St David's C of E Primary School

Calculation overview and progression document

May 2018

This calculation policy is intended to bring consistency, continuity and progression to ensure that the mathematical methods taught build upon each other from Reception to Year 6. Additional rapid recall strategies and mental calculation methods will serve to reinforce and supplement these written methods.

It is essential that rapid recall of key number facts is embedded prior to written calculations being taught. This is necessary as the written calculations outlined in this policy rely on mental strategies to process numbers efficiently and with confidence. Therefore, during mental arithmetic sessions, teachers must spend time teaching the relevant skills for each child to be successful at whatever stage they are at.

Key Areas to be kept consistent throughout the school

1. When solving a word problem – use RUCSAC mnemonic to aid children's approach:
R = Read the question
U = Understand what the question is asking you
C = Choose which operation you will need to use (+ - x ÷)
S = Solve it!
A = Answer the question
C = Check your answer!

2. When solving calculations, encourage children to approximate/estimate first.

3. From Year 2 onwards, ensure children understand the INVERSE methods of calculation e.g. addition / subtraction and multiplication / division.

4. When using NUMBER LINES:
Adding = jump forwards above the line
Subtracting = jump backwards below the line

5. Introduce and vary the language used for the four basic calculation operations, such as:
ADDITION: add, sum of, total, count on, increase by, plus, altogether
SUBTRACTION: take away, subtract, less than, minus, find the difference, count back, decrease
MULTIPLICATION: multiply, times, lots of / groups of, product

DIVISION: divide by, share, groups of, quotient

6. A range of manipulatives to be used from Early years through to year 6 to secure understanding of Mathematical concepts.

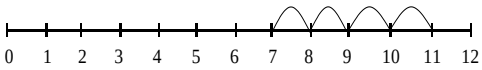
Addition

Pictures and symbols

4 + 1 = 5

Combining groups (option to use a number line)

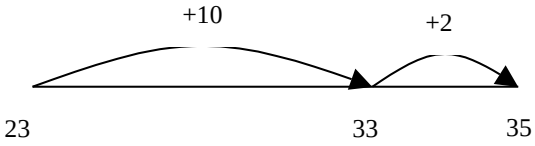
7 + 4 = 11
Children learn to put the biggest number in their head and count forward.
They may use a number line for this:



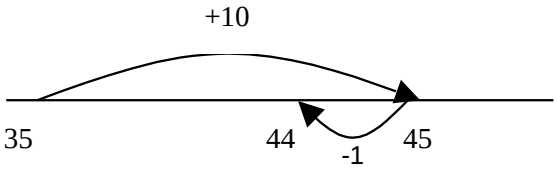
Recording by - drawing jumps on prepared number lines

Using a blank number line:

Example 1:
23 + 12 = 35



Example 2:
Add 9 or 11 by adding 10 and adjusting by 1
35 + 9 = 44



Mental methods using partitioning:

Stage 1

12 + 23 = (10 + 20) + (2+3)
30 + 5 = 35

Stage 2

e.g. 47 + 76 = (40 + 70) + (7+ 6)
= 110 + 13
= 123

Vertical Layout: (most significant digit first- i.e. in this example, add the tens before adding the units).

e.g.

47	
+ 76	
110	(40 + 70)
13	(6 + 7)
123	

Some children may miss this stage because they find too many methods confusing. The benefit of this method is that it will clearly show any misconceptions, so the teacher can diagnose areas of difficulty.

Compact written method:

Example 1

47
+ 76
123
1

Once children are confident they can move on to work with larger numbers and decimals including money.

Example 2

£ 2.50 + £ 1.75 = £ 4.25

£ 2.50
+ £ 1.75
£ 4.25
1

Example 3

124.9 + 117.25 = 242.15

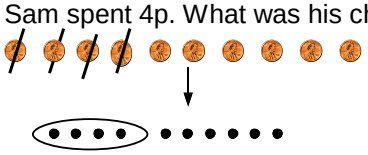
124.9
+ 117.25
242.15
11

Subtraction

Pictures and symbols

6 - 4 = 2

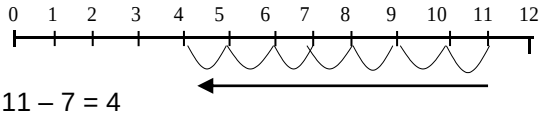
Sam spent 4p. What was his change from 10p?



