CALCULATION POLICY

Reviewed	September 2022
Next Review Date	September 2023
Adopted	

CALCULATION POLICY

What is the purpose of the policy?

The purpose of this calculation policy is to ensure consistency and progression in the teaching of the different calculation methods across the school. It aims to give an overview of the key written calculation strategies that will be taught in all year groups. All members of staff are expected to be familiar with this policy and apply it consistently across the school.

How is the calculation policy set out?

This calculation policy has been organised by year group, considering the national curriculum 2014 expectations. Each page refers to a different operation (addition, subtraction, multiplication and division) and shows a progression in calculation from the Foundation Stage upto Year Six.

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. These skills then lead on to more formal written methods of calculation.

It is important that children do not abandon jottings and mental methods once formal written methods are introduced. Therefore children should always be encouraged to look at a calculation/problem and then decide which is the best method to choose. As children become more confident with their calculation, they need to use the following steps when approaching problems:

- 'Can I solve this problem in my head and use a mental method?'
- 'Do I need to use some written jottings to help me?'
- 'Do I need to use more formal written method to solve the problem?'

Concrete, Pictorial, Abstract Approach

The calculation policy is laid out in accordance with one of the key learning principles behind Maths Mastery,Maths No Problem and the NCTEM. It supports how we teach maths, with challenge/depth for all at the heart. The approach we use is concrete, pictorial and abstract (often referred to as the CPA approach). The concrete, pictorial, abstract approach, based on research by psychologist Jerome Bruner, suggests that there are three steps (or representations) necessary for pupils to develop understanding of a concept. Reinforcement is achieved by going back and forth between these representations.

Concrete representation

The active stage - a student is first introduced to an idea or a skill by acting it out with real objects. In division, for example, this might be done by separating apples into groups of red ones and green ones or by sharing 12 biscuits amongst 6 children. This is a 'hands on' component using real objects and it is the foundation for conceptual understanding.

Pictorial representation

The iconic stage - a pupil has sufficiently understood the hands-on experiences performed and can now relate them to representations, such as a diagram or picture of the problem. In the case of a division exercise this could be the action of circling objects.

Abstract representation

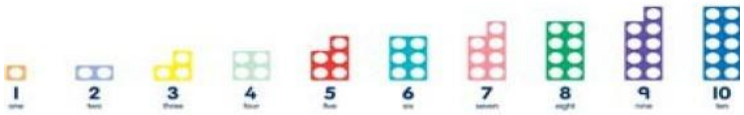
The symbolic stage - a pupil is now capable of representing problems by using mathematical notation, for example: $12 \div 2 = 6$.

Whilst this calculation policy aims to show the CPA approach to the different calculations, it is not always noted further up the year groups.However, it is expected that the CPA approach is used continuously in all new learning and calculations even when not noted.

This policy has been largely adapted from the White Rose Maths Hub Calculation Policy with further material added. It is a workingdocument and will be revised and amended as necessary.

Addition

EYFS
Before children can move on to the methods for addition they need to be able to count reliably, including one to one correspondence:



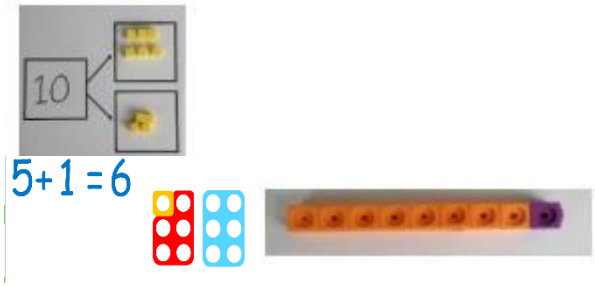
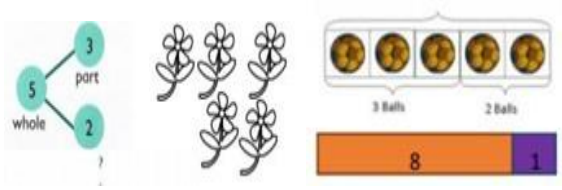
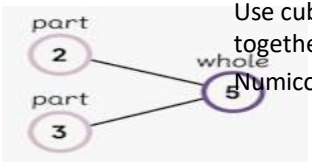
Children need to be able to count on from any number, combining two groups:

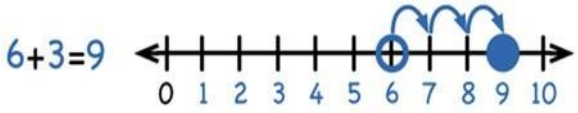
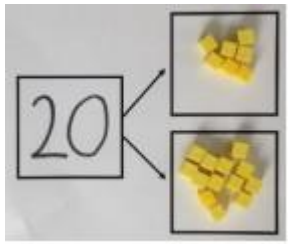
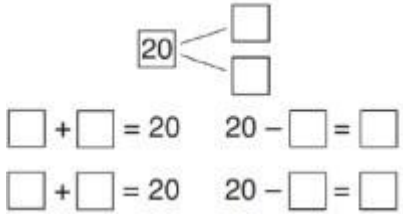
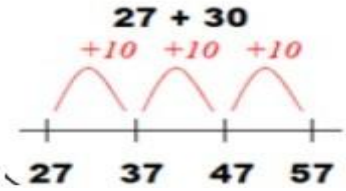
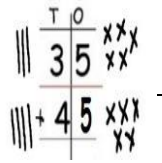
5 plus 3 = 8
3 more than 5 =8

