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CALCULATION

POLICY

REVISION DATE: ANNUALLY AUTUMN TERM

REVIEWED BY THE STRATEGIC LEADERSHIP TEAM JANUARY 2022

PURPOSE

Calculations are encountered by all children irrespective of age or stage of development. There is an acknowledged hierarchy in the strategies and skills needed for differing types of calculation but it is not intended to restrict the method or concept to specific age/year groups. It is however fundamental that children should have a core understanding in number concepts before beginning work on formal calculations.

In the EYFS there is an expectation that time and opportunity will be given to developing the understanding of the 5 principles of number and that work on calculations will complement this. It is important however to introduce children to concepts and experiences that expand their thinking and challenge their understanding of number and calculations; this should occur throughout the child's time at Ewell Grove.

The 2013 National Curriculum gave clear indications about the purpose and aims of maths within the curriculum. Great emphasis is given to the need for children to become fluent within the fundamentals of mathematics. This fluency will be developed through purposeful practise and practise with variation; enabling skills and concepts to be used and applied across contexts within and outside the sphere of maths.

Mathematical concepts should be developed using a recognised pattern of learning, manipulating...

- concrete materials
- symbols
- language
- pictures

Understanding of mathematical ideas happens when children make connections between real objects (manipulatives), symbols, language and pictures. This develops cognitive connections which enable children to make sense of new experiences by linking them to previous experiences. Wherever possible practical apparatus should be available for children to use. As they become more confident and flexible in their thinking and they begin to apply their knowledge and understanding they should be taught how to select the most appropriate materials for a task. There should be a clear progression through **concrete**, **pictorial** and **abstract** activities.

VOCABULARY

Children need to be introduced to precise mathematical language at the earliest possible opportunities.

Young children can revel in the sound and complexity of some vocabulary; think about how they can respond to the names of different dinosaurs.

Within calculations there are specific words used to indicate the function of a number within a number sentence.

The following vocabulary will be used:

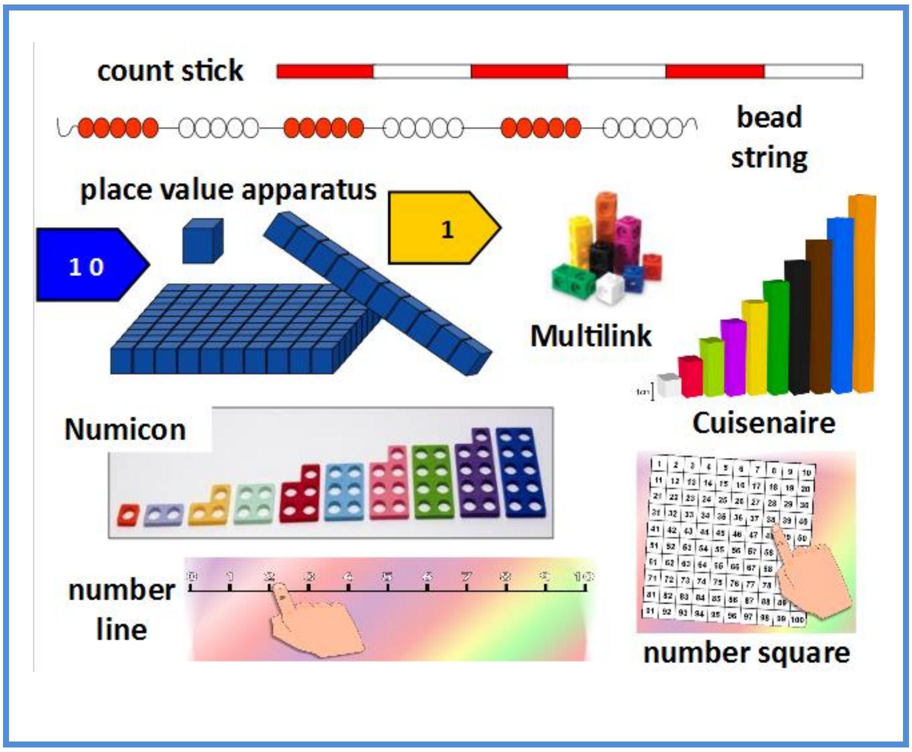
Addend + addend = sum or total

Minuend – subtrahend = difference

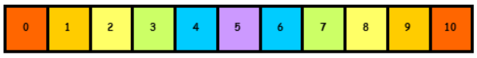
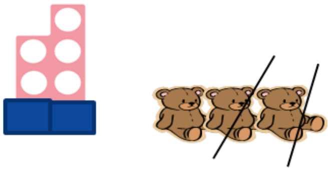
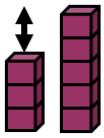
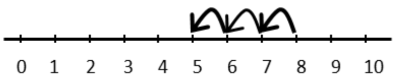
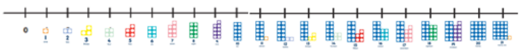
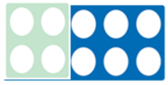
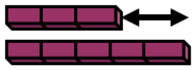
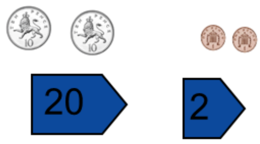
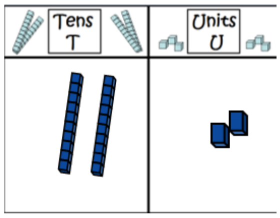
Multiplicand x multiplier = product

Dividend ÷ divisor = quotient

Any classroom resources can be used but these have been specifically provided to support counting and calculation activities.



Pictorial representations should be used to support children talking about what they have found out and to demonstrate their understanding; children should be encouraged to develop their own methods of recording or informal jottings.

Possible Concrete and Visual Representations Year 1	Possible Concrete and Visual Representations Year 2
   *'two more than three is five or two less than five is three'*   Use practical resources such as bears, counters, cubes and number lines/hundred squares and progress to a resource such as Numicon to encourage counting in groups rather than ones	  Finding the difference    Children should use concrete objects, pictorial representations and use numbers in different contexts e.g. money, measures Use Numicon, hundred squares, Dienes, place value grids, arrow cards

Formal recording will develop from the use of mental strategies and will provide a tangible means of recording processes.