Answer: 6p

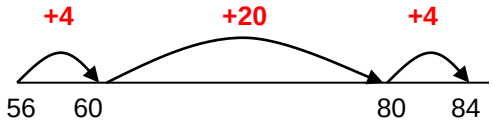
Subtraction as "taking away" using a number line by counting back:

11 – 7
(Start at 11 then count back 7 steps)



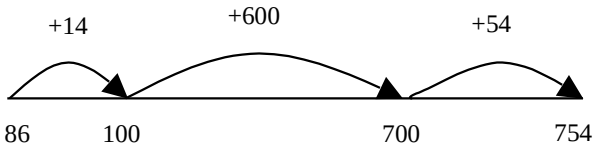
11 – 7 = 4

Subtraction as "adding on" using a number line:
Start from the 27 and move up the number line in easy jumps up to 52; add all the jumps (4 + 20 + 4).
84 – 56 = 28



This method also works for more complex calculations:

754 – 86 = 668



Subtraction using complementary addition:
(This is the same method as above, but without the number line.)

84 – 56 =

56 up to 60 = 4
60 up to 80 = 20 +
80 up to 84 = 4
28

This may be taught as a mental method leading on to working with differences between 3 and 4 digit numbers.

Subtraction using compact method:

Example 1

$$\begin{array}{r} {\scriptstyle 8\ 1} \\ \cancel{9}\,\cancel{2} \\ -\ 3\,8 \\ \hline 5\,4 \end{array}$$

Example 2

$$\begin{array}{r} {\scriptstyle 2\ 4\ 1} \\ 3\,\cancel{5}\,\cancel{2} \\ -\ 1\,7\,8 \\ \hline 1\,7\,4 \end{array}$$

We use decomposition when children need to *borrow* from the next column.

Once secure with this method children will move on to working with decimals starting with money.

£261.36 - £109.18

$$\begin{array}{r} {\scriptstyle 5\ 1\ \ 2\ 1} \\ 2\,\cancel{6}\,1\,.\,\cancel{3}\,6 \\ 1\,0\,9\,.\,1\,8 \\ \hline 1\,5\,2\,.\,1\,8 \end{array}$$

Multiplication

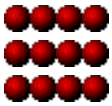
Pictures

There are 3 sweets in one bag.
How many sweets are there in 5 bags?

5 lots of 3 = 15 (The answer is 15)

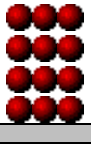
Symbols (often referred to as arrays)

3 lots of 4 = 12 (or 3 x 4 = 12)



If the array is turned 90°

4 lots of 3 = 12 (or 4 x 3 =12)



Multiplication as repeated addition:

e.g. 3 x 5 is exactly the same as 5 + 5 + 5

Multiplication using partitioning:

e.g. 38 x 7 = (30 x 7) + (8 x 7)
210 + 56 = 266

Grid method
(expanded method):
Example 1 38 x7 = 266

x	30	8
7	210	56

= 266

Example 2 33 x 21 = 693

x	**30**	**3**
20	600	60
1	30	3

= 6 6 0
= 3 3 +
6 9 3

Vertical method
(This is the same as the grid method above, but is a more formal way of recording the calculation)

You need to multiply the units first, then the tens, then add together:
38 x 7 =

3 8
x 7
5 6 (8 x 7)
2 1 0 (30 x 7)
2 6 6

Compact written method:
Example 1

3 8
x 7
2 6 6
5

'Carried' numbers can also sit on the top line of the answer box.
Example 2

1 2 5
x 7
8 7 5
1 3

Example 3

1 2 5
x 1 3 7
8 7 5
1 2 5 0
2 1 2 5

Division

Pictures and symbols

12 children get into teams of 4 to play a game. How many teams are there?

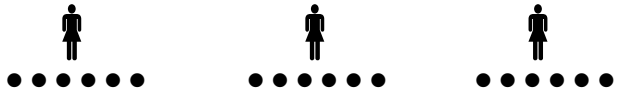
Answer – There are 3 teams (12 ÷ 4 = 3)

Understanding division as sharing and grouping

Example 1

Division as "sharing":

18 sweets are shared between 3 people. How many do they have each?