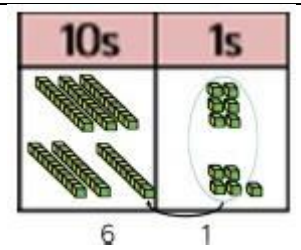
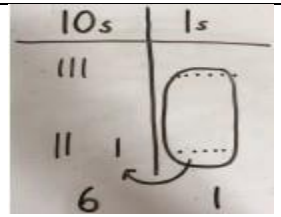
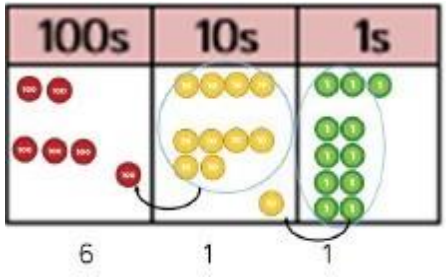
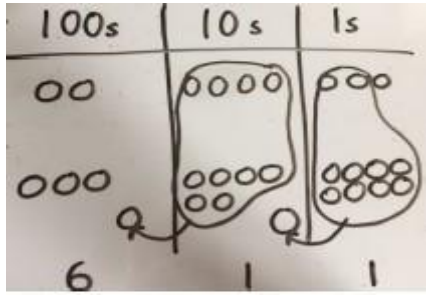
Children will begin to know addition facts to 10:

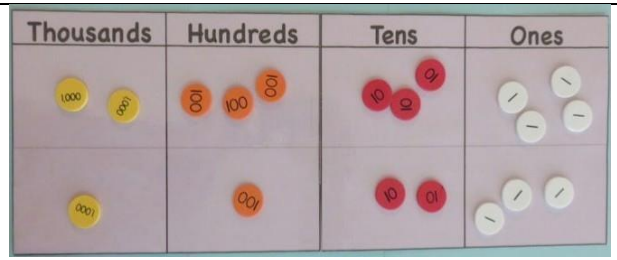
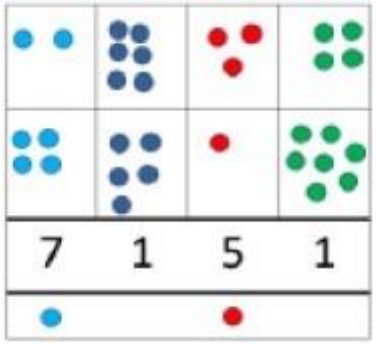
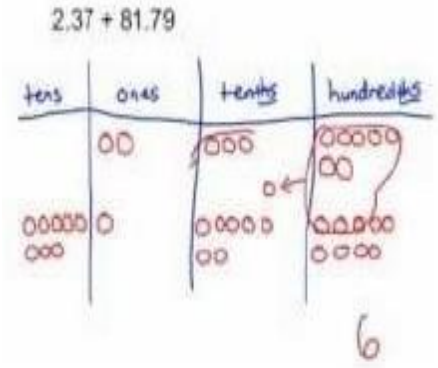
Numicon is used as a primary resource to support the teaching of addition where children are encouraged to visualise the numicon patterns and calculate by combining/partitioning the patterns rather than resort to counting. Practical experiences and activities are at the heart of developing mathematical concepts.

Year 1

Strategies	Concrete	Pictorial	Abstract
Combining two parts to make a whole using the part-part-whole model.		Use pictures to add two groups together in a bar or in a group. 	Use part-part-whole diagram as shown below to move into the abstract.  Use part-part-whole model. Use cubes to add two numbers together as a group or in a bar. Numicon can also be used. 2 + 3 = 5

Starting at the bigger number and counting on.	Start with the larger number on the beadstring and then count on to the smaller number 1 by 1 to find the answer. 	Start at the larger number on the number line and count on in ones to find the answer. 	Place the larger number in your head andcount on the smaller number to find youranswer. 6 + 3 = 9
Year 2			
Strategies	**Concrete**	**Pictorial**	**Abstract**
Use known number facts (part-part- whole method).	Children explore ways of making numbers within 20. 	Use part-part-whole diagram. 	
Add a 2 digit number and tens.	Use diennes and investigte the pattern (the ones stay the same).  25 + 10 = 35	Use number lines to count on in tens alongside concrete resources. 	27 + 10 = 37 27 + 20 = 47 27 + □ = 57
Add two 2-digit numbers	Model using dienes and a place value mat.	Children to represent dienes using lines for 10's and dots or crosses for ones.	**Expanded Column Addition:** partitioned numbers are written under one another: 

			47 = 40 + 7 +76 70 + 6 110 + 13 =123
Year 3			
Strategies	**Concrete**	**Pictorial**	**Abstract**
Add numbers with up to three digits, using formal written methods of columnar addition.	Use of place value counters. When there are 10 ones in the 1s column- we exchange for 1 ten, when there are 10 tens in the 10s column- we exchange for 1 hundred. 	Children to represent the counters in a place value chart, circling when they make an exchange. 	Compact Column Addition 789 + 642 becomes 7 8 9 + 6 4 2 1 4 3 1 1 1 Answer: 1431 Add the units first, carry numbers underneath the bottom line, remind pupils of actual value e.g.
Year 4			
Strategies	**Concrete**	**Pictorial**	**Abstract**
Add whole numbers with more than 4 digits, including using formal	Continue to use dienes and place value counters to add, exchanging ten ones for a ten and ten tens for a hundred and ten hundreds for a thousand. 2,334 + 1,123 =	Draw representations using place value diagram.	Continue from previous work to carry hundreds and tens. Relate to money andmeasures.

