Meadowhead Community Infant School and Nusery

Calculation Policy

This policy has been largely adapted from the White Rose Maths Hub Calculation Policy with further material added. It is a working document and will be revised and amended as necessary. Progression within each area of calculation is in line with the programme of study in the 2014 National Curriculum. This calculation policy should be used to support children to develop a deep understanding of number and calculation. This policy has been designed to teach children through the use of concrete, pictorial and abstract representations.

Teaching for Mastery

At the centre of the mastery approach to the teaching of maths is the belief that all children have the potential to succeed. They should have access to the same curriculum content and, rather than being extended with new learning, they should deepen their conceptual understanding by tackling challenging and varied problems. Similarly, with calculation strategies, children must not simply rote learn procedures but demonstrate their understanding of these procedures through the use of concrete materials and pictorial representations. This policy outlines the different calculation strategies that should be taught and used across the school, which is in line with the requirements of the 2014 Primary National Curriculum.

Mathematical Language

The 2014 National Curriculum is explicit in articulating the importance of children using the correct mathematical language as a central part of their learning (reasoning). In certain year groups, the non-statutory guidance highlights the requirement for children to extend their language around certain concepts. It is therefore essential that teaching using the strategies outlined in this policy is accompanied by the use of appropriate and precise mathematical vocabulary. New vocabulary should be introduced in a suitable context (for example, with relevant, real objects, apparatus, pictures of diagrams) and explained carefully. High expectations of the mathematical language used are essential, with teachers only accepting what is

C.P.A Calculation Policy

This policy has been designed to teach children through the use of concrete, pictorial and abstract methods. This calculation policy should be used to support children to develop a deep understanding of number and calculation.

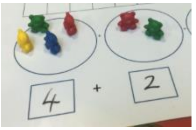
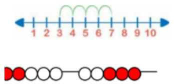
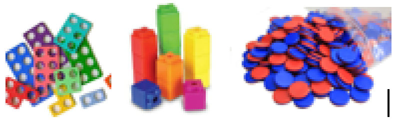
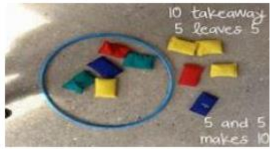
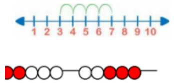
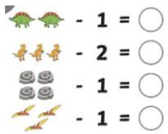
Using the Concrete-Pictorial-Abstract Approach: Children develop an understanding of a mathematical concept through the three steps of: concrete, pictorial and abstract approach. Reinforcement is achieved by going back and forth between these representations.

Concrete Representation: This is the first step in a child's learning. The child is introduced to an idea or skill by acting it out with real objects. This is a 'hands on' component using real objects and it is the foundation for conceptual understanding.

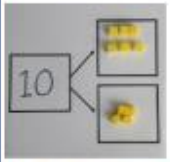
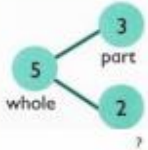
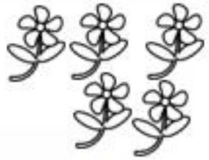
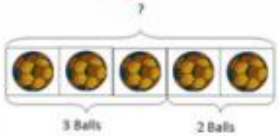
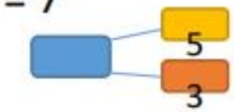
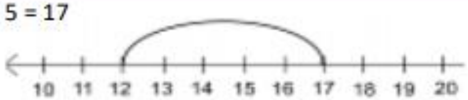
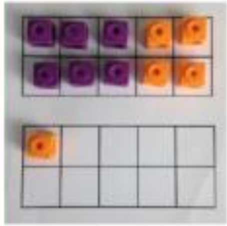
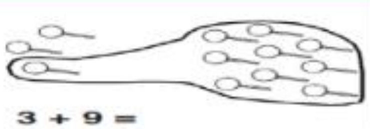
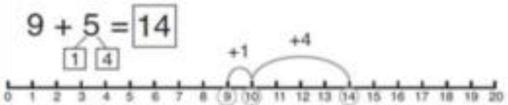
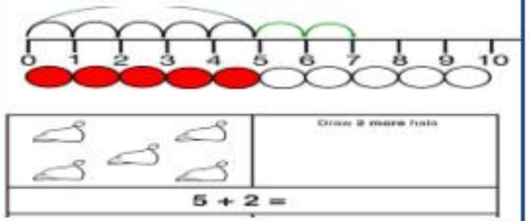
Pictorial Representation: Once the child has sufficiently understood the 'hands on' experience, they can be progressed onto relating them to pictorial representations, such as a diagram or a picture of the problem.

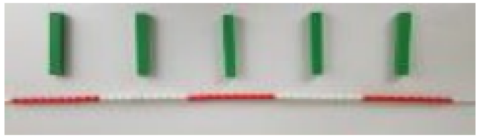
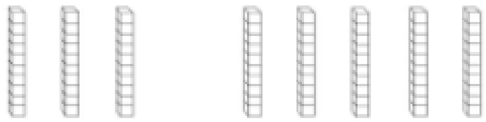
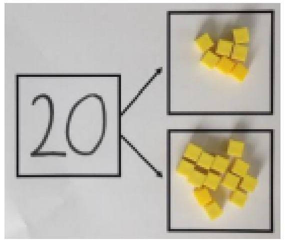
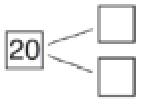
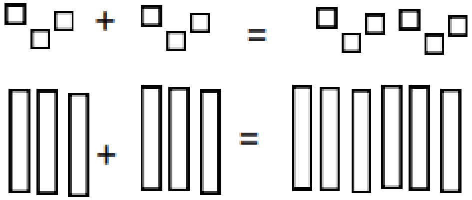
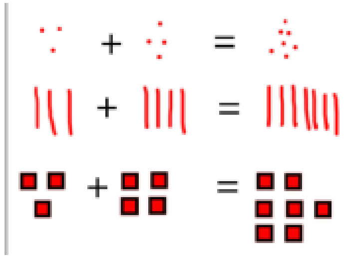
Abstract Representation: This is the third step in a child's learning. The child should now be capable of representing problems by using mathematical notation, for example: 12 ÷ 2 = 6

Nursery and Reception

Addition	Subtraction	Multiplication	Division
Children are encouraged to gain a sense of the number system through the use of counting concrete objects.  They combine objects in practical ways and count all.  They understand addition as counting on and will count on in ones and twos using objects, cubes, bead string and number line.  They use concrete and pictorial representation to record their calculations. They begin to use + and = They are encouraged to develop a mental picture of the number system in their heads to use for calculations. Higher attaining children may be able to represent their calculations using symbols and numbers within a written calculations.	Children are encouraged to gain a sense of the number system through the use of counting concrete objects.   They understand subtraction as counting out. They begin to count back in ones and twos using objects, cubes, bead string and number line.  They use concrete and pictorial representation to record their calculations. They begin to use - and =  They are encouraged to develop a mental picture of the number system in their heads to use for calculations. Higher attaining children may be able to represent their calculations using symbols and numbers within a written calculation.	Children use concrete objects to make and count equal groups of objects. They understand doubling as repeated addition. 2 + 2 = 4.  They use concrete and pictorial representation to record their calculations.  Higher attaining children may be able to represent their calculations using symbols and numbers within a written calculation.	Children use concrete objects to count and share equally into 2 groups. 6 cakes shared between 2 people each person gets 3 cakes. 6 ÷2 = 3  They count a set of objects and halve them by making two equal groups. They understand sharing and halving as dividing by 2. They will begin to use objects to make groups of 2 from a given amount.  They use concrete and pictorial representation to record their calculations. Higher attaining children may be able to represent their calculations using symbols and numbers within a written calculation.

Year 1 Addition

Objective & Strategy	Concrete	Pictorial	Abstract
Combining two parts to make a whole: part- whole model	   Use part part whole model. Use cubes to add two numbers together as a group or in a bar. 	    Use pictures to add two numbers together as a group or in a bar.	4 + 3 = 7  10= 6 + 4 Use the part-part whole diagram as shown above to move into the abstract.
Starting at the bigger number and counting on	 Start with the larger number on the bead string and then count on to the smaller number 1 by 1 to find the answer.	12 + 5 = 17  Start at the larger number on the number line and count on in ones or in one jump to find the answer.	5 + 12 = 17 Place the larger number in your head and count on the smaller number to find your answer.
Regrouping to make 10. *This is an essential skill for column addition later.*	 6 + 5 = 11  Start with the bigger number and use the smaller number to make 10. Use ten frames.	 Use pictures or a number line. Regroup or partition the smaller number using the part part whole model to make 10. 	7 + 4= 11 If I am at seven, how many more do I need to make 10. How many more do I add on now?
Represent & use number bonds and related subtraction facts within 20	 2 more than 5.		Emphasis should be on the language *'1 more than 5 is equal to 6.'* *'2 more than 5 is 7.'* *'8 is 3 more than 5.'*

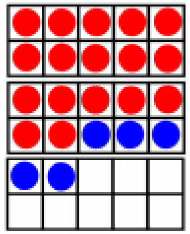
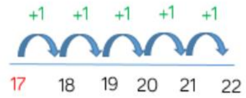
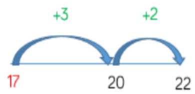
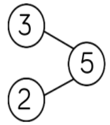
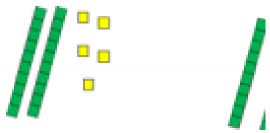
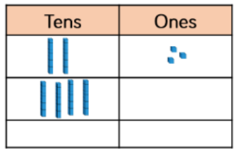
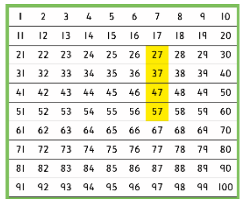
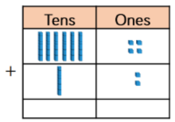
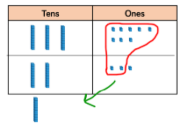
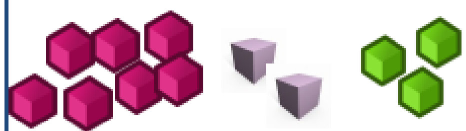
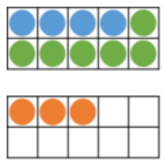
Objective & Strategy	Concrete	Pictorial	Abstract
Adding multiples of ten	50= 30 = 20  Model using dienes and bead strings	 3 tens + 5 tens = _____ tens 30 + 50 = _____ Use representations for base ten.	20 + 30 = 50 70 = 50 + 20 40 + □ = 60
Use known number facts Part part whole	 Children explore ways of making numbers within 20	 □ + □ = 20 20 – □ = □ □ + □ = 20 20 – □ = □	□ + 1 = 16 16 – 1 = □ 1 + □ = 16 16 – □ = 1
Using known facts		 Children draw representations of H,T and O	3 + 4 = 7 *leads to* 30 + 40 = 70 *leads to* 300 + 400 = 700

Year 2

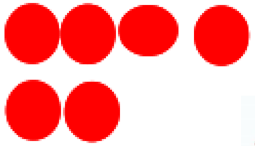
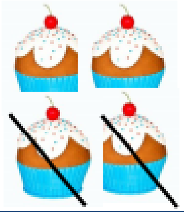
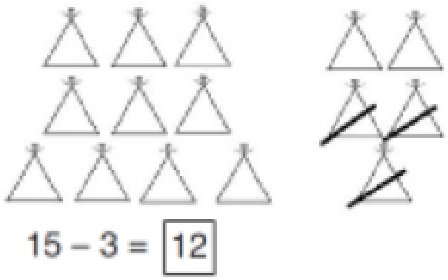
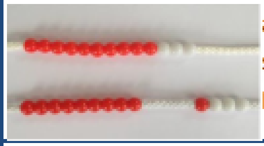
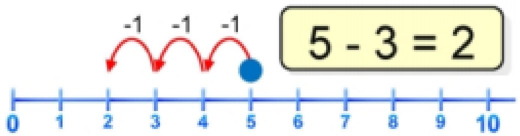
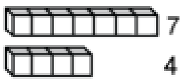
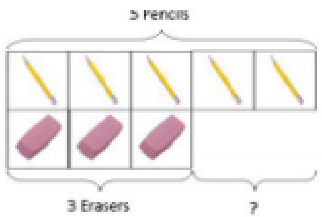
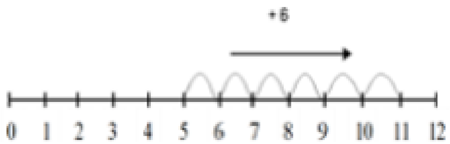
Addition

Year 2

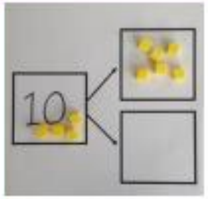
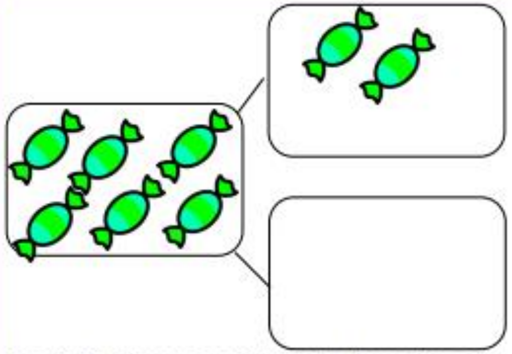
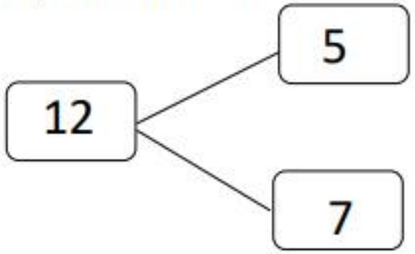
Addition

Objective & Strategy	Concrete	Pictorial	Abstract
Add a two digit number and ones	 17 + 5 = 22 Use ten frame to make 'magic ten Children explore the pattern. 17 + 5 = 22 27 + 5 = 32	17 + 5 =   We can partition 5 into 3 and 2 and use this to bridge the 10  	17 + 5 = 22 Explore related facts 17 + 5 = 22 5 + 17 = 22 22—17 = 5 22—5 = 17
Add a 2 digit number and tens	 25 + 10 = 35 Explore that the ones digit does not change	 	27 + 10 = 37 27 + 20 = 47 27 + □ = 57 $\begin{array}{r} 23 \\ +\,40 \\ \hline \\ \hline \end{array}$
Add two 2-digit numbers	 Model using dienes , place value counters and numicon	  Children draw their own sticks and dots to represent base 10.	T O $\begin{array}{r} 14 \\ +\,23 \\ \hline 37 \end{array}$ T O $\begin{array}{r} 78 \\ +\,15 \\ \hline 93 \\ {\scriptstyle 1} \end{array}$
Add three 1-digit numbers	 Combine to make 10 first if possible, or bridge 1o then add third digit	3 + 4 + 6 =  4 + 6 = 10 10 + 3 = 13	4 + 7 + 6 = $\boxed{10}$ + $\boxed{7}$ 10 = $\boxed{17}$ Combine the two numbers that make/ bridge ten then add on the third.

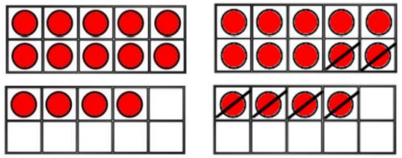
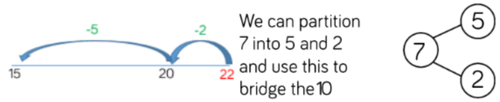
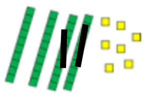
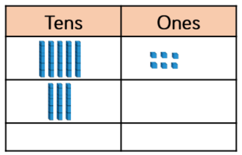
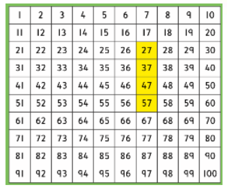
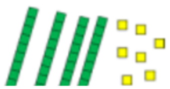
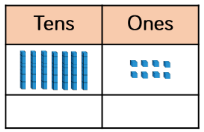
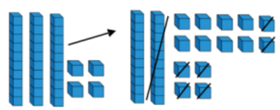
Year 1 Subtraction

Objective & Strategy	Concrete	Pictorial	Abstract
Taking away ones.	Use physical objects, counters , cubes etc to show how objects can be taken away.  6—4 = 2  4—2 = 2	 Cross out drawn objects to show what has been taken away.	7—4 = 3 16—9 = 7
Counting back	 Move objects away from the group, counting backwards.  Move the beads along the bead string as you count backwards.	 Count back in ones using a number line.	Put 13 in your head, count back 4. What number are you at?
Find the Difference	Compare objects and amounts  'Seven is 3 more than four' 'I am 2 years older than my sister'  Lay objects to represent bar model.	Count on using a number line to find the difference. 	Hannah has12 sweets and her sister has 5. How many more does Hannah have than her sister.?

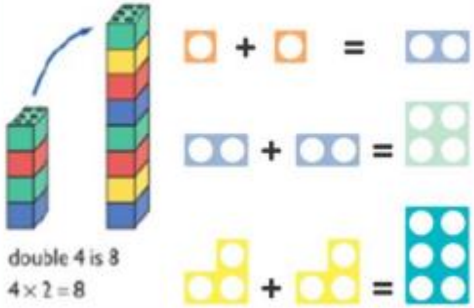
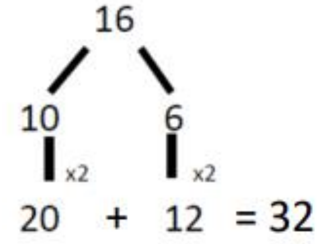
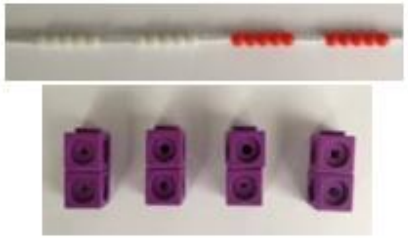
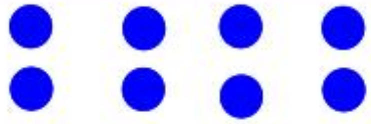
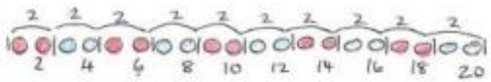
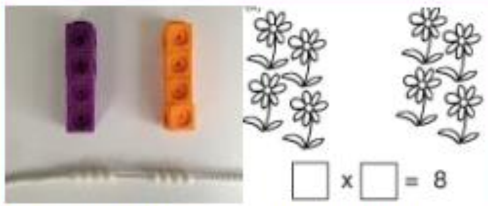
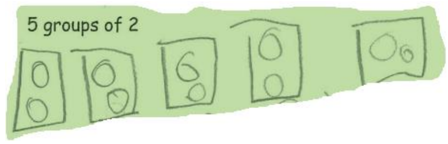
Year 1 Subtraction

Objective & Strategy	Concrete	Pictorial	Abstract
Represent and use number bonds and related subtraction facts within 20 Part Part Whole model	 Link to addition. Use PPW model to model the inverse. If 10 is the whole and 6 is one of the arts, what s the other part? 10—6 = 4	 Use pictorial representations to show the part.	Move to using numbers within the part whole model. 
Make 10	14—9  Make 14 on the ten frame. Take 4 away to make ten, then take one more away so that you have taken 5.	13—7  Jump back 3 first, then another 4. Use ten as the stopping point.	16—8 How many do we take off first to get to 10? How many left to take off?

Year 2 Subtraction

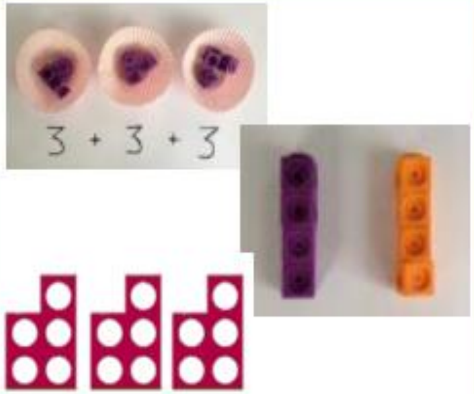
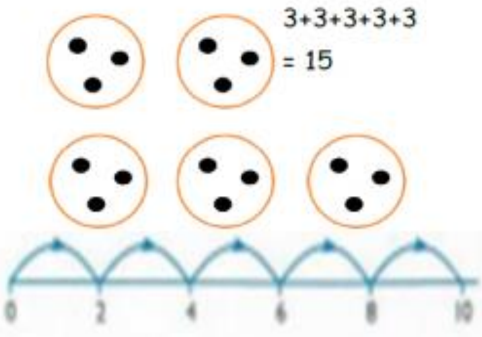
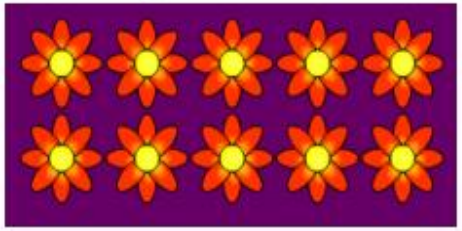
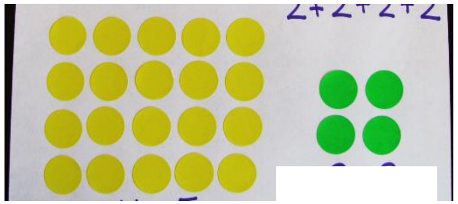
Objective & Strategy	Concrete	Pictorial	Abstract
Subtract a 1-digit number from a 2-digit number.	 Physically move counters on and off tens frame.	22- 7= 	20—4 = 16 20 – 16 = 4
Subtract a 2-digit number and tens	 47 – 20= Children take base 10 away.	 	47 – 40 = 7 47 – 30 = 17 47 – 20 = 27 $\begin{array}{rr} 5 & 6 \\ -\,3 & 0 \\ \hline \end{array}$
Subtract two 2 digit numbers	 47 – 25= Children take base 10 away. For bridging 10 children exchange 1 ten for 10 ones.	 Take 16 away from 34 	$\begin{array}{c\|c\|c} & T & O \\ & 2 & 5 \\ - & 1 & 3 \\ \hline & \mathbf{1} & \mathbf{2} \end{array}$ $\begin{array}{rr} T & O \\ \cancel{3} & {}^{1}4 \\ -\,1 & 6 \\ \hline 1 & 8 \end{array}$

Year 1 Multiplication

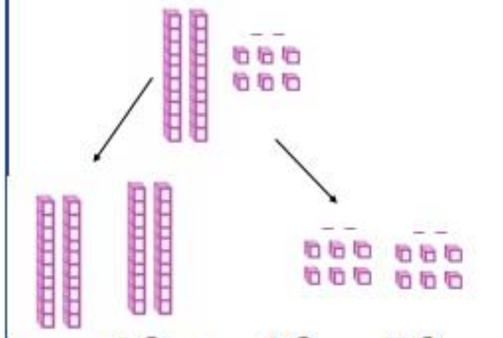
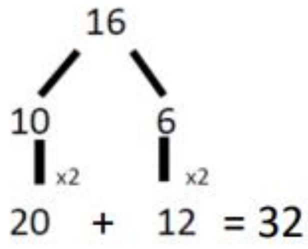
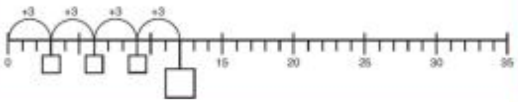
Objective & Strategy	Concrete	Pictorial	Abstract
Doubling	Use practical activities using manipultives including cubes and Numicon to demonstrate doubling 	Draw pictures to show how to double numbers Double 4 is 8 	Partition a number and then double each part before recombining it back together. 
Counting in multiples	Count the groups as children are skip counting, children may use their fingers as they are skip counting. 	 Children make representations to show counting in multiples. 	Count in multiples of a number aloud. Write sequences with multiples of numbers. 2, 4, 6, 8, 10 5, 10, 15, 20, 25 , 30
Making equal groups and counting the total	 Use manipulatives to create equal groups.	 There are ______ equal groups. There are _____ in each group. There are _______ altogether.	Children count in multiples to find the answer.

Year

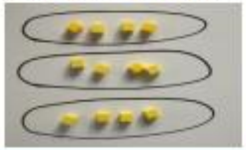
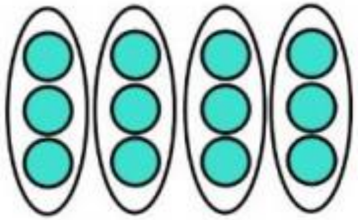
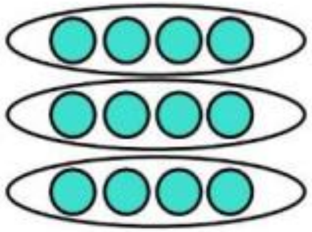
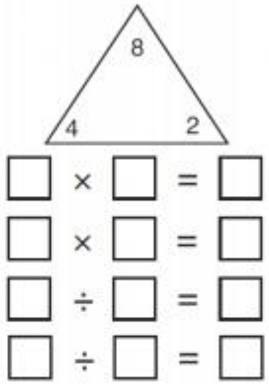
1

Objective & Strategy	Concrete	Pictorial	Abstract
Repeated addition	 Use different objects to add equal groups	Use pictorial including number lines to solve prob There are 3 sweets in one bag. How many sweets are in 5 bags altogether? 	Write addition sentences to describe objects and pictures. 
Understanding arrays	Use objects laid out in arrays to find the answers to 2 lots 5, 3 lots of 2 etc. 		Children record repeated addition 5 + 5 + 5 + 5 = 20 OR 4 + 4 + 4 + 4 + 4 = 20

1`

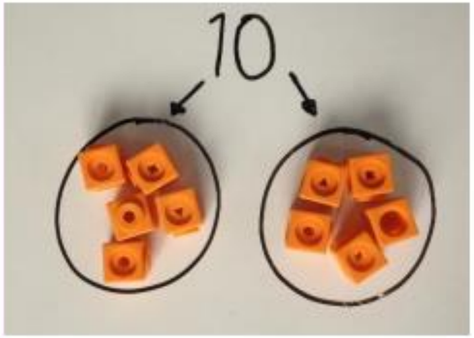
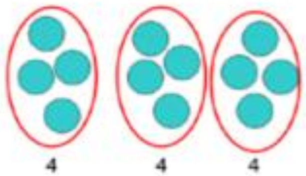
Objective & Strategy	Concrete	Pictorial	Abstract
Doubling	Model doubling using dienes and PV counters.  40 + 12 = 52	Draw pictures and representations to show how to double numbers	Partition a number and then double each part before recombining it back together. 
Counting in multiples of 2, 3, 5 and 10	Count the groups as children are skip counting, children may use their fingers as they are skip counting. Use bar models.  5 + 5 + 5 + 5 + 5 + 5 + 5 + 5 = 40 	Number lines, counting sticks and bar models should be used to show representation of counting in multiples.    	Count in multiples of a number aloud. Write sequences with multiples of numbers. 0, 2, 4, 6, 8, 10 0, 3, 6, 9, 12, 15 0, 5, 10, 15, 20, 25 , 30