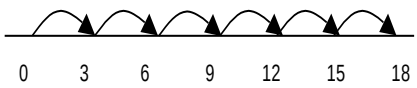


Answer: They have 6 sweets each. (18 ÷ 3 = 6)

Example 2

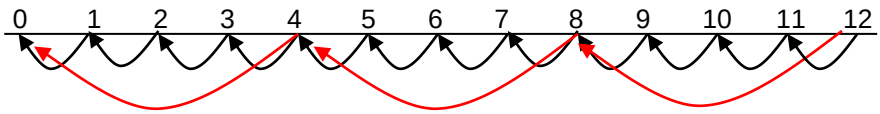
Division as "grouping":

How many 3's make 18? (Count the 'jumps')



Division as repeated subtraction

e.g. 12 ÷ 4 = 3 (Jumping back along the number line then counting the number of jumps (the red arrows).)



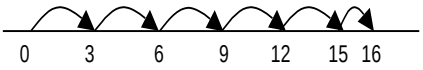
Remainders

Example 1

16 ÷ 3 = 5 r1

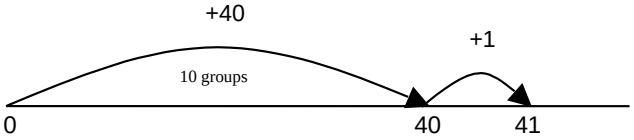
Sharing: 16 shared between 3, how many left over?

Grouping: How many 3's make 16, how many left over?



Example 2

41 ÷ 4 = 10 r 1



"Chunking"

(subtracting multiples of the divisor):

Example 1

72 ÷ 6

6 | **7 2**

- 6 0 (**10** x 6)

1 2

- 1 2 (**2** x 6)

0

So, altogether 12 lots of 6 Answer = **12**

Example 2

432 ÷12

12 | **4 3 2**

- 2 4 0 (**20** x12)

1 9 2

- 1 2 0 (**10** x12)

7 2

- 6 0 (**5** x12)

1 2

- 1 2 (**1** x12)

0

So, altogether 36 lots of 12. Answer = **36**

Children repeatedly subtract easy multiples of 12 until they are left with a manageable number.

Compact method of division

4 5 r3

6 | 27₃3

Bar modelling

A strategy that we're going to introduce to all year groups from Autumn 2018 to secure and improve understanding in the four calculations, especially useful for our visual learners and for solving tricky problems further on up the school.

Addition

?	
342	87

Bar Modelling allows the children to 'see' the maths and make connections between the numbers within the calculation. This is particularly useful when solving real-life problems as children are encouraged to represent the problem as an image.

Subtraction

108	
43	?

The bar model is used to develop connections between addition and subtraction and reinforce the idea that subtraction usually makes things smaller.

Multiplication

?							
12	12	12	12	12	12	12	12

The bar method is used to reinforce the idea of multiplication as repeated addition and is particularly useful for solving real-life problems involving multiplication

Division

72							
9	18	27	36	45	54	63	72

The bar method is used to represent real-life problems make links between division and multiplication.

EYFS			
	30-50 months	40-60 months	Early Learning Goal
Mathematics: Number	Uses some number names and number language spontaneously. •Uses some number names accurately in play. •Recites numbers in order to 10. •Knows that numbers identify how many objects are in a set. •Beginning to represent numbers using fingers, marks on paper or pictures. •Sometimes matches numeral and quantity correctly. •Shows curiosity about numbers by offering comments or asking questions. •Compares two groups of objects, saying when they have the same number. •Shows an interest in number problems. •Separates a group of three or four objects in different ways, beginning to recognise that the total is still the same. •Shows an interest in numerals in the environment. •Shows an interest in representing numbers. •Realises not only objects, but anything can be counted, including steps, claps or jumps.	•Recognise some numerals of personal significance. •Recognises numerals 1 to 5. •Counts up to three or four objects by saying one number name for each item. •Counts actions or objects which cannot be moved. •Counts objects to 10, and beginning to count beyond 10. •Counts out up to six objects from a larger group. •Selects the correct numeral to represent 1 to 5, then 1 to 10 objects. •Counts an irregular arrangement of up to ten objects. •Estimates how many objects they can see and checks by counting them. •Uses the language of 'more' and 'fewer' to compare two sets of objects. •Finds the total number of items in two groups by counting all of them. •Says the number that is one more than a given number. •Finds one more or one less from a group of up to five objects, then ten objects. • In practical activities and discussion, beginning to use the vocabulary involved in adding and subtracting. •Records, using marks that they can interpret and explain. •Begins to identify own mathematical problems based on own interests and fascinations.	Children count reliably with numbers from one to 20, place them in order and say which number is one more or one less than a given number. Using quantities and objects, they add and subtract two single-digit numbers and count on or back to find the answer. They solve problems, including doubling, halving and sharing.