written methods (columnar addition).			£ 32.50 + £ 21.75 = £54.25 £32.50 + £21.75 £54.25
Year 5			
Strategies	**Concrete**	**Pictorial**	**Abstract**
Add numbers with more than 4 digits. Add decimals with 2 decimal places, including money.	Introduce decimal place value counters and model exchange for addition. 	Draw representations using PV grid. 	Tenths, hundredths and thousandths should be correctly aligned, with the decimal point aligned vertically including in the answer. Empty decimal places can be filled with the zero to show the place value of each column. 
Year 6			
Strategies	**Concrete**	**Pictorial**	**Abstract**
Add several	As year 5		

numbers of increasing complexity.	

SUBTRACTION

EYFS

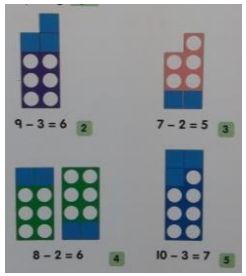
EYFS:

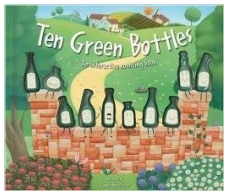
Before children can move onto the methods for subtraction they need to be able to count reliably including one to one correspondence. Children will be able to count up or back from any number and begin to understand subtraction as take away. The children will be supported with these concepts through singing songs and develop ways of recording calculations using pictures or apparatus, such as numicon.

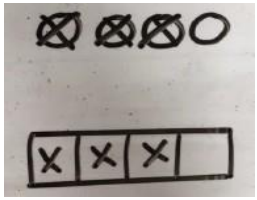
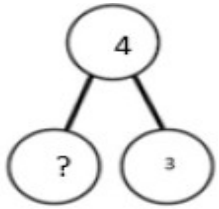
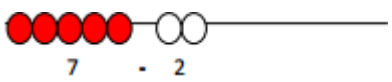
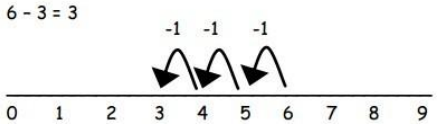
Relate subtraction to finding how many are left when some are removed:

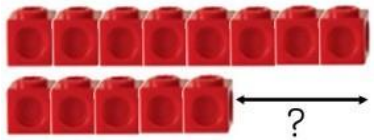
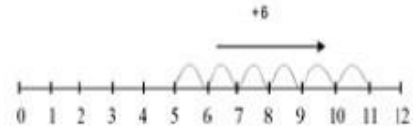
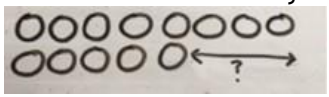
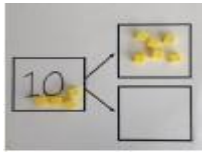
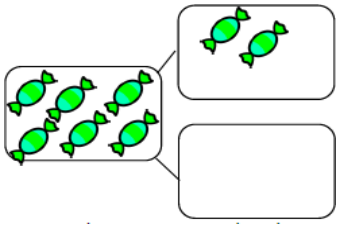
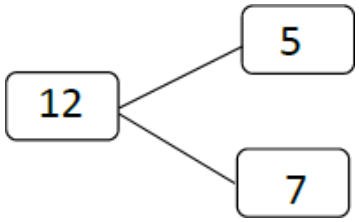
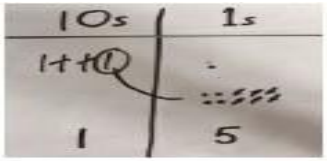
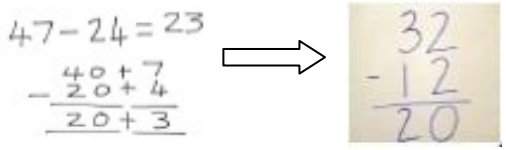
Children will begin to count backwards in familiar contexts such as number rhymes and stories:

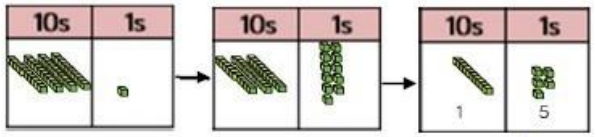
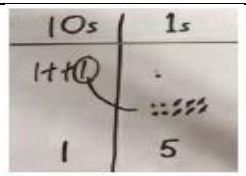
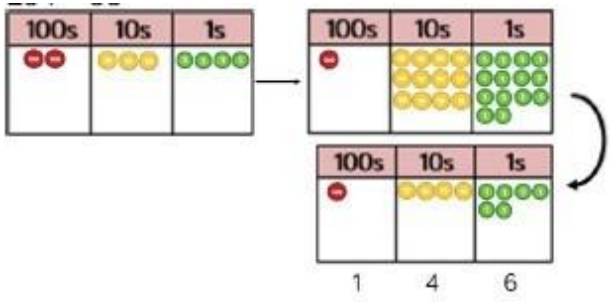
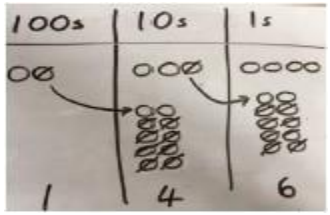
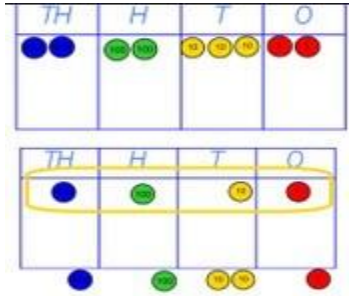
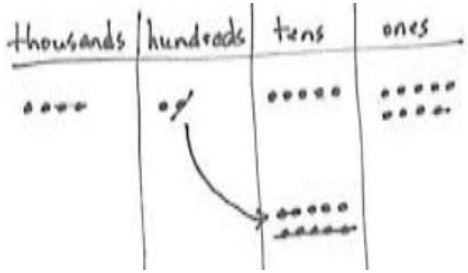
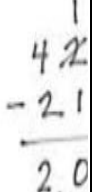
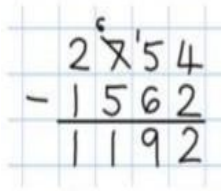
Numicon is used as a primary resource to support the teaching of subtraction. Practical experiences and activities are at the heart of developing mathematical concepts.

