parallelograms and triangles
					calculate, estimate and compare volume of cubes and cuboids using standard units, including cubic centimetres (cm^3) and cubic metres (m^3), and extending to other units [e.g. mm^3 and km^3].
					recognise when it is possible to use formulae for area and volume of shapes

Measurement

National Centre for Excellence in the Teaching of Mathematics

TELLING THE TIME					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
tell the time to the hour and half past the hour and draw the hands on a clock face to show these times.	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.	tell and write the time from an analogue clock, including using Roman numerals from I to XII, and 12-hour and 24-hour clocks	read, write and convert time between analogue and digital 12 and 24-hour clocks (appears also in Converting)		
recognise and use language relating to dates, including days of the week, weeks, months and years	know the number of minutes in an hour and the number of hours in a day. (appears also in Converting)	estimate and read time with increasing accuracy to the nearest minute; record and compare time in terms of seconds, minutes, hours and o'clock; use vocabulary such as a.m./p.m., morning, afternoon, noon and midnight (appears also in Comparing and Estimating)			
			solve problems involving converting from hours to minutes; minutes to seconds; years to months; weeks to days (appears also in Converting)	solve problems involving converting between units of time	

Measurement

National Centre for Excellence in the Teaching of Mathematics

CONVERTING					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	know the number of minutes in an hour and the number of hours in a day. (appears also in Telling the Time)	know the number of seconds in a minute and the number of days in each month, year and leap year	convert between different units of measure (e.g. kilometre to metre; hour to minute)	convert between different units of metric measure (e.g. kilometre and metre; centimetre and metre; centimetre and millimetre; gram and kilogram; litre and millilitre)	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 three decimal places
			read, write and convert time between analogue and digital 12 and 24-hour clocks (appears also in Converting)	solve problems involving converting between units of time	solve problems involving the calculation and conversion of units of measure, using decimal notation up to three decimal places where appropriate (appears also in Measuring and Calculating)
			solve problems involving converting from hours to minutes; minutes to seconds; years to months; weeks to days (appears also in Telling the Time)	understand and use equivalences between metric units and common imperial units such as inches, pounds and pints	convert between miles and kilometres

Geometry: Properties of Shapes

National Centre for Excellence in the Teaching of Mathematics

IDENTIFYING SHAPES AND THIER PROPERTIES					
Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
recognise and name common 2-D and 3-D shapes, including: * 2-D shapes [e.g. rectangles (including squares), circles and triangles] * 3-D shapes [e.g. cuboids (including cubes), pyramids and spheres].	identify and describe the properties of 2-D shapes, including the number of sides and line symmetry in a vertical line		identify lines of symmetry in 2-D shapes presented in different orientations	identify 3-D shapes, including cubes and other cuboids, from 2-D representations	recognise, describe and build simple 3-D shapes, including making nets (appears also in Drawing and Constructing)
	identify and describe the properties of 3-D shapes, including the number of edges, vertices and faces				illustrate and name parts of circles, including radius, diameter and circumference and know that the diameter is twice the radius
	identify 2-D shapes on the surface of 3-D shapes, [for example, a circle on a cylinder and a triangle on a pyramid]				
DRAWING AND CONSTRUCTING					
		draw 2-D shapes and make 3-D shapes using modelling materials; recognise 3-D shapes in different orientations and describe them	complete a simple symmetric figure with respect to a specific line of symmetry	draw given angles, and measure them in degrees ($^{\circ}$)	draw 2-D shapes using given dimensions and angles
					recognise, describe and build simple 3-D shapes, including making nets (appears also in Identifying Shapes and Their Properties)

Geometry: Properties of Shapes

National Centre for Excellence in the Teaching of Mathematics

COMPARING AND CLASSIFYING					
Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
	compare and sort common 2-D and 3-D shapes and everyday objects		compare and classify geometric shapes, including quadrilaterals and triangles, based on their properties and sizes	use the properties of rectangles to deduce related facts and find missing lengths and angles	compare and classify geometric shapes based on their properties and sizes and find unknown angles in any triangles, quadrilaterals, and regular polygons
				distinguish between regular and irregular polygons based on reasoning about equal sides and angles	
ANGLES					
		recognise angles as a property of shape or a description of a turn		know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles	
		identify right angles, recognise that two right angles make a half-turn, three make three quarters of a turn and four a complete turn; identify whether angles are greater than or less than a right angle	identify acute and obtuse angles and compare and order angles up to two right angles by size	identify: * angles at a point and one whole turn (total 360°) * angles at a point on a straight line and ½ a turn (total 180°) * other multiples of 90°	recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles
		identify horizontal and vertical lines and pairs of perpendicular and parallel lines			

