

# The Oaktree School Calculation Policy



**Created By:** Mrs Santos-Lewis (Maths Lead)

Review required: January 2022



# Our Calculation Policy



This policy has been created not only to meet the expectations for the National Curriculum but also to meet the needs of our children at The Oaktree School. The methods chosen match the National Curriculum but are also designed to ensure a Mastery-style Curriculum.

## Purpose

There is a dual purpose to this policy. Firstly, to make teachers aware of the strategies that are being formally taught to the pupils in each year group that will support them in written and mental calculations. Secondly, it helps the teachers identify the appropriate concrete, pictorial and abstract representations (and the resources that will be needed) to develop a deeper understanding.

## Navigating the Policy

For each of the four number rules, different strategies are presented alongside recommended concrete and pictorial representations. These examples are not exhaustive and teachers and pupils may develop strategies of their own. In order to master a mathematical concept children will need the opportunity to use their Maths using the Concrete-Pictorial-Abstract (CPA) approaches. Children should go back and forth over these representations in order to reinforce their learning.

## Mathematical Language

It is essential that the strategies outlined in this policy are taught using the correct mathematical vocabulary. New vocabulary needs to be introduced and explained carefully. Teachers should have high expectations of the mathematical vocabulary and should not accept incorrect terms.

The quality and variety of language that pupils hear and speak are key factors in developing their mathematical vocabulary and presenting a mathematical justification, argument or proof.

*2014 Maths Programme of Study*

✓	✗
ones	units
is equal to	equals
zero	oh (the letter O)

## Exemplification

Throughout this document calculations are presented in a range of different ways. It is important for children to work with calculations which involve missing numbers and the = symbol in different positions.

## Estimating

Children need to use their developing number knowledge from Year 1 to make predictions about their answers to their calculations. As their range of mental strategies progress their predictions should become more accurate and can be used to help check the sense and accuracy of their calculations.



# Progression in Calculations

## Reception

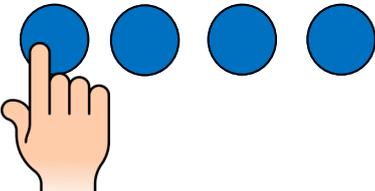
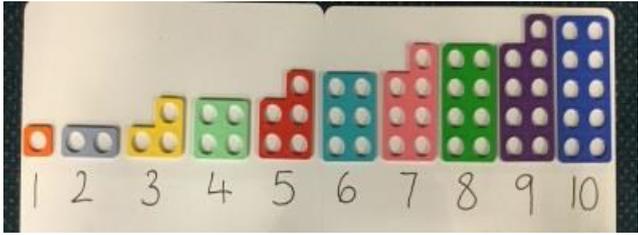
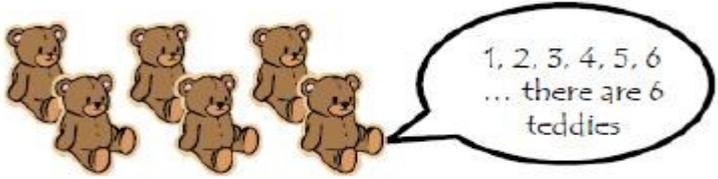
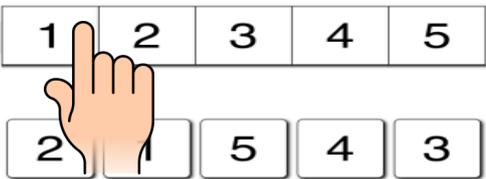
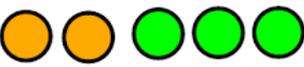


### *Number, Addition and Subtraction*

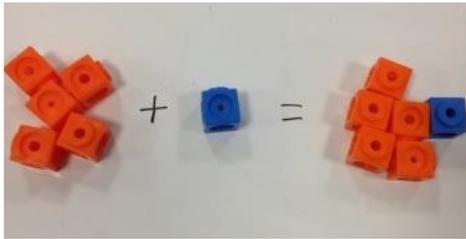
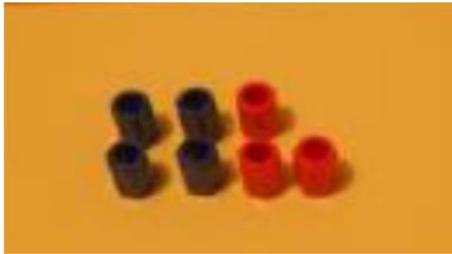
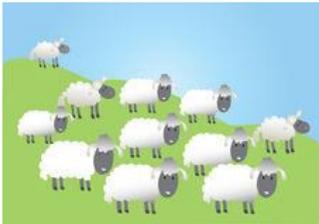
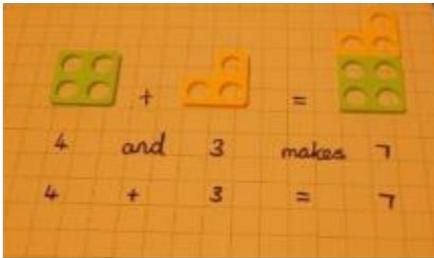
#### Early Years Framework objectives linked to number, addition and subtraction

Emerging ( 40-60 Months)	Expected	Exceeding
<ul style="list-style-type: none"> <li>Recognises some numerals of personal significance.</li> <li>Recognises numerals 1 to 5</li> <li>Counts up to 3 or 4 objects by saying one number name for each.</li> <li>Counts actions or objects that cannot be moved.</li> <li>Counts objects to 10, and beginning to count beyond 10.</li> <li>Counts out up to 6 objects from a larger group.</li> <li>Estimates how many objects they can see and checks by counting them.</li> <li>Uses the language of “more” and “fewer” to compare two sets of objects.</li> <li>Finds the total number of items in two groups by counting them all.</li> <li>Says the number that is one more than a given number.</li> <li>Finds one more or one less from a group of 5 objects, then up to 10.</li> <li>In practical activities and discussion beginning to use the vocabulary involved in addition and subtraction.</li> <li>Records, using marks that they can interpret and explain.</li> <li>Begins to identify own mathematical problems based on own interests or fascinations.</li> </ul>	<ul style="list-style-type: none"> <li>Children count reliably with numbers from one to 20, place them in order and say which number is one more or one less than a given number.</li> <li>Using quantities and objects, they add and subtract two single-digit numbers and count on or back to find the answer.</li> <li>They solve problems, including doubling, halving and sharing</li> </ul>	<ul style="list-style-type: none"> <li>Estimates a number of objects and checks quantities by counting up to 20.</li> <li>Solves practical problems that involve combining groups of 2, 5 or 10, or sharing into equal groups</li> </ul>