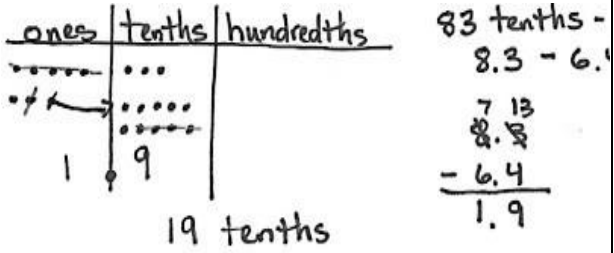
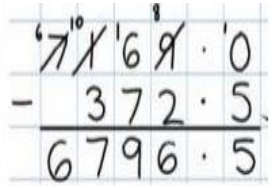




Year 1			
Strategies	**Concrete**	**Pictorial**	**Abstract**
Taking away ones.	Physically taking away and removingobjects from a whole (ten frames, Numicon, cubes and other items such as beanbags could be used).  	Children to draw the concrete resources they are using and cross out the correctamount. 	4 – 3 = 1  Use Part-part-whole diagram to link with addition.
Starting at the bigger number and counting back.	Move the beads along the bead string as you count backwards.  	Start at the larger number on the number line and count back in ones to find the answer. Encourage children to progress to an empty number line.  	Place the larger number in your head andcount back the smaller number to find your answer. 6 - 3 = 3
Find the difference.	Finding the difference (using cubes, Numicon or Cuisenaire rods, other objects can also be used). Calculate the difference between 8 and 5.	Count on using a number line to find the difference.	Find the difference between 8 and 5. 8 – 5, the difference is_____. Children to explore why: 9 - 6 = 8 – 5 = 7 – 4 have the same

		 Or children can draw the cubes they have used to illustrate what they need to calculate. 	difference.
Year 2			
Strategies	**Concrete**	**Pictorial**	**Abstract**
Represent and use number bonds and related subtraction facts within 20.	Link to addition. Use the Part-part-whole model to model the inverse.  If 10 is the whole and 6 is one of the parts. What is the other part?	Use part-part-whole diagram. 	
Partitioning to subtract without regrouping.	Use dienes to show how to partition the number when subtracting withoutregrouping.  34 – 13 = 21	Children draw representations of dienes using lines for tens and dots or crosses for ones. They then cross off the smaller amount. 	Expanded Column Subtraction leading to compact column subtraction. 
Partitioning to subtract with	Model using dienes and a place value mat.	Children to represent dienes using lines for 10's and dots or crosses for ones.	Expanded Column Subtraction leading to compact column method.

regrouping.	 41 – 26 = 15	 41 – 26 = 15	$\begin{array}{r} 70+4 \\ -\ 20+7 \\ \hline \end{array}$ $\begin{array}{r} {\scriptstyle 60}\ {\scriptstyle 14} \\ \cancel{70}+\cancel{4} \\ -\ 20+7 \\ \hline 40+7 \end{array}$ $\begin{array}{r} {\scriptstyle 6}\ {\scriptstyle 14} \\ \cancel{7}\,\cancel{4} \\ -\ 2\ 7 \\ \hline 4\ 7 \end{array}$
Year 3			
Strategies	**Concrete**	**Pictorial**	**Abstract**
Subtract numbers with up to three digits, using formal written methods of columnar addition.	Use of place value counters. 234 – 88 = 146 	Represent the place value counters pictorially; remembering to show what has been exchanged. 234 – 88 = 146 	Expanded Column Subtraction leading to compact column method. $\begin{array}{r} 700+40+1 \\ -\ 300+60+7 \\ \hline \end{array}$ $\begin{array}{r} {\scriptstyle 600}\ {\scriptstyle 130}\ {\scriptstyle 11} \\ \cancel{700}+\cancel{40}+\cancel{1} \\ -\ 300+60+7 \\ \hline 300+70+4 \end{array}$ $\begin{array}{r} {\scriptstyle 6}\ {\scriptstyle 13}\ {\scriptstyle 11} \\ \cancel{7}\,\cancel{4}\,\cancel{1} \\ -\ 3\ 6\ 7 \\ \hline 3\ 7\ 4 \end{array}$
Year 4			
Strategies	**Concrete**	**Pictorial**	**Abstract**
Subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition).	Children continue to use place value counters to subtract.  2232 – 1121 = 1111	Draw representations using place value diagram.  	Compact column method to subtract. 

