

## St Andrew's VC Lower School

### MATHEMATICS CALCULATION POLICY

At St Andrew's VC Lower School we believe that children should be introduced to the processes of calculation through practical, oral and mental activities. As children begin to understand the underlying ideas, they develop ways of recording to support their thinking and calculation methods, use particular methods that apply to special cases, and learn to interpret and use the signs and symbols involved.

Choosing the appropriate strategy, recording in mathematics and in particular, calculation, is an important tool both for furthering the understanding of ideas and for communicating those ideas to others. A useful written method is one that helps children carry out a calculation and can be understood by others.

Written methods are complementary to mental methods and should not be seen as separate from them. The aim is that children use mental methods when appropriate, but for calculations that they cannot do in their heads they use an efficient written method accurately and with confidence. It is important children acquire secure mental methods of calculation and one efficient written method of calculation for addition, subtraction, multiplication and division which they know they can rely on when mental methods are not appropriate.






This document identifies progression in calculation strategies rather than specifying which method should be taught in a particular year group. Children should not be made to go onto the next stage if:

- 1) they are not ready.
- 2) they are not confident.

By the end of Year 4, children should be encouraged to choose the most appropriate approach to solve a problem: making a choice between using jottings, an extended written method, an efficient written method or a mental method.

This policy contains the key pencil and paper procedures that will be taught within our school alongside practical resources. It has been written to ensure consistency and progression throughout the school and reflects a whole school agreement.

**Addition - EYFS** Maths for young children should be meaningful. Where possible, concepts should be taught in the context of real life.

GUIDANCE/MODELS AND IMAGES	KEY VOCABULARY
<p>If available, Numicon shapes are introduced straight away and can be used to:</p> <ul style="list-style-type: none"> <li>• identify 1 more/less</li> <li>• combine pieces to add.</li> <li>• find number bonds.</li> <li>• add without counting.</li> </ul> <p>Children can record this by printing or drawing around Numicon pieces.</p>  <p>Children begin to combine groups of objects using concrete apparatus</p>  <p>Construct number sentences verbally or using cards to go with practical activities.</p> <p>Children are encouraged to read number sentences aloud in different ways          "Three add two equals 5" "5 is equal to three and two"</p> <p>Children make a record in pictures, words or symbols of addition activities already carried out.</p> <p>Solve simple problems using fingers</p>  <p><math>5 + 1 = 6</math></p> <p>Number tracks can be introduced to count up on and to find one more: </p> <p>What is 1 more than 4? 1 more than 13?</p> <p>Number lines can then be used alongside number tracks and practical apparatus to solve addition calculations and word problems.</p>  <p><math>5 + 3 = 8</math></p> <p>Children will need opportunities to look at and talk about different models and images as they move between representations.</p>	<p>Games and songs can be a useful way to introduce the vocabulary of addition.</p> <p>add          more          and          make          sum          total          altogether          score          double          one more, two more, ten more          how many more to make...?          how many more is .....than?</p>

## Addition - Year 1

### + = signs and missing numbers

Children need to understand the concept of equality before using the '=' sign. Calculations should be written either side of the equality sign so that the sign is not just interpreted as 'the answer'.

$$2 = 1 + 1$$

$$2 + 3 = 4 + 1$$

Missing numbers need to be placed in all possible places.

$$3 + 4 = \square + 3 = 3 + 4$$

$$3 + \square = 7 \quad 7 = \square + 4$$

### Counting and Combining sets of Objects

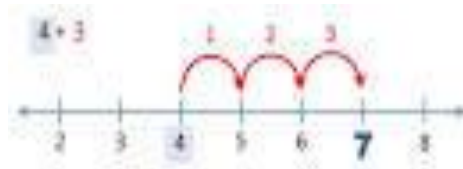
Combining two sets of objects (aggregation) which will progress onto adding on to a set (augmentation)



Understanding of counting on with a number track.



Understanding of counting on with a number line (supported by models and images).