Year 1		
Domain	Statutory Guidance	Notes and guidance (non-statutory)
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 twos, fives and tens • given a number, identify one more and one less • identify and represent numbers using concrete 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.	Pupils practise counting (1, 2, 3), ordering (e.g. first, second, third), or to indicate a quantity (e.g. 3 apples, 2 centimetres), including solving simple concrete problems, until they are fluent. Pupils begin to recognise place value in numbers beyond 20 by reading, writing, counting and comparing numbers up to 100, supported by objects and pictorial representations. They practise counting as reciting numbers and counting as enumerating objects, and counting in twos, fives and tens from different multiples to develop their recognition of patterns in the number system (e.g. odd and even numbers), including varied and frequent practice through increasingly complex questions. They recognise and create repeating patterns with objects and with shapes.
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 zero • solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = ? - 9.	Pupils memorise and reason with number bonds to 10 and 20 in several forms (e.g. 9 + 7 = 16; 16 - 7 = 9; 7 = 16 - 9). They should realise the effect of adding or subtracting zero. This establishes addition and subtraction as related operations. Pupils combine and increase numbers, counting forwards and backwards. They discuss and solve problems in familiar practical contexts, including using quantities. Problems should include the terms put together, add, altogether, total, take away, distance between, more than and less than, so that pupils develop the concept of addition and subtraction and are enabled to use these operations flexibly.
NUMBER : Multiplication and division	• solve one-step problems involving multiplication and division, calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.	Through grouping and sharing small quantities, pupils begin to understand: multiplication and division; doubling numbers and quantities; and finding simple fractions of objects, numbers and quantities. They make connections between arrays, number patterns, and counting in twos, fives and tens.
NUMBER : Fractions	• recognise, find and name a half as one of two equal parts of an object, shape or quantity • recognise, find and name a quarter as one of four equal parts of an object, shape or quantity.	Pupils are taught half and quarter as 'fractions of' discrete and continuous quantities by solving problems using shapes, objects and quantities. For example, they could recognise and find half a length, quantity, set of objects or shape. Pupils connect halves and quarters to the equal sharing and grouping of sets of objects and to measures, as well as recognising and combining halves and quarters as parts of a whole.

Year 2		
Domain	Statutory Guidance	Notes and guidance (non-statutory)
NUMBER : Number and place value	• count in steps of 2, 3, and 5 from 0, and in tens from any number, forward or backward • recognise the place value of each digit in a two-digit number (tens, ones) • 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.	Using materials and a range of representations, pupils practise counting, reading, writing and comparing numbers to at least 100 and solving a variety of related problems to develop fluency. They count in multiples of three to support their later understanding of a third. As they become more confident with numbers up to 100, pupils are introduced to larger numbers to develop further their recognition of patterns within the number system and represent them in different ways, including spatial representations. Pupils should partition numbers in different ways (e.g. 23 = 20 + 3 and 23 = 10 + 13) to support subtraction. They become fluent and apply their knowledge of numbers to reason with, discuss and solve problems that emphasise the value of each digit in two-digit numbers. They begin to understand zero as a place holder.
NUMBER : Addition and subtraction	• solve one-step 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 ones; a two-digit number and tens; two two-digit numbers; adding three one-digit numbers • show that addition of two numbers can be done in any order (commutative) and subtraction of one 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.	Pupils extend their understanding of the language of addition and subtraction to include sum and difference. Pupils practise addition and subtraction to 20 to become increasingly fluent in deriving facts such as using 3 + 7 = 10, 10 - 7 = 3 and 7 = 10 - 3 to calculate 30 + 70 = 100, 100 - 70 = 30 and 70 = 100 - 30. They check their calculations, including by adding to check subtraction and adding numbers in a different order to check addition (e.g. 5 + 2 + 1 = 1 + 5 + 2 = 1 + 2 + 5). This establishes commutativity and associativity of addition. Recording addition and subtraction in columns supports place value and prepares for formal written methods with larger numbers.
NUMBER : Multiplication and division	• 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	Pupils use a variety of language to describe multiplication and division. Pupils are introduced to the multiplication tables. They practise to become fluent in the 2, 5 and 10 multiplication tables and connect them to each other. They connect the 10 multiplication table to

