

# Bedmond Village Primary & Nursery School



## Calculation Policy

**Reviewed on: September 2014**

**Approved by the Governing Body on: 7<sup>th</sup> November 2014**

**Review by: September 2016**

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# Vision of the Calculation Policy

The aim of this policy is to ensure all children leave Bedmond Village Primary and Nursery School with a secure understanding of the four operations and can confidently use both written and mental calculation strategies in a range of contexts.

This policy states the required mental strategies and sets out the progression of written procedures that the children will use as they progress in their understanding of the four operations.

Note that in order for children to develop a full understanding of the written procedures, they must first have a firm understanding of place value.

It is expected that the majority of pupils will progress through the calculation stages as stated in this policy.

However, children **should not** be made to go onto the next stage if:

- 1. They are not ready.**
- 2. They are not confident.**

Children who do grasp concepts rapidly should be challenged through sophisticated and diverse problems, before being accelerated through new content.

Furthermore, it is essential that at each stage, children are making choices about whether to use a mental or written method.

Finally, it is essential that the strategies in this policy are being taught through mathematical problems and activities that are contextualised, relevant and rich in key mathematical vocabulary.

# Mathematical Vocabulary

It is essential that the children are exposed to and supported in developing quality and varied mathematical vocabulary. This will support them in accessing mathematical problems, as well as presenting mathematical justification, argument or reasoning.

Therefore, it is staff's responsibility to facilitate mathematical discussion within lessons through modelling the use of this vocabulary and displaying it within their classrooms. Furthermore, visual and concrete resources should be used wherever possible to ensure the maths curriculum is accessible for all learners, especially EAL and SENd learners.

Below is the list of vocabulary associated with each operation. Note that some pieces of vocabulary relate to various operations, so it is vital that the children become familiar with this vocabulary in appropriate contexts.

<b>Addition and subtraction:</b>	<b>Multiplication and division:</b>
<p>add, addition, more, plus, increase, and, make, sum, total, altogether score, double, half, halve one more, two more, ten more etc... how many more to make... ? how many more is... than...? how much more is...?</p> <p>subtract, take (away), minus, decrease, leave how many are left/left over? how many have gone? one less, two less... ten less etc... how many fewer is... than...? difference between, leave is the same as, inverse</p>	<p>lots of, groups of times, multiplication, multiply, multiplied by multiple of, product once, twice, three times etc... times as (big, long, wide, and so on) repeated addition array, row, column</p> <p>double, halve, share, share equally one each, two each, three each etc... group in pairs, threes... tens equal groups of divide, division, divided by, divided into, divisible by, remainder, left, left over, factor, quotient, inverse</p>

## PROGRESSION THROUGH CALCULATIONS FOR ADDITION

### MENTAL CALCULATIONS

#### Mental recall of number bonds

$$6 + 4 = 10$$

$$25 + 75 = 100$$

$$\square + 3 = 10$$

$$19 + \square = 20$$

#### Use near doubles

$$6 + 7 = \text{double } 6 + 1 = 13$$

#### Addition using partitioning and recombining

$$34 + 45 = (30 + 40) + (4 + 5) = 79$$

#### Counting on or back in repeated steps of 1, 10, 100, 1000

$$86 + 57 = 143 \text{ (by counting on in tens and then in ones)}$$

$$460 - 300 = 160 \text{ (by counting back in hundreds)}$$

#### Add the nearest multiple of 10, 100 and 1000 and adjust

$$24 + 19 = 24 + 20 - 1 = 43$$

$$458 + 71 = 458 + 70 + 1 = 529$$

#### Use the relationship between addition and subtraction

$$36 + 19 = 55$$

$$19 + 36 = 55$$

$$55 - 19 = 36$$

$$55 - 36 = 19$$

*MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.*

*CHILDREN SHOULD BE ENCOURAGED TO CONSIDER IF A MENTAL CALCULATION WOULD BE APPROPRIATE BEFORE USING WRITTEN METHODS.*

THE FOLLOWING ARE STANDARDS THAT WE EXPECT THE MAJORITY OF CHILDREN TO ACHIEVE.

### Nursery

Before addition can be introduced, children need to have a secure knowledge of number. In Nursery, children are introduced to the concept of counting, number order, representation and number recognition through practical activities and games.

This is taught through child initiated games such as hide and seek and I spy. Children also learn how to count 1-1 (pointing to each object as they count) and that anything can be counted, for example, claps, steps and jumps.

This is reinforced by opportunities provided in the outdoor area for the children to count e.g. counting building blocks, twigs etc.

### **Introduction to addition:**

Once children are secure in their number knowledge up to 10, children are introduced to the concept of more and less. Children learn how to distinguish the difference between sets of objects and when two groups are of the same size.

Adults model the initial addition vocabulary supported by age appropriate definition. An example of this is "this group has more, this group has less. Wow! These groups have the same. They are equal"

*Children are taught all number objectives within the 30-50 month age band from the Development Matters curriculum. Children are then given opportunities to transfer adult taught skills during independent play. This is supported by the three characteristics of effective learning: playing and exploring, active learning, creating and thinking critically*

## Reception

Before addition can be introduced, children in Reception build on concepts taught in Nursery by working through the number objectives in the 40 - 60 month band of Development Matters. Children need to have a secure knowledge of number in order to begin addition.

Children are then introduced to the concept of addition through practical games and activities. Children act out addition sums to physically add two groups of objects together and use arm gestures to represent the signs + and =.

This is reinforced by opportunities provided in the outdoor area for the children to use addition e.g. adding together groups of building blocks, twigs etc.

Children build on their previous knowledge of 'more' by learning that adding two groups of objects together gives them a larger number (more objects).

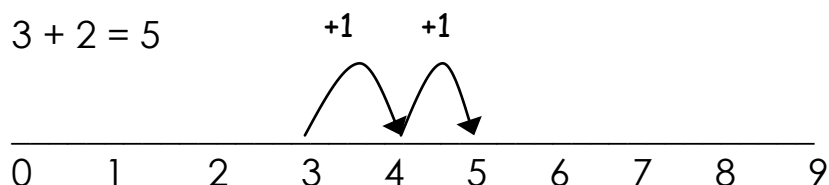
Adults model addition vocabulary supported by age appropriate definition. An example of this is "addition means we add two groups together / we put 2 lots of objects together. Equals means we find out how many we have got altogether. Wow! 3 add 2 equals 5! We have got 5 altogether".

Adults support children in recording their addition sums in the written form on whiteboards and on chosen paper. These are recorded in their Learning Journeys.

### **Number line:**

When children are ready, they use a numberline and **practical resources** to support addition e.g. child orientated / chosen characters linked to topic (e.g. Superman, Ben 10, Cinderella, Minnie Mouse).

Teachers *demonstrate* the use of the numberline counting on in ones.