Year 5			
Strategies	**Concrete**	**Pictorial**	**Abstract**
Subtract numbers with more than 4 digits. Subtract decimals with 2 decimal places.	Introduce decimal place value counters and model exchange for subtraction. 	Draw representations using PV grid. 	Children will subtract with decimal values, including mixtures of integers and decimals and aligning the decimal point. A zero will be used in any empty decimal place to aid understanding of what to subtract. 
Year 6			
Strategies	**Concrete**	**Pictorial**	**Abstract**
Subtract more complex numbers and decimal values.	As year 5 using more complex numbers.		

Multiplication

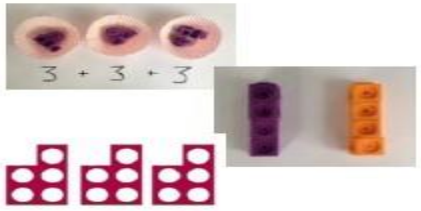
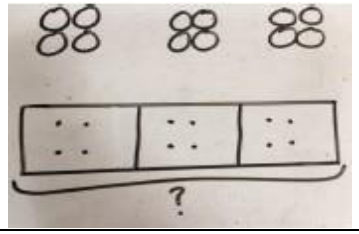
EYFS

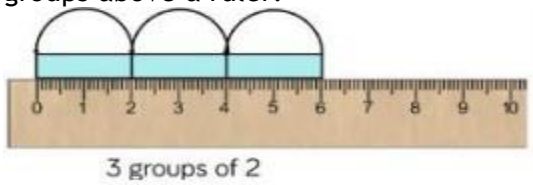
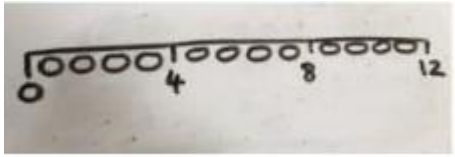
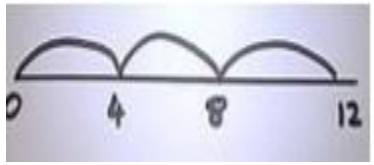
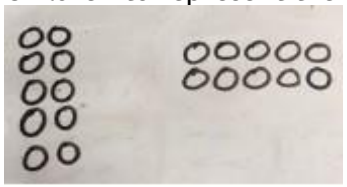
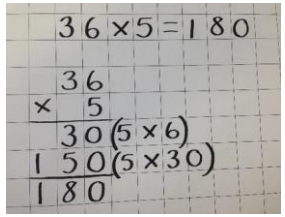
Understanding of multiplication begins with practical work as children begin to work with groups of equal amounts. They learn to count in 2s, 5s and 10s, and this is then linked to practical problems, for example, counting pairs of children in the line, repeated printing of numicon shapes etc.Children begin to double numbers, initially with objects and later through addition.

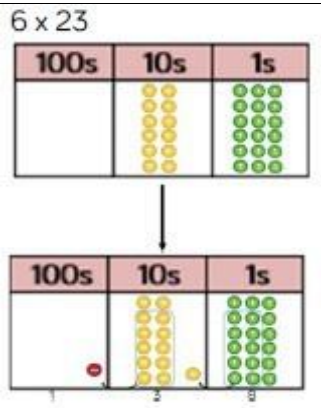
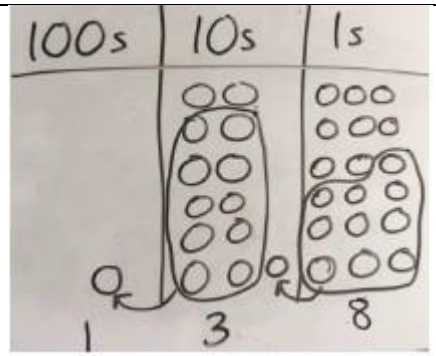
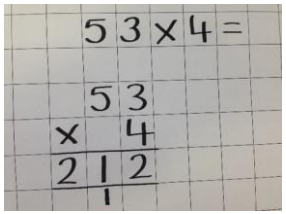
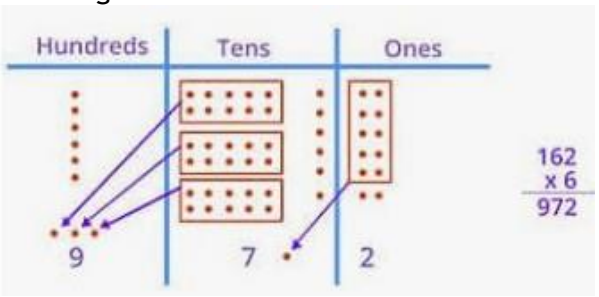
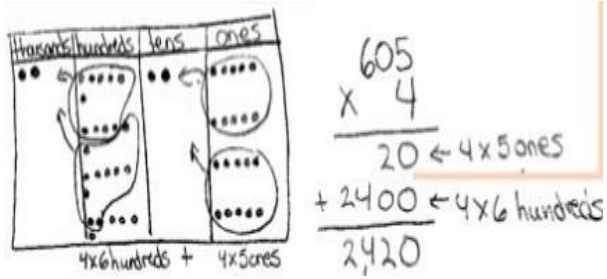
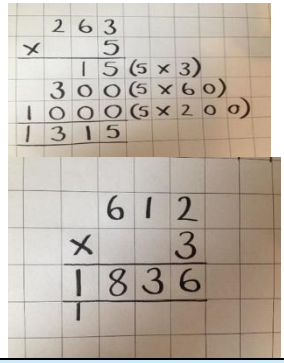
Children will begin to count objects in repeated sets:

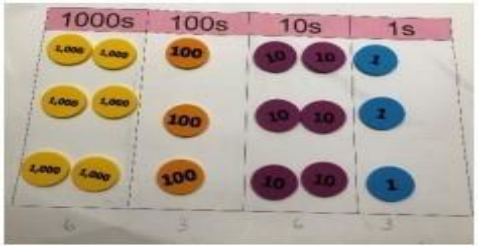
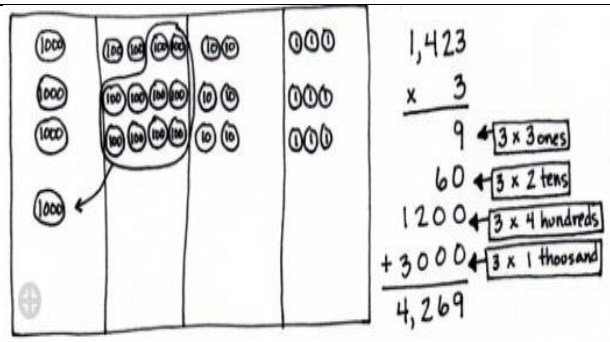
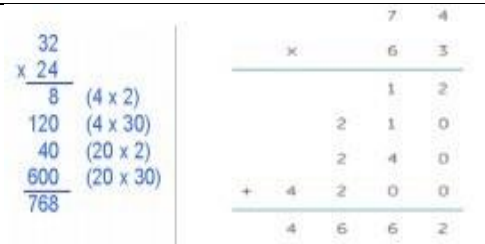
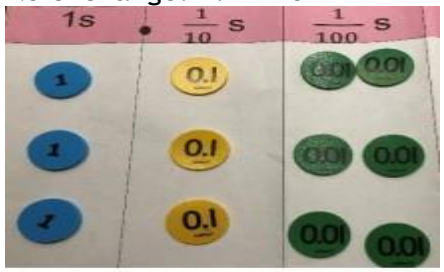
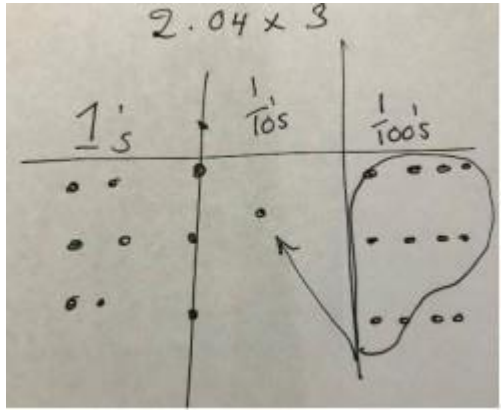
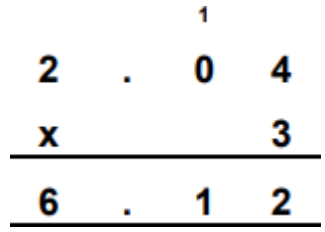
Using numicon to begin counting in repeated sets:

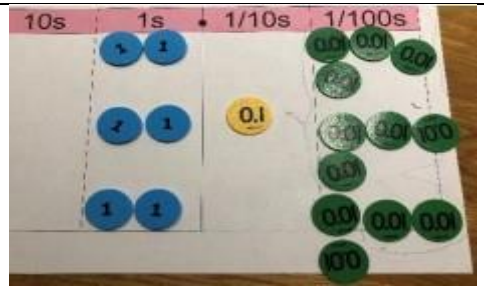
Year 1

Strategies	Concrete	Pictorial	Abstract
Repeated grouping/ repeated addition	Use manipulatives to make equal groups and count the total. 	Children to represent the practical resources in a picture. 	3 x 4 = 12 4 + 4+ 4 = 12

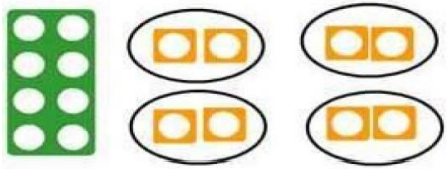
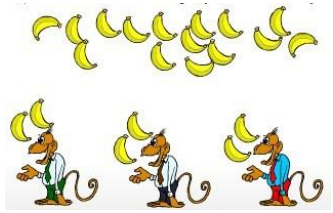
Year 2			
Strategies	**Concrete**	**Pictorial**	**Abstract**
Number line to show repeated addition.	Use Cuisenaire rods to show repeated groups above a ruler.  	Represent this pictorially alongside a number line.  	Abstract number line showing three jumps of four. 3 x 4 = 12 
Showing multiplication as an array. Exploring its commutative properties.	Objects, cubes, counters and cuisineraire rods can be used to make arrays.  	Children to represent the arrays pictorially.  5 x 2 = 2 x 5	Children to be able to use arrays to write a range of calculations e.g. 10 = 2 x 5 5 x 2 = 10 2 + 2 + 2 + 2 + 2 = 10 10 = 5 + 5
Year 3			
Strategies	**Concrete**	**Pictorial**	**Abstract**
Multiplying two digit numbers by one digit.	Use dienes or place value counters to show how we are finding groups of a number. Then start by counting the ones, then tens. Then progress to making exchanges.	Represent the dienes or place value counters pictorially; remembering to show what has been exchanged.	Expanded short multiplication leading to short multiplication. 

