Randlay Primary School and Nursery

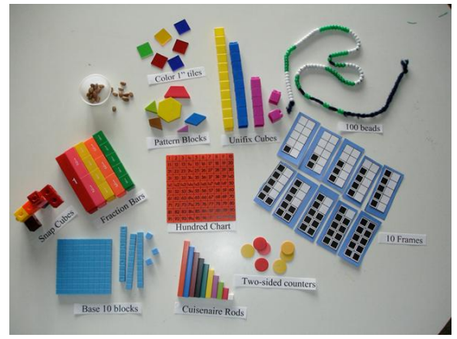
KS1 Addition and Subtraction

Concrete/Pictorial/Abstract

Maths Calculation Policy

This policy has created using a wide range of external sources (NCETM, White Rose Maths Hub and Click4teaching). It is a working document and will be revised and amended as necessary. Many variations have been included to provide teachers with a range of tools to support pupils in their grasp of number and calculation. To ensure consistency for pupils, it is important that the mathematical language used in maths lessons reflects the vocabulary used throughout this policy.

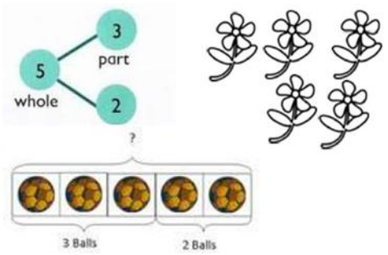
Concrete



The first part of the CPA approach is Concrete, which is known as the 'doing' stage. children use concrete objects to model problems. The CPA approach brings concepts to life by allowing children to experience and handle physical (concrete) objects, unlike traditional maths teaching methods where teachers demonstrate how to solve a problem. With the CPA framework, every abstract concept is first introduced using physical, interactive concrete materials.

As part of the CPA approach, new concepts are introduced through the use of physical objects or practical equipment. These can be physically handled, enabling children to explore different mathematical concepts. These are sometimes referred to as maths manipulatives and can include ordinary household items such as straws or dice, or specific mathematical resources such as dienes or numicon.

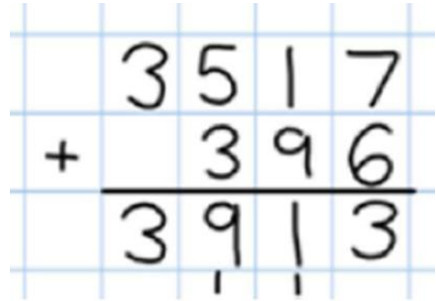
Pictorial



The second part of the CPA approach is pictorial, which is known as the 'seeing' stage. This is when visual representations of concrete objects are used to model problems. children are encouraged to make a mental connection between the physical object they have just handled and the abstract pictures, diagrams or models that represent the objects from the problem.

Building or drawing a model makes it easier for children to grasp difficult abstract concepts (for example, fractions). Once children are confident with a concept using concrete resources, they progress to drawing pictorial representations or quick sketches of the objects. By doing this, they are no longer manipulating the physical resources, but still benefit from the visual support the resources provide.

Abstract



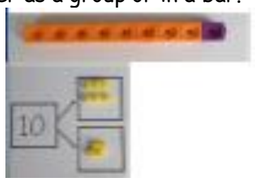
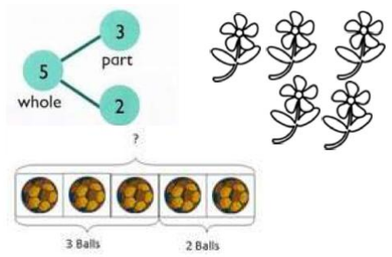
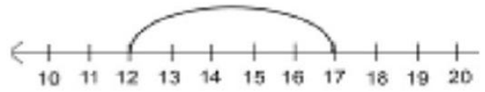
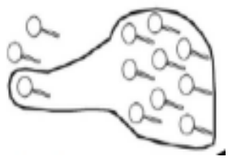
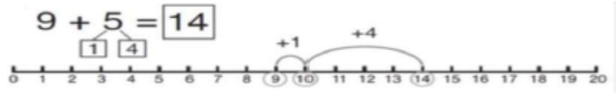
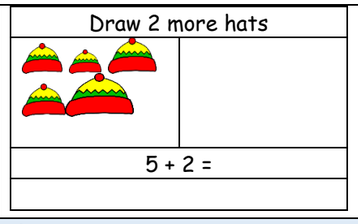
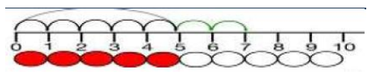
The final stage of the CPA approach is abstract, which is known as the 'symbolic' stage, where children use abstract symbols to model problems. children will not progress to this stage until they have demonstrated that they have a solid understanding of the concrete and pictorial stages of the problem. The abstract stage involves the teacher introducing abstract concepts (for example, mathematical symbols).