	them using the multiplication (×), division (÷) and equals (=) signs • show that multiplication of two numbers can be done in any order (commutative) and division of one 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.	place value, and the 5 multiplication table to the divisions on the clock face. They begin to use other multiplication tables and recall multiplication facts, including using related division facts to perform written and mental calculations. Pupils work with a range of materials and contexts in which multiplication and division relate to grouping and sharing discrete and continuous quantities, and relating these to fractions and measures (e.g. 40 ÷ 2 = 20, 20 is a half of 40). They use commutativity and inverse relations to develop multiplicative reasoning (e.g. 4 × 5 = 20 and 20 ÷ 5 = 4).
NUMBER : Fractions	• recognise, find, name and write fractions 1/3, 1/4, 2/4 and 3/4 of a length, shape, set of objects or quantity • write simple fractions e.g. 1/2 of 6 = 3 and recognise the equivalence of two quarters and one half.	Pupils use additional fractions as 'fractions of' discrete and continuous quantities by solving problems using shapes, objects and quantities. They connect unit fractions to equal sharing and grouping, to numbers when they can be calculated, and to measures, finding fractions of lengths, quantity, a set of objects or shapes. They meet3/4 as the first example of a non-unit fraction. Pupils should count in fractions up to 10, starting from any number and using the 1/2 and 2/4 equivalence on the number line (e.g. 11/4, 12/4 (or 11/2), 13/4, 2). This reinforces the concept of fractions as numbers and that they can add up to more than one.

Year 3		
Domain	Statutory Guidance	Notes and guidance (non-statutory)
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 three-digit number (hundreds, tens, ones) • compare and order numbers up to 1000 • identify, represent and estimate numbers using different representations • read and write numbers up to 1000 in numerals and in words • solve number problems and practical problems involving these ideas (appropriate for place value).	Pupils now use multiples of 2, 3, 4, 5, 8, 10, 50 and 100. They use larger numbers to at least 1000, applying partitioning related to place value using varied and increasingly complex problems, building on work in year 2 (e.g. 146 = 100 and 40 and 6, 146 = 130 and 16). Using a variety of representations, including those related to measure, pupils continue to count in ones, tens and hundreds, so that they become fluent in the order and place value of numbers to 1000
NUMBER : Addition and subtraction	• 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 with up to three 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.	Pupils practise solving varied addition and subtraction questions. For mental calculations with two-digit numbers, the answers could exceed 100. Pupils use their understanding of place value and partitioning, and practise using columnar addition and subtraction with increasingly large numbers up to three digits to become fluent.
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 integer scaling problems and correspondence problems in which n objects are connected to m objects.	Pupils continue to practise their mental recall of multiplication tables when they are calculating mathematical statements in order to improve fluency. Through doubling, they connect the 2, 4 and 8 multiplication tables. Pupils develop efficient mental methods, for example, using commutativity (e.g. $4 \times 12 \times 5 = 4 \times 5 \times 12 = 20 \times 12 = 240$) and multiplication and division facts (e.g. using $3 \times 2 = 6$, $6 \div 3 = 2$ and $2 = 6 \div 3$) to derive related facts ($30 \times 2 = 60$, $60 \div 3 = 20$ and $20 = 60 \div 3$). Pupils develop reliable written methods for multiplication and division, starting with calculations of two-digit numbers by one-digit numbers and progressing to the formal written methods of short multiplication and division. Pupils solve simple problems in contexts, deciding which of the four operations to use and why, including measuring and scaling