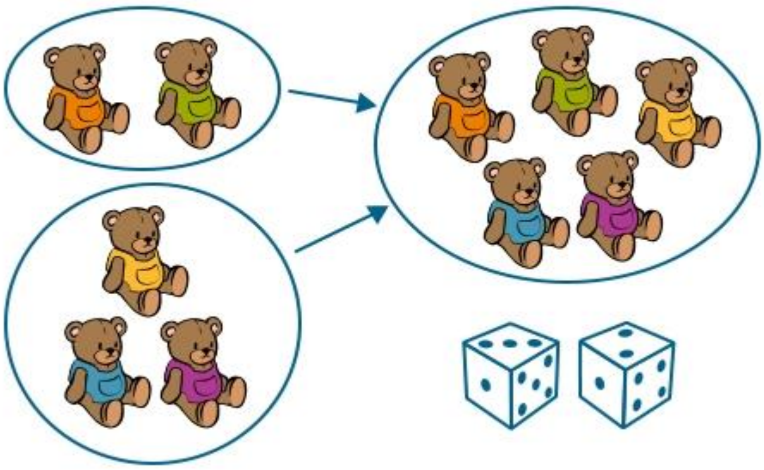
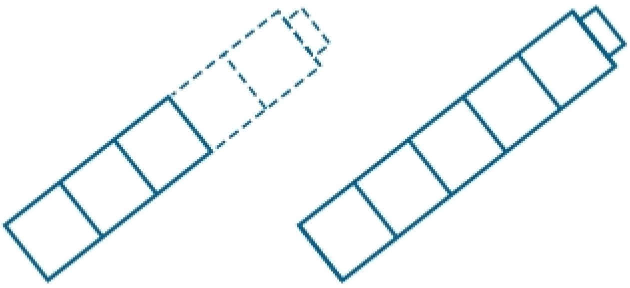
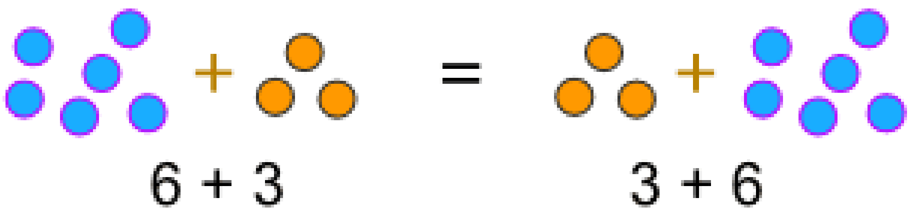
FIVE PRINCIPLES OF NUMBER

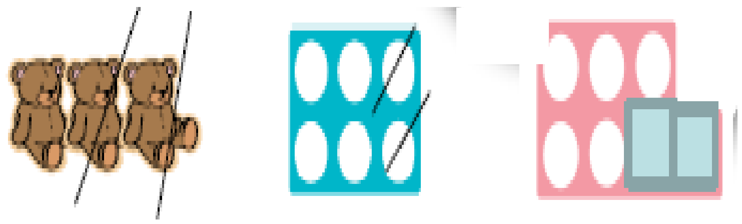
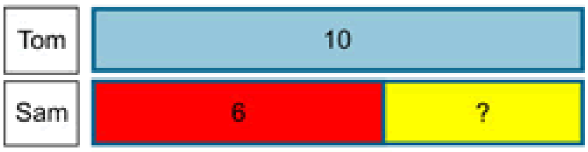
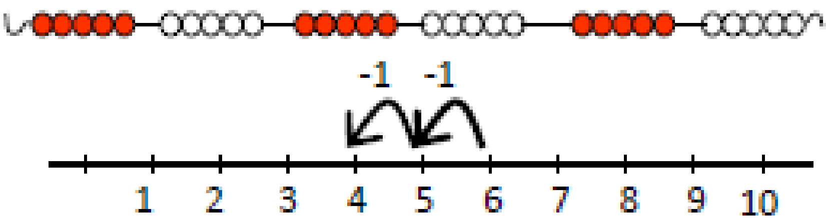
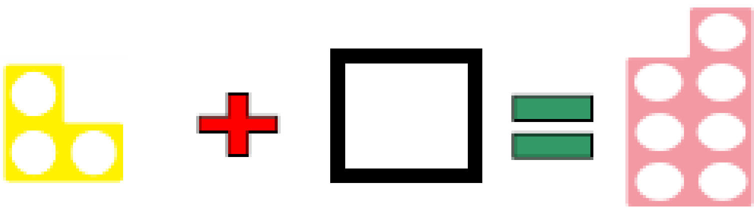
Principle (learning intention)	Success criteria	Context
Stable order principle	Can say some number names when asked to count.	Counting objects as they are put out on a table for art, role play, games.... Counting children in a group. Counting around a group up to a target number.
	Can join in with saying number names in order.	
	Can say number names in order to 10 starting with 0.	
	Can say number names in order to 20 starting with 0.	
One to one principle	Can point to objects as a number name is being said.	Moving counting objects from a pot into a tub as they are counted. Holding objects in hand and placing them down on the table one by one saying the number each time. Counting beads along a bead string.
	Can move objects as the number names are being said one at a time.	
	Can point to each object (or move it) only once as it is being counted.	
Cardinal principle	Can respond to "how many?" by saying number names in order and knowing last number said is how many.	Using pointing or moving strategy count sets of counters, pencils, paperclip, leaves, bean bags…
	Can repeat how many are in the set without having to recount it.	
Order irrelevance principle	Can say how many are in a set despite having the set rearranged between requests.	Practise making and moving sets of objects without adding or taking any away. Make patterns and pictures using counted sets. Make sets using objects of mixed varying sizes.
Abstraction principle	Can count a series of claps, coin drops (to 10/20).	Practise saying number names in order to a signal such as a clap, wave, nod… Count actions as well as objects, count words on a page, words spoken, foot tapped… Play "my turn your turn" for showing a target number.
	Can count a series of own actions, e.g. jumps, clap?	

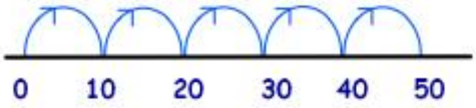
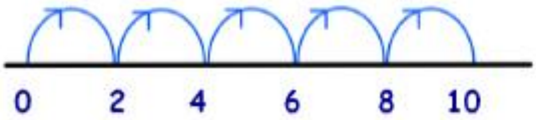
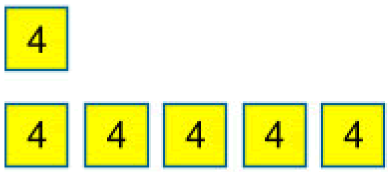
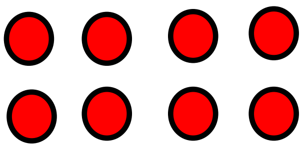
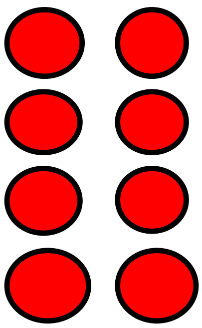
Place value should be taught once the 5 principles of number are secure.