Once children have a secure understanding of the concept through the use of concrete resources and visual images, they are then able to move on to the abstract stage. Here, children are using abstract symbols to model problems – usually numerals. To be able to access this stage effectively, children need access to the previous two stages alongside it.

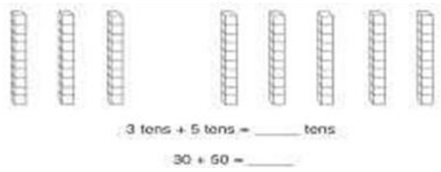
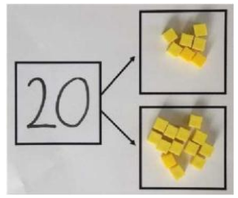
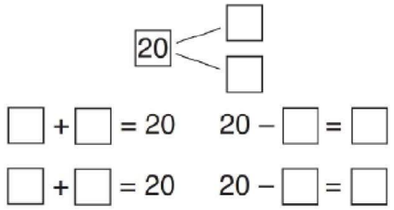
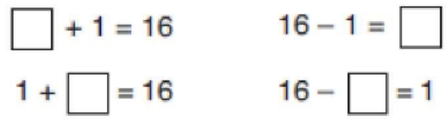
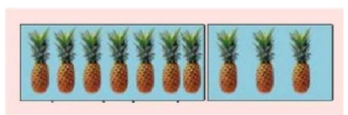
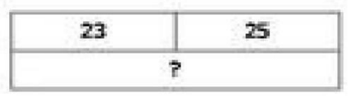
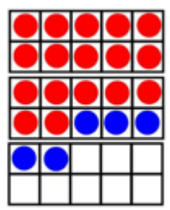
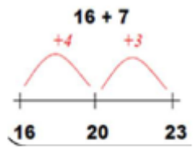
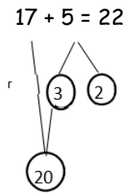
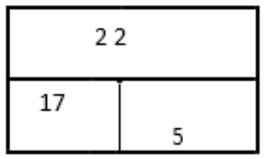
Concrete, pictorial, abstract (CPA) concepts should not be confused as differentiation for lower, middle, higher attaining children. CPA is an approach to be used with the whole class and teachers should promote each area as equally valid. Manipulatives in particular must not be presented as a resource to support the less confident or lower attaining pupils.

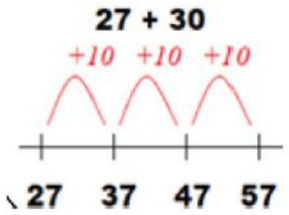
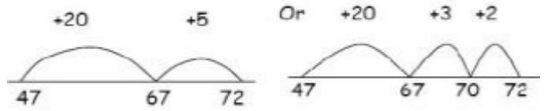
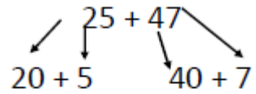
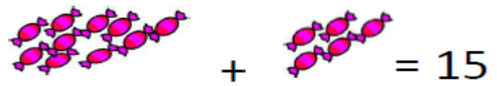
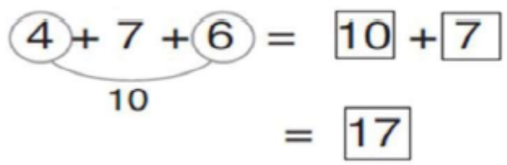
True mastery aims to develop all children's mathematical understanding at the same pace. As much as possible, children should be accessing the same learning. Differentiation should primarily be through support, scaffolding and deepening, not through task. Consistency in language is essential for pupils to understand the concepts presented in mathematics. If other, 'child-friendly' terminology is used, this must be alongside the current terminology recommended by the maths subject leader. Using this will support children with their examinations and throughout secondary school.