		contexts, and correspondence problems in which m objects are connected to n objects (e.g. 3 hats and 4 coats, how many different outfits?; 12 sweets shared equally between 4 children; 4 cakes shared equally between 8 children).
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 (e.g. 5/7 + 1/7 = 6/7) • compare and order unit fractions, and fractions with the same denominator • solve problems that involve all of the elements of the above.	Pupils connect tenths to place value, decimal measures and to division by 10. They begin to understand unit and non-unit fractions as numbers on the number line, and deduce relations between them, such as size and equivalence. They should go beyond the [0, 1] interval, relating this to measure. Pupils understand the relation between unit fractions as operators (fractions of), and division by integers. They continue to recognise fractions in the context of parts of a whole, numbers, measurements, a shape, or unit fractions as a division of a quantity. Pupils practise adding and subtracting fractions with the same denominator through a variety of increasingly complex problems to improve fluency.

Year 4		
Domain	Statutory Guidance	Notes and guidance (non-statutory)
NUMBER : Number and place value	• count in multiples of 6, 7, 9, 25 and 1000 • find 1000 more or less than a given number • count backwards through zero to include negative numbers • recognise the place value of each digit in a four-digit number (thousands, hundreds, tens, and ones) • order and compare numbers beyond 1000 • identify, represent and estimate numbers using different representations • round any number to the nearest 10, 100 or 1000 • 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 understand how, over time, the numeral system changed to include the concept of zero and place value.	Using a variety of representations, including measures, pupils become fluent in the order and place value of numbers beyond 1000, including counting in tens and hundreds, and maintaining fluency in other multiples through varied and frequent practice. They begin to extend their knowledge of the number system to include the decimal numbers and fractions that they have met so far. They connect estimation and rounding numbers to the use of measuring instruments. Roman numerals should be put in their historical context so pupils understand that there have been different ways to write whole numbers and that the important concepts of zero and place value were introduced over a period of time.
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.	Pupils continue to practise both mental methods and columnar addition and subtraction with increasingly large numbers to aid fluency.
NUMBER : Multiplication and division	• recall multiplication and division facts for multiplication tables up to 12 × 12 • 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 • 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 2 digit numbers by 1 digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects.	Pupils continue to practise recalling and using multiplication tables and related division facts to aid fluency. Pupils practise mental methods and extend this to three-digit numbers to derive facts, for example 200 × 3 = 600 into 600 ÷ 3 = 200. Pupils practise to become fluent in the formal written method of short multiplication for multiplying using multi-digit numbers, and short division with exact answers when dividing by a one-digit number. Pupils write statements about the equality of expressions (e.g. use the distributive law 39 × 7 = 30 × 7 + 9 × 7 and associative law (2 × 3) × 4 = 2 × (3 × 4)). They combine their knowledge of number facts and rules of arithmetic to solve mental and written calculations e.g. 2 x 6 x 5 = 10 x 6. Pupils solve two-step problems in contexts, choosing the

		appropriate operation, working with increasingly harder numbers. This should include correspondence questions such as the numbers of choices of a meal on a menu, or three cakes shared equally between 10 children.
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 a hundred and dividing tenths by ten • 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 hundredths • recognise and write decimal equivalents to 1/4, 1/2, and ¾ • 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 • round decimals with one decimal place to the nearest whole number • compare numbers with the same number of decimal places up to two decimal places • solve simple measure and money problems involving fractions and decimals to two decimal places	Pupils should connect hundredths to tenths and place value and decimal measure. They extend the use of the number line to connect fractions, numbers and measures. Pupils understand the relation between non-unit fractions and multiplication and division of quantities, with particular emphasis on tenths and hundredths Pupils make connections between fractions of a length, of a shape and as a representation of one whole or set of quantities. Pupils use factors and multiples to recognise equivalent fractions and simplify where appropriate (e.g. 6/9 = 2/3 or 1/4 = 2/8). Pupils continue practice in adding and subtracting fractions with the same denominator, to become fluent through a variety of increasingly complex problems beyond one whole. Pupils are taught throughout that decimals and fractions are different ways of expressing numbers and proportions. Pupils' understanding of the number system and decimal place value is extended at this stage to tenths and then hundredths. This includes relating the decimal notation to division of whole number by 10 and later 100. They practise counting using simple fractions and decimal fractions, both forwards and backwards. Pupils learn decimal notation and the language associated with it, including in the context of measurements. They make comparisons and order decimal amounts and quantities that are expressed to the same number of decimal places. They should be able to represent numbers with one or two decimal places in several ways, such as on number lines.