# Counting and Ordering in Reception

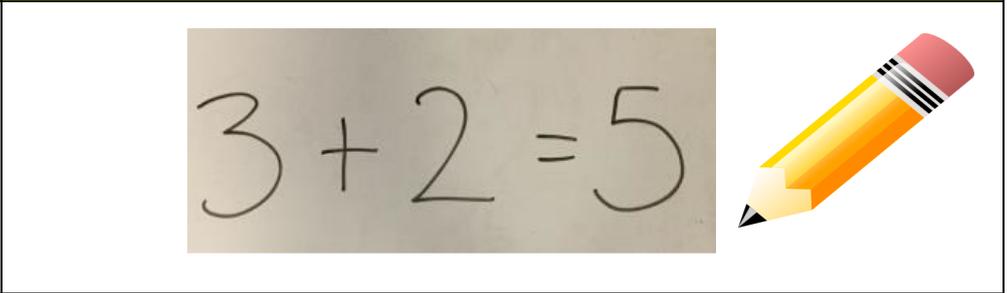
Strategy and Guidance	CPA
<p>Children count using 1:1 Correspondence saying one number name as they count.</p>	<p>Placing objects in a row to form a pictorial number lines supports accurate counting.</p> 
<p>Children recognise numbers to 10 and beyond.</p>	
<p>Children count to 10 and beyond. ( 1:1 correspondence)</p>	
<p>Children match numbers to groups of objects 0 to 10 and then 0 to 20.</p>	
<p>Children select numerals and place them in order to form a visual number line 0 to 10 and then 0 to 20.</p>	
<p>Children are able to identify the "hidden numbers" within numbers to support understanding of the value of each number. 0 to 10 and then 10 to 20</p>	<div style="display: flex; align-items: center;">  <div> <p>1 and 4 makes 5</p>  <p>2 and 3 makes 5</p>  </div> </div>

## Addition in Reception– Combining groups of objects

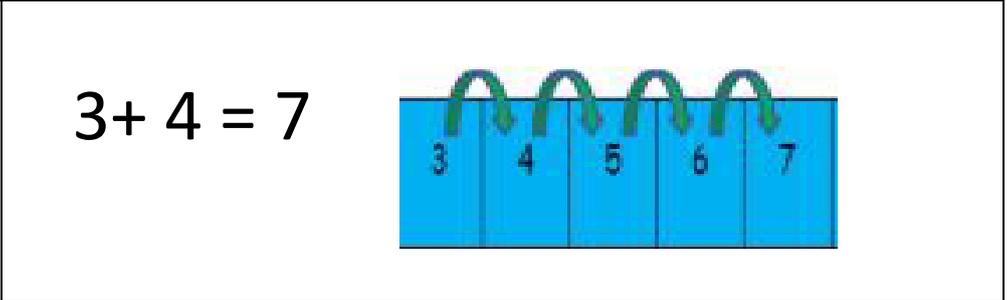
Strategy and Guidance	CPA
Children use images and resources to add one more and find the total.	
Children combine two groups of objects together and count all of the objects, then learn to count on from the first number	
Children represent simple number problems through models, images and resources.	<div style="display: flex; align-items: center;">  <div> <p>There are 10 sheep in the field. One more comes over the hill.</p> <p>How many sheep are there now?</p> </div> </div>
Children explain what addition is and use associated vocabulary .	<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="border: 1px solid blue; border-radius: 15px; background-color: #4a86e8; color: white; padding: 10px; width: 30%;"> <p style="text-align: center; margin: 0;">Addition is when numbers are combined to find a total.</p> </div> <div style="width: 60%;"> <p>How many altogether?</p> <p>total                    plus</p> <p>equals                    add, addition</p> <p>count forwards</p> </div> </div>
Children write a number sentence to match a group of objects. “How many altogether?”	
Children read and understand an addition number sentence using the symbols + and =.	<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="border: 1px solid gray; background-color: #d3d3d3; padding: 10px; width: 40%; text-align: center;"> <math style="font-size: 2em;">3 + 2 = 5</math> </div> <div style="width: 55%;"> <div style="border: 1px solid purple; border-radius: 15px; background-color: #d8bfd8; padding: 10px; margin-bottom: 10px;"> <p>Three add two equals five.</p> </div> <div style="border: 1px solid purple; border-radius: 15px; background-color: #d8bfd8; padding: 10px;"> <p>Three plus two totals five.</p> </div> </div> </div>

Strategy and Guidance	CPA
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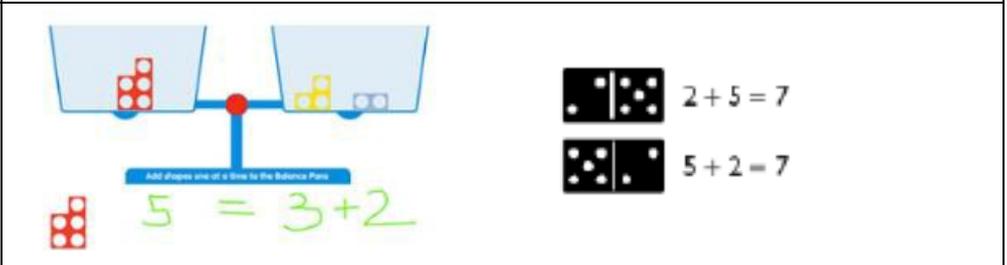
Children use the + and = signs to record mental calculations in a number sentence.



Children begin to use a number line to count on.

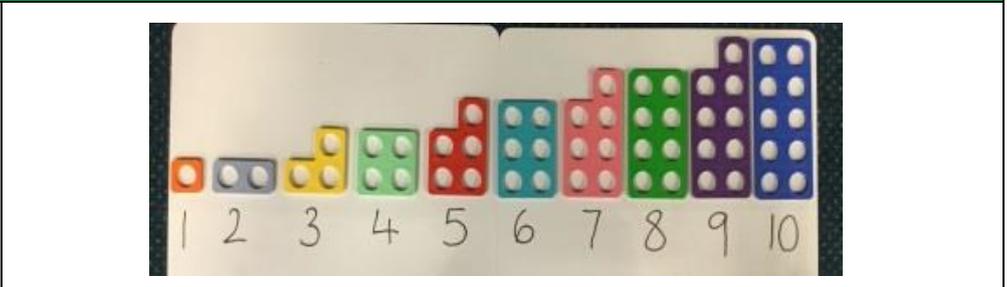


Children understand that addition can be done in any order.