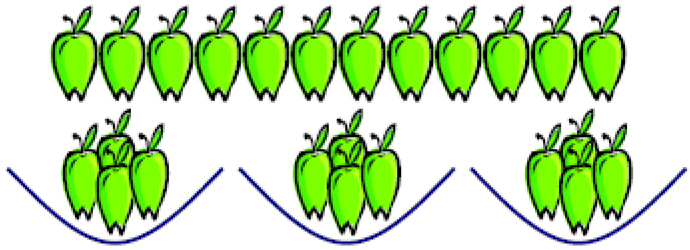
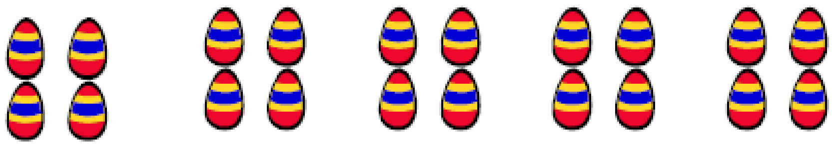
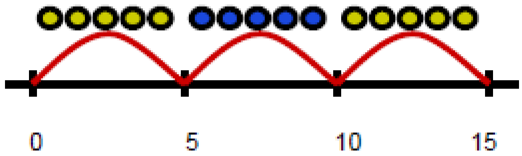
Structures of The Four Operations

Addition, subtraction, multiplication and division are the four main operations within mathematics. There are many links and connections between and within these operations and the intention in good maths teaching is to make these connections tangible. It is important that children are taught the different structures for each of the operations and are encouraged to explore and challenge their understanding by using the different structures within a wide range of contexts. The ability to manipulate objects and use practical apparatus will enable children to develop practical and then mental strategies for different calculations. Each of the 4 operations is made up of different structures which need to be experienced and understood. Flexibility in interpreting and solving calculations will develop alongside the introduction and recognition of these calculation structures.

Structures of Addition	
Aggregation The union of two sets. How many altogether?	
Augmentation Start at … and count on… *Mental strategy;* put the biggest number in your head and count on.	
Commutative Law; Understanding that addition can be done in any order. (The bar model highlights the connection between +/-)	

Structures of Subtraction	
Partitioning Removing objects from an original set. How many are left? (Relating to cardinal numbers) or How much is left? (relating to measures)	
Comparison What is the difference? How many more/less? How much heavier/taller/older?	 Tom has 10 pencils and Sam has 6 pencils. How many more does Tom have?
Complement How many do not have this attribute?	 12-3 There are 12 stars and 3 are yellow. How many are not yellow?
Reduction Start at … and count back… Reduce the quantity by… (Reverse of augmentation for addition.) *Mental strategy;* put 12 in your head and count back 3.	
Inverse of addition; What must be added to 3 to make 12? How much more is needed to make…?	

Structures of Multiplication	
Repeated addition So many *sets of* so many. So many *lots of* so many.	 Three sweets in each bag, there are 5 bags. How many altogether?    
Scaling Doubling, trebling… A quantity is scaled by a factor. So many times bigger/longer/heavier then… So many times as much as…	 Peter has 4 books and Harry has 5 times as many books as Harry. How many books does Harry have? (Using the bar method)
Commutative law 6×3 or 3×6 It does not matter which number (factor) comes first the answer will be the same. Nine times three means nine three times. (9×3)	Rectangular arrays make the commutative property of multiplication transparent.  4×2  2×4

Structures of Division	
Equal sharing Sharing equally between… How many each? How much each?	 12 shared between 3
Inverse of multiplication So many lots of so many. Share equally into groups of…	 4 eggs in each box. How many boxes for 20 eggs? Use of a number line to show repeated subtraction.  15 ÷ 5

A sound understanding of the number system is essential for children to carry out calculations efficiently and accurately. Written methods of calculations are based on mental strategies. Each of the four operations builds on mental skills which provide the foundation for jottings and informal written methods of recording. Skills need to be taught, practised and reviewed constantly. Strategies for calculation need to be represented by models and images to support, develop and secure understanding. When teaching a new strategy it is important to start with numbers that the pupil can easily manipulate so that they can understand the methodology. Where ever possible the connections between strategies and methodology should be explicitly taught and time given to explore and embed the connections.

Alongside the development of practical and then abstract strategies for solving calculations mental strategies need to be explicitly taught and practised.

EYFS	KS1
• Partition and recombine • Doubles and near doubles • Use number pairs to 10 and 100 • Counting on	• Adding near multiples of ten and adjusting • Using patterns of similar calculations • Using known number facts • Bridging though ten, hundred, tenth • Use relationships between operations

Year 1

Addition and subtraction; Statutory requirements from NC 2013

Pupils should be taught to:

- Read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs.
- Represent and use number bonds and related subtraction facts within 20.
- Add and subtract one-digit and two-digit numbers to 20, including 0.
- Solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7= ☐ - 9.

Non-statutory guidance.

- *Pupils memorise and reason with number bonds to 20 and 20 in several forms (for example, 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, difference between, more then and less than, so that pupils develop the concept of addition and subtraction and are enables to use these operations flexibly.*

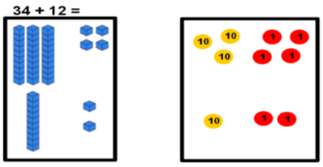
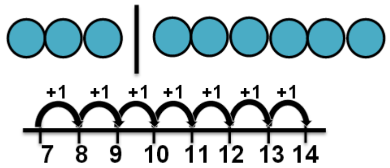
Multiplication and division; Statutory requirements from NC 2013

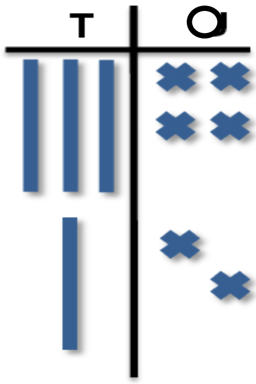
Pupils should be taught to:

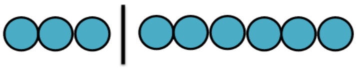
- Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.

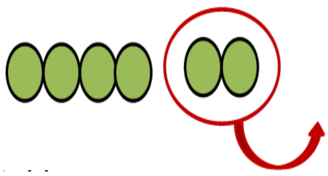
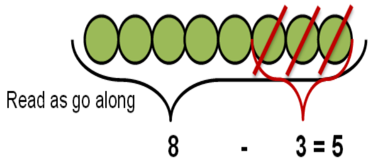
Non-statutory guidance.

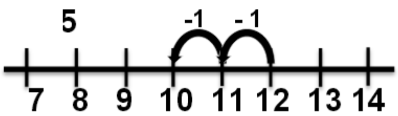
- *Through grouping and sharing small quantities, pupils begin to understand: multiplication and division; doubling numbers and quantities; and finding simple fractions of objects, numbers and quantities.*
- *They make connections between arrays, number patterns, counting in twos, fives and tens.*

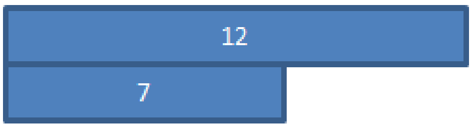
<table>
<tr><th>Concrete</th><th>Pictorial</th><th>Abstract</th></tr>
<tr><td colspan="3">Addition:</td></tr>
<tr>
<td>Pupils must experience combining two, then more, groups of objects using counting on.
Using concrete apparatus to first count all and then by counting on from the largest number.
Pupils should be able to partition numbers in different ways e.g.
5 as 2 + 2 + 1 or 4 + 1
27 as 20 +
7 or 10 + 17
Using equipment to actively demonstrate partitioning e.g

</td>
<td>Record building visual images e.g


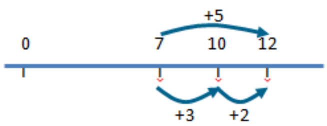
34 + 12 =


Without exchanging</td>
<td>Progressing to recording number sentences alongside e.g

3 and 6
3 + 6
44 + 15 = 59
40 4 10 5
40 + 10 = 50
4 + 5 = 9
50 + 9 = 59
Without exchanging
14 + 6 = 10

10 - ☐ = 4
(Using mental strategy of number bonds)
6 +11= 17
(Using mental strategy of add 10 and adjust.)</td>
</tr>
<tr><td colspan="3">Subtraction:</td></tr>
<tr>
<td>Pupils must experience finding out how many are left.
Pupils should begin to use apparatus to actively take a number of objects away.
</td>
<td>Pupils should begin to record building visual images e.g.




Counting back


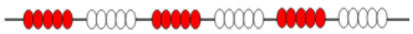
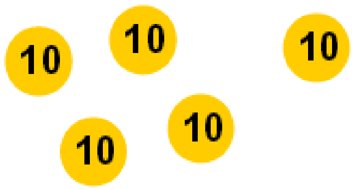
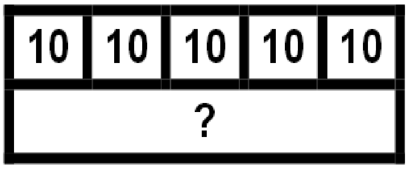
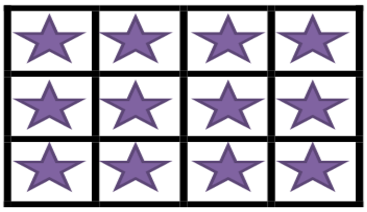
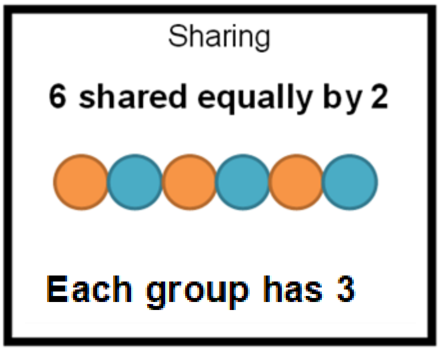
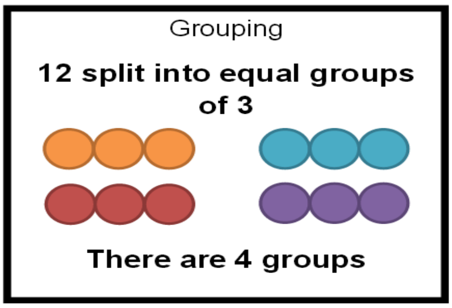
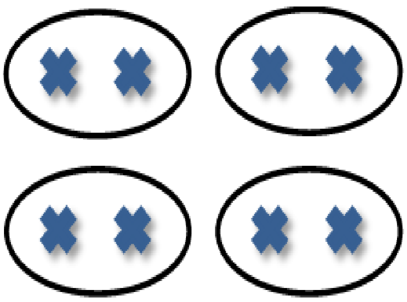
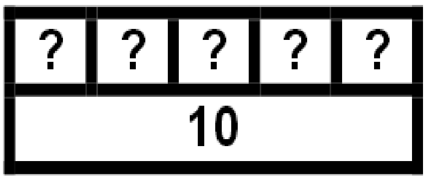
Finding the difference using a number line.

</td>
<td>18 – 3 = 15

18 = ☐ - 10 (Using mental strategy of add/remove 10.)

10 people on the bus and 5 get off how many are left on the bus?

12 count back 7 = 5

4 o’clock finish, race takes 3 hours. When did the race start?</td>
</tr>
</table>

Multiplication:		
Pupils should recognise how grouping similar objects can support calculations. Pupils begin to use manipulatives to represent groups or 'lots of' objects.   Pupils should recognise how to represent repeated addition problems using arrays. 	 **10 × 5 =**  **10 × 5 =** 	2 + 2 + 2 + 2 = 8 2 × 4 = 8 (Read as 4 lots of 2 Or 2 4 times.) **4 × 3 = 12** Read as 3 groups of 4
Division:		
Grouping and sharing equally.   	  	6 shared between 3 8 divided into 4 equal groups 18 ÷ 6 = 3 (Using where possible inverse of multiplication.)

Year 2

Addition and subtraction; Statutory requirements from NC 2013

Pupils should be taught to:

- Solve problems with addition and subtraction :

  using concrete objects and pictorial representations, including those involving numbers, quantities and measures,

  applying their increasing knowledge of mental and written methods.
- Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100.
- Add and subtract numbers using concrete objects, pictorial representations and mentally including:

  a two-digit number and ones

  a two-digit number and tens

  two two-digit numbers and 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.

Non-statutory guidance.

- *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 (for example, 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.*

Multiplication and division; Statutory requirements from NC 2013

Pupils should be taught to:

- Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers.
- Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), 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.

Non-statutory guidance.

- *Pupils use a variety of language to describe multiplication and division.*
- *Pupils are introduces 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 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, to arrays and to repeated addition. They begin to relate these to fractions and measures (for example, 40÷2+20, 20 is half of 40). They use commutativity and inverse relations to develop multiplicative reasoning (for example, 4×5=20 and 20÷5= 4)*

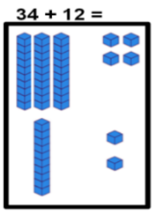
Addition:

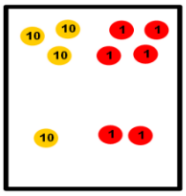
Pupils should be able to partition numbers in different ways e.g.

5 as 2 + 2 + 1 or 4 + 1

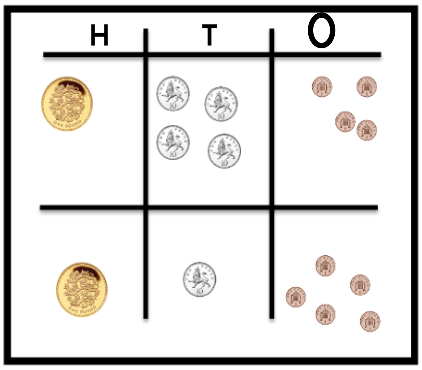
27 as 20 + 7 or 10 + 17

Using equipment to actively demonstrate partitioning for example:

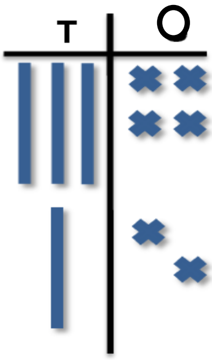




144 + 115 =

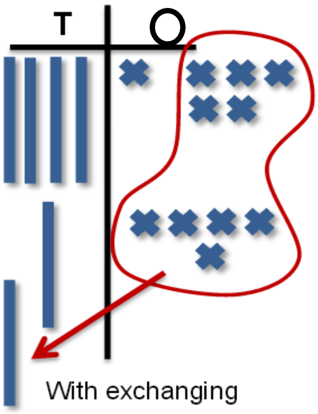


34 + 12 =



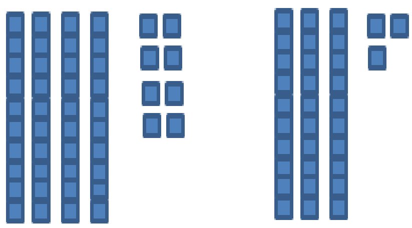
Without exchanging

46 + 15 =



With exchanging

Use of manipulatives to lead to short method: 48 + 33



44 + 15 = 59

40 4 10 5

40 + 10 = 50

4 + 5 = 9

50 + 9 = 59

Without exchanging

27 + 16 = 43

20 | 7

30 | 13

10 | 6

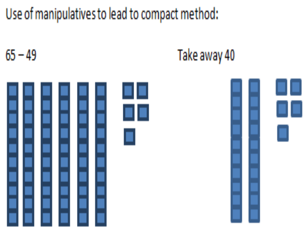
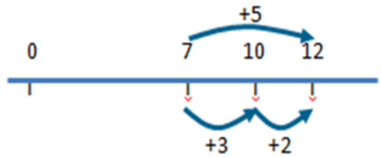
30 + 13

With exchanging

Introduce to vertical format without exchanging.

H		T		O
100	+	40	+	4
100	+	10	+	5
200	+	50	+	9
				= 259

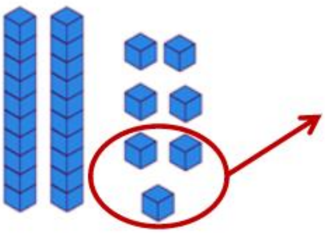
Without exchanging

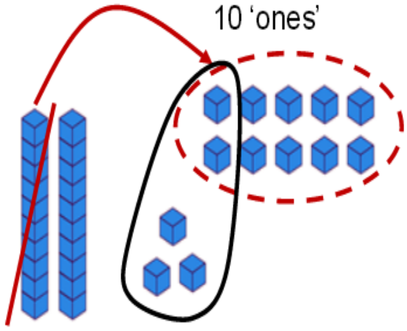
<table>
<tr><td colspan="3">Subtraction:</td></tr>
<tr>
<td>Continue with counting back along a numberline moving onto the use of blank numberlines.

</td>
<td>

Using knowledge of bonds to 10 and finding the difference.</td>
<td>Sequencing

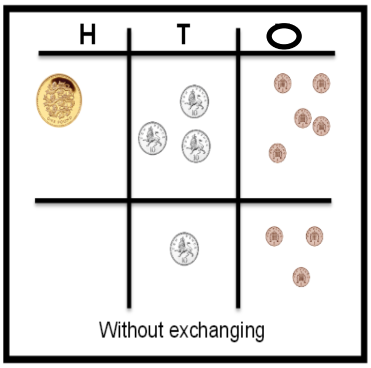
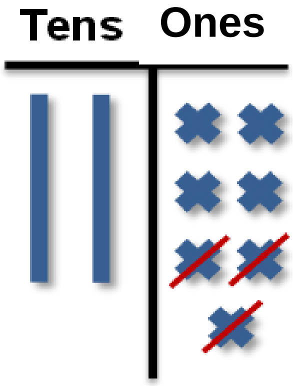
56 – 24

56 – 20 – 4 = 36 – 4 = 32

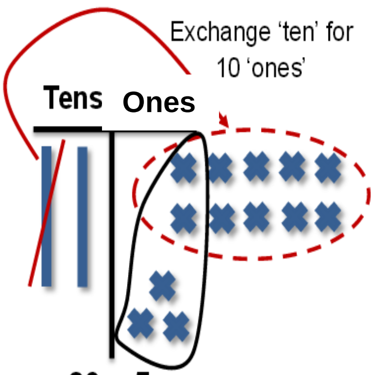
56 – 13 = 43
Using take 10 away and adjust.</td>
</tr>
<tr>
<td>Pupils should begin to exchange numbers.

27 – 3 =
Without exchanging



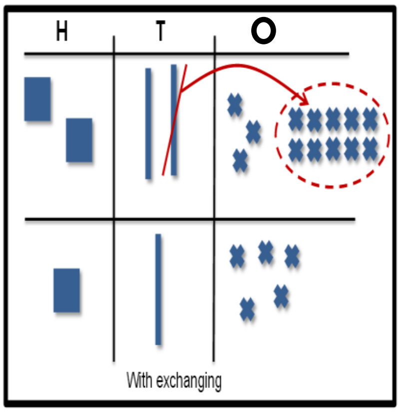
23 – 5 =
With exchanging

135 – 13 =

</td>
<td>

27 – 3 =
Without exchanging



23 – 5 =
With exchanging

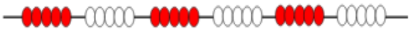
223 – 115 =

</td>
<td>Vertical format used as written recording of use of abacus sheets.
Without exchanging.

74 – 21= 53
T O
70 4
- 20 1
50 3 = 53

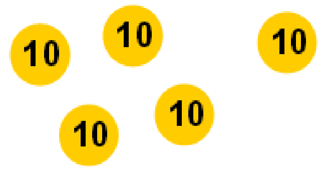
147 – 132 = 15
H T O
100 40 7
- 100 30 2
0 10 5 = 15</td>
</tr>
</table>

<table>
<tr><th colspan="3">Multiplication:</th></tr>
<tr>
<td>
Pupils should recognise how grouping similar objects can support calculations.

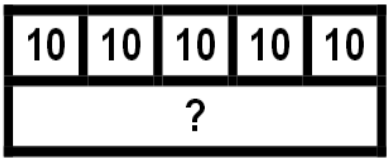
Pupils begin to use manipulatives to represent groups or ‘lots of’ objects.



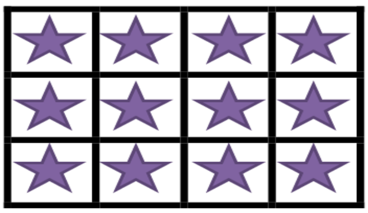

Pupils should recognise how to represent repeated addition problems using arrays.