Year 1 Addition

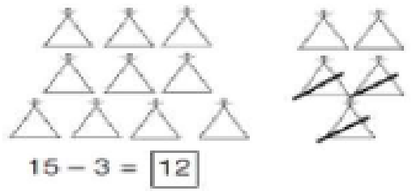
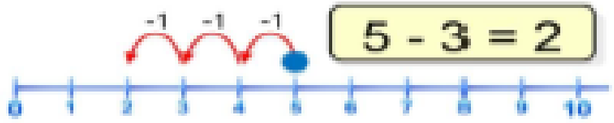
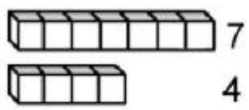
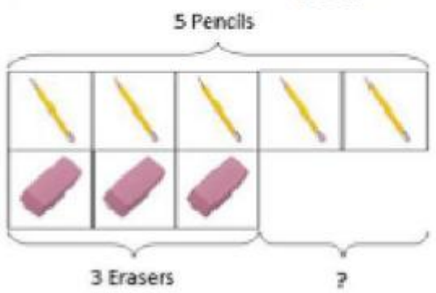
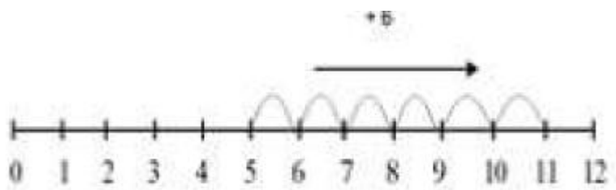
	Vocabulary: +, add, more plus make, sum, total altogether score double, near double one more, two more… ten more how many more to make…? how many more is… than…? how much more is…?		**Instructional vocabulary:** start from, start with, start at look at point, to show me
Objective/Strategy	**Concrete** **"doing stage"**	**Pictorial** **"seeing stage"**	**Abstract** **"symbolic stage"**
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.   	8 = 5 + 3 5 + 3 = 8  Use the part part whole diagram as shown above to move into the abstract. Include missing number questions to support varied fluency: 8 = ? + 3 5 + ? = 8
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.	3 + 9 =  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.	  	Include missing number questions: 8 = ? + 3 5 + ? = 8 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.'
Known facts	Represent & use number bonds and related subtraction facts within 20	Add and subtract 1 digit and 2 digit numbers to 20, including zero	
Essential Knowledge by the end of Year 1.	1 more	Add 10.	Number bonds: 5 and 6
	Largest number first.	Ten plus ones.	Number bonds: 7 and 8
	Doubles up to 10.		Number bonds:9 and 10
			Use number bonds of 10 to derive bonds of 11

Year 2 Addition

	Vocabulary: +, add, addition, more, plus make, sum, total altogether score double, near double one more, two more... ten more... one hundred more how many more to make…? how many more is… than…? how much more is…?		**Instructional vocabulary:** tell me, describe, name, pick out, discuss, talk about, explain, explain your method, explain how you got your answer, give an example of… show how you…
Objective/Strategy	**Concrete** **"doing stage"**	**Pictorial** **"seeing stage"**	**Abstract** **"symbolic stage"**
Adding multiples of ten	50 = 30 + 20  Model using dienes and bead strings	 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		Explore commutativity of addition by swapping the addends to build a fact family. Explore the concept of the inverse relationship of addition and subtractions and use this to check calculations. 
Bar model	 3 + 4 = 7	 7 + 3 = 10	 23 + 25 = 48
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 	Use part part whole and number line to model.  	17 + 5 = 22 Explore related facts 17 + 5 = 22 5 + 17 = 22 22—17 = 5 22—5 = 17  Lead into recording in column format, to reinforce place value and prepare children for formal written methods with larger values.