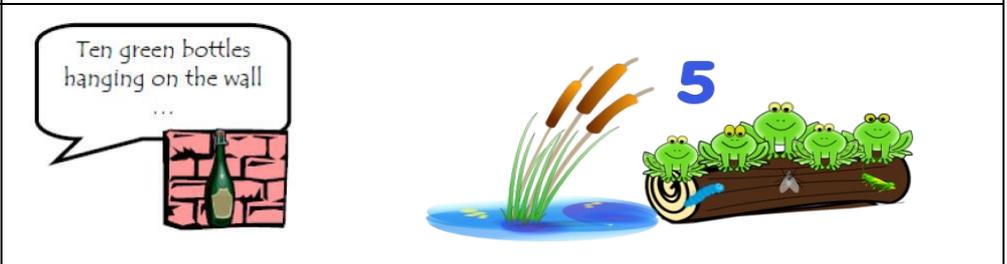


## Subtraction in Reception—taking objects from a group

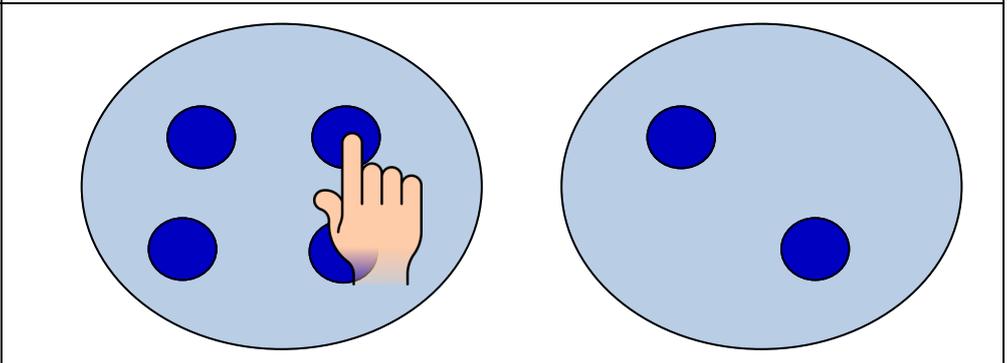
Children count backwards from 10

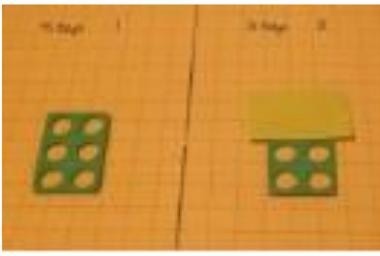
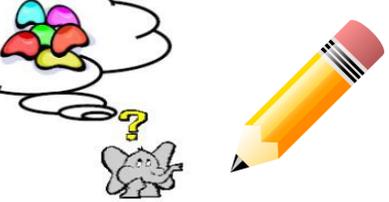
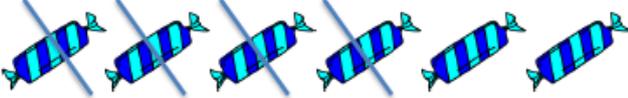
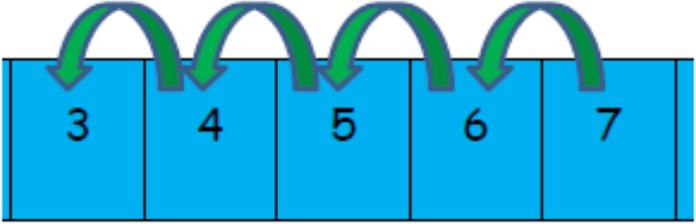


Children count backwards in familiar contexts ( Rhymes and stories)



Children subtract by taking objects from a group and counting what is left.  
( Including one less)



Strategy and Guidance	CPA
<p>Children represent their thinking using images or numicon and then “mask” the number being subtracted.</p>	
<p>Children explain what subtraction is and use associated vocabulary.</p>	<div data-bbox="571 546 1018 801" style="border: 1px solid black; border-radius: 15px; padding: 10px; background-color: #d8bfd8;"> <p>Subtraction is taking one number away from another.</p> <p>Subtraction is finding how many is left?</p> </div> <div style="display: flex; flex-direction: column; align-items: flex-start; margin-top: 10px;"> <p>subtraction</p> <p>count backwards      less</p> <p>take away              minus</p> <p>how many is left?</p> </div>
<p>Children read and understand a subtraction number sentence using the symbols—and =.</p>	<div style="display: flex; align-items: center; justify-content: center;"> <div style="font-size: 48px; margin-right: 20px;"><math>7 - 5 = 2</math></div> <div data-bbox="1050 855 1449 1070" style="border: 1px solid black; border-radius: 15px; padding: 10px; background-color: #add8e6;"> <p>Seven take away five equals two.</p> <p>Seven minus five equals two</p> </div> </div>
<p>Children use the—and = sign to record mental calculations in a number sentence.</p>	<div style="text-align: center;"> <p data-bbox="721 1124 1241 1258" style="border: 1px solid black; border-radius: 50%; padding: 10px; display: inline-block;">             Maria had six sweets and she ate four. How many did she have left?           </p>  </div> <div style="text-align: center; margin-top: 10px;"> <div style="border: 1px solid black; padding: 5px; display: inline-block;"><math>6 - 4 = 2</math></div> </div>
<p>Children draw pictures to work out calculations as well as handling objects.</p>	<p data-bbox="549 1393 1126 1420">John has 6 sweets. He eats 4. How many are left?</p>  
<p>Children use a number line to count back in ones, counting the number of jumps or steps.</p>	<div style="text-align: center; font-size: 36px; margin-bottom: 20px;"><math>7 - 4 = 3</math></div> 



# Progression in Calculations

## Year One and Two



### *Addition and Subtraction*

#### **National Curriculum objectives linked to addition and subtraction**

These objectives are specifically covered by the strategies outlined in this document:

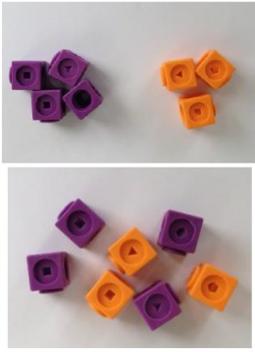
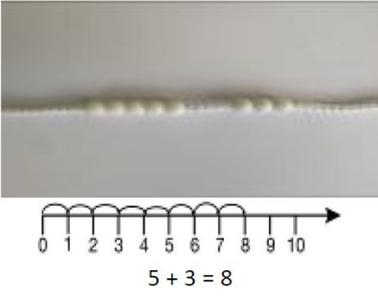
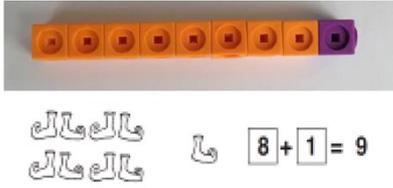
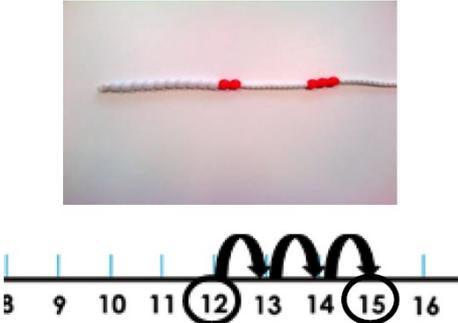
- Add and subtract numbers to 20 including zero.
- Represent and use number bonds and related subtraction facts within 20.
- Given a number, identify one more/ one less.
- Add and subtract numbers using concrete objects, pictorial representations, and mentally including a two-digit number and ones, a two-digit number and tens, 2 two-digit numbers; and 3 one-digit numbers.
- Show that the addition of numbers can be done in any order but subtraction cannot.
- Recognise the inverse relationship of addition and subtraction and use this to solve missing number problems.
- Recall and use subtraction facts to 20 fluently and use related facts up to 100.