Year 5		
Domain	Statutory Guidance	Notes and guidance (non-statutory)
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 through zero • round any number up to 1 000 000 to the nearest 10, 100, 1000, 10 000 and 100 000 • solve number problems and practical problems that involve all of the above • read Roman numerals to 1000 (M) and recognise years written in Roman numerals.	Pupils identify the place value in large whole numbers They continue to use number in context, including measurement. Pupils extend and apply their understanding of the number system to the decimal numbers and fractions that they have met so far. They should recognise and describe linear number sequences, including those involving fractions and decimals, and find the term-to-term rule.
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.	Pupils practise using the formal written methods of columnar addition and subtraction with increasingly large numbers to aid fluency. They practise mental calculations with increasingly large numbers to aid fluency (e.g. 12,462 – 2,300 = 10,162).
NUMBER : Multiplication and division	• identify multiples and factors, including finding all factor pairs of a number, and common factors of two 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	Pupils practise and extend their use of the formal written methods of short multiplication and short division. They apply all the multiplication tables and related division facts frequently, commit them to memory and use them confidently to make larger calculations. They use and understand the terms factor, multiple and prime, square and cube numbers. Pupils interpret non-integer answers to division by expressing results in different ways according to the context, including with

	• 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 1000 • recognise and use square numbers and cube numbers, and the notation for squared (^{2}) and cubed (^{3}) • 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	remainders, as fractions, as decimals or by rounding (e.g. 98 ÷ 4 = 24 r 2 = 241/2 = 24.5 ≈ 25). Pupils use multiplication and division as inverses to support the introduction of ratio in year 6, for example, by multiplying and dividing by powers of 10 in scale drawings or by multiplying and dividing by powers of a 1000 in converting between units such as kilometres and metres. Distributivity can be expressed as a(b + c) = ab + ac in preparation for using algebra.
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 (e.g. 2/5 + 4/5 = 6/5 = 1 1/5) • add and subtract fractions with the same denominator and 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 (e.g. 0.71 = 71/100) • recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents • round decimals with two decimal places to the nearest whole number and to one decimal place • read, write, order and compare numbers with up to three decimal places	Pupils should be taught throughout that percentages, decimals and fractions are different ways of expressing proportions. They extend their knowledge of fractions to thousandths and connect to decimals and measures. Pupils connect equivalent fractions > 1 that simplify to integers with division and fractions > 1 to division with remainders, using the number line and other models, and hence move from these to improper and mixed fractions. Pupils connect multiplication by a fraction to using fractions as operators (fractions of), and to division, building on work from previous years. This relates to scaling by simple fractions, including fractions > 1. Pupils practise adding and subtracting fractions to become fluent through a variety of increasingly complex problems. They extend their understanding of adding and subtracting fractions to calculations that exceed 1 as a mixed number. Pupils read and write proper fractions and mixed numbers accurately and continue to practise counting forwards and backwards in simple fractions. Pupils continue to develop their understanding of fractions as numbers, measures and operators by finding fractions of numbers

	• solve problems involving number up to three decimal places • recognise the percent symbol (%) and understand that percent relates to "number of parts per hundred", and write percentages as a fraction with denominator hundred, 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 with a denominator of a multiple of 10 or 25	and quantities, writing remainders as a fraction. Pupils extend counting from year 4, using decimals and fractions including bridging zero, for example on a number line. Pupils say, read and write decimal fractions and related tenths, hundredths and thousandths accurately and are confident in checking the reasonableness of their answers to problems. They mentally add and subtract tenths, and one-digit whole numbers and tenths. They practise adding and subtracting decimals, including a mix of whole numbers and decimals, decimals with different numbers of decimal places, and complements of 1 (e.g. 0.83 + 0.17 = 1). Pupils should go beyond the measurement and money models of decimals, for example by solving puzzles involving decimals. Pupils should make connections between percentages, fractions and decimals (e.g. 100% represents a whole quantity and 1% is 1/100, 50% is 50/100, 25% is 25/100) and relate this to finding 'fractions of'. They recognise that percentages are proportions of quantities as well as operators on quantities.

