

*'...those who hope in the LORD will renew their strength.  
They will soar on wings like eagles; they will run and not grow weary,  
they will walk and not be faint' Isaiah 40:31*

connect | nurture | aspire | learn | excel | hope



## Reculver Church of England Primary School



# Calculation Policy

Date adopted by Local Governing Body:

Date of next Review:

September 2019



# 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.

$$3 + 4 = \square$$

$$\square = 3 + 4$$

$$3 + \square = 7$$

$$7 = \square + 4$$

## Counting and Combining sets of Objects

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



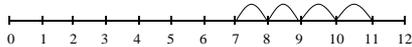
## Understanding of counting on with a number track.



## Understanding of counting on with a number line

(supported by models and images).

$$7 + 4$$



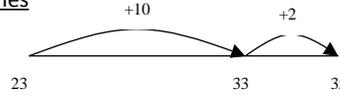
# Year 2

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 number lines to develop understanding of:

## Counting on in tens and ones

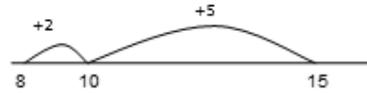
$$\begin{aligned} 23 + 12 &= 23 + 10 + 2 \\ &= 33 + 2 \\ &= 35 \end{aligned}$$



## 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.

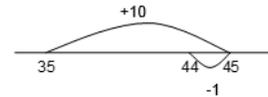
$$8 + 7 = 15$$



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

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

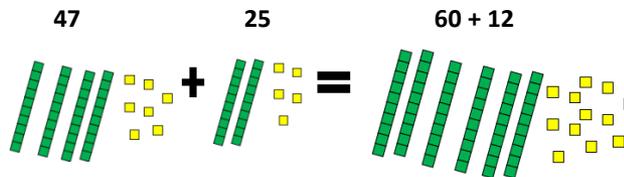
$$35 + 9 = 44$$



## Towards a Written Method

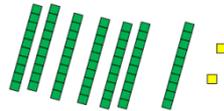
Partitioning in different ways and recombine

$$47 + 25$$



Leading to exchanging:

$$72$$



## Expanded written method

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

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

$$60 + 12 = 72$$

$$\begin{aligned} &40 + 7 \\ &+ 20 + 5 \\ &60 + 12 = 72 \end{aligned}$$

# 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.

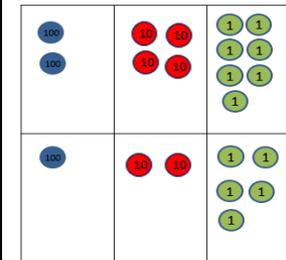
Count on by partitioning the second number only e.g.

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

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

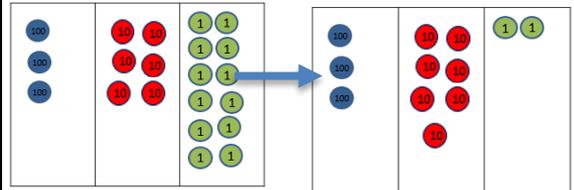
## Towards a Written Method (up to 3 digits)

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



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

Leading to children understanding the exchange between tens and ones.



Children will begin to use a formal columnar algorithm.

$$\begin{array}{r} 247 \\ +125 \\ \hline 372 \\ \hline 1 \end{array}$$

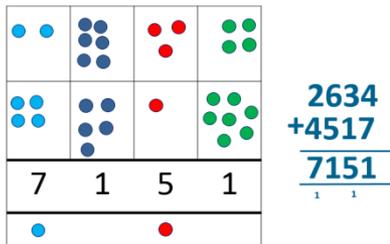
## Year 4

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.

### **Compact written method**

Extend to numbers with at least four digits.



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

$$\begin{array}{r}
 72.8 \\
 + 54.6 \\
 \hline
 127.4 \\
 \small{1 \quad 1}
 \end{array}$$

## Year 5

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. Children should practise with increasingly large numbers to aid fluency  
e.g.  $12462 + 2300 = 14762$

### **Written methods (progressing to more than 4-digits)**

Children will use the formal columnar method for whole numbers and decimal numbers as an efficient written algorithm.

$$\begin{array}{r}
 172.83 \\
 + 54.68 \\
 \hline
 227.51 \\
 \small{1 \quad 1 \quad 1}
 \end{array}$$

Place value counters can be used alongside the columnar method to develop understanding of addition with decimal numbers.

## Year 6

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**

As year 5, progressing to larger numbers, aiming for both conceptual understanding and procedural fluency with columnar method to be secured. Continue calculating with decimals, including those with different numbers of decimal places

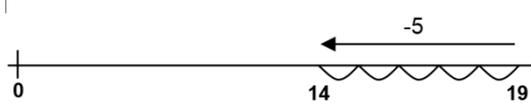
### **Problem Solving**

Teachers should ensure that pupils have the opportunity to apply their knowledge in a variety of contexts and problems (exploring cross curricular links) to deepen their understanding.

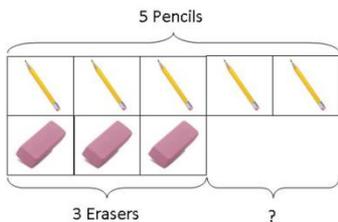
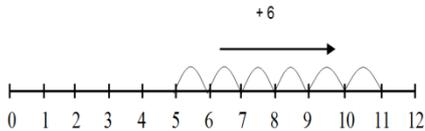
## Year 1

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:

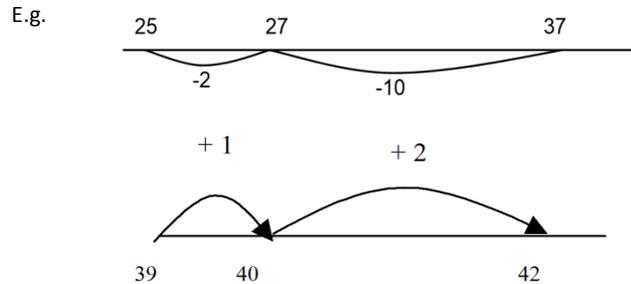


The above model would be introduced with concrete objects which children can move (including cards with pictures) before progressing to pictorial representation.

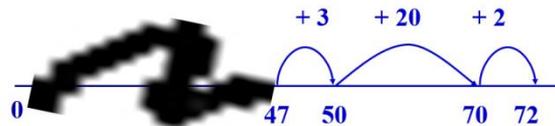
The use of other images is also valuable for modelling subtraction e.g. Numicon, bundles of straws, Dienes apparatus, multi-link cubes, bead strings

## 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.



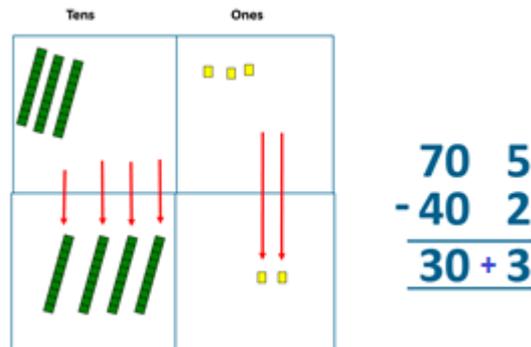
The link between the two may be supported by an image like this, with 47 being taken away from 72, leaving the difference, which is 25.



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.  $75 - 42$



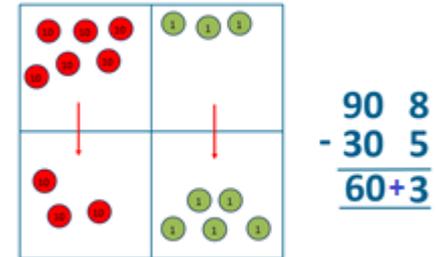
## Year 3

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.

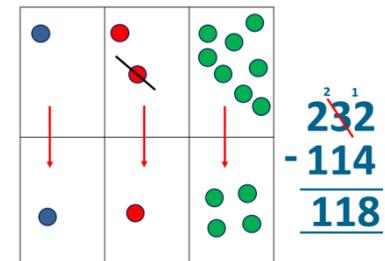
### Written methods (progressing to 3-digits)

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



This will lead to exchanging, modelled using place value counters (or Dienes).

Children will 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.



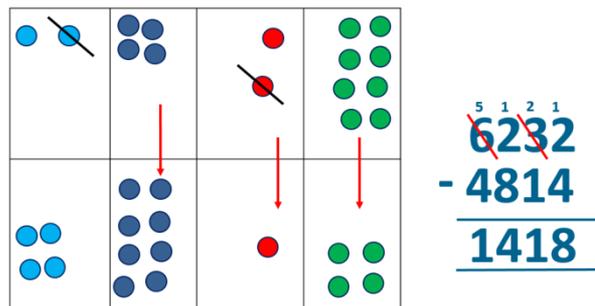
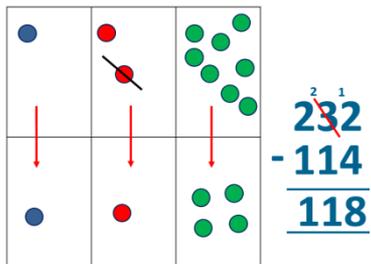
## Year 4

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)

Children will use the formal method of decomposition, which again can be initially modelled with place value counters., progressing to calculations with 4-digit numbers.