Geometry: Position and Direction

National Centre for Excellence in the Teaching of Mathematics

<table>
<tr><th colspan="6">POSITION, DIRECTION AND MOVEMENT</th></tr>
<tr><th>Year 1</th><th>Year 2</th><th>Year 3</th><th>Year 4</th><th>Year 5</th><th>Year 6</th></tr>
<tr><td rowspan="2">describe position, direction and movement, including half, quarter and three-quarter turns.</td><td rowspan="2">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)</td><td rowspan="2"></td><td>describe positions on a 2-D grid as coordinates in the first quadrant</td><td rowspan="2">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</td><td>describe positions on the full coordinate grid (all four quadrants)</td></tr>
<tr><td>describe movements between positions as translations of a given unit to the left/right and up/down</td><td>draw and translate simple shapes on the coordinate plane, and reflect them in the axes.</td></tr>
<tr><td></td><td></td><td></td><td>plot specified points and draw sides to complete a given polygon</td><td></td><td></td></tr>
<tr><th colspan="6">PATTERN</th></tr>
<tr><td></td><td>order and arrange combinations of mathematical objects in patterns and sequences</td><td></td><td></td><td></td><td></td></tr>
</table>

Statistics

National Centre for Excellence in the Teaching of Mathematics

INTERPRETING, CONSTRUCTING AND PRESENTING DATA					
Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
	interpret and construct simple pictograms, tally charts, block diagrams and simple tables	interpret and present data using bar charts, pictograms and tables	interpret and present discrete and continuous data using appropriate graphical methods, including bar charts and time graphs	complete, read and interpret information in tables, including timetables	interpret and construct pie charts and line graphs and use these to solve problems
	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				
SOLVING PROBLEMS					
		solve one-step and two-step questions [e.g. 'How many more?' and 'How many fewer?'] using information presented in scaled bar charts and pictograms and tables.	solve comparison, sum and difference problems using information presented in bar charts, pictograms, tables and other graphs.	solve comparison, sum and difference problems using information presented in a line graph	calculate and interpret the mean as an average

The progression of calculations

Calculations

One of our school priorities has been to develop children's skills in the four areas of calculation. A great deal of work has been undertaken in conjunction with other local schools, in developing the way we approach the teaching of calculation strategies and the images we want the children to have. The intended outcome of this work is:

- to see children with a wider range of strategies to aid their calculation skills
- for children to have concrete understanding of concepts and what number means before being rushed onto more formal methodology before they are ready
- for children to have strong models and images and rely less upon abstract concepts
- for all sectors of the school community to have the same appreciation of this approach.

For adults this can be tricky as often we only really know what we were taught at school and therefore there can be a conflict of opinion when supporting our children and they are insistent that *your* way is not *their* way. With that in mind we have produced a very brief summary of the route through each of the four operations which we hope will go some way to addressing this issue.

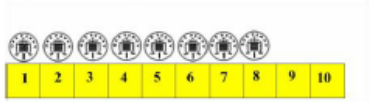
The Journey through Addition

Children start by counting and saying how many there are altogether, by counting all the objects.

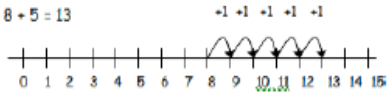
e.g.
Count out 3 strawberries. Count out 2 strawberries. How many strawberries altogether?

Children should then combine sets to make a total.
- counting on from the largest number.

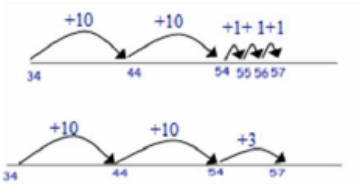
e.g. I have 5 pennies and 3 pennies. How many have I altogether?



Children then begin to use numbered lines to support their own calculations using a numbered line to count on in ones.

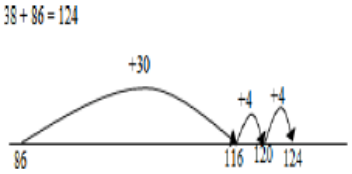


Partition into tens and ones then re-combine.
34 + 23

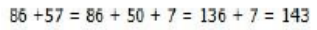


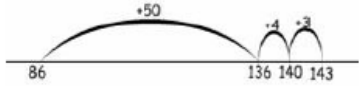
34 + 23 = 30 + 4 + 20 + 3
= 50 + 7
= 57

Counting on from the largest number irrespective of the order of the calculation.