Year 6		
Domain	Statutory Guidance	Notes and guidance (non-statutory)
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 zero • solve number problems and practical problems that involve all of the above	Pupils use the whole number system, including saying, reading and writing numbers accurately.
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 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 four 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.	Pupils practise addition, subtraction, multiplication and division for larger numbers, using the formal written methods of columnar addition and subtraction, short and long multiplication, and short and long division. They undertake mental calculations with increasingly large numbers and more complex calculations. Pupils continue to use all the multiplication tables to calculate mathematical statements in order to maintain their fluency. Pupils round answers to a specified degree of accuracy, e.g. to the nearest 10, 20, 50 etc, but not to a specified number of significant figures. Pupils explore the order of operations using brackets; for example, 2 + 1 x 3 = 5 and (2 + 1) x 3 = 9. Common factors can be related to finding equivalent fractions

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 (e.g. 1/4 × 1/2 = 1/8) • divide proper fractions by whole numbers (e.g. 1/3 ÷ 2 = 1/6). • associate a fraction with division to calculate decimal fraction equivalents (e.g. 0.375) for a simple fraction (e.g. 3/8) • 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 • multiply one digit numbers with up to two decimal places by whole numbers • use written division methods in cases where the answer has up to two 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	Pupils should practise, use and understand the addition and subtraction of fractions with different denominators by identifying equivalent fractions with the same denominator. They should start with fractions where the denominator of one fraction is a multiple of the other (e.g. 1/2 + 1/8 = 5/8) and progress to varied and increasingly complex problems. Pupils should use a variety of images to support their understanding of multiplication with fractions. This follows earlier work about fractions as operators (fractions of), as numbers, and as equal parts of objects, for example as parts of a rectangle. Pupils use their understanding of the relationship between unit fractions and division to work backwards by multiplying a quantity that represents a unit fraction to find the whole quantity (e.g. if 1/4 of a length is 36cm, then the whole length is 36 × 4 = 144cm). They practise with simple fractions and decimal fraction equivalents to aid fluency, including listing equivalent fractions to identify fractions with common denominators. Pupils can explore and make conjectures about converting a simple fraction to a decimal fraction (e.g. 3 ÷ 8 = 0.375). For simple fractions with recurring decimal equivalents, pupils learn about rounding the decimal to three decimal places, or other appropriate approximations depending on the context. Pupils multiply and divide numbers with up to two decimal places by one-digit and two-digit whole numbers. Pupils multiply decimals by whole numbers, starting with the simplest cases, such as 0.4 × 2 = 0.8, and in practical contexts, such as measures and money. Pupils are introduced to the division of decimal numbers by one-digit whole numbers and, initially, in practical contexts involving measures and money. They recognise division calculations as the inverse of multiplication. Pupils also develop their skills of rounding and estimating as a means of predicting and checking the order of magnitude of their answers to decimal calculations. This includes rounding answers to a specified degree of accuracy and checking the reasonableness of their answers.
RATIO AND PROPORTION	• solve problems involving the relative sizes of two quantities, where missing values can be found by using integer multiplication and division facts	Pupils recognise proportionality in contexts when the relations between quantities are in the same ratio (e.g. similar shapes, recipes).

	• solve problems involving the calculations of percentages (e.g. of measures) 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	Pupils link percentages or 360° to calculating angles of pie charts. Pupils should consolidate their understanding of ratio when comparing quantities, sizes and scale drawings by solving a variety of problems. They might use the notation a:b to record their work. Pupils solve problems involving unequal quantities e.g. 'for every egg you need three spoonfuls of flour', '3/5 of the class are boys'. These problems are the foundation for later formal approaches to ratio and proportion.
ALGEBRA	• express missing number problems algebraically • use simple formulae expressed in words • generate and describe linear number sequences • find pairs of numbers that satisfy number sentences involving two unknowns. • enumerate all possibilities of combinations of two variables	Pupils should be introduced to the use of symbols and letters to represent variables and unknowns in mathematical situations that they already understand, such as: • missing numbers, lengths, coordinates and angles • formulae in mathematics and science • arithmetical rules (e.g. a + b = b + a) • generalisations of number patterns • number puzzles (e.g. what two numbers can add up to).