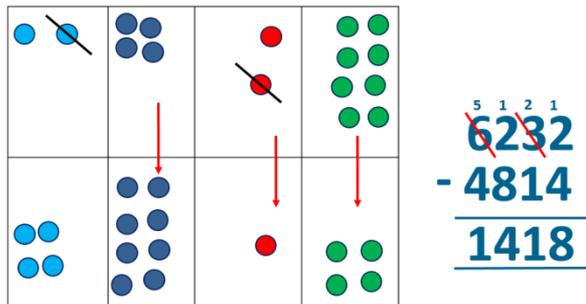
## Year 5

Missing number/digit problems:  $6.45 = 6 + 0.4 + \square$ ;  
 $119 - \square = 86$ ;  $1\ 000\ 000 - \square = 999\ 000$ ;  $600\ 000 + \square + 1000 = 671\ 000$ ;  $12\ 462 - 2\ 300 = \square$

**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.

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

Children will use the formal method of decomposition, which again can be initially modelled with place value counters., progressing to calculations with more than 4-digit numbers.



Progress to calculating with decimals, including those with different numbers of decimal places.

## Year 6

Missing number/digit problems:  $\square$  and  $\#$  each stand for a different number.  $\# = 34$ .  $\# + \# = \square + \square + \#$ . What is the value of  $\square$ ? What if  $\# = 28$ ? What if  $\# = 21$

$10\ 000\ 000 = 9\ 000\ 100 + \square$

$7 - 2 \times 3 = \square$ ;  $(7 - 2) \times 3 = \square$ ;  $(\square - 2) \times 3 = 15$

**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

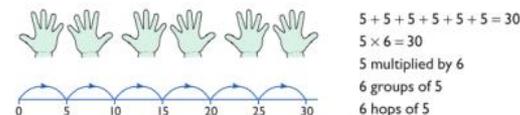
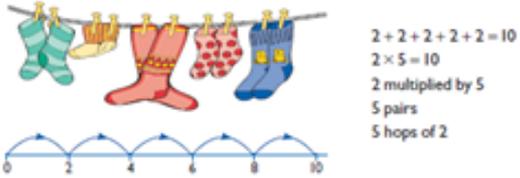
As year 5, progressing to larger numbers, aiming for both conceptual understanding and procedural fluency with decomposition to be secure.

Continue calculating with decimals, including those with different numbers of decimal places.

# Year 1

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

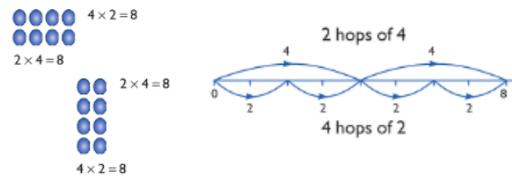
Washing line, and other practical resources for counting. Concrete objects. Numicon; bundles of straws, bead strings



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)



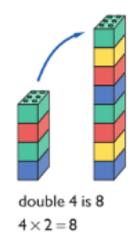
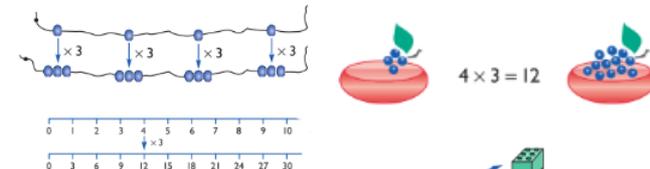
# Year 2

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

$7 \times 2 = \square$        $\square = 2 \times 7$   
 $7 \times \square = 14$        $14 = \square \times 7$   
 $\square \times 2 = 14$        $14 = 2 \times \square$   
 $\square \times \square = 14$        $14 = \square \times \square$

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

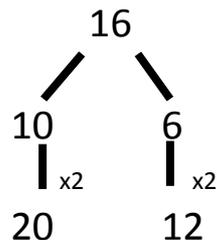
Begin to develop understanding of multiplication as scaling (3 times bigger/taller)



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.