***Children are taught all number objectives within the 40-60 month age band (including ELG) from the Development Matters curriculum. Children are then given opportunities to transfer adult taught skills during independent play. This is supported by the***

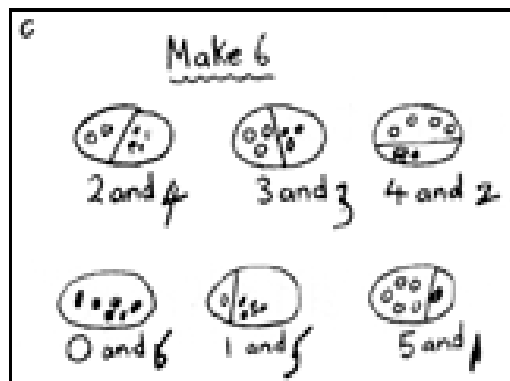
*three characteristics of effective learning: playing and exploring, active learning, creating and thinking critically*



## Year 1

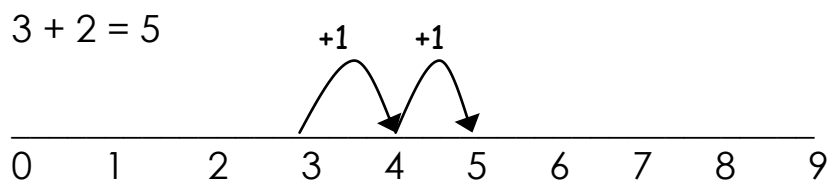
Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations using pictures, etc.

They should be encouraged to add through practical activities in meaningful contexts including using the outdoor area, as well as counting on using fingers.

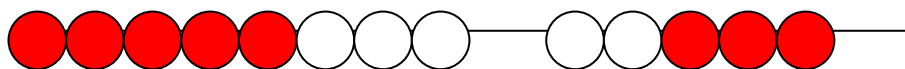


They use numberlines and **practical resources** to support calculation e.g. cubes, Numicon, Dienes, counters, beads etc.

Teachers *demonstrate* the use of the numberline counting on in ones.



**Bridging:** Bead strings or Dienes can be used to illustrate addition including bridging through ten by counting on 2 then counting on 3.



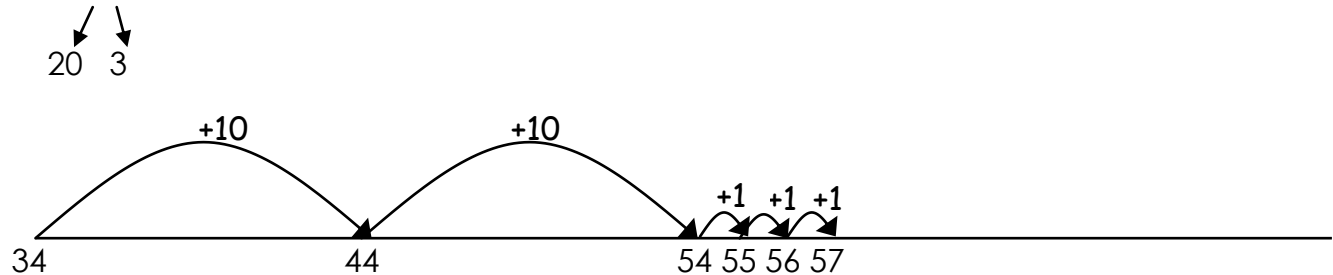
Video clips: [Using a range of equipment and strategies to reinforce addition statements / bonds to 10](#)

## Year 2

Children will begin to use 'empty number lines' themselves. Firstly partitioning the smaller number and then counting on from the larger number.

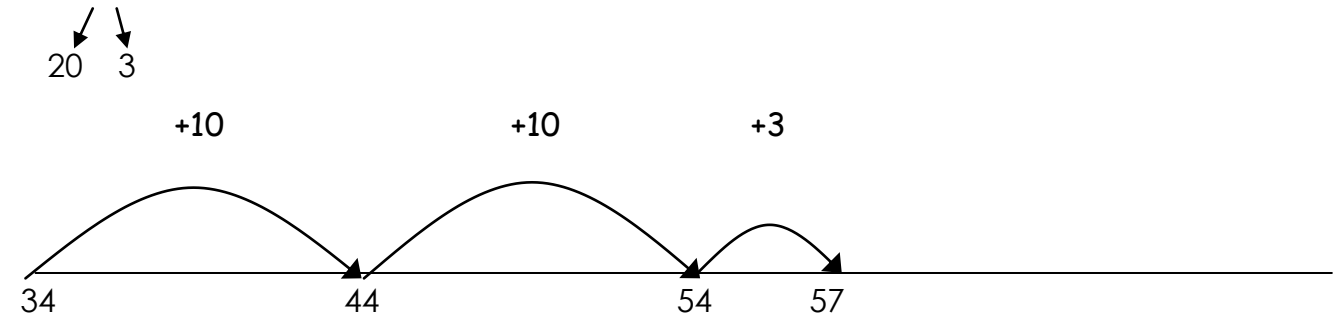
First counting on in tens and then ones.

$$34 + 23 = 57$$



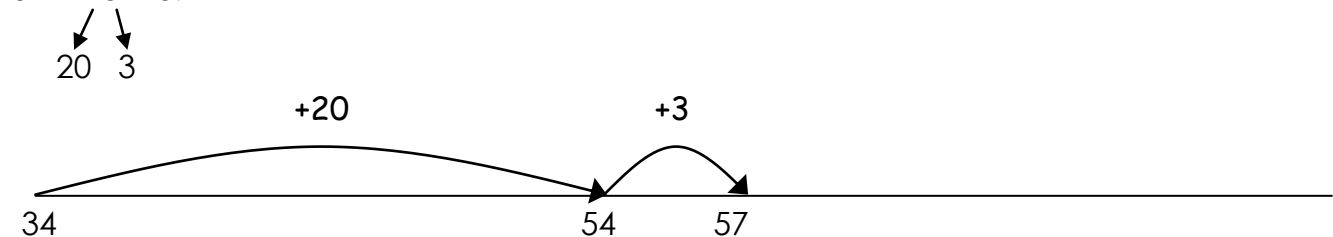
Then helping children to become more efficient by adding the units in one jump (by using the known fact  $4 + 3 = 7$ ).

$$34 + 23 = 57$$



Followed by adding the tens in one jump and the units in one jump.