Year 2

Objective & Strategy	Concrete	Pictorial	Abstract
Multiplication is commutative	Create arrays using counters and cubes and Numicon.    Pupils should understand that an array can represent different equations and that, as multiplication is commutative, the order of the multiplication does not affect the answer.  	Use representations of arrays to show different calculations and explore commutativity.  	12 = 3 × 4 12 = 4 × 3 Use an array to write multiplication sentences and reinforce repeated addition.  5 + 5 + 5 = 15 3 + 3 + 3 + 3 + 3 = 15 5 x 3 = 15 3 x 5 = 15
Using the Inverse *This should be taught alongside division, so pupils learn how they work alongside each other.*			2 x 4 = 8 4 x 2 = 8 8 ÷ 2 = 4 8 ÷ 4 = 2 8 = 2 x 4 8 = 4 x 2 2 = 8 ÷ 4 4 = 8÷ 2 Show all 8 related fact family sentences.

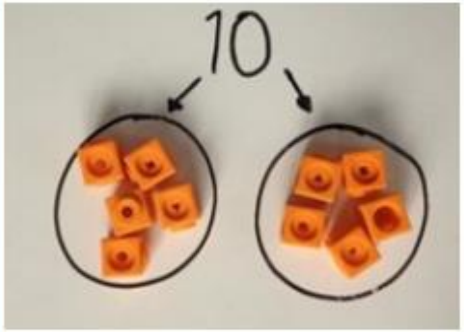
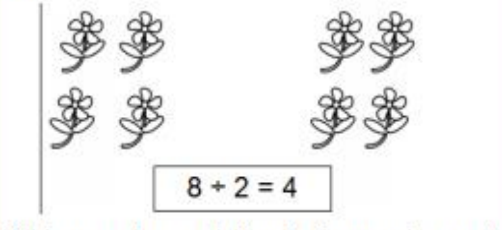
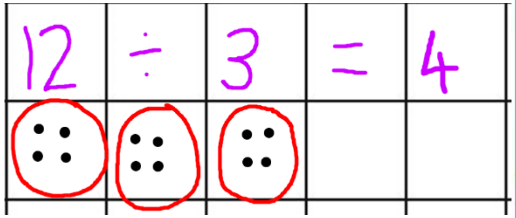
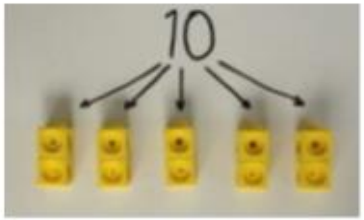
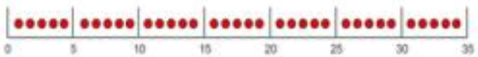
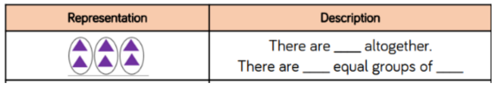
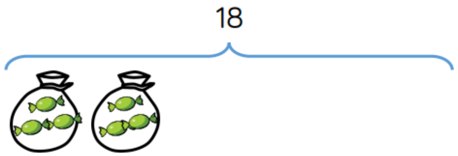
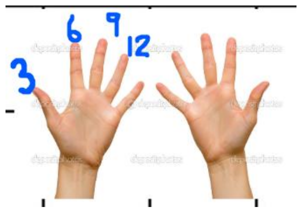
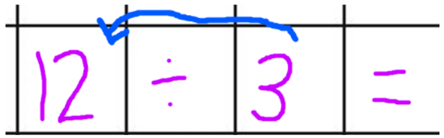
Year 1

Division

Objective & Strategy	Concrete	Pictorial	Abstract
Division as sharing *Use Gordon ITPs for modelling*	   I have 10 cubes, can you share them equally in 2 groups?	Children use pictures or shapes to share quantities.  8 shared between 2 is 4 Sharing:  12 shared between 3 is 4	12 shared between 3 is 4

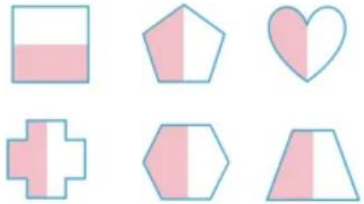
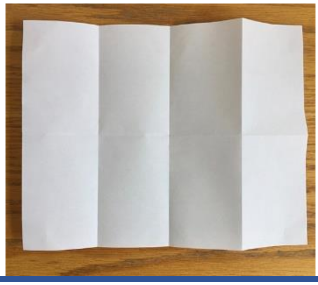
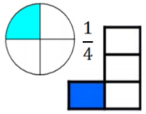
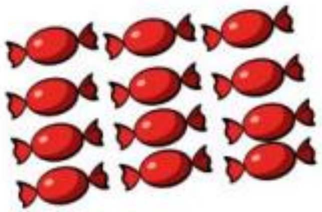
Year 2