# Year 3

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

### Mental methods

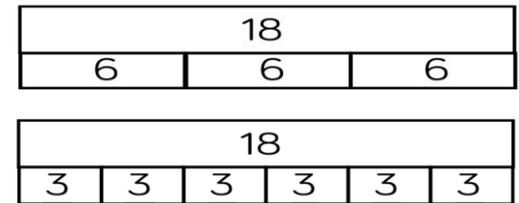
Doubling 2 digit numbers using partitioning (see year 2)

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

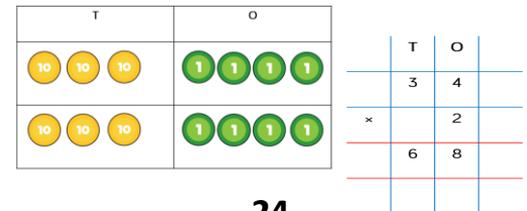
$13 \times 4 = 10 \text{ groups } 4 + 3 \text{ groups of } 4$

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

Developing written methods using understanding of visual images



Give children opportunities for children to explore this and deepen understanding using place value counters Begin to introduce short multiplication.



$24$   
 $\times 6$   
 $\hline 144$   
 $2$

## Year 4

Continue with a range of equations as in Year 2 but with appropriate numbers. Also include equations with missing digits

$$\square 2 \times 5 = 160$$

### 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 1d & increasing to 4d x 1d & 2d x 2d)

Children to embed and deepen their understanding of using short multiplication and long multiplication in the column method to multiply 2d x 2d.  
Multiply by the ones digit first, then the tens digit.

$$\begin{array}{r} 124 \\ \times 6 \\ \hline 744 \\ 12 \\ \hline 24 \\ \times 13 \\ \hline 72 \\ 1 \\ \hline 240 \\ \hline 311 \end{array}$$

1

## Year 5

Continue with a range of equations as in Year 2 but with appropriate numbers. Also include equations with missing digits

### Mental methods

X by 10, 100, 1000 using moving digits ITP  
Use practical resources and jottings to explore equivalent statements (e.g.  $4 \times 35 = 2 \times 2 \times 35$ )  
Recall of prime numbers up to 19 and identify prime numbers up to 100 (with reasoning)  
Solving practical problems where children need to scale up. Relate to known number facts.  
Identify factor pairs for numbers

### Written methods (progressing to 3d x 2d & 4d x 2d)

Children to use short multiplication for 2 digit x 1 digit  
Long multiplication using place value counters  
Multiply by the ones digit first, then the tens digit.

$$\begin{array}{r} 253 \\ \times 24 \\ \hline 1012 \\ \phantom{1012} 21 \\ \hline 9060 \\ \phantom{9060} 1 \\ \hline 10072 \end{array}$$

## Year 6

Continue with a range of equations as in Year 2 but with appropriate numbers. Also include equations with missing digits

### Mental methods

Identifying common factors and multiples of given numbers  
Solving practical problems where children need to scale up. Relate to known number facts.

### Written methods

Continue to refine and deepen understanding of written methods including fluency for using long multiplication

# Year 1

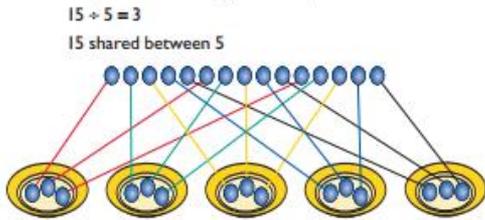
Children must have secure counting skills- being able to confidently count in 2s, 5s and 10s.

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

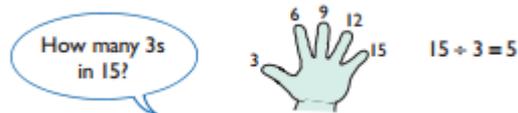
Develops importance of one-to-one correspondence.



Children should be taught to share using concrete apparatus.

### Grouping

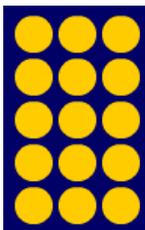
Children should apply their counting skills to develop some understanding of grouping.



Use of arrays as a pictorial representation for division.

15 ÷ 3 = 5 There are 5 groups of 3.

15 ÷ 5 = 3 There are 3 groups of 5.



Children should be able to find ½ and ¼ and simple fractions of objects, numbers and quantities.

# Year 2

## ÷ = signs and missing numbers

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

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

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

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

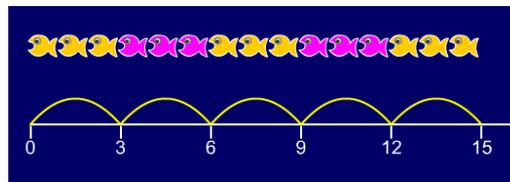
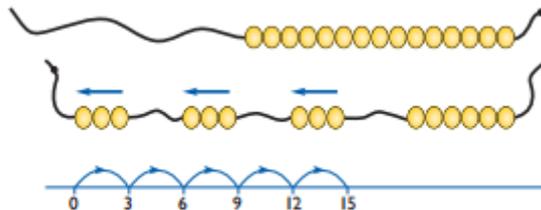
Know and understand sharing and grouping- introducing children to the ÷ sign.

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?

# Year 3

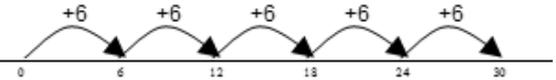
## ÷ = signs and missing numbers

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

## Grouping

How many 6's are in 30?

30 ÷ 6 can be modelled as:



## Becoming more efficient using a numberline

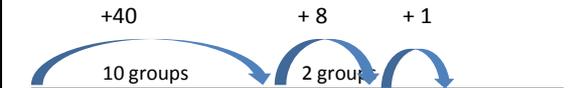
Children need to be able to partition the dividend in different ways.

$$48 \div 4 = 12$$



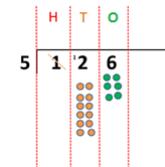
## Remainders

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



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.  
Some children will begin to use formal short division



## Year 4

## Year 5

## Year 6

### $\div$ = 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:
  - Dividend just over 10x the divisor, e.g.  $84 \div 7$
  - 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  $102 \div 17$ )
  - Dividend over 100x the divisor, e.g.  $840 \div 7$
  - 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)



### Jottings

$$7 \times 100 = 700$$

$$7 \times 10 = 70$$

$$7 \times 20 = 140$$

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

Continue using a range of equations but with appropriate numbers

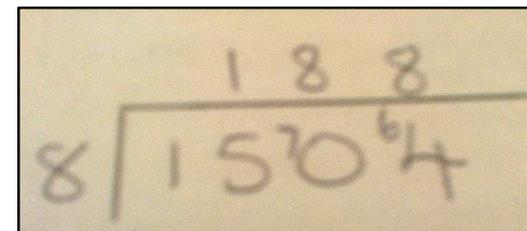
### Sharing and Grouping and using a number line

Children will continue to explore division as sharing and grouping, and to represent calculations on a number line as appropriate.

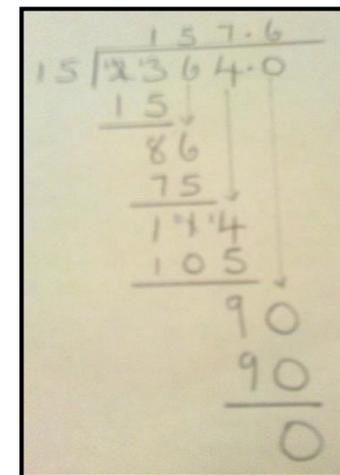
Quotients should be expressed as decimals and fractions

### Formal Written Methods – long and short division

E.g.  $1504 \div 8$

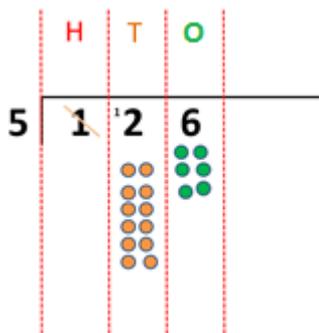


E.g.  $2364 \div 15$



### Formal Written Methods

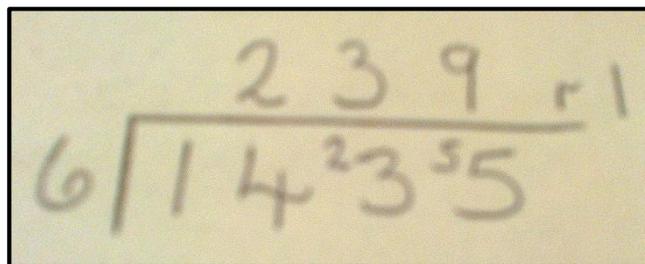
Short division to be modelled for understanding using place value counters as shown below. Children use the short method to solve 3 digit by 1 digit.



### Formal Written Methods

Continued as shown in Year 4, leading to the efficient use of a formal method.

E.g.  $1435 \div 6$



Children begin to practically develop their understanding of how express the remainder as a decimal or a fraction. Ensure practical understanding allows children to work through this (e.g. what could I do with this remaining 1? How could I share this between 6 as well?)

### Division using Factor pairs

E.g.  $7848 \div 24$  use between 2 & 12, 4 & 6 (See WRH Yr 6 Block 2 P.9 & 10)