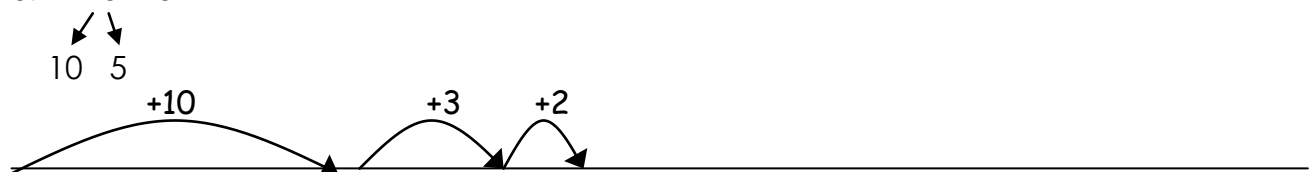
$$34 + 23 = 57$$



### **Bridging:**

Bridging through the next ten can help children become more efficient.

$$37 + 15 = 52$$





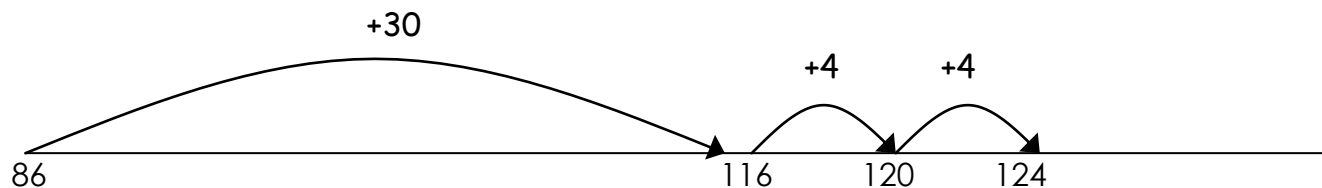
## Year 3

Children will continue to use empty number lines with increasingly large numbers, including adjusting where appropriate.

Count on from the largest number irrespective of the order of the calculation.

$$38 + 86 = 124$$

$$\begin{array}{r} \downarrow \searrow \\ 30 \quad 8 \end{array}$$

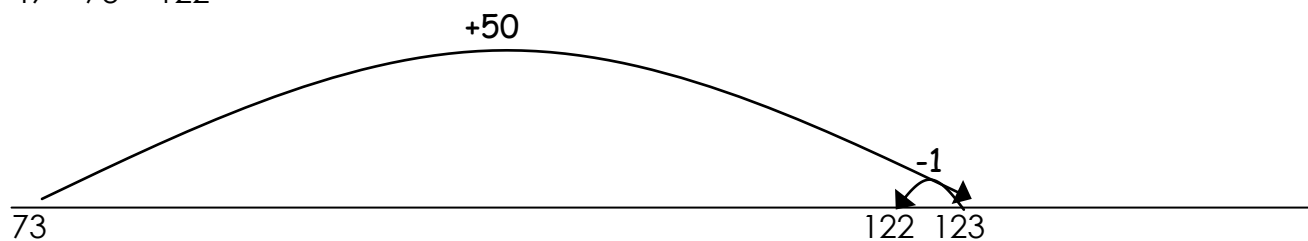


### **Adjusting:**

When adding amounts that are close to a multiple of ten, e.g. 9 or 11, children:

1. Adjust the number to make it a multiple of ten ( $49 + 1 = 50$ )
2. Add the multiple of ten to the larger number ( $73 + 50$ )
3. Adjust the answer by subtracting the amount you added in step 1 ( $123 - 1 = 122$ )

$$49 + 73 = 122$$



Children will move onto expanded methods of addition arranged in columns, partitioned in full to consolidate understanding of place value.

$$\begin{array}{r} 67 \\ + \underline{24} \\ 11 \quad (7 + 4) \\ \underline{80} \quad (60 + 20) \\ \underline{91} \end{array}$$

Video clip: [Demonstration of expanded 3-digit column addition](#)

## Year 4

Until necessary, children will continue to use empty number lines with increasingly large numbers, including adjusting where appropriate.

From this, children will begin to carry below the line.

$$\begin{array}{r} 625 \\ + 48 \\ \hline 673 \\ \text{\small 1} \end{array}$$

$$\begin{array}{r} 783 \\ + 42 \\ \hline 825 \\ \text{\small 1} \end{array}$$

$$\begin{array}{r} 367 \\ + 85 \\ \hline 452 \\ \text{\small 11} \end{array}$$

Using similar methods, children will:

- ✓ add several numbers with different numbers of digits;
- ✓ begin to add two or more three-digit sums of money, with or without adjustment from the pence to the pounds;
- ✓ know that the decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. £3.59 + 78p.

- Videos:** 1—[Subtraction—teaching children to consider the most appropriate methods before calculating](#)  
2—[Introducing partitioned column subtraction method, from practical to written](#)  
3—[Moving to the compact column method of subtraction](#)

## Year 5

Children should extend the carrying method to numbers with at least four digits.

$$\begin{array}{r} 587 \\ + 475 \\ \hline 1062 \\ \hline 11 \end{array}$$

$$\begin{array}{r} 3587 \\ + 675 \\ \hline 4262 \\ \hline 111 \end{array}$$

Using similar methods, children will:

- ✓ add several numbers with different numbers of digits;
- ✓ begin to add two or more decimal fractions with up to three digits and the same number of decimal places;
- ✓ know that decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. 3.2 m - 280 cm.

**Videos:** [Moving to the compact column method of subtraction](#)

## Year 6

Children should extend the carrying method to number with any number of digits.

$$\begin{array}{r} 7648 \\ + 1486 \\ \hline 9134 \\ \hline 111 \end{array}$$

$$\begin{array}{r} 6584 \\ + 5848 \\ \hline 12432 \\ \hline 111 \end{array}$$

$$\begin{array}{r} 42 \\ 6432 \\ 786 \\ 3 \\ + 4681 \\ \hline 11944 \\ \hline 121 \end{array}$$

Using similar methods, children will

- ✓ add several numbers with different numbers of digits;
- ✓ begin to add two or more decimal fractions with up to four digits and either one or two decimal places;
- ✓ know that decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g.  $401.2 + 26.85 + 0.71$ .

# PROGRESSION THROUGH CALCULATIONS FOR SUBTRACTION

## MENTAL CALCULATIONS

### **Mental recall of addition and subtraction facts**

$$10 - 6 = 4$$

$$17 - \square = 11$$

$$20 - 17 = 3$$

$$10 - \square = 2$$

### **Find a small difference by counting on**

$$82 - 79 = 3$$

### **Counting on or back in repeated steps of 1, 10, 100, 1000**

$$86 - 52 = 34 \text{ (by counting on/back in tens and then in ones)}$$

$$460 - 300 = 160 \text{ (by counting on/back in hundreds)}$$

### **Subtract the nearest multiple of 10, 100 and 1000 and adjust**

$$24 - 19 = 24 - 20 + 1 = 5$$

$$458 - 71 = 458 - 70 - 1 = 387$$

### **Use the inverse relationship between addition and subtraction**

$$36 + 19 = 55$$

$$19 + 36 = 55$$

$$55 - 19 = 36$$

$$55 - 36 = 19$$

*MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.*

*CHILDREN SHOULD BE ENCOURAGED TO CONSIDER IF A MENTAL CALCULATION WOULD BE APPROPRIATE BEFORE USING WRITTEN METHODS.*



THE FOLLOWING ARE STANDARDS THAT WE EXPECT THE MAJORITY OF CHILDREN TO ACHIEVE.

## **Nursery**

Before subtraction can be introduced, children need to have a secure knowledge of number.

In Nursery, children are introduced to the concept of counting backwards. This is taught through child initiated games indoors and outdoors such as acting out counting songs and running races (children shouting "5,4,3,2,1,0, GO!").

### **Introduction to subtraction:**

Once children are secure in their number knowledge up to 10, children are introduced to the concept of less and subtracting by counting backwards. Children learn how to take 1 object away through singing songs such as '5 little monkeys'. Children use their fingers to represent how many monkey's left with adults modelling how to 'subtract' one finger / monkey away each time.

Adults model the initial subtraction vocabulary supported by age appropriate definition. An example of this is "subtract / take away, we have one less monkey, OH NO! one monkey has gone away!"

*Children are taught all number objectives within the 30-50 month age band from the Development Matters curriculum. Children are then given opportunities to transfer adult taught skills during independent play. This is supported by the three characteristics of effective learning: playing and exploring, active learning, creating and thinking critically*

## Reception

Before subtraction can be introduced, children in Reception build on concepts taught in Nursery by working through the number objectives in the 40 - 60 month band of Development Matters. Children need to have a secure knowledge of number in order to begin subtraction.

Children are then introduced to the concept of subtraction through practical games and activities. Children act out subtractions to physically subtract a number of objects from a group. Children use arm gestures to represent the signs - and =.

This is reinforced by opportunities provided in the outdoor area for the children to count e.g. counting building blocks, twigs etc.

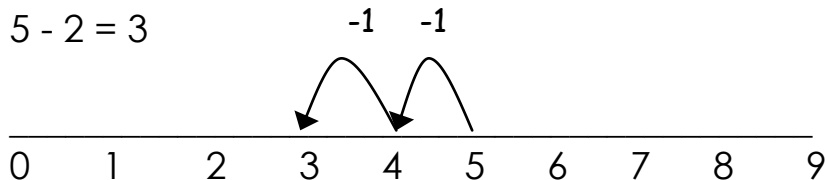
Children build on their previous knowledge of 'less' by learning that subtracting means taking away a certain number of objects from a group (leaving them with less objects).

Adults model subtraction vocabulary supported by age appropriate definition. An example of this is "subtraction means we take away objects from a group / we have got less objects now. Equals means we find out how many we have got left. Wow! We have only got 3 left!" Adults support children in recording their subtractions in the written form on whiteboards and in their maths books.

### **Number line:**

When children are ready, they use a numberline and **practical resources** to support subtraction by counting back e.g. child orientated / chosen characters linked to the children's interests (e.g. Superman, Ben 10, Cinderella, Minnie Mouse).

Teachers *demonstrate* the use of the numberline counting back in ones.



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*three characteristics of effective learning: playing and exploring, active learning, creating and thinking critically*

## Year 1

Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations using pictures etc.

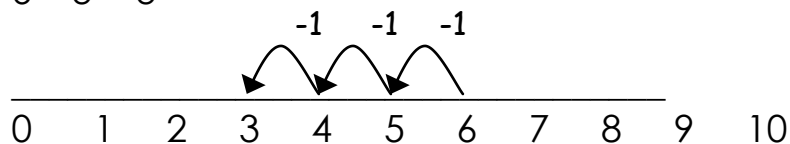
They should be encouraged to subtract through practical activities in meaningful contexts including the outdoor area, as well as counting on using fingers.



Children use numberlines and **practical resources** to support calculation e.g. cubes, Numicon, Dienes, counters, beads etc.

Teachers *demonstrate* the use of the numberline counting back in ones.

$$6 - 3 = 3$$

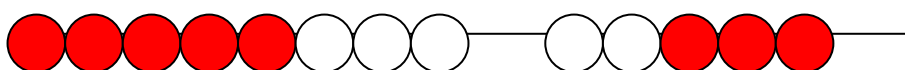


The numberline should also be used to show that  $6 - 3$  means the 'difference between 6 and 3' or 'the difference between 3 and 6' and how many jumps they are apart.

### **Bridging:**

Bead strings or Dienes can be used to illustrate subtraction, including bridging through ten by counting back 3 then counting back 2.

$$13 - 5 = 8$$



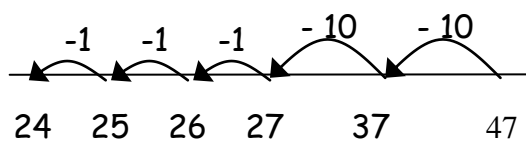
## Year 2

Children will begin to use empty number lines to support calculations.

**Counting back** - Firstly partitioning the smaller number and then counting back from the larger number.

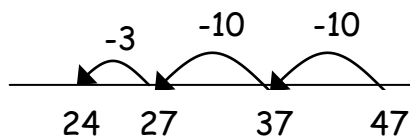
First counting back in tens and ones.

$$47 - 23 = 24$$



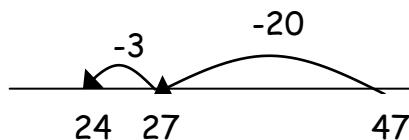
Then helping children to become more efficient by subtracting the units in one jump (by using the known fact  $7 - 3 = 4$ ).

$$47 - 23 = 24$$



If ready, followed by subtracting the tens in one jump and the units in one jump.

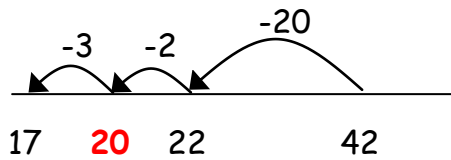
$$47 - 23 = 24$$



## Bridging:

Bridging through ten can help children become more efficient.

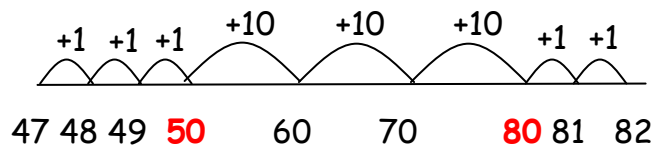
$$42 - 25 = 17$$



## Counting on: Firstly in jumps of 10 and 1

If the numbers involved in the calculation are close together or near to multiples of 10, 100 etc, it can be more efficient to count on.

$$82 - 47 = 35$$



Help children to become more efficient with counting on by:

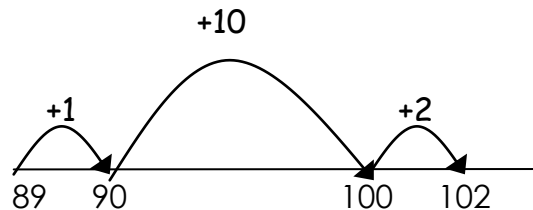
- ✓ Subtracting the units in one jump;
- ✓ Subtracting the tens in one jump and the units in one jump;
- ✓ Bridging through ten.
- ✓ Practising finding change

## Year 3

### Numberlines: Counting on

Children will continue to use empty number lines to subtract numbers with up to three digits.

$$102 - 89 = 13$$



### Adjusting:

When subtracting amounts that are close to a multiple of ten or 100 e.g. 97 or 197 children:

- Adjust the number to make it a multiple of ten ( $197 + 3 = 200$ )
- Subtract the multiple of ten, 100 etc from the larger number ( $511 - 197$ )
- Adjust the answer by adding the amount you adjusted by in step 1 ( $311 + 3 = 314$ )

$$511 - 197 = 314$$



Children will use estimation and inverse operations to check answers.

### Partitioning and decomposition:

This process should be demonstrated using practical resources such as arrow cards to show the partitioning and Dienes materials to show the decomposition of the number.

**NOTE:** When solving the calculation  $89 - 57$ , children should know that 57 **does NOT EXIST AS AN AMOUNT** it is what you are subtracting from the other number.

Therefore, when using Dienes materials, children would need to count out only the 89.

$$\begin{array}{r} 89 \\ - 57 \\ \hline \end{array} = \begin{array}{r} 80 + 9 \\ - 50 + 7 \\ \hline 30 + 2 = 32 \end{array}$$

## Exchanging:

From this the children will begin to exchange.

$$\begin{array}{r} 71 \\ - 46 \\ \hline \end{array} =$$

$$\text{Step 1} \quad \begin{array}{r} 70 + 1 \\ - 40 + 6 \\ \hline \end{array}$$

$$\text{Step 2} \quad \begin{array}{r} 60 + 11 \\ - 40 + 6 \\ \hline 20 + 5 = 25 \end{array}$$

6 subtracted from 1 will give a negative number, so we exchange a ten to make it 11.

This would be recorded by the children as

$$\begin{array}{r} 60 \\ \overline{70} + 11 \\ - 40 + 6 \\ \hline 20 + 5 = 25 \end{array}$$

## Video clips: Subtraction

[Teaching children to consider the most appropriate methods before calculating](#)  
[Introducing partitioned column subtraction method, from practical to written](#)



## Year 4

### Numberlines and Adjusting:

As with Year 3, children will continue to use empty number lines to subtract numbers, with numbers with up to four digits.

Children will use estimation and inverse operations to check answers.

### Partitioning and decomposition:

$$\begin{array}{r} 754 \\ - 86 \\ \hline \end{array} =$$

$$\text{Step 1} \quad \begin{array}{r} 700 + 50 + 4 \\ - \quad \quad 80 + 6 \\ \hline \end{array}$$

$$\text{Step 2} \quad \begin{array}{r} 700 + 40 + 14 \\ - \quad \quad 80 + 6 \\ \hline \end{array} \quad (\text{adjust from T to U})$$

$$\text{Step 3} \quad \begin{array}{r} 600 + 140 + 14 \\ - \quad \quad 80 + 6 \\ \hline 600 + 60 + 8 = 668 \end{array} \quad (\text{adjust from H to T})$$

This would be recorded by the children as

$$\begin{array}{r} \overset{600}{\cancel{700}} + \overset{140}{\cancel{50}} + 14 \\ - \quad \quad 80 + 6 \\ \hline 600 + 60 + 8 = 668 \end{array}$$

### Decomposition:

Using this method, children should:

- ✓ be able to subtract numbers with different numbers of digits;

$$754 - 86 = 668$$

$$\begin{array}{r} \overset{6}{7} \overset{14}{5} \overset{1}{4} \\ - \quad 8 \quad 6 \\ \hline 6 \quad 6 \quad 8 \end{array}$$

Then begin to find the difference between two three-digit sums of money, with or without 'adjustment' from the pence to the pounds (knowing that decimal points line up under each other).

$$\begin{array}{r}
 \text{£}8.95 \\
 \underline{-\text{£}4.38} \\
 \hline
 \end{array}
 =
 \begin{array}{r}
 8 + 0.9 + 0.05 \\
 - 4 + 0.3 + 0.08 \\
 \hline
 \end{array}
 \quad \text{leading to}$$
  

$$\begin{array}{r}
 = \\
 \begin{array}{r}
 8 + 0.8 + 0.15 \\
 - 4 + 0.3 + 0.08 \\
 \hline
 4 + 0.5 + 0.07
 \end{array}
 \quad (\text{adjust from } T \text{ to } U)
 \end{array}$$
  

$$\begin{array}{r}
 \begin{array}{r}
 8 \text{ } 1 \\
 8.95 \\
 - 4.38 \\
 \hline
 4.57
 \end{array} \\
 = \text{£}4.57
 \end{array}$$

Alternatively, children can convert the amounts to whole numbers, i.e. 895 - 438, and convert to pounds after the calculation.

**NB: When children have reached this concise stage they will then continue this method through into Years 5 and 6.**

**They will not go back to using the expanded partitioning methods.**

## Years 5 & 6

Children will continue to use decomposition to subtract increasingly large numbers, with varying digits and where zero values exist in the large number.

$$\begin{array}{r} 0171 \\ 1283 \\ - 956 \\ \hline 327 \end{array}$$

Children will use the compact decomposition method moving onto decimals and questions where zero values exist in the larger number.

$$1308.3 - 295.7 = 1012.7$$

$$\begin{array}{r} 2171 \\ 1308.3 \\ - 295.6 \\ \hline 1012.7 \end{array}$$

# PROGRESSION THROUGH CALCULATIONS FOR MULTIPLICATION

## MENTAL CALCULATIONS

### Doubling and halving

Applying the knowledge of doubles and halves to known facts.

e.g.  $8 \times 4$  is double  $4 \times 4$

### Using multiplication facts

Tables should be taught every day from Y1 onwards.

<b>Year 1</b>	1 times table 2 times table 10 times table	<b>Year 2</b>	3 times table 4 times table 5 times table
<b>Year 3</b>	6 times table 7 times table 8 times table 9 times table	<b>Year 4, 5 &amp; 6</b>  Derive and recall all multiplication facts up to $12 \times 12$	

### Using and applying division facts

Children should be able to utilise their tables knowledge to derive other facts.

e.g. If I know  $3 \times 7 = 21$ , what else do I know?

$30 \times 7 = 210$ ,  $300 \times 7 = 2100$ ,  $3000 \times 7 = 21\ 000$ ,  $0.3 \times 7 = 2.1$  etc

$\square \times 7 = 21$                    $300 \times \triangle = 2100$                    $\square \times \circ = 2.1$

### Use closely related facts already known

$$\begin{aligned} 13 \times 11 &= (13 \times 10) + (13 \times 1) \\ &= 130 + 13 \\ &= 143 \end{aligned}$$

### Multiplying by 10 or 100

Knowing that the effect of multiplying by 10 is a shift in the digits one place to the left.

Knowing that the effect of multiplying by 100 is a shift in the digits two places to the left.

### Partitioning

$$\begin{aligned} 23 \times 4 &= (20 \times 4) + (3 \times 4) \\ &= 80 + 12 \\ &= 102 \end{aligned}$$

### Use of factors

$$8 \times 12 = 8 \times 4 \times 3$$

*MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.*

*CHILDREN SHOULD BE ENCOURAGED TO CONSIDER IF A MENTAL CALCULATION WOULD BE APPROPRIATE BEFORE USING WRITTEN METHODS.*

THE FOLLOWING ARE STANDARDS THAT WE EXPECT THE MAJORITY OF CHILDREN TO ACHIEVE

## Nursery and Reception

By the end of Reception, children are expected to understand the concept of doubling and to be able to double a number up to 10. Before doubling can be introduced, children need to have a secure knowledge of counting, number facts and addition in order to double.

Children are then introduced to the concept of doubling through practical games and activities, including the use of the outdoor areas. Children act out 'doubling' by physically add two equal groups together to find out the 'doubles' answer.

### What is double 2?

#### Double 2 equals 4

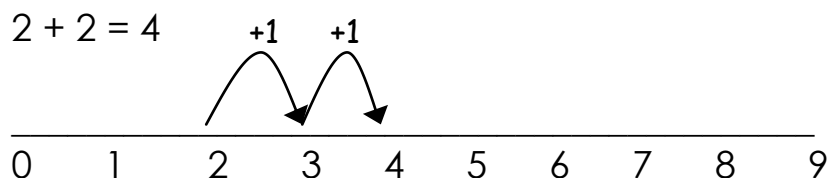
Children build on their previous knowledge of 'addition' by learning that doubling is when you add two equal amounts together.

Adults model doubling and initial multiplication vocabulary supported by age appropriate definition. An example of this is "double 2 is 4! Wow - that means that 2 add 2 equals 4, 2 times 2 equals 4". Adults support children in recording their doubling sums in the written form on whiteboards and in their maths books.

#### Number line:

When children are ready, they use a numberline and **practical resources** to support doubling e.g. child orientated / chosen characters linked to the children's interests (e.g. Superman, Ben 10, Cinderella, Minnie Mouse).

Teachers *demonstrate* the use of the numberline counting on in ones to find the answer to their doubles problem / question.



***Children are then given opportunities to transfer adult taught skills during independent play. This is supported by the three characteristics of effective learning: playing and exploring, active learning, creating and thinking critically.***

## Years 1 and 2

As with Nursery and Reception, children will experience equal groups of objects and will count in 2s, 10s and 5s.

They will work on practical problem solving activities using practical resources, involving equal sets or groups.

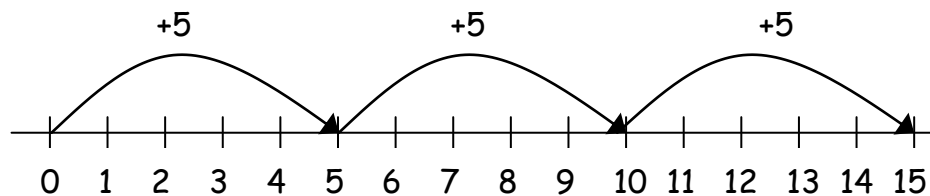
Following this, children will develop their understanding of multiplication and use jottings to support calculation:

### **Repeated addition:**

3 times 5 is  $5 + 5 + 5 = 15$  or 3 lots of 5 or  $5 \times 3$

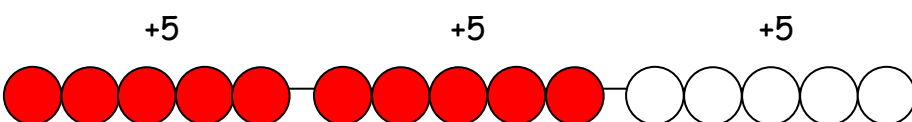
Repeated addition can be shown easily on a number line:

$$5 \times 3 = 5 + 5 + 5$$



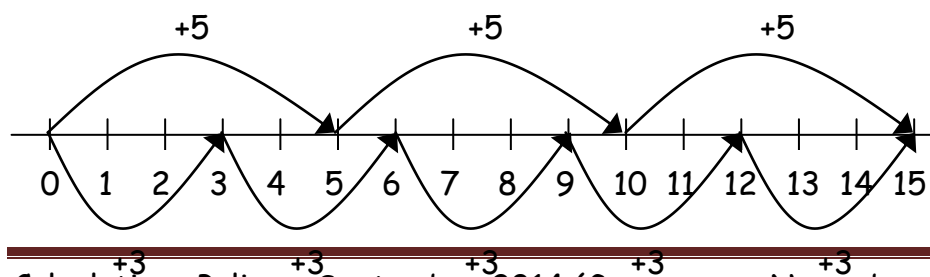
and on a bead bar:

$$5 \times 3 = 5 + 5 + 5$$



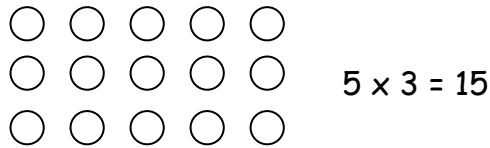
### **Commutativity:**

Children should know that  $3 \times 5$  has the same answer as  $5 \times 3$ . This can also be shown on the number line.



### Arrays:

With support, children should be able to model a multiplication calculation using an array. This knowledge will support with the development of the grid method.



$$3 \times 5 = 15$$

### Doubling:

Children should begin to understand the term doubling and be able to double amounts of objects and up to 2 digit numbers by using number lines, objects and partitioning if ready.

$$\begin{array}{l} 12 \times 2 = 24 \\ \downarrow \searrow \\ 20 + 4 \end{array}$$

### Video clips:

[Teaching for understanding of multiplication facts](#)

[Practical multiplication and the commutative law](#)

## Year 3

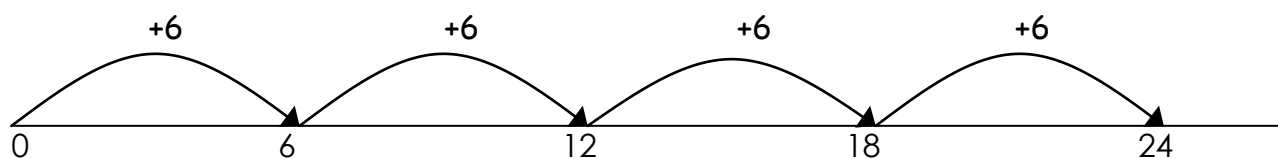
Children will continue to use the following strategies, including two digit times one digit numbers:

### Repeated addition:

4 times 6 is  $6 + 6 + 6 + 6 = 24$  or 4 lots of 6 or  $6 \times 4$

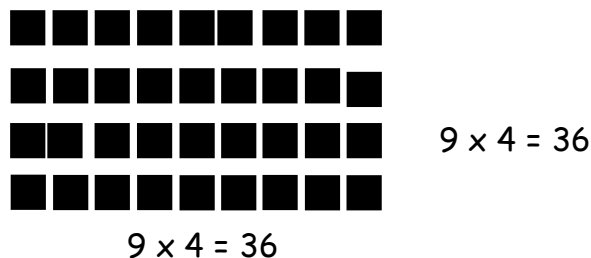
72 times 3 is  $72 + 72 + 72$  or 72 lots of 3 or  $72 \times 3$

Children should use number lines or bead bars to support their understanding.



### Arrays:

Children should be able to independently model a multiplication calculation using an array. This knowledge will support with the development of the grid method.



### Partitioning:

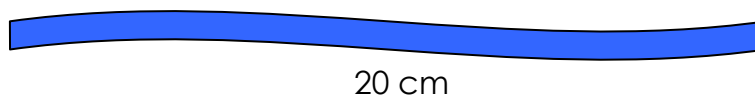
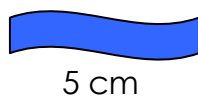
Children should multiply amounts using partitioning, with objects if necessary.

$$\begin{aligned} 38 \times 5 &= (30 \times 5) + (8 \times 5) \\ &= 150 + 40 \\ &= 190 \end{aligned}$$

This method can also be applied to doubling

### Scaling:

E.g. Find a ribbon that is 4 times as long as the blue ribbon



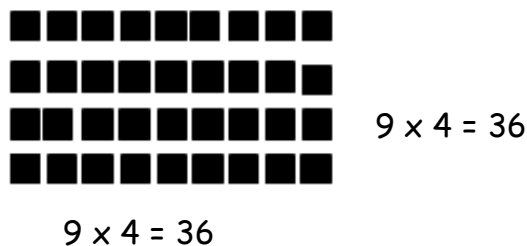
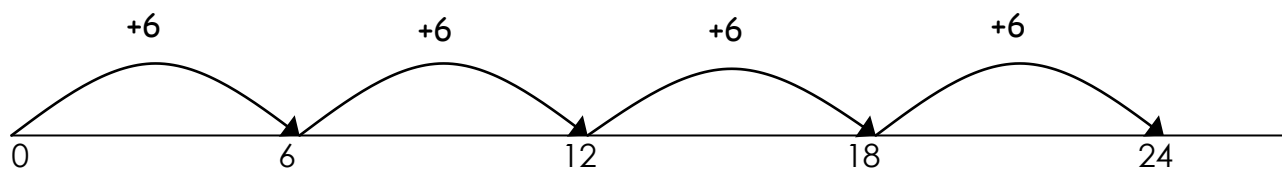


**Video clips:** [Teaching the grid method as an interim step](#) (partitioning and counters to introduce grid)

## Year 4

### Arrays and Numberlines:

Children will continue to use arrays and numberlines where appropriate, leading into the grid method of multiplication.



### Grid method:

Children will use the grid method to multiply two digit and three digit numbers by a one digit number.

### TU x U

$$23 \times 8 =$$

Children will:

1. Approximate first ( $23 \times 8$  is approximately  $25 \times 8 = 200$ ).
2. Partition the numbers and place them into the grid.
3. Multiply the partitioned numbers.
4. Use the column method to add up the answers in the grid.

$$23 \times 8 = 184$$

$$\begin{array}{r} \downarrow \searrow \\ 20 \quad 3 \end{array}$$

x	20	3	
8	160	24	

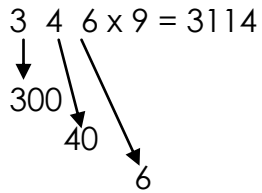
$$\begin{array}{r} 160 \\ + 24 \\ \hline 184 \end{array}$$

## HTU x U

$$346 \times 9 =$$

Children will:

1. Approximate first ( $346 \times 9$  is approximately  $346 \times 10 = 3460$ ).
2. Partition the numbers and place them into the grid.
3. Multiply the partitioned numbers.
4. Use the column method to add up the answers in the grid.

$$346 \times 9 = 3114$$


x	300	40	6
9	2700	360	54

$$\begin{array}{r} 2700 \\ + 360 \\ + 54 \\ \hline 3114 \\ 11 \end{array}$$

## Short method of multiplication:

Children should practise using the short formal method of multiplication for multiplying 2 digits by 1 digit numbers when ready.

## TU x U

$$\begin{array}{r} 23 \\ \times 8 \\ \hline 24 \text{ (3X8)} \\ 160 \text{ (20X8)} \\ \hline 184 \end{array}$$

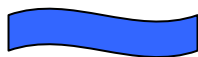
(make notes)

leading to

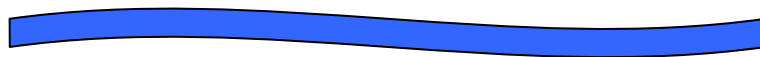
$$\begin{array}{r} 23 \\ \times 8 \\ \hline 184 \\ 2 \end{array}$$

## Scaling:

E.g. Find a ribbon that is 4 times as long as the blue ribbon



5 cm



20 cm

Children will apply these methods in a range of contexts and problem solving situations and should be able to pick the most appropriate method, whether mental or written.

## Year 5

In Year 5, children will continue to multiply 2 and 3 digit numbers by 1 digit numbers and will begin to multiply 4 digit numbers by 1 digit numbers. Then when confident, they will begin to multiply numbers with up to 4 digits by 2 digit numbers.

It is at the teacher's discretion whether to use the grid method to consolidate the children's understanding of place value and partitioning for some or all of the children. However, the short method of multiplication **must** be taught and learnt in Year 5.

### **Grid method:**

#### **TU x TU**

$$72 \times 38$$

Children will:

1. Approximate first ( $72 \times 38$  is approximately  $70 \times 40 = 2800$ ).
2. Partition the numbers and place them into the grid.
3. Multiply the partitioned numbers.
4. Use the column method to add up the answers in the grid.

$$\begin{array}{r} 72 \times 38 = \\ \downarrow \quad \searrow \quad \downarrow \quad \searrow \\ 70 \quad 2 \quad 30 \quad 8 \end{array}$$

x	70	2
30	2100	60
8	560	16

$$\begin{array}{r} 2100 \\ + 560 \\ + 60 \\ + 16 \\ \hline 2736 \\ \phantom{00}1 \end{array}$$

**See next page for ThHTU x U**

## ThHTU × U

$$4346 \times 8$$

Children will:

1. Approximate first ( $4346 \times 8$  is approximately  $4346 \times 10 = 43460$ ).
2. Partition the numbers and place them into the grid.
3. Multiply the partitioned numbers.
4. Use the column method to add up the answers in the grid.

$$\begin{array}{r} 4346 \times 8 = \\ \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \\ 4000 \quad 300 \quad 40 \quad 6 \end{array}$$

x	4000	300	40	6
8	32000	2400	320	48

$$\begin{array}{r} 32000 \\ + 2400 \\ + 320 \\ + 48 \\ \hline 34768 \end{array}$$