			
Year 4			
Strategies	**Concrete**	**Pictorial**	**Abstract**
Multiplying two and three digit numbers by one digit.	Use dienes or place value counters to show how we are finding groups of a number. Then start by counting the ones, then tens and hundreds. Then progress to making exchanges. 	Represent the dienes or place value counters pictorially; remembering to show what has been exchanged. 	Expanded Short Multiplication leading to Short Multiplication: 
Year 5			
Strategies	**Concrete**	**Pictorial**	**Abstract**
Multiply numbers up to 4	Pupils to use place value counters to represent 4 digit x 1 digit calculations.	Pupils to represent place value counters pictorially.	Consolidate short multiplication before moving on to expanded long multiplication:

digits by a one or two digit number.	2,121 x 3 = 		 Once secure introduce formal long multiplication: 124 x 26 becomes 1 2 4 x 2 6 7 4 4 2 4 8 0 3 2 2 4 1 1 Answer: 3224
Year 6			
Strategies	**Concrete**	**Pictorial**	**Abstract**
Multiply numbers up to 4 digits by a one or two digit number. (See Year 5) Multiplying decimals up to 2 places by a whole	Use place value counters to multiply decimals. No exchange: 1.12 x 3  With exchange: 2.04 x 3	Use pictorial representations. 	Formal method for multiplication. 

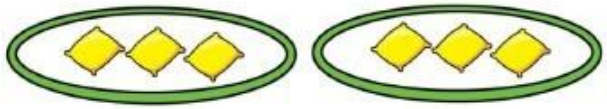
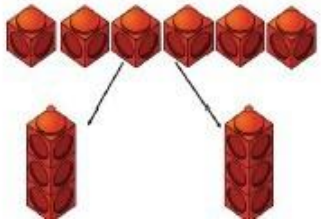
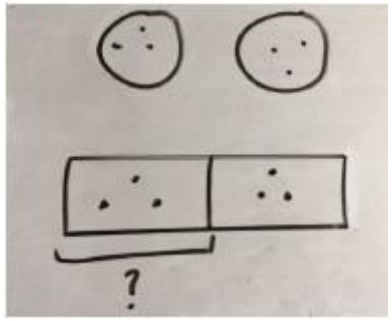
number.			

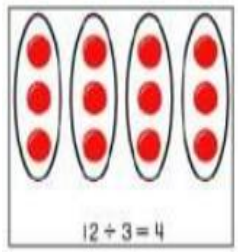
Division

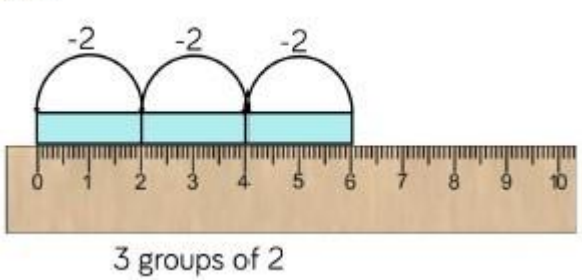
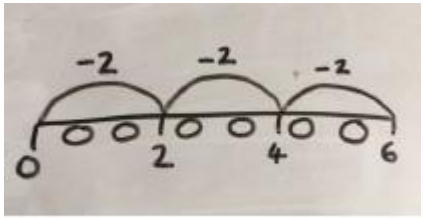
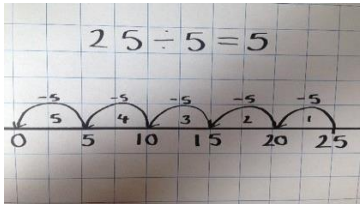
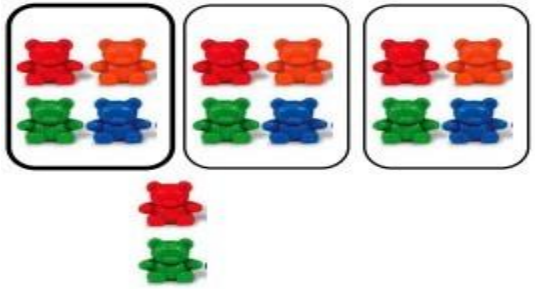
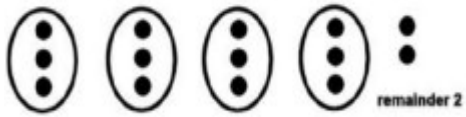
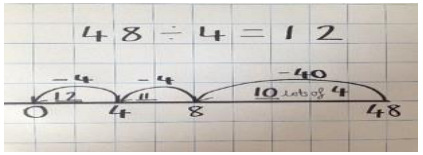
EYFS
Children will engage in a wide variety of songs and rhymes, games and activities. In practical activities and through discussion they will begin to solve problems involving halving and sharing. The children will understand sharing as giving everyone the same amount. Make use of everyday situations e.g. sharing fruit out at snack time, in the role play area, sharing out objects in a practical way.    