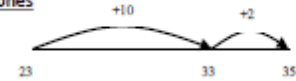
## Addition - Year 2

Missing number problems e.g.  $14 + 5 = 10 + \square$      $32 + \square + \square = 100$   
 $35 = 1 + \square + 5$

It is valuable to use a range of representations (also see Y1). Continue to use numberlines to develop understanding of:

### Counting on in tens and ones

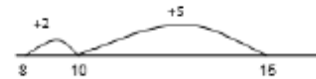
$$\begin{aligned} 23 + 12 &= 23 + 10 + 2 \\ &= 33 + 2 \\ &= 35 \end{aligned}$$



### Partitioning and bridging through 10.

The steps in addition often bridge through a multiple of 10 e.g. Children should be able to partition the 7 to relate adding the 2 and then the 5.

$$8 + 7 = 15$$



### Adding 9 or 11 by adding 10 and adjusting by 1

e.g. Add 9 by adding 10 and adjusting by 1

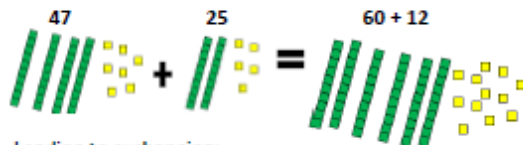
$$35 + 9 = 44$$



### Towards a Written Method

Partitioning in different ways and recombine

$$47 + 25$$



Leading to exchanging:



### Expanded written method

$$40 + 7 + 20 + 5 =$$

$$40 + 20 + 7 + 5 =$$

$$60 + 12 = 72$$

$$\begin{array}{r} 40 + 7 \\ + 20 + 5 \\ \hline 60 + 12 = 72 \end{array}$$

## Addition - Year 3

Missing number problems using a range of equations as in Year 1 and 2 but with appropriate, larger numbers.

### Partition into tens and ones

Partition both numbers and recombine.

Count on by partitioning the second number only e.g.

$$\begin{aligned} 247 + 125 &= 247 + 100 + 20 + 5 \\ &= 347 + 20 + 5 \\ &= 367 + 5 \\ &= 372 \end{aligned}$$

Children need to be secure adding multiples of 100 and 10 to any three-digit number including those that are not multiples of 10. Numberlines can still be used.

### Towards a Written Method

Introduce expanded column addition modelled with place value counters (Dienes could be used for those who need a less abstract representation)

			$\begin{aligned} 200 + 40 + 7 \\ 100 + 20 + 5 \\ 300 + 60 + 12 &= 372 \end{aligned}$
			$\begin{array}{r} 247 \\ +125 \\ \hline 12 \\ 60 \\ \hline 300 \\ 372 \end{array}$

Leading to children understanding the exchange between tens and ones.

Some children may begin to use a formal columnar algorithm, initially introduced alongside the expanded method. The formal method should be seen as a more streamlined version of the expanded method, not a new method.

$$\begin{array}{r} 247 \\ +125 \\ \hline 372 \\ \hline 10 \end{array}$$

## Addition - Year 4

Missing number/digit problems:

**Mental methods** should continue to develop, supported by a range of models and images, including the number line. The bar model should continue to be used to help with problem solving.

### Written methods (progressing to 4-digits)

Expanded column addition modelled with place value counters, progressing to calculations with 4-digit numbers.

			$\begin{aligned} 200 + 40 + 7 \\ 100 + 20 + 5 \\ 300 + 60 + 12 &= 372 \end{aligned}$
			$\begin{array}{r} 247 \\ +125 \\ \hline 12 \\ 60 \\ \hline 300 \\ 372 \end{array}$

### Compact written method

Extend to numbers with at least four digits.



		$\begin{array}{r} 2634 \\ +4517 \\ \hline 7151 \end{array}$
		$\begin{array}{r} 2634 \\ +4517 \\ \hline 7151 \end{array}$

Children should be able to make the choice of reverting to expanded methods if experiencing any difficulty.

Extend to up to two places of decimals (same number of decimal places) and adding several numbers (with different numbers of digits).

$$\begin{array}{r} 72.8 \\ +54.6 \\ \hline 127.4 \\ \hline 11 \end{array}$$

**Subtraction - EYFS** Maths for young children should be meaningful. Where possible, concepts should be taught in the context of real life.

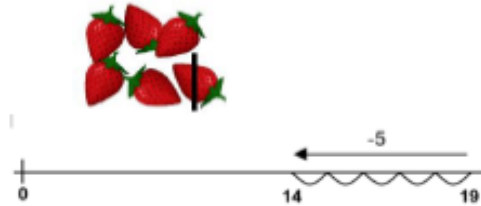
GUIDANCE/MODELS AND IMAGES	KEY VOCABULARY
<p>Children begin with mostly pictorial representations</p> <p>X X X    <span style="border: 1px solid black; padding: 2px;">X X</span></p> <p>Concrete apparatus is used to relate subtraction to taking away and counting how many objects are left.</p> <p>Concrete apparatus models the subtraction of 2 objects from a set of 5.</p> <p>Construct number sentences verbally or using cards to go with practical activities.</p> <p>Children are encouraged to read number sentences aloud in different ways "five subtract one leaves four" "four is equal to five subtract one"</p> <p>Children make a record in pictures, words or symbols of subtraction activities already carried out.</p> <p>Solve simple problems using fingers</p> <p> <math>5 - 1 = 4</math></p> <p>Number tracks can be introduced to count back and to find one less:</p> <p><span style="border: 1px solid black; padding: 2px;">1</span> <span style="border: 1px solid black; padding: 2px;">2</span> <span style="border: 1px solid black; padding: 2px;">3</span> <span style="border: 1px solid black; padding: 2px;">4</span> <span style="border: 1px solid black; padding: 2px;">5</span> <span style="border: 1px solid black; padding: 2px;">6</span></p> <p>What is 1 less than 9? 1 less than 20?</p> <p>Number lines can then be used alongside number tracks and practical apparatus to solve subtraction calculations and word problems. Children count back under the number line.</p> <p><math>8 - 3 = 5</math> </p> <p>Children will need opportunities to look at and talk about different models and images as they move between representations.</p>	<p>Games and songs can be a useful way to introduce the vocabulary of subtraction.</p> <p>take (away) leave how many are left /left over? how many are gone? one less, two less, ten less.. how many fewer is...? difference between</p>

## Subtraction - Year 1

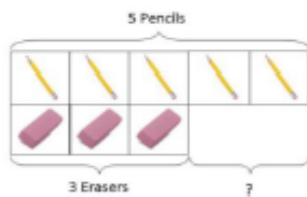
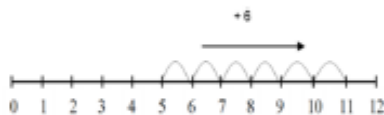
Missing number problems e.g.  $7 = \square - 9$ ;  $20 - \square = 9$ ;  $15 - 9 = \square$ ;  $\square - \square = 11$ ;  $16 - 0 = \square$

Use concrete objects and pictorial representations. If appropriate, progress from using number lines with every number shown to number lines with significant numbers shown.

Understand subtraction as take-away:



Understand subtraction as finding the difference:



The above model would be introduced with concrete objects which children can move (including cards with pictures) before progressing to pictorial representation.

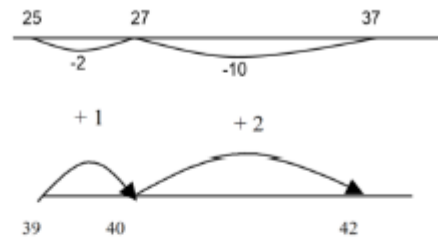
The use of other images is also valuable for modelling subtraction e.g. Numicon, bundles of straws, Dienes apparatus, multi-link cubes, bead strings

## Subtraction - Year 2

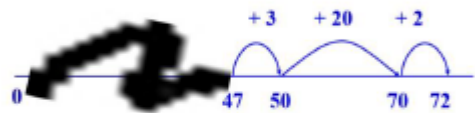
Missing number problems e.g.  $52 - 8 = \square$ ;  $\square - 20 = 25$ ;  $22 = \square - 21$ ;  $6 + \square + 3 = 11$

It is valuable to use a range of representations (also see Y1). Continue to use number lines to model take-away and difference.

E.g.



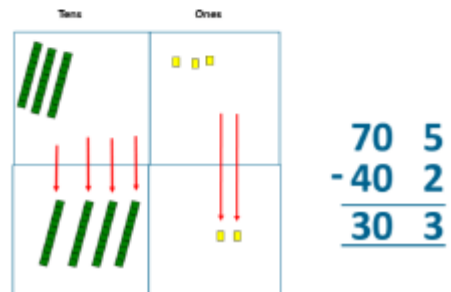
The link between the two may be supported by an image like this, with 47 being taken away from 72, leaving the difference, which is 25.



The bar model should continue to be used, as well as images in the context of measures.

**Towards written methods**

Recording addition and subtraction in expanded columns can support understanding of the quantity aspect of place value and prepare for efficient written methods with larger numbers. The numbers may be represented with Dienes apparatus. E.g.  $75 - 42$



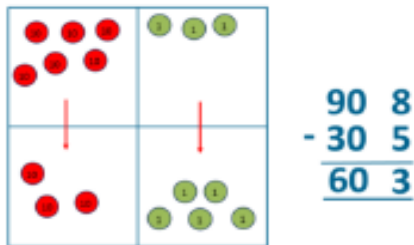
## Subtraction - Year 3

Missing number problems e.g.  $\square = 43 - 27$ ;  $145 - \square = 138$ ;  $274 - 30 = \square$ ;  $245 - \square = 195$ ;  $532 - 200 = \square$ ;  $364 - 153 = \square$

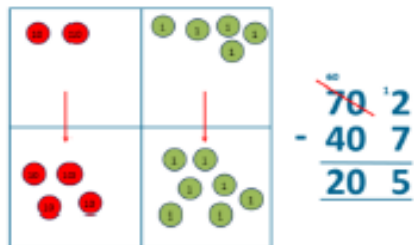
**Mental methods** should continue to develop, supported by a range of models and images, including the number line. The bar model should continue to be used to help with problem solving (see Y1 and Y2). Children should make choices about whether to use complementary addition or counting back, depending on the numbers involved.

### Written methods (progressing to 3-digits)

Introduce expanded column subtraction with no decomposition, modelled with place value counters (Dienes could be used for those who need a less abstract representation)



For some children this will lead to exchanging, modelled using [place value counters](#) (or [Dienes](#)).



A number line and expanded column method may be compared next to each other.

Some children may begin to use a formal columnar algorithm, initially introduced alongside the expanded method. The formal method should be seen as a more streamlined version of the expanded method, not a new method.

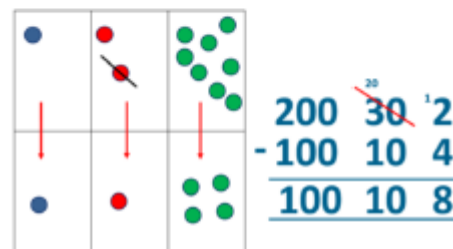
## Subtraction - Year 4

Missing number/digit problems:  $456 + \square = 710$ ;  $1\square7 + 6\square = 200$ ;  $60 + 99 + \square = 340$ ;  $200 - 90 - 80 = \square$ ;  $225 - \square = 150$ ;  $\square - 25 = 67$ ;  $3450 - 1000 = \square$ ;  $\square - 2000 = 900$

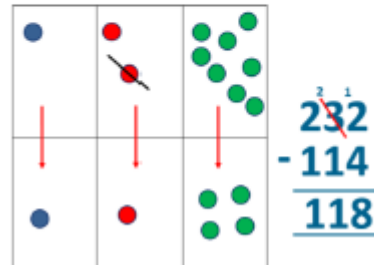
**Mental methods** should continue to develop, supported by a range of models and images, including the number line. The bar model should continue to be used to help with problem solving.

### Written methods (progressing to 4-digits)




Expanded column subtraction with decomposition, modelled with place value counters, progressing to calculations with 4-digit numbers.]



If understanding of the expanded method is secure, children will move on to the formal method of decomposition, which again can be initially modelled with place value counters.



**Multiplication - EYFS** Maths for young children should be meaningful. Where possible, concepts should be taught in the context of real life.

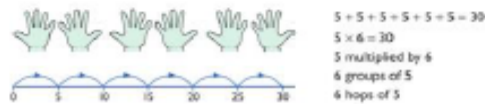
GUIDANCE/MODELS AND IMAGES	KEY VOCABULARY
<p>The link between addition and multiplication can be introduced through doubling.</p> <p>If available, Numicon is used to visualise the repeated adding of the same number. These can then be drawn around or printed as a way of recording.</p> <p>Children begin with mostly pictorial representations:</p>  <p>How many groups of 2 are there?</p> <p>Real life contexts and use of practical equipment to <u>count in repeated groups of the same size</u>:</p>  <p>How many wheels are there altogether?      How much money do I have?</p> <p>Count in twos; fives; tens both aloud and with  objects</p> <p>Children are <u>given multiplication problems set in a real life context</u>. Children are encouraged to visualise the problem.</p> <p>How many fingers on two hands?    How many sides on three triangles?    How many legs on four ducks?</p> <p>Children are encouraged to read number sentences aloud in different ways "five times two make ten" "ten is equal to five multiplied by two"</p>	<p>Lots of Groups of times multiply once, twice, three times .... repeated difference between</p>



## Multiplication - Year 1

Understand multiplication is related to doubling and combining groups of the same size (repeated addition)

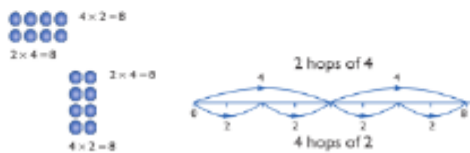
Washing line, and other practical resources for counting. Concrete objects. Numicon; bundles of straws, bead strings



Problem solving with concrete objects (including money and measures)

Use cuisenaire and bar method to develop the vocabulary relating to 'times' –  
Pick up five, 4 times

Use arrays to understand multiplication can be done in any order (commutative)



## Multiplication - Year 2

Expressing multiplication as a number sentence using x  
Using understanding of the inverse and practical resources to solve missing number problems.

$$7 \times 2 = \square \quad \square = 2 \times 7$$

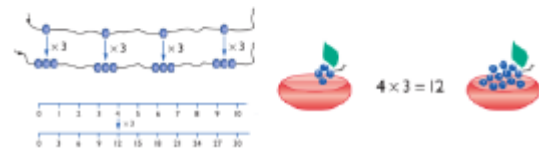
$$7 \times \square = 14 \quad 14 = \square \times 7$$

$$\square \times 2 = 14 \quad 14 = 2 \times \square$$

$$\square \times \square = 14 \quad 14 = \square \times \square$$

Develop understanding of multiplication using array and number lines (see Year 1). Include multiplications not in the 2, 5 or 10 times tables.

Begin to develop understanding of multiplication as scaling (3 times bigger/taller)

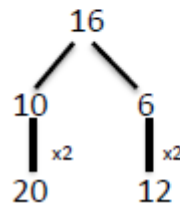


Doubling numbers up to 10 + 10  
Link with understanding scaling  
Using known doubles to work out double 2d numbers  
(double 15 = double 10 + double 5)



Towards written methods

Use jottings to develop an understanding of doubling two digit numbers.



## Multiplication - Year 3

Missing number problems  
Continue with a range of equations as in Year 2 but with appropriate numbers.  
Continue using the number line

### Mental methods

Doubling 2 digit numbers using partitioning

Demonstrating multiplication on a number line – jumping in larger groups of amounts

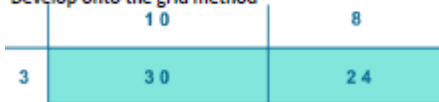
$$13 \times 4 = 10 \text{ groups of } 4 = 3 \text{ groups of } 4$$

### Written methods (progressing to 2d x 1d)

Developing written methods using understanding of visual images



Develop onto the grid method



Give children opportunities for children to explore this and deepen understanding using Dienes apparatus and place value counters

## Multiplication - Year 4

Continue with a range of equations as in Year 2 but with appropriate numbers. Also include equations with missing digits  
 $\square \times 5 = 160$

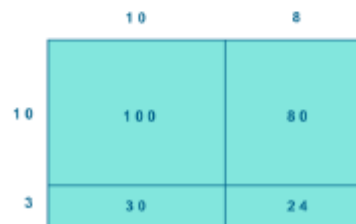
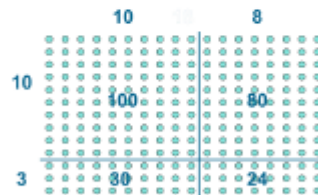
### Mental methods

Counting in multiples of 6, 7, 9, 25 and 1000, and steps of 1/100.

Solving practical problems where children need to scale up. Relate to known number facts. (e.g. how tall would a 25cm sunflower be if it grew 6 times taller?)

### Written methods (progressing to 3d x 2d)

Children to embed and deepen their understanding of the grid method to multiply up 2d x 2d. Ensure this is still linked back to their understanding of arrays and place value counters.





$$\begin{array}{r} 23 \\ \times 6 \\ 18 \\ + 120 \\ \hline 138 \end{array}$$

$$23 \times 6 =$$

$$6 \begin{array}{|c|c|} \hline 20 & 3 \\ \hline 120 & 18 \\ \hline \end{array}$$

$$\begin{array}{l} 20 \times 6 \quad 3 \times 6 \\ 23 \times 6 = 120 + 18 \\ = 138 \end{array}$$

**Division - EYFS** Maths for young children should be meaningful. Where possible, concepts should be taught in the context of real life.

GUIDANCE/MODELS AND IMAGES	KEY VOCABULARY
<p>The ELG states that children solve problems, including doubling, halving and sharing.</p> <p>Children need to see and hear representations of division as both grouping and sharing.</p> <p>Division can be introduced through halving.</p> <p>Children begin with mostly pictorial representations linked to real life contexts:</p> <div style="display: flex; align-items: flex-start;"> <div style="margin-right: 20px;">  <p><b>Grouping model</b> Mum has 6 socks. She grouped them into pairs – how many pairs can she make?</p> </div> <div style="margin-right: 20px;">  <p><b>Sharing model</b> I have 10 sweets. I want to share them with my friend. How many will we each have?</p> </div> </div> <p>Children have a go at recording the calculation that has been carried out.</p>	<p>halve</p> <p>share</p> <p>share</p> <p>equally</p> <p>one each,</p> <p>two each...</p> <p>group in</p> <p>pairs,</p> <p>threes...</p> <p>equal</p> <p>groups of</p> <p>divide</p> <p>divided by</p> <p>divided into</p> <p>left, left</p> <p>over</p>

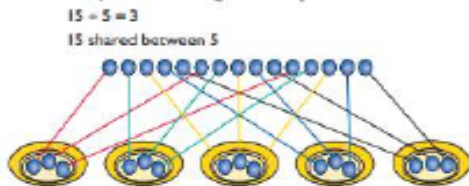
## Division - Year 1

Children must have secure counting skills- being able to confidently count in 2s, 5s and 10s.  
Children should be given opportunities to reason about what they notice in number patterns.

**Group AND share small quantities- understanding the difference between the two concepts.**

### Sharing

Develops importance of one-to-one correspondence.



Children should be taught to share using concrete apparatus.

### Grouping

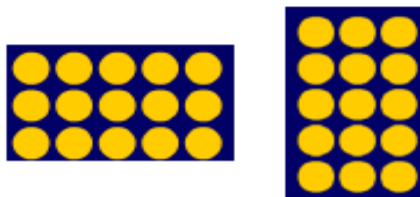
Children should apply their counting skills to develop some understanding of grouping.



Use of arrays as a pictorial representation for division.

$15 \div 3 = 5$  There are 5 groups of 3.

$15 \div 5 = 3$  There are 3 groups of 5.



Children should be able to find  $\frac{1}{2}$  and  $\frac{1}{4}$  and simple fractions of objects, numbers and quantities.

## Division - Year 2

$\div$  = signs and missing numbers

$$6 \div 2 = \square \quad \square = 6 \div 2$$

$$6 \div \square = 3 \quad 3 = 6 \div \square$$

$$\square \div 2 = 3 \quad 3 = \square \div 2$$

$$\square \div \nabla = 3 \quad 3 = \square \div \nabla$$

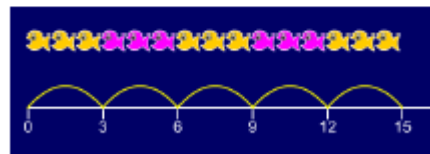
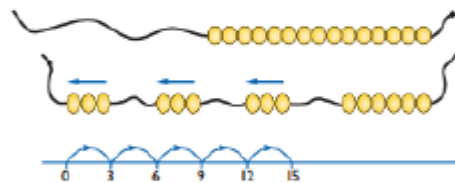
Know and understand sharing and grouping- introducing children to the  $\div$  sign.

Children should continue to use grouping and sharing for division using practical apparatus, arrays and pictorial representations.

Grouping using a numberline

Group from zero in jumps of the divisor to find our 'how many groups of 3 are there in 15?'

$$15 \div 3 = 5$$



Continue work on arrays. Support children to understand how multiplication and division are inverse. Look at an array – what do you see?

--	--

## Division - Year 3

### $\div$ = signs and missing numbers

Continue using a range of equations as in year 2 but with appropriate numbers.

#### Grouping

How many 6's are in 30?

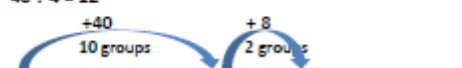
$30 \div 6$  can be modelled as:



#### Becoming more efficient using a number line

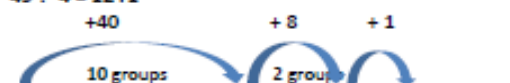
Children need to be able to partition the dividend in different ways.

$$48 \div 4 = 12$$



#### Remainders

$$49 \div 4 = 12 \text{ r}1$$



Sharing – 49 shared between 4. How many left over?

Grouping – How many 4s make 49. How many are left over?

Place value counters can be used to support children apply their knowledge of grouping.

For example:

$$60 \div 10 = \text{How many groups of 10 in 60?}$$

$$600 \div 100 = \text{How many groups of 100 in 600?}$$

## Division - Year 4 (Leading to Year 5)

### $\div$ = signs and missing numbers

Continue using a range of equations as in year 3 but with appropriate numbers.

#### Sharing, Grouping and using a number line

Children will continue to explore division as sharing and grouping, and to represent calculations on a number line until they have a secure understanding. Children should progress in their use of written division calculations:

- Using tables facts with which they are fluent
- Experiencing a logical progression in the numbers they use, for example:
  1. Dividend just over 10x the divisor, e.g.  $84 \div 7$
  2. Dividend just over 10x the divisor when the divisor is a teen number, e.g.  $173 \div 15$  (learning sensible strategies for calculations such as  $102 \div 17$ )
  3. Dividend over 100x the divisor, e.g.  $840 \div 7$
  4. Dividend over 20x the divisor, e.g.  $168 \div 7$

All of the above stages should include calculations with remainders as well as without.

Remainders should be interpreted according to the context. (i.e. rounded up or down to relate to the answer to the problem)

e.g.  $840 \div 7 = 120$

#### Jottings

$$7 \times 100 = 700$$

$$7 \times 10 = 70$$

$$7 \times 20 = 140$$



## Division

Grouping Expanded (The Bus Stop Method)

$$196 \div 6 = 32 \text{ R } 4$$

$$\begin{array}{r} 6 \overline{) 196} \\ \underline{-60} \quad (6 \times 10) \\ 136 \\ \underline{-60} \quad (6 \times 10) \\ 76 \\ \underline{-60} \quad (6 \times 10) \\ 16 \\ \underline{-12} \quad (6 \times 2) \\ 4 \end{array}$$