The following objectives should be planned for lessons where new strategies are being introduced and developed:

- Read, write and interpret mathematical statements using the +, - and = symbols.
- Solve one step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems.
- Solve problems with addition and subtraction:

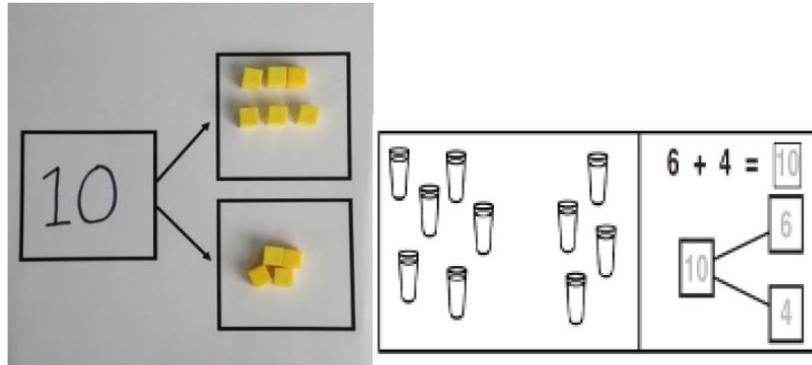
*Using concrete objects and pictorial representations, including those using numbers, quantities and measures and applying their increased knowledge of mental methods.*

# ADDITION

Strategy and Guidance	CPA
<p>Joining two groups and then recounting all objects using one-to-one correspondence.</p>	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p><math>3 + 4 = 7</math></p>  </div> <div style="text-align: center;">  <p><math>5 + 3 = 8</math></p> </div> </div>
<p><b>Counting On</b></p> <p><i>As a strategy this should be limited to adding only small quantities with pupils understanding that counting on from the greater is more efficient. Pupils should be encouraged to use number bonds knowledge as time goes on rather than relying on counting on as their main strategy.</i></p>	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p><math>8 + 1 = 9</math></p>  </div> <div style="text-align: center;"> <p><math>15 = 12 + 3</math></p>  </div> </div>
<p><b>Numicon as groups</b></p> <p><i>Numicon is a useful resource for adding two or more numbers together. The children can recognise the pieces as the number before they are able to form the number and can begin by counting up the holes before learning to find the solution by looking at the shape that they have made.</i></p>	<div style="display: flex; justify-content: space-around; align-items: center;">   </div>

**Part-Part-Whole**

*Pupils will use this model to understand the link between addition and subtraction. Pupils could place 10 on top of the model as well as writing it down. The parts could also be written in alongside the concrete representation. Pupils will become aware that parts will make a whole in any order.*



$$10 = 6 + 4$$

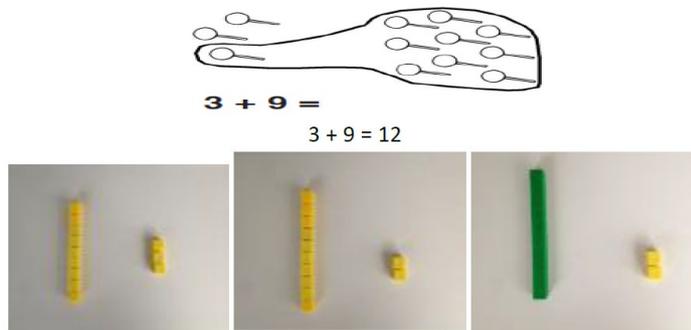
$$10 - 6 = 4$$

$$10 - 4 = 6$$

$$10 = 4 + 6$$

**Regrouping ten ones to make ten**

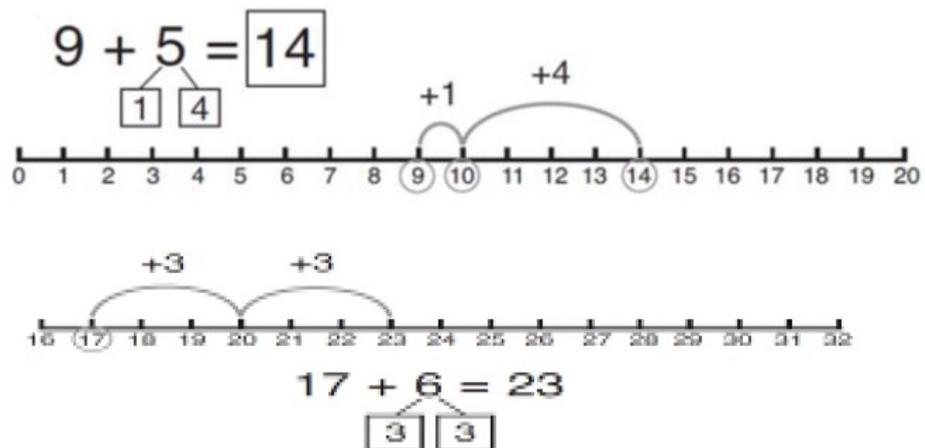
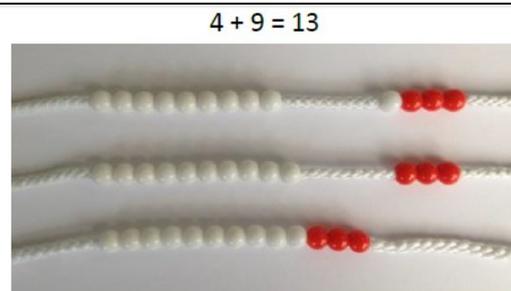
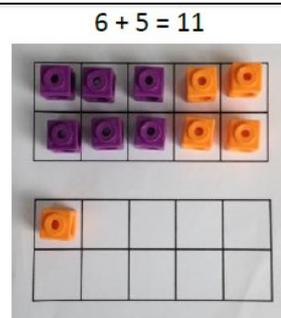
*This is an essential skill that will support column addition later on.*



**'Make ten' strategy**

*Pupils should be encouraged to start at the greatest value and use the smaller to make ten.*

*The colours of the beads on the string make it clear how many more are needed to make ten. The empty spaces on the ten frame also makes this clear.*



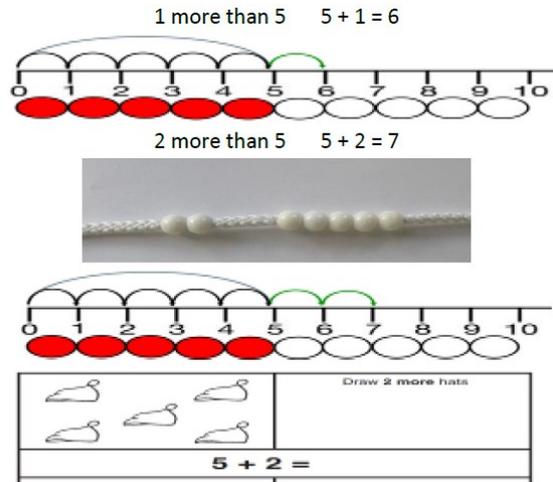
Adding 1, 2 or 3 more

Here the emphasis should be on language rather than strategy. As the pupils are using the beadstring, ensure that they are explaining using language such as;

'One more than 5 is equal to 6'

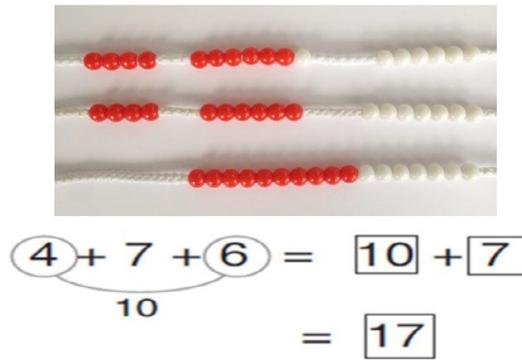
'2 more than 5 is 7'

'8 is 3 more than 5'

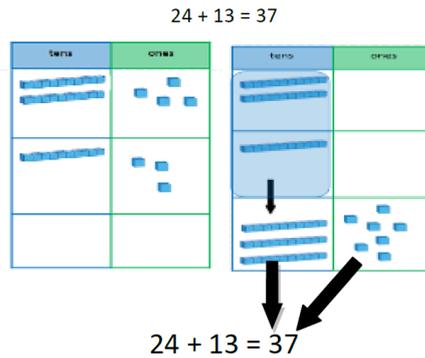


Add 3 one-digit numbers

Pupils may need to try different combinations before they find two numbers that make 10. The first bead string shows 4, 7 and 6. The colours of the beadstring show that it makes more than 10.

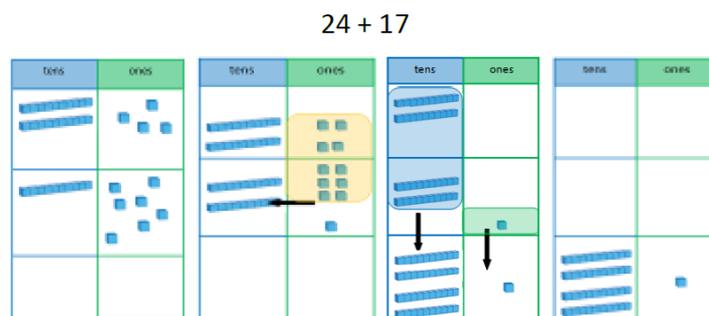


Partitioning to add (no regrouping)



Introducing column methods for addition

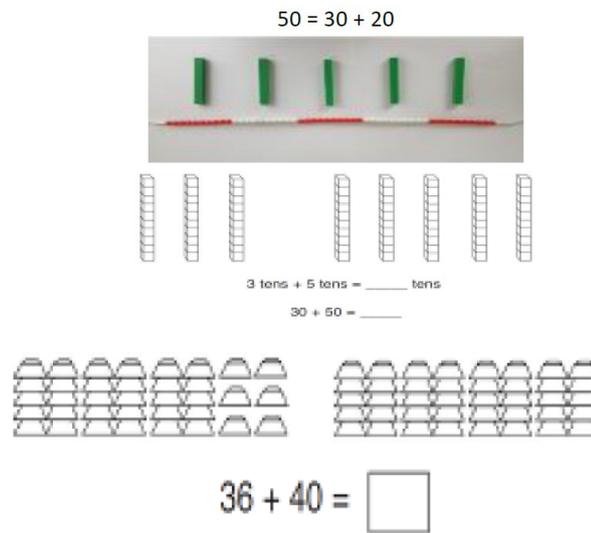
Even when working pictorially children should have access to Dienes sticks.



## Adding multiples of ten

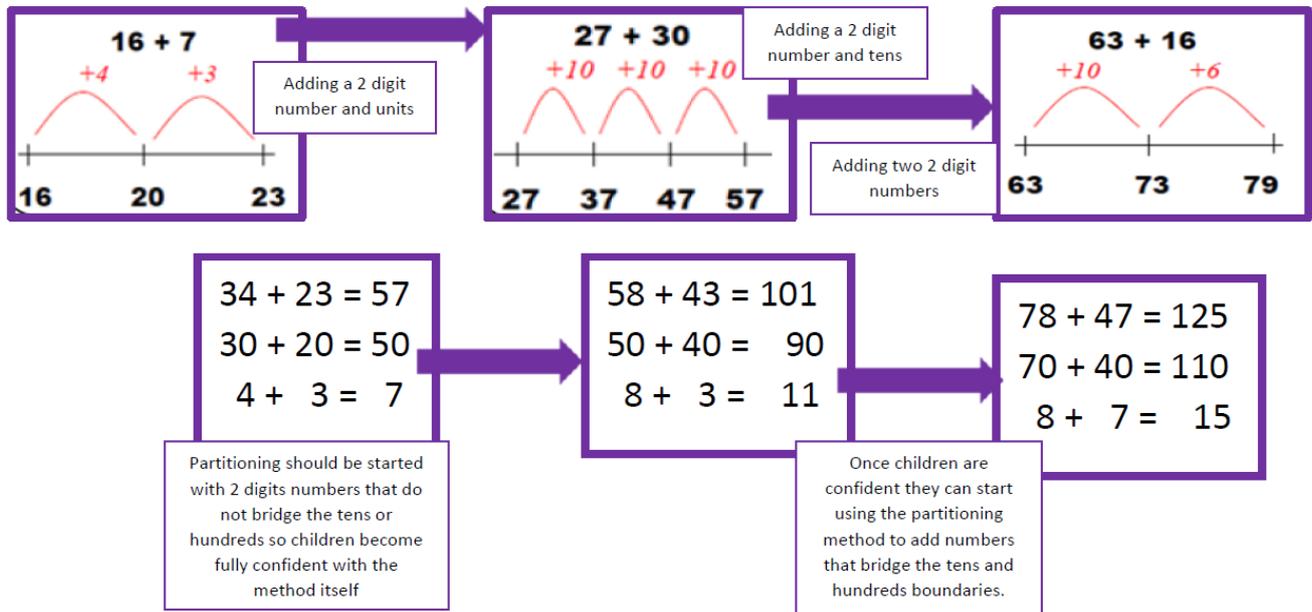
Using the vocabulary of 1 ten, 2 tens, 3 tens etc. alongside 10, 20, 30 is important as pupils need to understand that it is a **ten** and not a one being added.

It also emphasises the link to the known number fact. E.g. '2+3 is equal to 5 so 20+30 will be equal to 50'.



## Empty Number Lines

Children should explore and understand how to use empty number lines to add using their knowledge of place value and how to partition numbers in different ways.



## Key Vocabulary

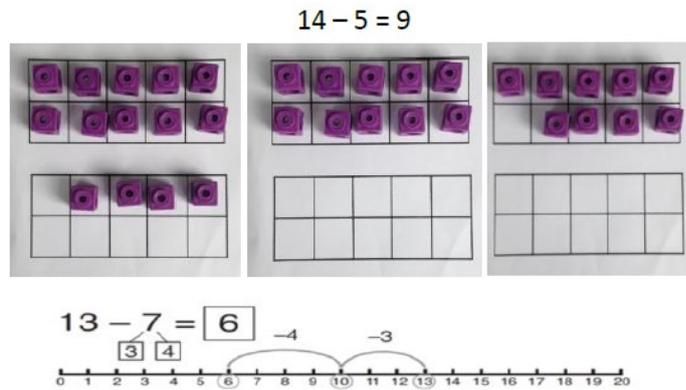
Add, more, plus, and, altogether, total, most, count on, number line, Numicon, Part-Part-Whole, regrouping, Make 10, Partitioning, Column, digit.

# SUBTRACTION

Strategy and Guidance	CPA
<p>Taking away from the ones</p> <p><i>This works best if when introduced, concrete objects are placed upon the pictures and the physically 'taken away'.</i></p>	<p>Examples of CPA for subtraction:</p> <ul style="list-style-type: none"> <li><math>7 - 3 = 4</math> (using ten blocks)</li> <li><math>37 - 3 = 30</math> (using ten blocks)</li> <li><math>15 - 3 = 12</math> (using triangles)</li> <li><math>28 - 4 =</math> (using leaves)</li> <li><math>6 - 2 = 4</math> (using chairs)</li> </ul>
<p>Counting Back</p> <p><i>Pupils should be encouraged to rely on number bond knowledge as time goes on, rather than counting back as their main strategy.</i></p>	<p>Examples of CPA for counting back:</p> <ul style="list-style-type: none"> <li>Red beads on a string representing <math>16 - 2 = 14</math></li> <li>Number bond for <math>4 = 6 - 2</math> (using birds)</li> <li>Number line for <math>16 - 2 = 14</math> (with arrows showing jumps back)</li> </ul>
<p>Part-Part-Whole</p> <p><i>This model will help children to realise the link between addition and subtraction. Pupils start with ten cubes based on the whole. They then remove what is being taken away from the whole and place it in one of the parts. The remaining cubes are the other part and also the answer. These can be moved into the second space.</i></p>	<p>Examples of CPA for part-part-whole:</p> <ul style="list-style-type: none"> <li><math>10 - 6 = 4</math> (using yellow cubes in a part-part-whole model)</li> <li>Tables representing subtraction (e.g., <math>4 - 1 =</math>)</li> </ul>

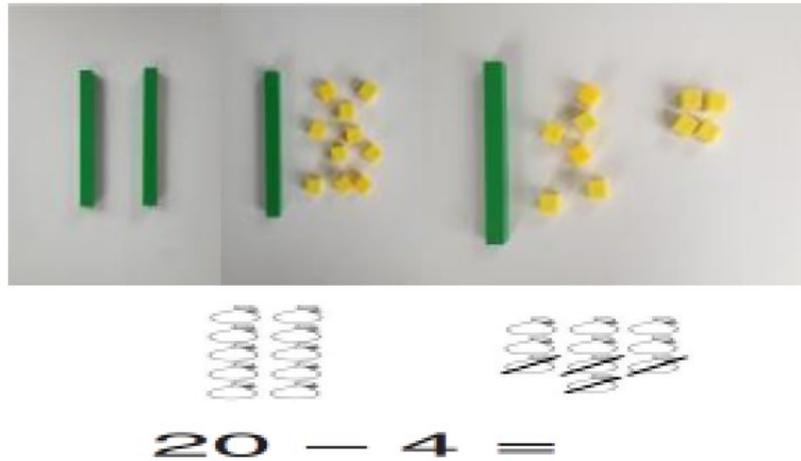
### Make ten strategy

*Pupils identify how many need to be taken away to make ten first. They then subtract the rest to reach the answer.*



### Regroup a ten into 10 ones

*Base Ten could be placed on a Place Value chart to support Place Value understanding. This will support the students when they later use the column method.*



### Numicon

*The children can find the starting number piece of Numicon. They then cover the piece with the number that it being subtracted and count up what is left. This helps reinforce that the starting number must be the number with the greatest value.*



Partitioning to subtract without regrouping

Placing the Base Ten on a Place Value chart reinforces the basic concept of Place Value.

$$34 - 13 = 21$$

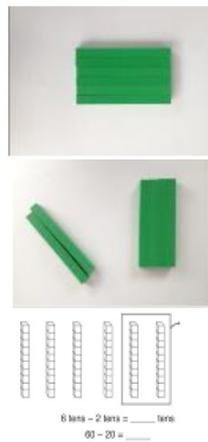


$$34 - 13 = 21$$

Subtracting multiples of ten

Using the vocabulary of one ten, two tens, three tens etc. alongside 10, 20 and 30 is important as pupils need to understand that it is a **ten** not a one that is being subtracted.

$$40 = 60 - 20$$



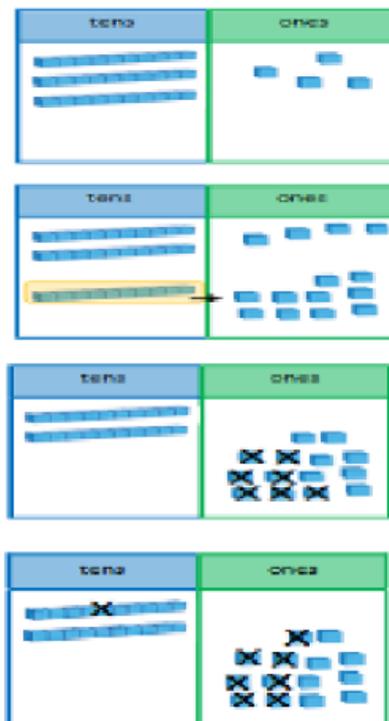
$$38 - 10 = 28$$



$$34 - 17 = 17$$

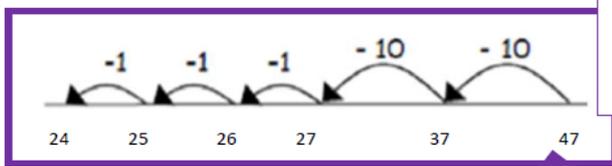
Column method with regrouping

Pupils should work practically when regrouping. There is no formal recording in columns in Year 1 but this practical work will help pupils prepare for formal methods in Year 2.



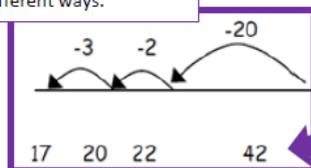
## Subtracting with 2 digit numbers on a number line

In Year 2 children will start to use blank number lines to subtract by counting back which will greatly support the development of mental subtraction skills.

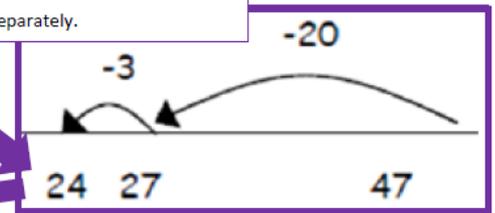


For  $47 - 23 = 24$ , children should start by partitioning the tens number and subtracting that first by counting back in tens. They will then subtract the units number and subtract that by counting back in 1s.

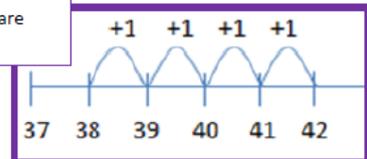
Once confident with efficient jumps, children are ready to subtract by bridging through 10, again partitioning is very important here and the children will need to be very confident with partitioning in different ways.