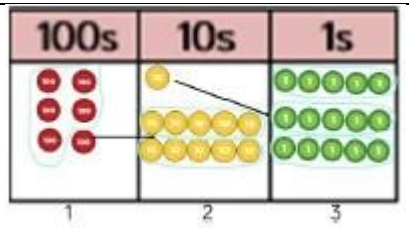
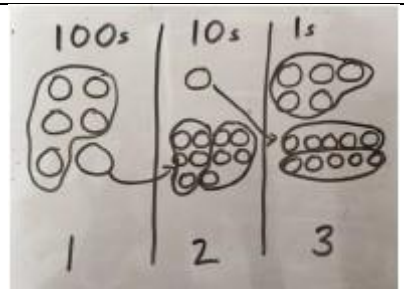
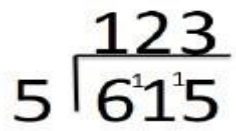
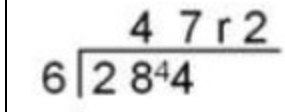
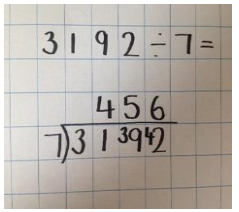
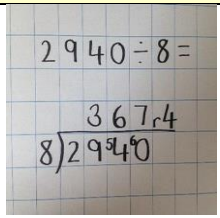
Share the apples between two people.

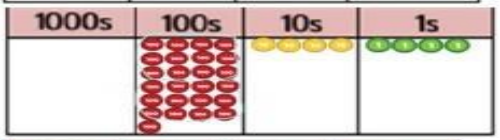
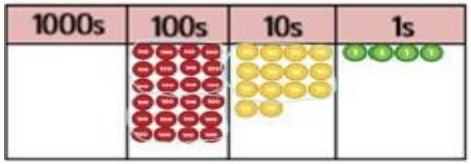
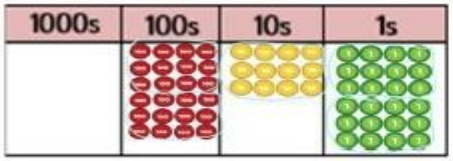
'Half the apples for me, half the apples for you.'

Year 1			
Strategies	**Concrete**	**Pictorial**	**Abstract**
Division as sharing.	Sharing using a range of resources.  	Represent the sharing pictorially. 	6 ÷ 2 = 3

Year 2			
Strategies	**Concrete**	**Pictorial**	**Abstract**
Showing division as an array. (division as grouping)	Numicon should be used to show how many groups of a number are in another number.  e.g. 6 ÷ 2 = 3 "How many groups of 2 are there in 6?"	Children to represent the arrays pictorially.  This represents 12 ÷ 3, posed as how many groups of 3 are in 12. Pupils should also know that the same array can represent 12 ÷ 4 if grouped horizontally.	Children to be able to use arrays to write a range of calculations e.g. 12 ÷ 3 = 4 12 ÷ 4 = 3 4 x 3 = 12 3 x 4 = 12

Number line to show repeated subtraction. (division as grouping)	Use Cuisenaire rods to show repeated groups above a ruler. 6 ÷ 2  	Represent this pictorially alongside a number line.  	Abstract number line showing repeated groups subtracted. 25 ÷ 5 = 5 
Year 3			
Strategies	**Concrete**	**Pictorial**	**Abstract**
Dividing two digit numbers by one digit including with remainders.	Divide objects between groups and see how much is left over. 	Children to carry out grouping pictorially using dots or crosses.  	Abstract number line showing repeated groups subtracted and remainder using times tables facts to help them.  Encourage children to take larger chunks using 'friendly' multiples of 2, 5 and 10. 
Year 4			
Strategies	**Concrete**	**Pictorial**	**Abstract**
Dividing two and three digit numbers using short division, including	Short division using place value counters to group. 615 ÷ 5 =	Represent the dienes or place value counters pictorially; remembering to show what has been exchanged.	Children to represent the calculation using the short division scaffold:

remainders.	 1. Make 615 with place value counters 2. How many groups of 5 hundreds can you make with 6 hundred counters? 3. Exchange 1 hundred for 10 tens. 4. How many groups of 5 tens can you make with 11 ten counters? 5. Exchange 1 ten for 10 ones. 6. How many groups of 5 ones can you make with 15 ones?		 Once the children are confident with this, they can then move on to using short division withremainders. 
Year 5			
Strategies	**Concrete**	**Pictorial**	**Abstract**
Divide four digit numbers by one digit including remainders.	Continue to use place value counters as in year 4.	Continue to represent place value counters pictorially as in year 4.	  Answers could also be given as remainders, decimals or fractions e.g. 2940 ÷ 8 = 367 r4 = 367 1/2 = 367.5
Year 6			
Strategies	**Concrete**	**Pictorial**	**Abstract**

Divide four digits numbers by two digit numbers using long division.	Use Place value counters alongside the calculation. 2544 ÷ 12  We can't group 2 thousands into groups of 12 so will exchange them.  We can group 24 hundreds into groups of 12 which leaves with 1 hundred. 02 12 | 2544 24 1  After exchanging the hundred, we have 14 tens. We can group 12 tens into a group of 12, which leaves 2 tens. 021 12 | 2544 24 14 12 2  After exchanging the 2 tens, we have 24 ones. We can group 24 ones into 2 group of 12, which leaves no remainder. 0212 12 | 2544 24 14 12 24 24 0

Note: