Valley End C of E School Maths Written Calculation Policy

Updated 2022-23

This Policy supports the White Rose Maths scheme used throughout Valley End School. 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.

- Concrete representation— a pupil is first introduced to an idea or skill by acting it out with real objects. This is a ‘hands on’ component using real objects and is a foundation for conceptual understanding.
- Pictorial representation – 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.
- Abstract representation—a pupil is now capable of representing problems by using mathematical notation, for example 12 x 2 = 24.

It is important that conceptual understanding, supported by the use of representation, is secure for all procedures. Reinforcement is achieved by going back and forth between these representations.

Mathematics Mastery

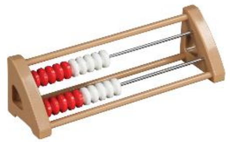
At the centre of the Mastery Approach to the teaching of Mathematics, is the belief that all children have the potential to succeed. They should have access to the same curriculum content and, rather than being extended with new learning, they should deepen their conceptual understanding by tackling 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 in EYFS, Year 1 and Year 2, in line with the requirements of the EYFS Reforms Curriculum and the 2014 Primary National Curriculum.

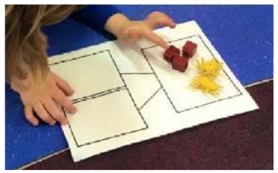
How to use the Policy:

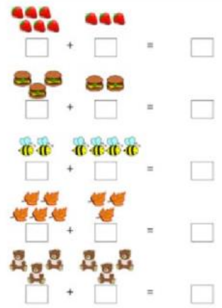
This Mathematics Policy is a guide for all staff at Valley End C of E Infant School and has been adapted from work by the NCETM. All teachers have been given the Scheme of Work from the White Rose Maths Hub and are required to base their planning around their year group’s modules and not to move onto a higher year group’s scheme work. These modules use the Singapore Maths Methods and are affiliated to the workings of the 2014 Maths Programme of Study. Teachers can use any teaching resources that they wish to use and the policy does not recommend one set of resources over another, rather that, a variety of resources are used. For each of the four rules of number, different strategies are laid out, together with examples of what concrete materials can be used and how, along with suggested pictorial representations. The principle of the concrete-pictorial-abstract (CPA) approach [Make it, Draw it, Write it] is for children to have a true understanding of a mathematical concept, they need to master all three phases within a year group’s Scheme of Work.

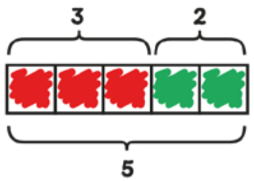
<table>
<tr><th colspan="4">Addition - EYFS</th></tr>
<tr><th>Objectives</th><th>Concrete</th><th>Pictorial</th><th>Abstract</th></tr>
<tr>
<td>Knows that a group of things change in quantity when something is added.
- Find the total number of items in two groups by counting all of them.
- Says the number that is one more than a given number.
Finds one more from a group of up to five objects, then ten objects.
- In practical activities and discussion, beginning to use the vocabulary involved in adding.
- Using quantities and objects, they add two single digit numbers and count on to find the answer.

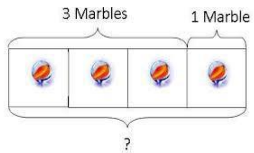
- Solve problems including doubling.</td>
<td>
Use toys and general classroom resources for children to physically manipulate, group/regroup.

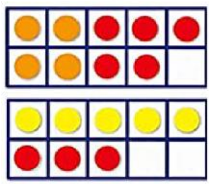
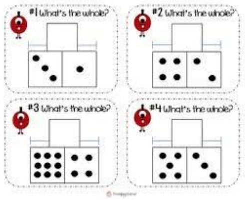
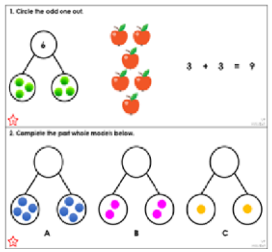
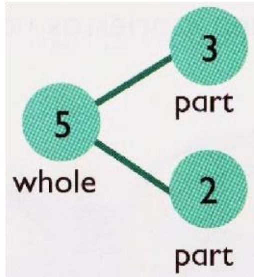
Use specific maths resources such as counters, snap Multilink, Numicon and Rekenreks etc.


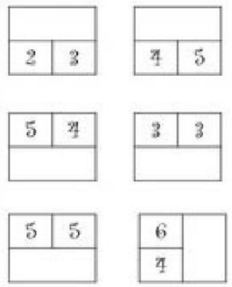



Use visual supports such as ten frames, part part whole and addition mats, with the physical objects and resources that can be manipulated.</td>
<td>

Two groups of pictures so children are able to count the total.




Bar model using visuals, pictures/icons or colours.

Use visual supports such as ten frames, part part whole and addition mats with pictures/icons.

</td>
<td>A focus on symbols and numbers to form a calculation.
$5+2=7$




No expectation for children to be able to record a number sentence/addition calculation.</td>
</tr>
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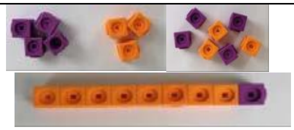
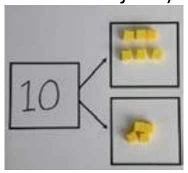
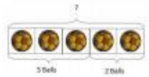
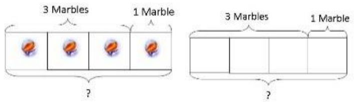
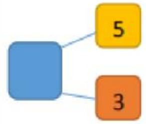
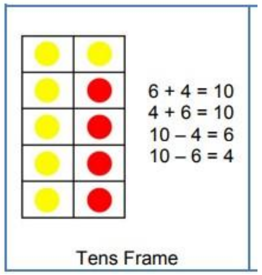
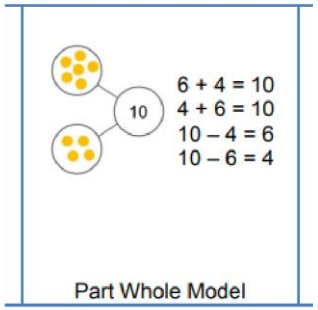
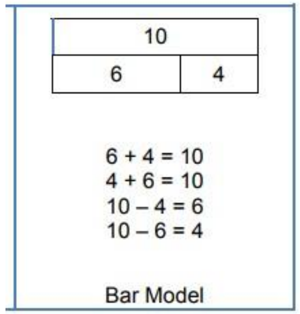
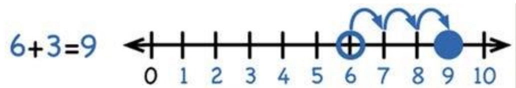
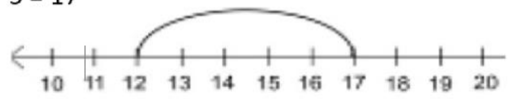
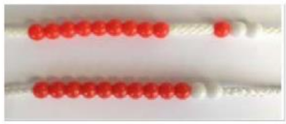
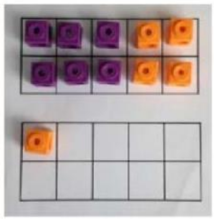
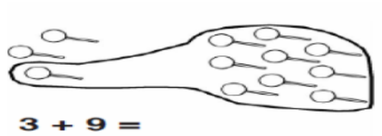
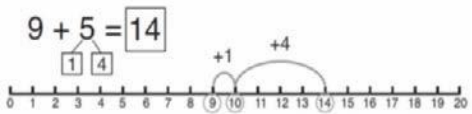
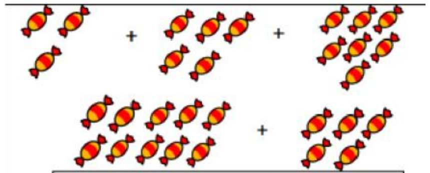
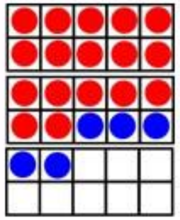
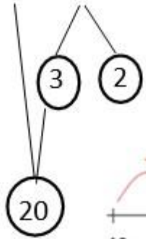
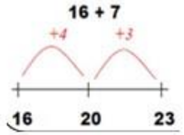
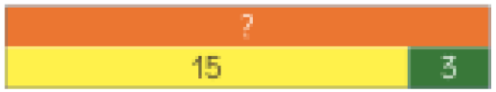
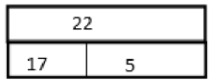
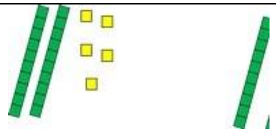
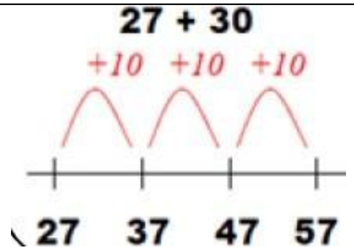
Addition- Year 1

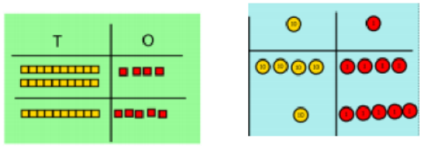
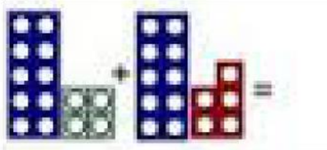
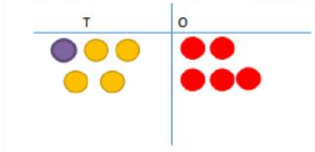
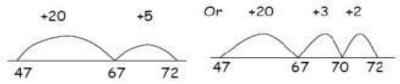
Objective and Strategy	Concrete	Pictorial	Abstract
Combining two parts to make a whole: part- whole model	 Use cubes to add two numbers together as a group or in a bar. (Some children may still need to use real objects)  Use part-part whole model	 Use pictures to add two numbers together as a group or in a bar.   <u>The Bar Model</u> will be continued from EYFS as a method to support problem solving involving addition, continuing with the concrete representations and moving onto using pictorial representations of objects. Some children will also move onto the abstract. Pictorial Abstract  (concrete)	 Use the part-part whole diagram as shown above to move into the abstract. **4 + 3 = 7** **10= 6 + 4**
Represent and use number bonds and related subtraction facts within 20	 (Some children may need to initially use real objects then move onto the representation, egg boxes may also be used to support this)	 	 Bar model and part-part whole to be used alongside abstract
Addition and subtraction of one-digit and two-digit numbers to 20 including		 Start at the larger number on the number line and count on in ones.	5 + 12 = 17 17= 12 + 5

0.			
Start at the bigger number and counting on	Start with the larger number on the bead string and then count of 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.	Place the larger number in your head and count on the smaller number to find your answer.
Regrouping to make 10 (The 'Make 10' strategy)	 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?
Vocabulary	add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, balancing, part, part, whole		

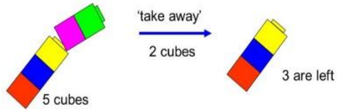
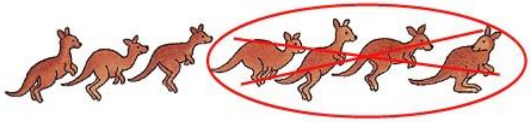
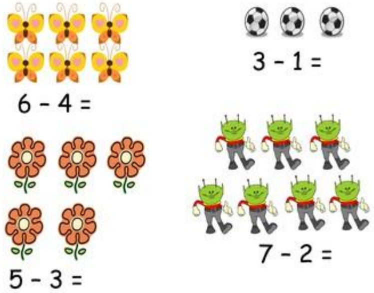
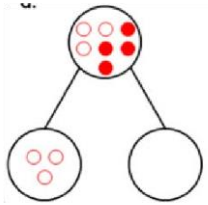
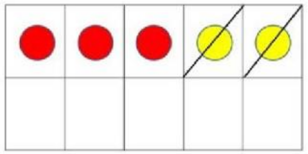
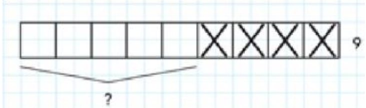
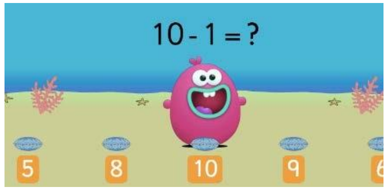
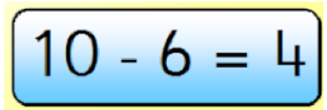
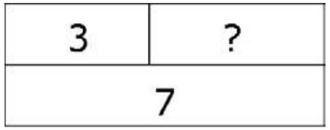
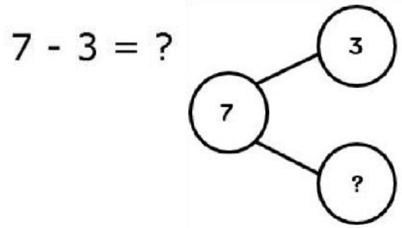
Addition- Year 2