Once children develop their confidence of counting back they will be able to select more efficient jumps to solve a problem and will not have to partition the tens and units numbers separately.



**Counting on as a mental method**  
Counting on is a super mental method! It is especially useful for finding the difference problems and numbers that are close together. It is important that children understand that although they are counting on, they are finding the difference which is subtraction!



## Key Vocabulary

Take, take away, less, minus, subtract, leaves, difference between, how many fewer/ less, least, count back, strategy, method, tens, ones, partition, regrouping.



# Progression in Calculations

## Year One and Two



### *Multiplication and Division*

#### **National Curriculum objectives linked to multiplication and division**

These objectives are specifically covered by the strategies outlined in this document:

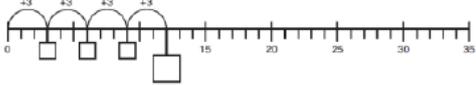
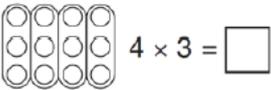
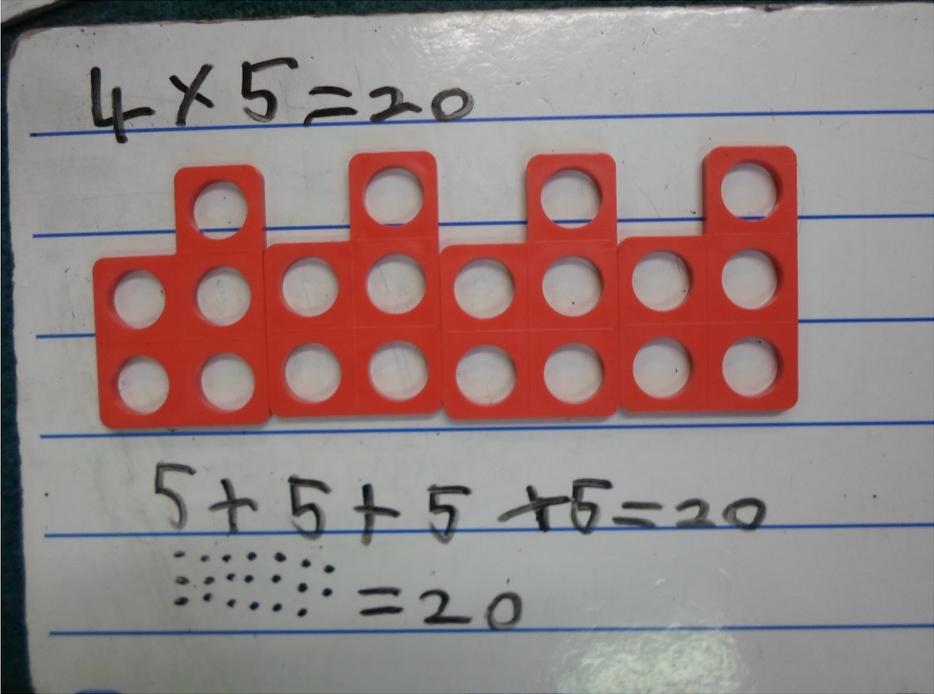
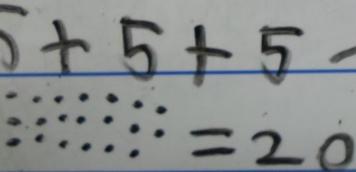
- Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers.
- Show that the multiplication of two numbers can be done in any order (commutative) but division of one number by another cannot.

The following objectives should be planned for lessons where new strategies are being introduced and developed:

- Calculate statements for multiplication and division within the multiplication tables and write them using the multiplication ( $\times$ ), division ( $\div$ ) and equal to ( $=$ ) symbols.
- Solve problems involving multiplication and division.

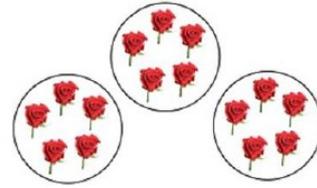
*Using materials, arrays, repeated addition, mental methods and multiplication and division facts.*

# MULTIPLICATION

Strategy and Guidance	CPA
<p>Skip counting in multiples of 2, 3, 5 and 10 from 0</p> <p><i>Pupils can use fingers or bead strings as they are skip counting to help them develop an understanding of 'groups of'.</i></p>	
<p>Multiplication as repeated addition</p> <p><i>Pupils will apply skip counting to help them find the totals of these repeated additions.</i></p>	  $5 + 5 + 5 + 5 + 5 + 5 + 5 = \square$  $4 \times 3 = \square$  
<p>Repeated addition using Numicon</p> <p><i>Numicon is a useful resource for repeated addition. At a basic level, if a child is not ready to skip count, Numicon can help them to understand the basic idea of 'groups of'.</i></p>	  $5 + 5 + 5 + 5 = 20$  $= 20$

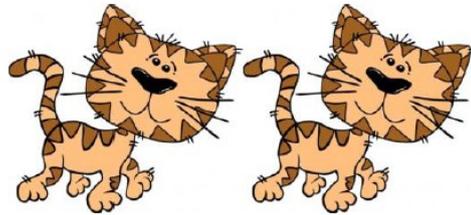
Repeated Addition using Pictorial Representations

There are 5 roses in each garden. How many roses in 3 gardens?



$$5 + 5 + 5 = 15$$

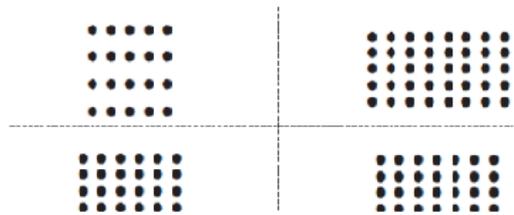
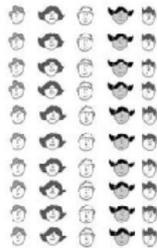
How many legs will 2 cats have?



$$4 + 4 = 8$$

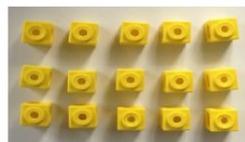
Using arrays to support multiplication

Concrete objects, pictures and then dots can be arranged into arrays. It is important to discuss with the children how arrays can be useful. Pupils will begin to understand multiplication as a more abstract concept and apply their skip-counting to multiply by 2, 5 and 10. This also introduces the relationship between multiplication and division.



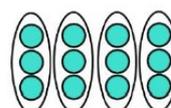
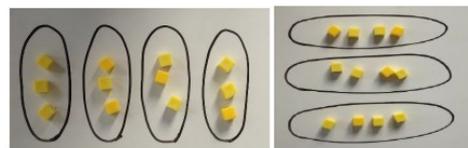
Multiplication is commutative

Pupils should understand that arrays (and later bar models) can represent different equations and that multiplication can be done in any order.