Practise making sets of 2s, 5s and 10s. Link to counting in 2s, 5s and 10s. Count large sets by splitting into multiples and using counting in multiples to count total.
</td>
<td>


10 × 5 =



10 × 5 =

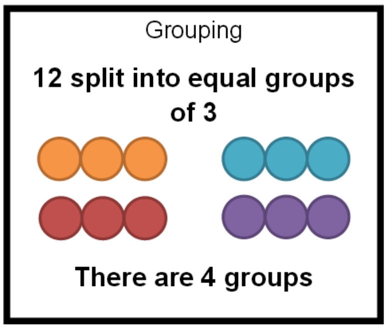
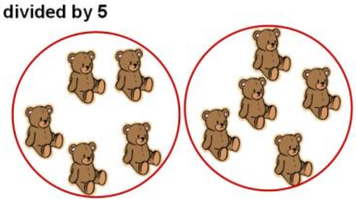
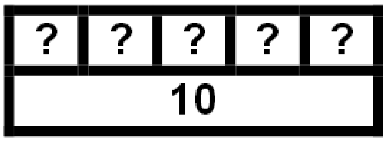
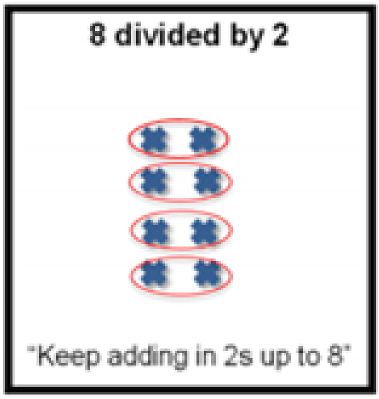
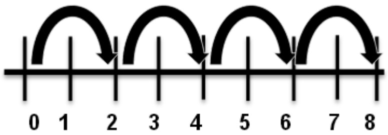
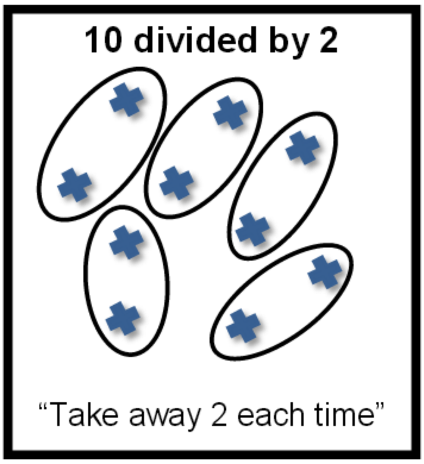
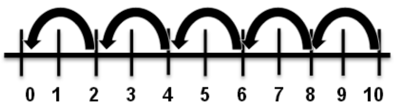


Use grids and arrays to show multiples of 2, 5 and 10.
</td>
<td>
Begin to learn by heart 2, 5 and 10 times table.

Use grids and arrays to solve 6 × 5, 10 × 2.

Make connections between 10 times table and place value.

Make connections between 2 times table and doubling numbers.
</td>
</tr>
</table>

Division:		
 Pupils should be used to repeated subtraction and addition with links to arrays and numberlines. 10 divided by 5 	     	**6 shared between 3** **8 divided into 4 equal groups** $6 \div 3 =$ Begin to divide numbers into equal parts which leave a remainder when using whole numbers. Relate multiplication tables for 2, 5 and 10 to their connected division facts. Know which numbers are odd and even by reference to ones digit.

Year 3

Addition and subtraction; Statutory requirements from NC 2013

Pupils should be taught to:

- 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.

Non-statutory guidance

- *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*

Multiplication and division; Statutory requirements from NC 2013

Pupils should be taught to:

- recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables
- write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods
- solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects.

Non-statutory guidance

- *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 and associativity (for example, $4 \times 12 \times 5 = 4 \times 5 \times 12 = 20 \times 12 = 240$) and multiplication and division facts (for example, using $3 \times 2 = 6$, $6 \div 3 = 2$ and $2 = 6 \div 3$) to derive related facts (for example, $30 \times 2 = 60$, $60 \div 3 = 20$ 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. These include measuring and scaling contexts, (for example, four times as high, eight times as long etc.) and correspondence problems in which m objects are connected to n objects (for example, 3 hats and 4 coats, how many different outfits?; 12 sweets shared equally between 4 children; 4 cakes shared equally between 8 children).*

- *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 and associativity (for example, $4 \times 12 \times 5 = 4 \times 5 \times 12 = 20 \times 12 = 240$) and multiplication and division facts (for example, using $3 \times 2 = 6$, $6 \div 3 = 2$ and $2 = 6 \div 3$) to derive related facts (for example, $30 \times 2 = 60$, $60 \div 3 = 20$ 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. These include measuring and scaling contexts, (for example, four times as high, eight times as long etc.) and correspondence problems in which m objects are connected to n objects (for example, 3 hats and 4 coats, how many different outfits?; 12 sweets shared equally between 4 children; 4 cakes shared equally between 8 children).*

<table>
<tr><td colspan="3">Addition:</td></tr>
<tr>
<td>

<u>Partition into tens and ones</u>

Partition both numbers and recombine.

Count on by partitioning the second number only e.g.

247 + 125 = 247 + 100 + 20+ 5

= 347 + 20 + 5

= 367 + 5

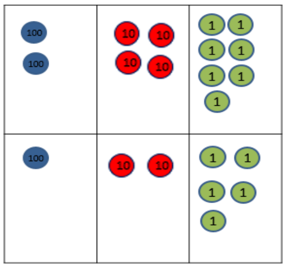
= 372

Children need to be secure adding multiples of 100 and 10 to any three-digit number including those that are not multiples of 10

</td>
<td>

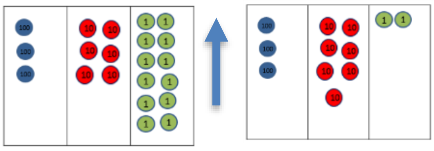
<u>Towards a Written Method (up to 3 digits)</u>

Introduce expanded column addition modelled with place value counters (Dienes could be used for those who need a less abstract representation)



200 + 40 + 7
100 + 20 + 5
300 + 60 +12 = 372

Leading to children understanding the exchange between tens and ones



</td>
<td>

Children will begin to use a formal columnar algorithm

$$\begin{array}{r} 247 \\ +125 \\ \hline 372 \\ {\scriptstyle 1} \end{array}$$

</td>
</tr>
<tr><td colspan="3">Subtraction:</td></tr>
<tr>
<td>

Missing number problems for example:

□ = 43 – 27

145 – □ = 138

274 – 30 = □

245 – □ = 195

532 – 200 = □

364 – 153 = □

<u>Mental methods</u> should continue to develop, supported by a range of models and images, including the number line. The bar model should continue to be used to help with problem solving (see Y1 and Y2).

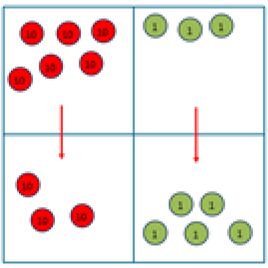
Children should make choices about whether to use complementary addition or counting back, depending on the numbers involved.

</td>
<td>

<u>Written methods (progressing to 3-digits)</u>

Introduce expanded column subtraction with no decomposition, modelled with place value counters (Dienes could be used for those who need a less abstract representation)

e.g. 98 - 35



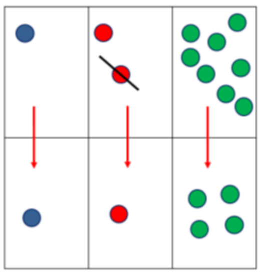
$$\begin{array}{r} 90\ \ 8 \\ -\ 30\ \ 5 \\ \hline 60+3 \end{array}$$

This will lead to exchanging, modelled using place value counters (or Dienes).