Jottings for calculations which cannot easily be done mentally will build on existing mental strategies.





Numberlines will continue to be used before moving into the expanded method.
427 + 356

400 + 300 = 700

20 + 50 = 70

7 + 6 = 13

783

427 + 356 = 427 + (300 + 50 + 6)
= 727 + 50 + 6
= 777 + 6
= 783

400 + 20 + 7
300 + 50 + 6
700 + 70 + 13

Moving towards the more traditional form for written addition will involve children in partitioning both numbers and then re-combining. To follow on from mental strategies, children are initially taught to add the most significant digits first.

67 + 24 = (60 + 20) + (7 + 4) = 80 + 11
= 91

67
24
80
11
91

Some children may be at the stage of adding the most significant digit first.

367
85
300 Add mentally from top
140
12
452

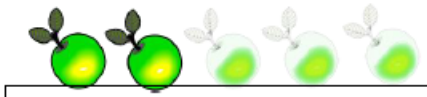
Adding the least significant digits first in preparation for 'carrying'

625	625
48	48
13	673
60	1
600	
763	

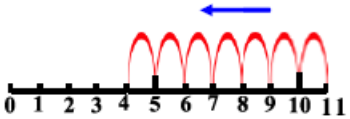
The Journey through Subtraction

In the initial stages children begin to relate subtraction to 'taking away', and counting how many are left

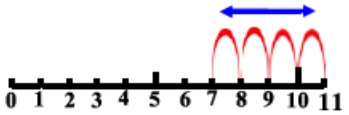
Work out by counting how many more are needed to make a larger number.



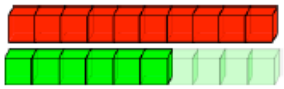
Later, equal prominence is given to the image of subtraction as 'take away' and as 'difference'.



The 'take away' model.



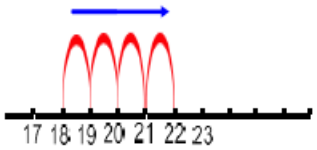
The find the difference (counting on) model.



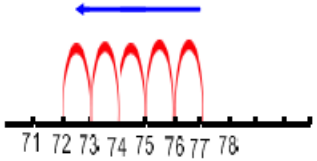
Children need lots of opportunities to consider which strategy best suits the numbers in the subtraction problem.

If the numbers are close together encourage counting up.

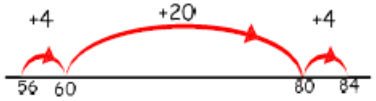
If the numbers are 'far apart' encourage taking away.
22 – 18 =4



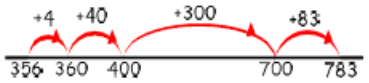
77 – 5 = 72



Counting up from the smaller to the larger number.
84 – 56 = 28

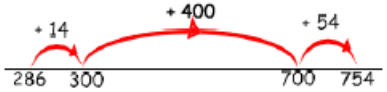


783 – 356 = 427



Counting up from the smaller to the larger number.

754 – 286 = 468



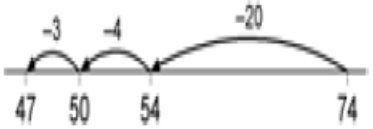
Leading to more formal recording.

$$\begin{array}{r} 754 \\ -\ 286 \\ \hline 14 \end{array}$$ to make 300

$$\begin{array}{r} 400 \\ 468 \end{array}$$ to make 700 / to make 754

Partitioning for Subtraction

74 – 27 = 47 (27 is partitioned into 20 + 4 + 3)



Partitioned numbers are then written under one another:
Example: 74 - 27

$$\begin{array}{r} 70+4 \\ -\ 20+7 \\ \hline \end{array}$$

$$\begin{array}{r} \overset{60}{\cancel{70}}+\overset{14}{\cancel{4}} \\ -\ 20+7 \\ \hline 40+7 \end{array}$$

$$\begin{array}{r} \overset{6}{\cancel{7}}\ \overset{14}{\cancel{4}} \\ -\ 2\ 7 \\ \hline 4\ 7 \end{array}$$