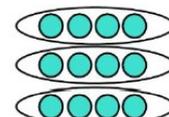


$3 \times 5 = \square$

$5 \times 3 = \square$



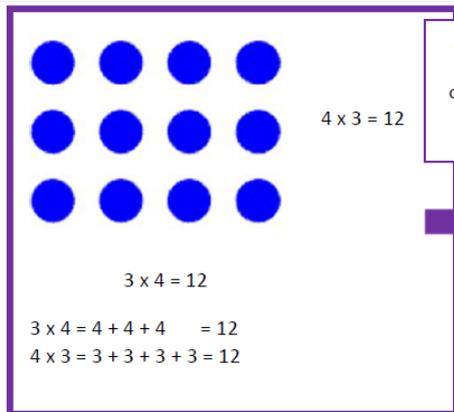
$12 = 3 \times 4$



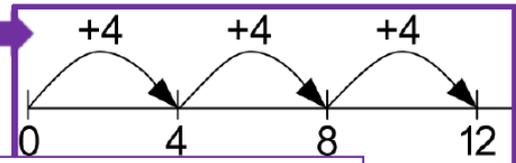
$12 = 4 \times 3$

## Multiplying using arrays and repeated addition

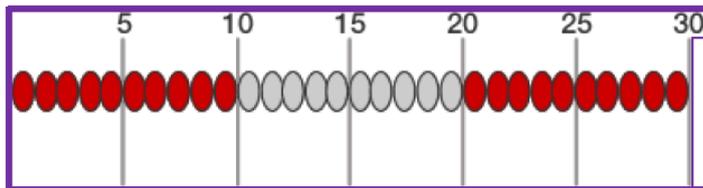
*In Year 2 children will develop knowledge of how to make their own arrays to solve a problem and also how repeated addition on a number line can get them a solution.*



Arrays are super for children to solve the answer to simple problems. They are also great for showing children the commutative law, for example, if you turned this array for  $3 \times 4 = 12$  sideways you would see that  $4 \times 3$  also equals 12.



Repeated addition is a good progression from arrays. It encourages the children to use addition facts on a blank numberline and count up to their answer as shown on the example above which models that  $3 \times 4 = 12$ .

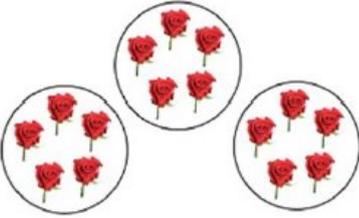
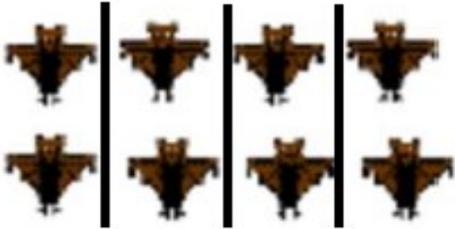
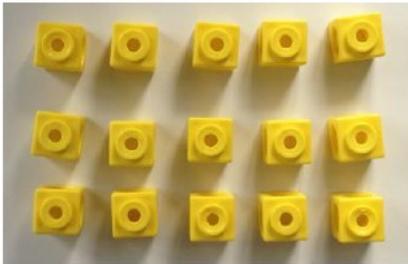
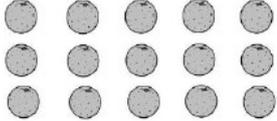


Mental methods and practical apparatus are still very important at this stage. Visual images such as the bead string to the left that demonstrates  $6 \times 5 = 30$  will support children's visualization of multiplication and allow them to develop stronger mental skills.

### Key Vocabulary

Groups of, lots of, sets of, times, array, altogether, multiply, multiplied by, repeated addition, column, row, commutative, equal groups.

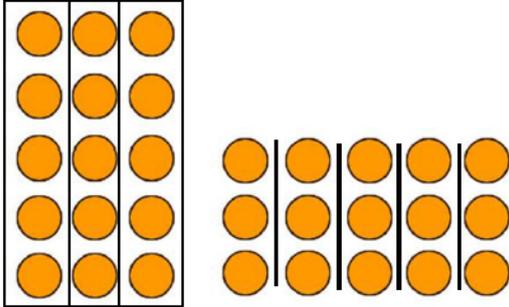
# DIVISION

Strategy and Guidance	CPA
<p>Division as sharing</p> <p><i>This should be introduced using physical objects with emphasis on the need for <b>equal</b> groups.</i></p>	<p style="text-align: center;">A farmer has 15 roses and shares them between 3 friends. How many roses do they each get?</p> <div style="text-align: center;">  </div> <p style="text-align: center;">15 roses shared between 3 = 5 roses each</p>
<p>Division as grouping</p>	<p style="text-align: center;">Bats fly in groups of 2. How many groups of 2 will there be if there are 8 bats?</p> <div style="text-align: center;">  </div> <p style="text-align: center;">8 bats shared into groups of 2 = 2 bats in each group</p>
<p>Use of arrays to emphasise the relationship between multiplication and division</p> <p><i>Pupils use different types of arrays to find division sentences.</i></p>	<div style="text-align: center;">  </div> <div style="display: flex; justify-content: space-around; margin-top: 20px;"> <div style="text-align: left;"> <math>15 \div 5 = \boxed{3}</math>  <math>15 \div 3 = \boxed{5}</math> </div> <div style="text-align: center;">  </div> </div> <p style="text-align: center; font-size: small;">Write the division equations that the array represents.</p> <hr style="width: 50%; margin: 10px auto;"/> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="text-align: center;"> <math>20 \div 4 = \boxed{\phantom{00}}</math> </div> <div style="text-align: center;"> <math>20 \div 5 = \boxed{\phantom{00}}</math> </div> </div>

## Grouping and sharing larger quantities using written methods and symbols

Children will continue to use their understanding of sharing and grouping in division using concrete objects to support their understanding of arrays. They will also use their number line for grouping.

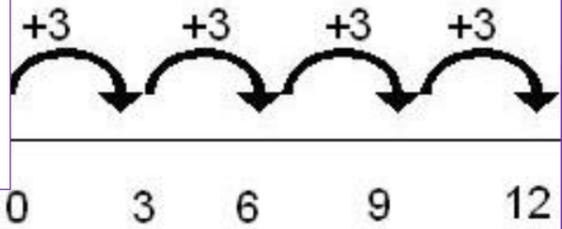
To solve problems such as  $15 \div 3 =$ , children will share 15 objects into 3 groups like in the first array or make groups of 3 until they get to 15, like in the second image.



Completing both of these processes will help children see the link between sharing and grouping but also the link between  $15 \div 3 = 5$  and  $15 \div 5 = 3$ .

The difference between grouping and sharing should be discussed regularly and visual models and diagrams are very important. Children should solve a variety of contextual problems that will require them to group or share.

Children will start to group on a numberline- which will help cement their understanding of division as grouping. When grouping on a numberline, children will start with a zero at the beginning and will write the dividend at the end of the line, they will then jump in steps of the divisor. The example to the right shows a numberline for the calculation  $12 \div 3 = 4$  as there were 4 jumps of 3 to get to 12.



### Key Vocabulary

Share, share equally, groups of, lots of, sets of, array, divide, divided by, divided into, division, grouping, number line, left, left over.