</td>
<td>

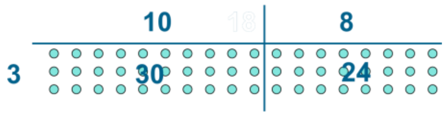
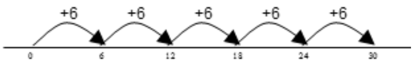
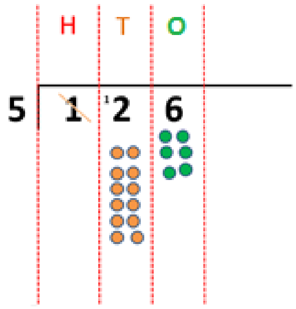
Children will begin to use a formal columnar algorithm, initially introduced alongside the expanded method. The formal method should be seen as a more streamlined version of the expanded method, not a new method.

232 - 114



$$\begin{array}{r} 2\overset{2}{\cancel{3}}\,{}^{1}2 \\ -\ 114 \\ \hline 118 \end{array}$$

</td>
</tr>
</table>

Multiplication:		
Missing number problems Continue with a range of equations as in Year 2 but with appropriate numbers. <u>Mental methods</u> Doubling 2 digit numbers using partitioning (see year 2) Demonstrating multiplication on a number line – jumping in larger groups of amounts 13 x 4 = 10 groups 4 = 3 groups of 4	<u>Written methods (progressing to 2digit x 1digit)</u> Developing written methods using understanding of visual images 18 x 3 	Develop onto the grid method  Give children opportunities to explore this and deepen understanding using Dienes apparatus and place value counters
Division:		
<u>÷ = signs and missing numbers</u> Continue using a range of equations as in year 2 but with appropriate numbers. <u>Grouping</u> How many 6s are in 30? 30 ÷ 6 can be modelled as: 	<u>Becoming more efficient using a numberline</u> Children need to be able to partition the dividend in different ways. 48 ÷ 4 = 12 40 ÷ 4 = 10 8 ÷ 4 = 2 10 + 2 = 12 <u>Remainders</u> 49 ÷ 4 = 12 r1 40 ÷ 4 = 10 9 ÷ 4 = 2 r1 10 + 2 r1 = 12 r1 Sharing – 49 shared between 4. How many left over? Grouping – How many 4s make 49. How many are left over?	Place value counters can be used to support children apply their knowledge of grouping. Some children will begin to use formal short division 126 ÷ 5 

Year 4

Addition and subtraction; Statutory requirements from NC 2013

Pupils should be taught to:

- 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.

Non-statutory guidance

- *Pupils continue to practise both mental methods and columnar addition and subtraction with increasingly large numbers to aid fluency*

Multiplication and division; Statutory requirements from NC 2013

Pupils should be taught to:

- 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 two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects.

Non-statutory guidance

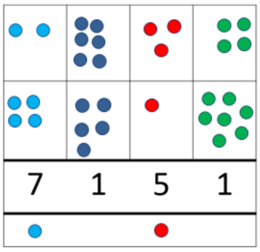
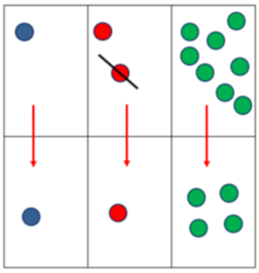
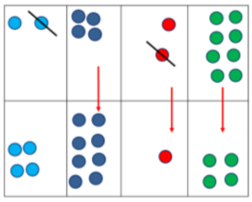
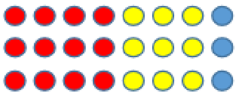
- *Pupils continue to practise recalling and using multiplication tables and related division facts to aid fluency.*

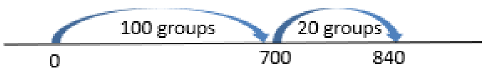
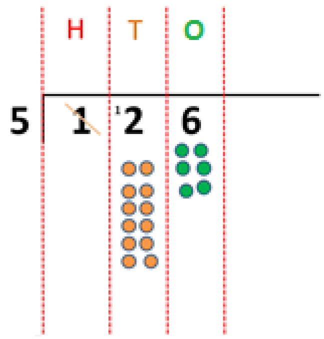
- *Pupils practise mental methods and extend this to three-digit numbers to derive facts, (for example 600 ÷ 3 = 200 can be derived from 2 x 3 = 6).*

- *Pupils practise to become fluent in the formal written method of short multiplication and short division with exact answers (see Mathematics Appendix 1).*

- *Pupils write statements about the equality of expressions (for example, 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 for example, 2 x 6 x 5 = 10 x 6 = 60.*

- *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.*

Addition:		
<u>Mental methods</u> should continue to develop, supported by a range of models and images, including the number line. The bar model should continue to be used to help with problem solving	<u>Compact written method</u> Extend to numbers with at least four digits.  2634 +4517 7151 1 1	Extend to up to two places of decimals (same number of decimals places) and adding several numbers (with different numbers of digits). 72.8 + 54.6 127.4 11
Subtraction:		
Missing number/digit problems: 456 + □ = 710; 1□7 + 6□ = 200 60 + 99 + □ = 340 200 – 90 – 80 = □ 225 - □ = 150 □ – 25 = 67 3450 – 1000 = □ □ - 2000 = 900 <u>Mental methods</u> should continue to develop, supported by a range of models and images, including the number line. The bar model should continue to be used to help with problem solving.	<u>Written methods (progressing to 4-digits)</u> Children will use the formal method of decomposition, which again can be initially modelled with place value counters, progressing to calculations with 4-digit numbers.  2 1 232 - 114 118	 5 1 12 1 6232 - 4814 1418
Multiplication:		
<u>Mental methods</u> Counting in multiples of 6, 7, 9, 25 and 1000, and steps of 1/100. Solving practical problems where children need to scale up. Relate to known number facts. (e.g. how tall would a 25cm sunflower be if it grew 6 times taller?)	<u>Written methods (progressing to 3digits x 2digits)</u> Children to embed and deepen their understanding of the grid method to multiply up 2digits x 2digits. Ensure this is still linked back to their understanding of arrays and place value counters. For example: 431 x 3  | 400 | 30 | 1 3 | 1200 | 90 | 3 1 293	431 x 3 1293 24 x 6 144 2

Division:		
<u>Sharing, Grouping and using a number line</u> Children will continue to explore division as sharing and grouping, and to represent calculations on a number line until they have a secure understanding. Children should progress in their use of written division calculations: • Using tables facts with which they are fluent • Experiencing a logical progression in the numbers they use, for example: 1. Dividend just over 10x the divisor, e.g. 84 ÷ 7 2. Dividend just over 10x the divisor when the divisor is a teen number, e.g. 173 ÷ 15 (learning sensible strategies for calculations such as 102 ÷ 17) 3. Dividend over 100x the divisor, e.g. 840 ÷ 7 4. Dividend over 20x the divisor, e.g. 168 ÷ 7	**e.g. 840 ÷ 7 = 120** *<u>Jottings</u>* *7 x 100 = 700* *7 x 10 = 70* *7 x 20 = 140*  	<u>Formal Written Methods</u> Short division to be modelled for understanding using place value counters as shown below. Children use the short method to solve 3 digit by 1 digit. 

Year 5

Addition and subtraction; Statutory requirements from NC 2013

Pupils should be taught to:

- 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.

Non-statutory guidance

- *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 (for example, 12 462 – 2300 = 10 162).*

Multiplication and division; Statutory requirements from NC 2013

Pupils should be taught to:

- 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 (nonprime) numbers
- establish whether a number up to 100 is prime and recall prime numbers up to 19
- multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers
- multiply and divide numbers mentally drawing upon known facts
- divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context
- multiply and divide whole numbers and those involving decimals by 10, 100 and 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.

Non-statutory guidance

- *Pupils practise and extend their use of the formal written methods of short multiplication and short division (see Mathematics Appendix 1). They apply all the multiplication tables and related division facts frequently, commit them to memory and use them confidently to make larger calculations.*

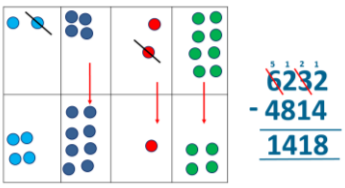
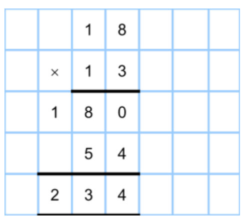
- *They use and understand the terms factor, multiple and prime, square and cube numbers. Pupils interpret non-integer answers to division by expressing results in different ways according to the context, including with remainders, as fractions, as decimals or by rounding (for example, 98 ÷ 4 = 4 98 = 24 r 2 = 24 2 1 = 24.5 ≈ 25).*

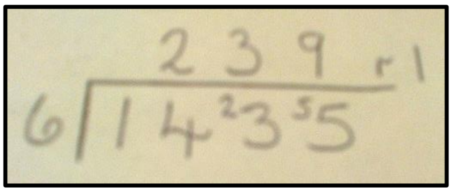
- *Pupils use multiplication and division as inverses to support the introduction of ratio in year 6, for example, by multiplying and dividing by powers of 10 in scale drawings or by multiplying and dividing by powers of a 1000 in converting between units such as kilometres and metres.*

- *Distributivity can be expressed as a(b + c) = ab + ac.*

- *They understand the terms factor, multiple and prime, square and cube numbers and use them to construct equivalence statements (for example, 4 x 35 = 2 x 2 x 35; 3 x 270 = 3 x 3 x 9 x 10 = 92 x 10).*

- *Pupils use and explain the equals sign to indicate equivalence, including in missing number problems (for example, 13 + 24 = 12 + 25; 33 = 5 x).*

Addition:		
Mental methods should continue to develop, supported by a range of models and images, including the number line. The bar model should continue to be used to help with problem solving. Children should practise with increasingly large numbers to aid fluency e.g. 12462 + 2300 = 14762	Written methods (progressing to more than 4-digits) Children will use the formal columnar method for whole numbers and decimal numbers as an efficient written algorithm. 172.83 + 54.68 227.51 11.1	Place value counters can be used alongside the columnar method to develop understanding of addition with decimal numbers.
Subtraction:		
Mental methods should continue to develop, supported by a range of models and images, including the number line. The bar model should continue to be used to help with problem solving.	Written methods (progressing to more than 4-digits) Children will use the formal method of decomposition, which again can be initially modelled with place value counters., progressing to calculations with more than 4-digit numbers. 	Progress to calculating with decimals, including those with different numbers of decimal places.
Multiplication:		
Mental methods X by 10, 100, 1000 Use practical resources and jottings to explore equivalent statements (e.g. 4 x 35 = 2 x 2 x 35) Recall of prime numbers up 19 and identify prime numbers up to 100 (with reasoning) Solving practical problems where children need to scale up. Relate to known number facts. Identify factor pairs for numbers	Written methods (progressing to 4digits x 2digits) Children to use short multiplication for 2 digit x 1 digit Long multiplication using place value counters Children to explore how the grid method supports an understanding of long multiplication (for 2digits x 2digits)	24 x 6 144 2 

Division:		
• Using tables facts with which they are fluent • Experiencing a logical progression in the numbers they use, for example: 1. Dividend just over 10x the divisor, e.g. 84 ÷ 7 2. Dividend just over 10x the divisor when the divisor is a teen number, e.g. 173 ÷ 15 (learning sensible strategies for calculations such as 102 ÷ 17) 3. Dividend over 100x the divisor, e.g. 840 ÷ 7 4. Dividend over 20x the divisor, e.g. 168 ÷ 7	<u>Formal Written Methods</u> Continued as shown in Year 4, leading to the efficient use of a formal method. E.g. 1435 ÷ 6 	Children begin to practically develop their understanding of how to express the remainder as a decimal or a fraction. Ensure practical understanding allows children to work through this (e.g. what could I do with this remaining 1? How could I share this between 6 as well?)

Year 6

Addition, subtraction, multiplication and division; Statutory requirements from NC 2013

Pupils should be taught to:

- multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication
- divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
- divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context
- perform mental calculations, including with mixed operations and large numbers
- identify common factors, common multiples and prime numbers
- use their knowledge of the order of operations to carry out calculations involving the 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.

Non-statutory guidance

- *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 (see Mathematics Appendix 1).*
- *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, for example, 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.*

Addition:		
<u>Mental methods</u> should continue to develop, supported by a range of models and images, including the number line. The bar model should continue to be used to help with problem solving.	<u>Written methods</u> As year 5, progressing to larger numbers, aiming for both conceptual understanding and procedural fluency with columnar method to be secured. Continue calculating with decimals, including those with different numbers of decimal places	<u>Problem Solving</u> Teachers should ensure that pupils have the opportunity to apply their knowledge in a variety of contexts and problems (exploring cross curricular links) to deepen their understanding.
Subtraction:		
<u>Mental methods</u> should continue to develop, supported by a range of models and images, including the number line. The bar model should continue to be used to help with problem solving.	<u>Written methods</u> As year 5, progressing to larger numbers, aiming for both conceptual understanding and procedural fluency with decomposition to be secure.	Continue calculating with decimals, including those with different numbers of decimal places.
Multiplication:		
<u>Mental methods</u> Identifying common factors and multiples of given numbers Solving practical problems where children need to scale up. Relate to known number facts.	<u>Written methods</u> Continue to refine and deepen understanding of written methods including fluency for using long multiplication	1342 x 18 13420 10736 2 3 1 24156 1
Division:		
<u>÷ = signs and missing numbers</u> Continue using a range of equations but with appropriate numbers <u>Sharing and Grouping and using a number line</u> Children will continue to explore division as sharing and grouping, and to represent calculations on a number line as appropriate. Quotients should be expressed as decimals and fractions	<u>Formal Written Methods</u> <u>long and short division</u> E.g. 1504 ÷ 8