Objective and Strategy	Concrete	Pictorial	Abstract
Adding 3 1-digit numbers	**4 + 7 + 6= 17** Put 4 and 6 together to make 10. Add on 7.  Following on from making 10, make 10 with 2 of the digits (if possible) then add on the third digit.	 Add together three groups of objects. Draw a picture to recombine the groups to make 10.	$4 + 7 + 6 = \boxed{10} + \boxed{7}$ 10 $= \boxed{17}$ Combine the two numbers that make 10 and then add on the remainder.
Adding a 2-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 = 22 Use part part whole and number line to model.    Bar Model	17 + 5 = 22 Explore related facts 17 + 5 = 22 5 + 17 = 22 22—17 = 5 22—5 = 17 

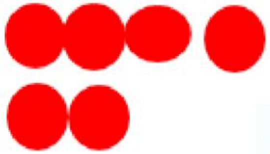
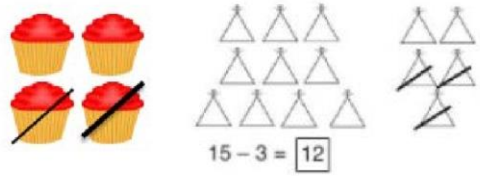
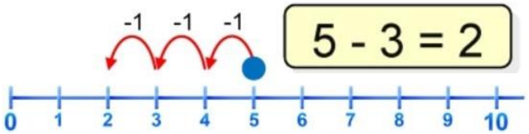
Adding a 2-digit number and multiples of 10	 25 + 10 = 35 Explore that the ones digit does not change	 Base 10 may be used above the number line initially. The calculation will be shown alongside the number line to see the connection	27 + 10 = 37 27 + 20 = 47 27 + □ = 57

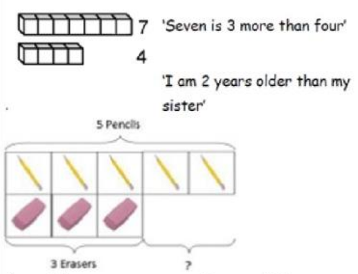
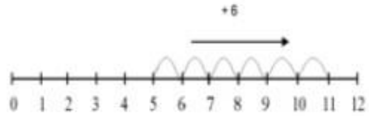
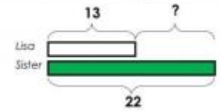
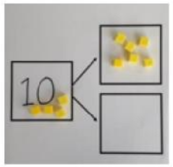
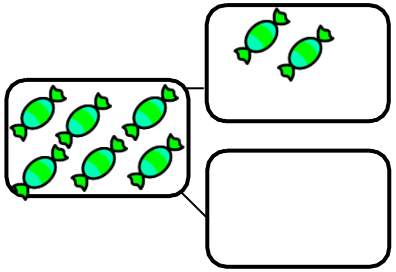
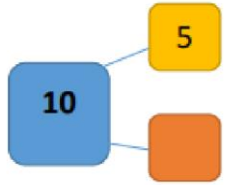
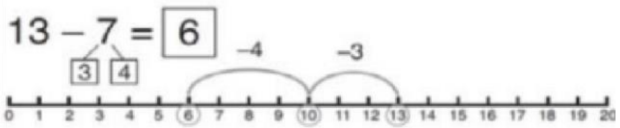
Adding two 2-digit numbers (No re-grouping)	**24 + 15=** Add together the ones first then add the tens. Use the Base 10 blocks first before moving onto place value counters.  (Some children may not be ready for place value counters in Y2) Numicon may also be used 	After practically using the base 10 blocks and place value counters, children can draw the counters to help them to solve additions.   Use number line and bridge ten using part whole if necessary. Base 10 may be used above the number line. The calculation will be shown alongside the number line to see the connection **Model** | **Calculation** The Bar Model (Singapore maths) will be used to support problem solving moving onto the generalisation that b+c=a. Children will focus on using the abstract representation with the pictorial to support where necessary.	25 + 47 20 + 5 40 + 7 20 + 40 = 60 5+ 7 =12 60 + 12 = 72 Partitioning: *Recording addition in columns supports place value and prepares for formal written methods with larger numbers.* Toward the end of the year, children move to more formal recording using partitioning method: 40 + 7 30 + 5 70 + 12
Vocabulary	add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, addition, column, tens boundary		

Subtraction- EYFS

Objectives	Concrete	Pictorial	Abstract
- Knows that a group of things change in quantity when something is taken away - Find one less from a group of five objects, then ten objects. - In practical activities and discussion, beginning to use the vocabulary involved in subtracting. - Using quantities and objects, they subtract two single digit numbers and count back to find the answer.	   Use toys and general classroom resources for children to physically manipulate, group/regroup.    Use specific maths resources such as Multilink, Rekenreks, Numicon, bead strings etc.   Use visual supports such as ten frames, part part whole and subtraction mats, with the physical objects and resources that can be manipulated.	  A group of pictures for children to cross out or cover quantities to support subtraction.    Use visual supports such as ten frames, part part whole and bar model with pictures/icons.	A focus on symbols and numbers to form a calculation.     * No expectation for children to be able to record a number sentence/addition calculation.

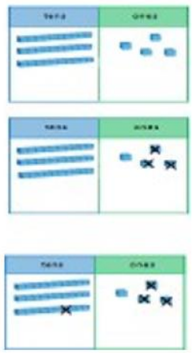
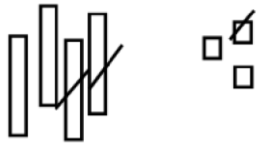
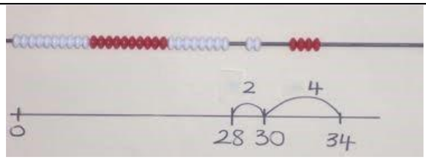
Subtraction- Year 1			
Objective and Strategy	**Concrete**	**Pictorial**	**Abstract**

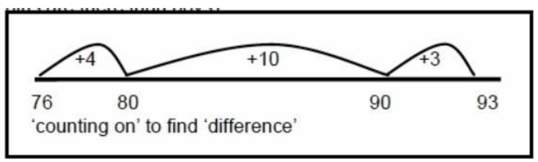
Subtract one-digit and two-digit numbers to 20, including 0. Taking away ones	Use physical objects, counters , cubes etc to show how objects can be taken away.  6—4 = 2  4—2 = 2	Cross out drawn objects to show what has been taken away. 	7—4 = 3 16—9 = 7
Counting back	Make the larger number in your subtraction. Move the beads along your bead string as you count backwards in ones. **13 – 4**  Use counters and move them away from the group as you take ther away counting backwards as you go. 	 Count back on a number line or track Start at the bigger number and count back the smaller number showing the jumps on the number line.	Put 13 in your head, count back 4. What number are you at? (Use your fingers to help you)

Find the difference	Compare objects and amounts  Lay objects to represent bar model.	 Count on to find the difference. Comparison Bar Models Draw bars to find the difference between 2 numbers. Lisa is 13 years old. Her sister is 22 years old. Find the difference in age between them.  	Hannah has12 sweets and her sister has 5. How many more does Hannah have than her sister?
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 a pictorial representation of objects to show the part-part whole model	 Move to using numbers within the part whole model.
Make 10	**14 – 9 =**  Make 14 on the ten frame. Take away the four first to make 10 and then takeaway one more so you have taken away 5. You are left with the answer of 9.	 Start at 13. Take away 3 to reach 10. Then take away the remaining 4 so you have taken away 7 altogether. You have reached your answer.	16 – 8= How many do we take off to reach the next 10? How many do we have left to take off?

Vocabulary	equal to, take, take-away, less, minus, subtract, leaves, distance between, how many more, how many fewer/less than, most, least count back, how many left, how much less is…

<table>
<tr><th colspan="4">Subtraction- Year 2</th></tr>
<tr><th>Objective and Strategy</th><th>Concrete</th><th>Pictorial</th><th>Abstract</th></tr>
<tr>
<td>Subtract a two-digit number and ones, a twodigit number and tens, two two-digit numbers

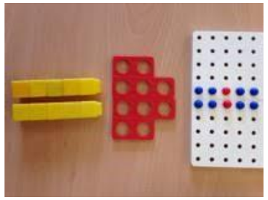
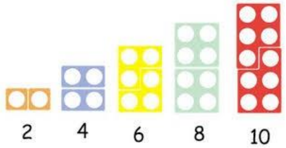
Partitioning to subtract without re-
Grouping: ‘Friendly numbers’</td>
<td>34—13 = 21

Use Dienes to show how to partition the number when subtracting without regrouping.
The calculation will be shown alongside the manipulative used
<table><tr><th>Model</th><th>Calculation</th></tr><tr><td></td><td></td></tr></table></td>
<td>Children draw representations of Dienes and cross off.

43—21 = 22</td>
<td>43—21 = 22
Recording subtraction in columns supports place value and prepares for formal written methods with larger numbers.
Toward the end of the year, children move to more formal recording using partitioning method:
e.g. 43-21=22
40 and 3
-20 and 1
20 and 2</td>
</tr>
<tr>
<td>Make ten strategy</td>
<td>

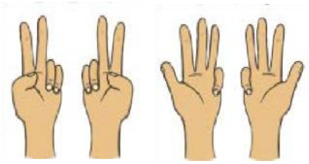
34—28
Use a bead bar or bead strings to model counting to next ten and the rest.</td>
<td>

Use a number line to count on to next ten and then the rest.</td>
<td>93—76 = 17</td>
</tr>
<tr><td>Vocabulary</td><td colspan="3">equal to, take, take-away, less, minus, subtract, leaves, distance between, how many more, how many fewer/less than, most, least count back, how many left, how much less is…difference, count on, strategy, partition, tens units</td></tr>
</table>

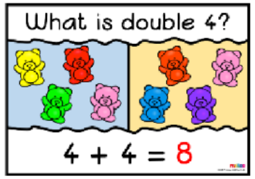
Multiplication-EYFS

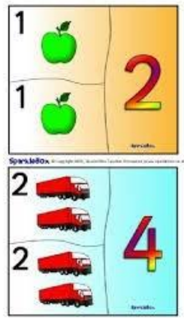
<table>
<tr><th>Objectives</th><th>Concrete</th><th>Pictorial</th><th>Abstract</th></tr>
<tr>
<td>- Solve problems including doubling</td>
<td>

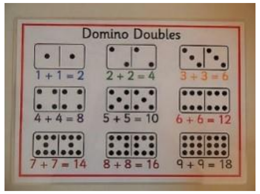



Counting and other maths resources for children to make 2 equal groups.



Physical and real life examples that encourage children to see concept of doubling as adding two equal groups.

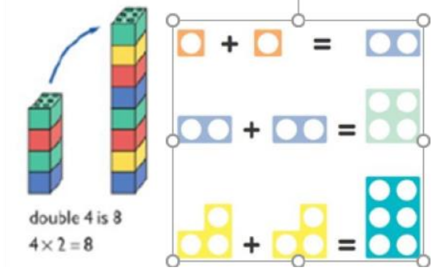
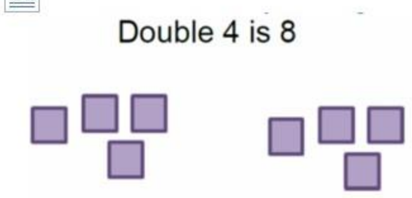
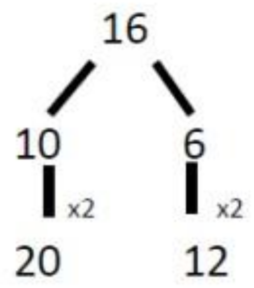
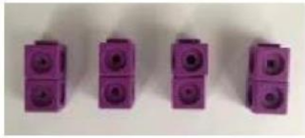
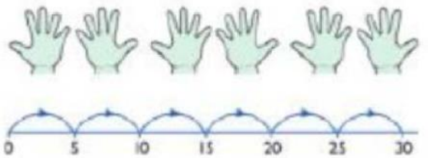
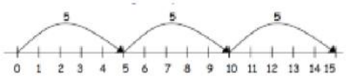
</td>
<td>


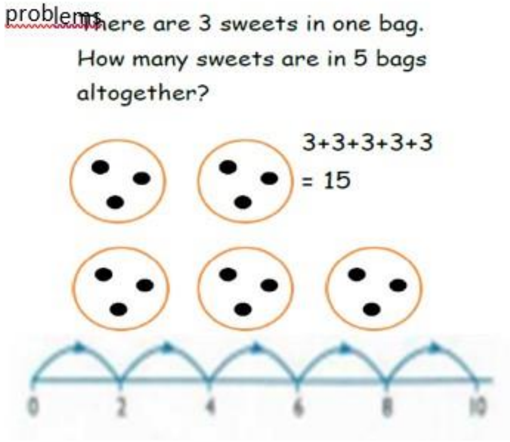
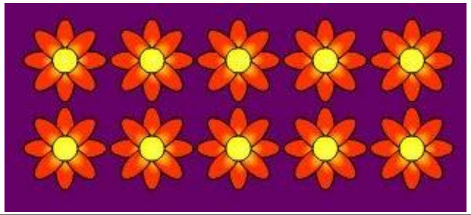




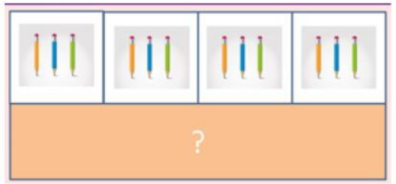
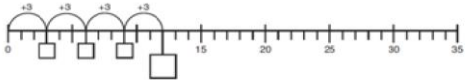
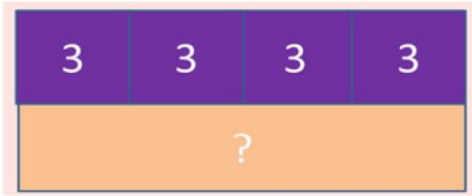
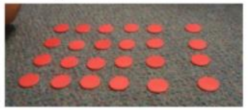
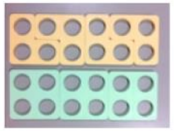
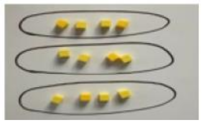
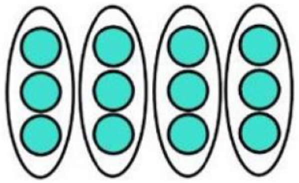
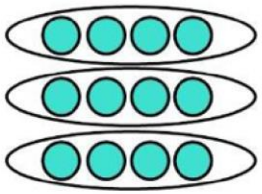
Pictures and icons that encourage children to see concept of doubling as adding two equal groups.
</td>
<td>
<table>
<tr><td>1+1=</td><td>7+7=</td></tr>
<tr><td>2+2=</td><td>8+8=</td></tr>
<tr><td>3+3=</td><td>9+9=</td></tr>
<tr><td>4+4=</td><td>10+10=</td></tr>
<tr><td>5+5=</td><td>11+11=</td></tr>
<tr><td>6+6=</td><td>12+12=</td></tr>
</table>
Addition calculations to model adding two equal groups.
</td>
</tr>
</table>

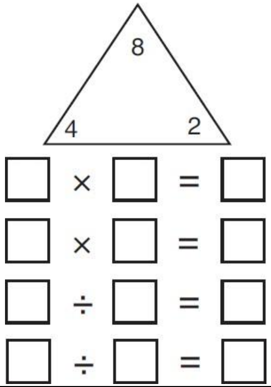
Multiplication- Year 1

Objective and Strategy	Concrete	Pictorial	Abstract
Doubling	Use practical activities using manip-ultives including cubes and Numicon to demonstrate doubling 	Draw pictures to show how to double numbers 	 Partition a number and then double each part before recombining it back together.
Counting in multiples	  Count in multiples supported by concrete objects in equal groups.	 Use a number line or pictures to continue support in 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**
Repeated addition	  Use different objects to add equal groups.	  5 + 5 + 5 = 15	Write addition sentences to describe objects and pictures.  2 + 2 + 2 + 2 + 2 = 10

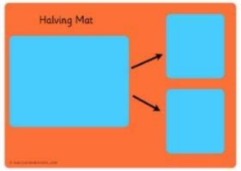
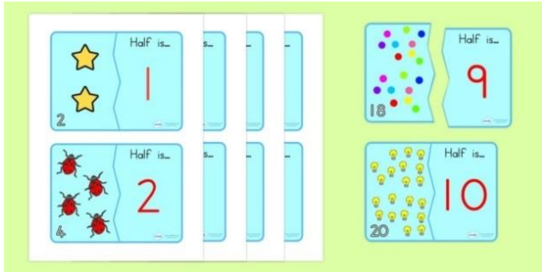
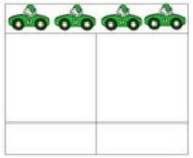
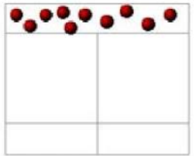
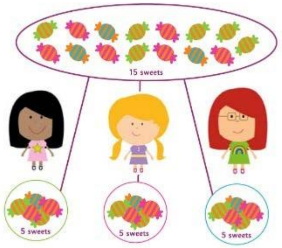
<table>
<tr><td></td><td></td><td>Use pictorial including number lines to solve problems

</td><td></td></tr>
<tr><td>Understanding arrays</td><td>Use objects laid out in arrays to find the answers to 2 lots 5, 3 lots of 2 etc.
</td><td></td><td>3 x 2 = 6
2 x 5 = 10</td></tr>
<tr><td>Vocabulary</td><td colspan="3">Groups of, lots of, times, array, altogether, multiply</td></tr>
</table>