Division

Objective & Strategy	Concrete	Pictorial	Abstract
Division as sharing	 I have 10 cubes, can you share them equally in 2 groups?	Children use pictures or shapes to share quantities.   	$12 \div 3 = 4$
Division as grouping	Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.   	 $18 \div 3 =$   	$18 \div 3 =$ Divide 18 into 3 groups. How many are there in each group?  Children use fingers to count up in multiples of 3 until they reach 12.

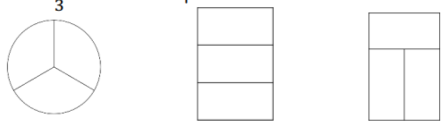
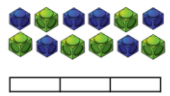
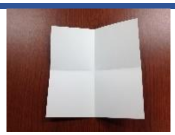
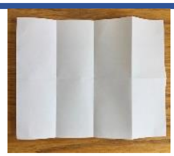
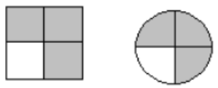
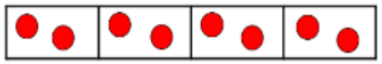
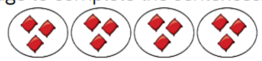
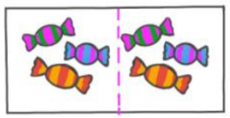
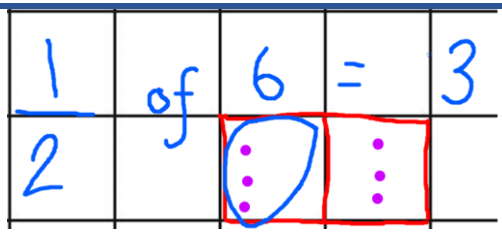
Year 1

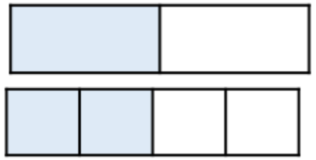
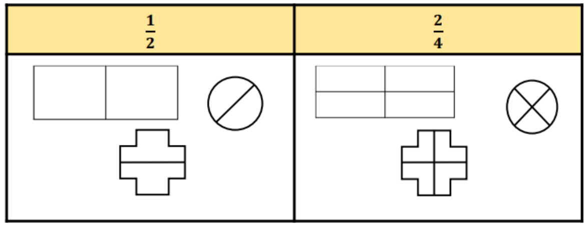
Fractions

Objective and Strategy	Concrete	Abstract	Pictorial
Finding ½	Using real objects showing children how they can be cut into halves.  	Shading or splitting shapes into halves.  Finding halves of amounts 	Share each quantity into 2 equal  There are ____ marbles. Half of ____ is ____ Groups.
Finding ¼	 	Shading or splitting shapes into ¼  Finding ¼ of amounts. 	Share each quantity into four equal groups.  There are __ cakes. There is __ cake in each quarter. A quarter of __ is __

Year 2

Fractions

Objective and Strategy	Concrete	Pictorial	Abstract
Finding 1/3	 	Shading or splitting shapes into thirds. Shade $\frac{1}{3}$ of each shape.  Finding thirds of amounts 	Use the cubes to make three equal groups.  There are ___ cubes altogether. One third of ____ is ____ $\frac{\square}{\square}$ of ___ is ___
Finding ¾	 	Shading or splitting shapes into 3/ 4  Finding 3/4 of amounts. 	Amir shares 12 beanbags into 4 equal groups. Use the image to complete the sentences.  There are ___ bean bags altogether. Three quarters of __ is ___
Finding a fraction of a number.	Sharing cubes, counters, objects into the equal groups. ½ of 6= 	 	$\frac{1}{2}$ of 4 = $\square$ $\frac{1}{2}$ of 40 = $\square$ $\frac{1}{2}$ of 6 = $\square$ $\frac{1}{2}$ of 60 = $\square$ $\frac{1}{2}$ of 8 = $\square$ $\frac{1}{2}$ of 80 = $\square$ Children to take note of numerator and denominator

Equivalence of ½ and 2/4	Using strips of paper  Also use counters/cubes sort into ½ and 2/4 what do you notice?	Shade one half and two quarters of each shape. 	1/ 2 = to 2/4