Partitioning for Subtraction

Example: 563 – 278, adjustment from the hundreds to the tens and the tens to the ones

$$\begin{array}{r} 500+60+3 \\ -\ 200+70+8 \\ \hline \end{array}$$

$$\begin{array}{r} 400+150+13 \\ -\ 200+\ 70+\ 8 \\ \hline 200+\ 80+\ 5 \end{array}$$

$$\begin{array}{r} \overset{400}{\cancel{500}}+\overset{150}{\cancel{60}}+\overset{13}{\cancel{3}} \\ -\ 200+70+8 \\ \hline 200+80+5 \end{array}$$

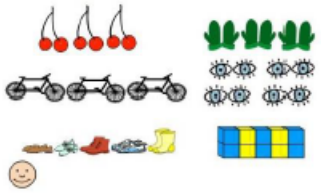
$$\begin{array}{r} \overset{4}{\cancel{5}}\ \overset{15}{\cancel{6}}\ \overset{13}{\cancel{3}} \\ -\ 2\ 7\ 8 \\ \hline 2\ 8\ 5 \end{array}$$

Here both the tens and the ones digits to be subtracted are bigger than both the tens and the ones digits you are subtracting from. 60 + 3 is partitioned into 50 + 13, and then how 500 + 50 can be partitioned into 400 + 150, and how this helps when subtracting.

It is vital that children go through this process before leaping straight into that final step. Jumping too early to this stage can result in children having no sense of Place Value nor reasonableness of an answer.

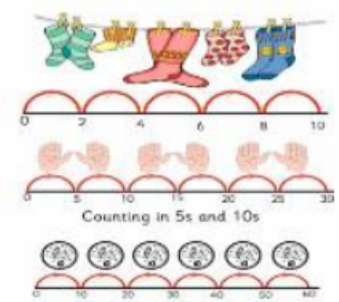
The Journey through Multiplication

Children start by counting in sets e.g. of twos or of tens.

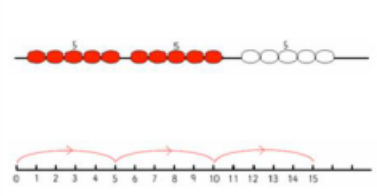


How many pairs of shoes? How many shoes? 2, 4, 6 etc

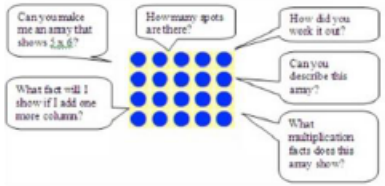
The number line image should be developed alongside the practical counting and problem solving that children engage in and not as a separate, abstract idea. The number line image will support e.g. year 2's work on developing the repeated addition image for multiplication.



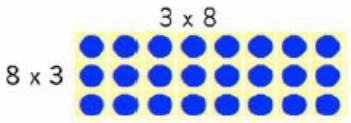
Introducing multiplication through repeated addition.
5 x 3 = 5 + 5 + 5



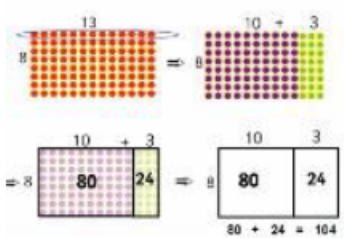
The repeated addition image leads into the array image, where the item being repeatedly added is a column or a row in the array. Building up the array in this way provides a powerful image.



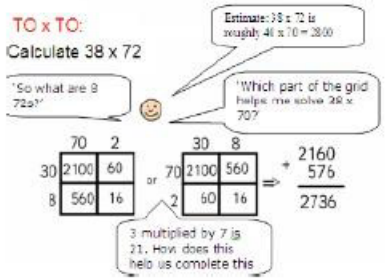
Arrays support later work with the grid method of multiplication.



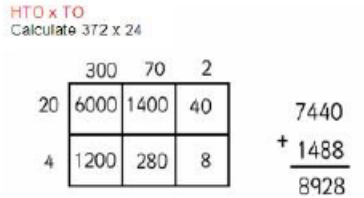
Arrays once again provide a useful image for introducing the grid method of multiplication. For some children who are ready, this will lead to vertical recording in the 'standard' form. For many children though, the grid method will be **the** written method throughout.
e.g. 8 x 13



(10 x 8) 80
(3 x 8) 24
104



The principles of the grid method can then be applied to a more formal presentation of the same strategies.



372
24
(372 x 20) 7440
(372 x 4) 1488
8928

When the understanding is there, then children can be moved towards the more traditional approach. However, some children will choose not use this method. Some feel more secure using the grid method.

125
5 x
25 (5 x 5)
100 (20 x 5)
500 (100 x 5)
625

72
3 x
216

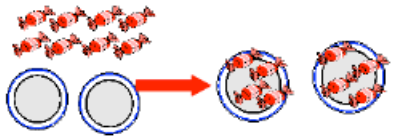
38
7 x
266
5

742
8 x
5936
31

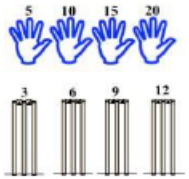
The Journey through Division

Counting rhymes and practical activities that support the understanding of sharing and counting in equal jumps will help develop children's 'everyday' language and support later work.

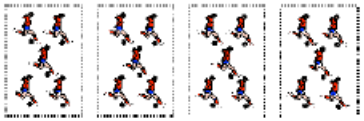
e.g. Can we share these 8 sweets between 2 friends?



It is vital that from very early on, children should encounter the grouping image for division alongside the sharing image. This will aid later work on chunking.



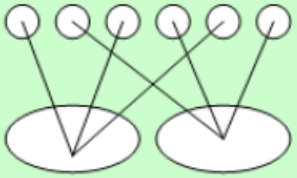
20 children get into teams of 5 to play a game. How many teams are there?



The difference between a sharing image of division and a grouping image of division:

Sharing Image

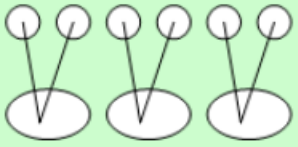
There are 6 biscuits and two children. How many biscuits each?



Sharing
(½ of 6)

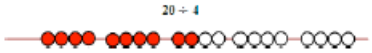
Grouping Image

There are 6 biscuits. How many children can have two biscuits each?

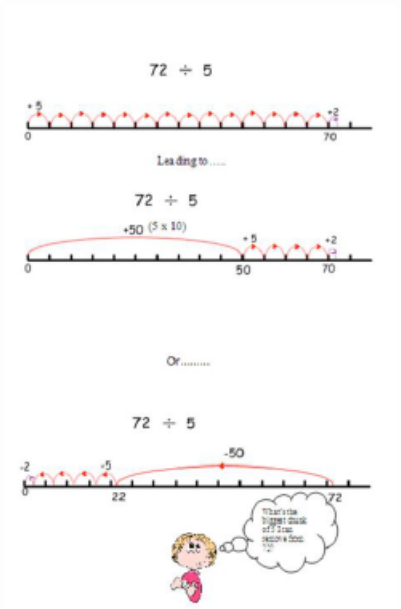


Grouping
(Repeatedly subtract 2)

The grouping image of division is the basis of 'chunking'. Children should interpret a division sentence such as '20 ÷ 4 'as 'How many groups of 4 in 20?'

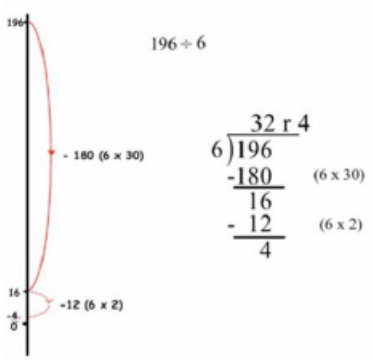


This is reinforcing the concept of division as 'repeated subtraction'.
A further example…

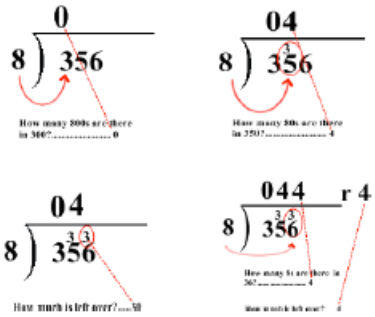


Rather than add/subtract single steps of the divisor (in this case 5) the children start looking for the biggest chunk of 5 they can subtract.

This is then presented in vertical form to prepare for the later more traditional 'bus shelter' method. Included here is the complimentary written form of the chunking method. Some children will opt to stay with the numberline method.



This leads us to the more familiar 'bus shelter method' e.g. for 356 ÷ 8.



It is important that the link with chunking is maintained. The thought process should still be 'How many 8s are in 356? What's the biggest chunk of 8 I can take out of 356? Can I take any 800s? What about 80s? 8s?'