Multiplication- Year 2

Objective and Strategy	Concrete	Pictorial	Abstract
Counting in multiples of 2, 3, 4, 5, 10 from 0 (repeated addition)	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 $4 \times 3 = \square$
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

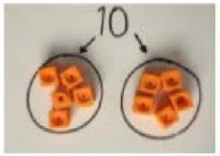
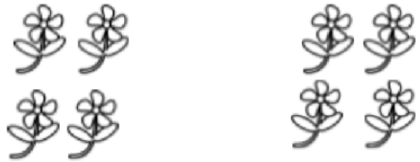
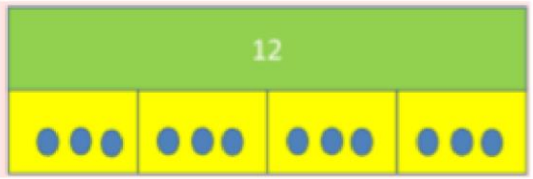
Using the Inverse *This should be taught alongside division, so pupils learn how they work alongside each other.*			2 x 4 = 8 4 x 2 = 8 8 ÷ 2 = 4 8 ÷ 4 = 2 8 = 2 x 4 8 = 4 x 2 2 = 8 ÷ 4 4 = 8÷ 2 Show all 8 related fact family sentences.
Vocabulary	Groups of, lots of, times, array, altogether, multiply, multiplied by, repeated addition, sets of, equal groups, times as big as, commutative.		

Division- EYFS

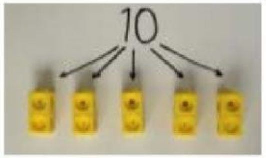
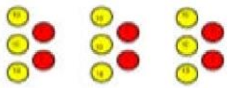
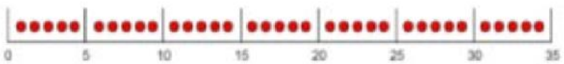
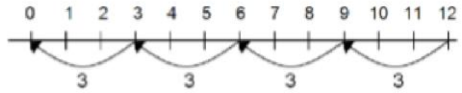
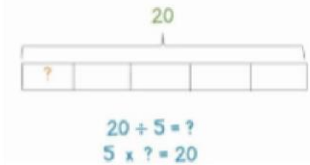
Objectives	Concrete	Pictorial	Abstract
Solve problems including halving and sharing. • Halving a whole, halving a quantity of objects. • Sharing a quantity of objects.	   Children have the opportunity to physically cut objects, food or shapes in half.    Use visual supports such as halving mats and part part whole, with the physical objects and resources that can be manipulated.  Counting and other maths resources for children to explore sharing between 3 or more. Counting and other	 Pictures and icons that encourage children to see concept of halving in relation to subitising, addition and subtraction knowledge. i.e. Knowing 4 is made of 2 groups of 2, so half of 4 is 2.   Bar model with pictures or icons to support understanding of finding 2 equal parts of a number, to further understand how two halves make a whole.  Pictures for children to create and visualise 3 or more equal groups.	

	maths resources for children to share into two equal groups.		

Division- Year 1

Objective and Strategy	Concrete	Pictorial	Abstract
Division as sharing (sharing objects into groups)	   I have 10 cubes, can you share them equally in 2 groups?	Children use pictures or shapes to share quantities.  $\boxed{8 \div 2 = 4}$ Children use bar modelling to show and support understanding.  $12 \div 4 = 3$	**Share 9 buns between three people.** **$9 \div 3 = 3$**
Vocabulary	share, share equally, one each, two each…, group, groups of, lots of, array		

Division- Year 2

Objective and Strategy	Concrete	Pictorial	Abstract
Division as grouping	Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.  96 ÷ 3 = 32   	Use a number line to show jumps in groups. The number of jumps equals the number of groups.  Think of the bar as a whole. Split it into the number of groups you ar dividing by and work out how many would be within each group.  	**28 ÷ 7 = 4** **Divide 28 into 7 groups. How many are in each group?**
Vocabulary	share, share equally, one each, two each…, group, groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over		

Minimal Resources required to support the CPA approach (depending on year group):

- 10 frames (including egg boxes)
- Straws/pipe cleaners
- Bead strings (to 20 and 100)
- Rekenrek frames
- Base 10/Dienes (including magnetic to model on flip chart)
- Place value grids
- Double-sided counters
- Part-part whole templates
- Place value counters (KS2)
- Multi-link cubes