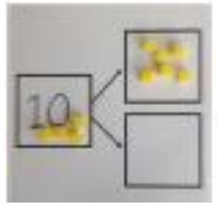
<table>
<tr><td>Add a 2 digit number and tens</td><td>25 + 10 = 35
 
Explore that the ones digit does not change.</td><td>  </td><td>27 + 10 = 37
27 + 20 = 47
27 + □ = 57</td></tr>
<tr><td>Add two 2-digit numbers</td><td>Model using dienes,
place value counters and numicon
  </td><td> 
Use number line and bridge ten using part whole if necessary.</td><td> 
20 + 40 = 60
5+ 7 =12
60 + 12 = 72
Lead into recording in column format, to reinforce place value and prepare children for formal written methods with larger values.</td></tr>
<tr><td>Add three 1-digit numbers</td><td>Combine to make 10 first if possible, or bridge 1o then add third digit
  </td><td> 
Regroup and draw representation A
  </td><td> 
Combine the two numbers that make/bridge ten then add on the third</td></tr>
<tr><td>Known facts</td><td colspan="3">Recall and use addition and subtraction facts to 20 fluently and derive and use related facts up to 100.</td></tr>
<tr><td rowspan="4">Essential Knowledge by the end of Year 2.</td><td>10 more</td><td>Number bonds:20,12 and 13</td><td>Partition and recombine.</td></tr>
<tr><td>Add 1 digit to 2 digit by bridging</td><td>Number bonds: 14 and 15</td><td>Doubles up to 20 and multiples of 5.</td></tr>
<tr><td>Partition second number and add tens then ones.</td><td>Number bonds: 16 and 17</td><td>Add near multiples of 10.</td></tr>
<tr><td>Add 10 and multiples of 10.</td><td>Number bonds: 18 and 19</td><td></td></tr>
</table>

Year 1 Subtraction

	Vocabulary: take away, distance between, difference between, less than. How many more? How much greater? How many fewer? how much more is…? – subtract, take (away), minus, leave, how many are left/left over? how many have gone? one less, two less, ten less… how many fewer is… than…? how much less is…? difference between half, halve = equals, sign, is the same as		**Instructional vocabulary:** start from, start with, start at look at point, to show me
Objective/Strategy	**Concrete** **"doing stage"**	**Pictorial** **"seeing stage"**	**Abstract** **"symbolic stage"**
Taking away ones.	Use physical objects, counters, cubes etc to show how objects can be taken away.  4—2 = 2	Cross out drawn objects to show what has been taken away. 	7—4 = 3 16—9 = 7
Counting back	 Move the objects from the group, counting backwards. Move the beads alone the 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 the 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?

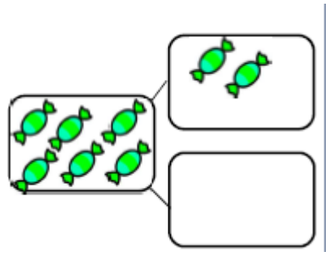
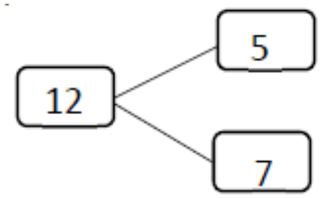
<table>
<tr>
<td>Represent and use number bonds and related subtraction facts within 20

Include subtracting zero

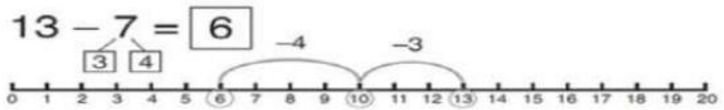
Part Part Whole model</td>
<td> 

Link to addition. Use Part Whole model to model the inverse.

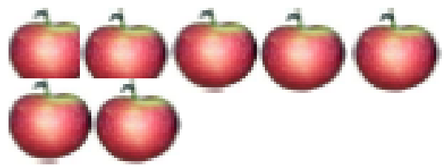
DIf 10 is the whole and 6 is one of the arts, what s the other part?

10—6 = 4</td>
<td> 
Use pictorial representations to show the part.</td>
<td> 

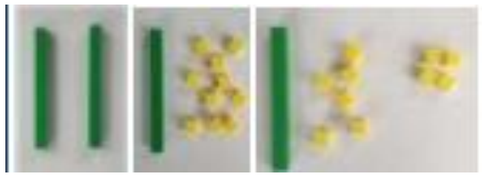
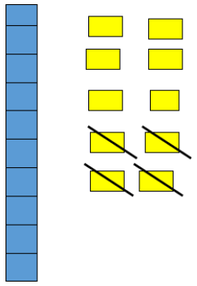
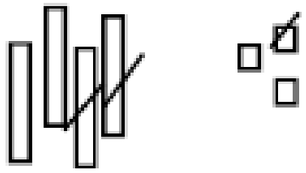
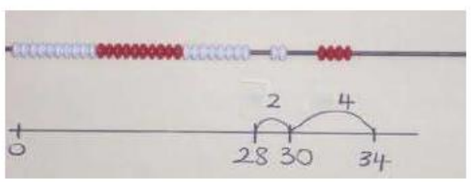
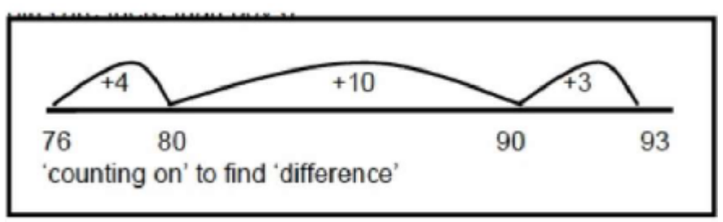
Move to using numbers with the part whole model

Include missing number problems:
12 - ? = 5
7 = 12 - ?</td>
</tr>
<tr>
<td>Make 10</td>
<td>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.</td>
<td>Jump back 3 first, then another 4. Use ten as the stopping point
 

13—7</td>
<td>16 – 8 =

How many do we take off first to get to 10?
How many left to take off?</td>
</tr>
<tr>
<td>Bar model
Including the inverse operations.</td>
<td> 
5—2 = 3</td>
<td>  </td>
<td><table>
<tr><td colspan="2">10</td></tr>
<tr><td>8</td><td>2</td></tr>
</table>
10 = 8 + 2
10 = 2 + 8
10—2 = 8
10—8 = 2</td>
</tr>
<tr>
<td>Known facts</td>
<td colspan="3">Represent & use number bonds and related subtraction facts within 20
Add and subtract 1 digit and 2 digit numbers to 20, including zero</td>
</tr>
<tr>
<td rowspan="4">Essential Knowledge by the end of Year 1.</td>
<td>1 less</td>
<td>Number bonds: subtraction 5 and 6</td>
<td></td>
</tr>
<tr>
<td>Count back</td>
<td>Number bonds: subtraction 7 and 8</td>
<td></td>
</tr>
<tr>
<td>Subtract 10.</td>
<td>Number bonds: subtraction 9 and 10</td>
<td></td>
</tr>
<tr>
<td>Teens subtract 10</td>
<td>Difference between</td>
<td></td>
</tr>
</table>

Year 2 Subtraction

	Vocabulary: subtract, subtraction, take (away), minus leave, how many are left/left over? one less, two less… ten less… one hundred less how many fewer is… than…? how much less is…? difference between half, halve = equals, sign, is the same as tens boundary difference, partition, rearrange, inverse, place value		**Instructional vocabulary:** tell me, describe, name, pick out, discuss, talk about, explain, explain your method, explain how you got your answer, give an example of… show how you…
Objective/Strategy	**Concrete "doing stage"**	**Pictorial "seeing stage"**	**Abstract "symbolic stage"**
Regroup a ten into ten ones	Use a place value chart to show how to change a ten into ten ones, use the term 'take and make'. 	 20 - 4 = 16	20—4 = 16
Partitioning to subtract without regrouping.	 Use Dienes to show how to partition the number when Subtracting without regrouping. 34 – 13 = 21	Children draw representations of dienes and cross off  43—21 = 22	43—21 = 22
Make ten strategy Progression should be crossing one ten, crossing more than one ten, crossing the hundreds.	 34—28 Use a bead bar or bead stings to model counting to next ten and the rest.	 Use a number line to count on to next ten and then the rest	93 – 76 - 17
Known facts	Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100.		
Essential Knowledge by the end of Year 2.	10 less	Number bonds: subtraction 20,12 and 13	Subtract near multiples of 10.
	Subtract 1 digit from 2 digit by bridging	Number bonds: subtraction 14 and 15	Difference between
	Partition second number and count back in tens then ones.	Number bonds: subtraction 16 and 17	Add near multiples of 10.
	Subtract 10 and multiples of 10.	Number bonds: subtraction 18 and 19	