## HTU × TU

$$372 \times 24$$

Children will:

1. Approximate first ( $372 \times 24$  is approximately  $400 \times 25 = 10000$ ).
2. Partition the numbers and place them into the grid.
3. Multiply the partitioned numbers.
4. Use the column method to add up the answers in the grid.

$$\begin{array}{r} 372 \times 24 = \\ \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \\ 300 \quad 70 \quad 20 \quad 4 \end{array}$$

x	300	70	2
20	6000	1400	40
4	1200	280	8

$$\begin{array}{r} 6000 \\ + 1400 \\ + 1200 \\ + 280 \\ + 40 \\ + 8 \\ \hline 8928 \end{array}$$

**Short Multiplication:****TU x U**

$$\begin{array}{r}
 23 \\
 \times 8 \\
 \hline
 24 \text{ (3X8)} \\
 160 \text{ (20X8)} \\
 \hline
 184
 \end{array}$$

(make notes)

leading to

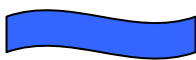
$$\begin{array}{r}
 23 \\
 \times 8 \\
 \hline
 184 \\
 2
 \end{array}$$

**HTU x TU**

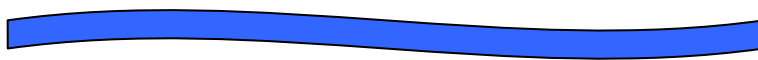
$$\begin{array}{r}
 233 \\
 \times 32 \\
 \hline
 466 \\
 6990 \\
 \hline
 7456 \\
 11
 \end{array}$$

**Scaling:**

E.g. Find a ribbon that is 4 times as long as the blue ribbon



5 cm



20 cm

**Video clips:**

[Moving from grid method to a compact method](#)

[Reinforcing rapid times table recall](#)

[Demonstration of long multiplication](#)

## Year 6

In Year 6, children will multiply multi-digit numbers of up to 4 digits by a 1 or 2 digit number.

The majority of children should be using the short method of multiplication, with some using the grid method as appropriate (see Year 5 multiplication pages for examples).

### **Multiplying by decimals:**

Using similar methods, they will be able to multiply decimals with **one decimal place** by a **one or two digit number** ( $U.t \times U$  and  $TU.t \times U$ ).

Children will:

1. Approximate first ( $4.9 \times 3$  is approximately  $5 \times 3 = 15$ ).
2. Partition the numbers and place them into the grid.
3. Multiply the partitioned numbers.
4. Use the column method to add up the answers in the grid.

$$4.9 \times 3 =$$



$$4 \quad 0.9$$

x	4	0.9		
	3	12	2.7	
				12.0
				+ 2.7
				<u>14.7</u>

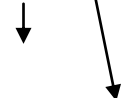
**ONLY** once children have a **secure understanding** of the above, should they be extended to multiplying decimals with **two decimal places** by a **single digit number** ( $U.th \times U$ ).

$$4.92 \times 3$$

Children will:

1. Approximate first ( $4.92 \times 3$  is approximately  $5 \times 3 = 15$ ).
2. Partition the numbers and place them into the grid.
3. Multiply the partitioned numbers.
4. Use the column method to add up the answers in the grid.

$$4.92 \times 3 =$$

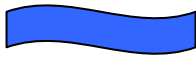


x	4	0.9	0.02		
	3	12	2.7	0.06	
				12.00	
				+ 2.70	
				+ 0.06	
				<u>14.76</u>	

4  
↓  
0.9  
0.02

### Scaling:

E.g. Find a ribbon that is 4 times as long as the blue ribbon



5 cm



20 cm

Children will apply these methods in a range of contexts and problem solving situations and should be able to pick the most appropriate method, whether mental or written.

### Video clips:

[Moving from grid method to a compact method](#)

[Reinforcing rapid times table recall](#)

[Demonstration of long multiplication](#)



# PROGRESSION THROUGH CALCULATIONS FOR DIVISION

## MENTAL CALCULATIONS

### Doubling and halving

Knowing that halving is dividing by 2

### Deriving and recalling division facts

Tables should be taught every day and used to derive division facts from Y1 onwards.

<b>Year 1</b>	1 times table 2 times table 10 times table	<b>Year 2</b>	3 times table 4 times table 5 times table
<b>Year 3</b>	6 times table 7 times table 8 times table 9 times table	<b>Year 4, 5 &amp; 6</b>  Derive and recall all multiplication facts up to 12 x 12	

### Using and applying division facts

Children should be able to utilise their tables knowledge to derive other facts.

E.g. If I know  $3 \times 7 = 21$ , what else do I know?

$30 \times 7 = 210$ ,  $300 \times 7 = 2100$ ,  $3000 \times 7 = 21\ 000$ ,  $0.3 \times 7 = 2.1$  etc

$\square \div 2 = 4$        $80 \div \triangle = 40$        $\square \div \triangle = 40$

### Dividing by 10 or 100

Knowing that the effect of dividing by 10 is a shift in the digits one place to the right.

Knowing that the effect of dividing by 100 is a shift in the digits two places to the right.

### Use of factors

$72 \div 18$        $\longrightarrow$        $72 \div 6 = 12$        $\longrightarrow$        $12 \div 3 = 4$        $\longrightarrow$        $72 \div 18 = 4$   
(6 and 3 are factors of 18)

### Use related facts

Given that  $1.4 \times 1.1 = 1.54$

What is  $1.54 \div 1.4$ , or  $1.54 \div 1.1$ ?

*MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.*

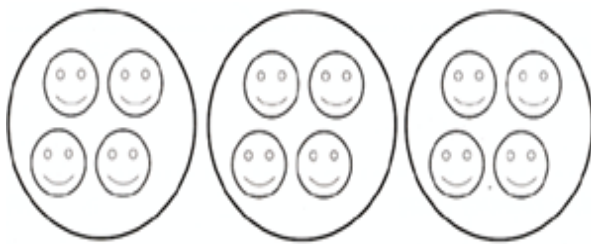
*CHILDREN SHOULD BE ENCOURAGED TO CONSIDER IF A MENTAL CALCULATION WOULD BE APPROPRIATE BEFORE USING WRITTEN METHODS.*

THE FOLLOWING ARE STANDARDS THAT WE EXPECT THE MAJORITY OF CHILDREN TO ACHIEVE.

## Nursery and Reception

By the end of Reception, children are expected to understand the concept of halving and sharing. Before this can be introduced, children need to have a secure knowledge of counting backwards, number facts and subtraction in order to halve and share.

Children are then introduced to the concept of halving and sharing through practical games and activities. They act out 'halving and sharing' through activities such as sharing food for their Teddy Bear's Picnic, sharing resources equally to play a game. This is reinforced by opportunities provided in the outdoor area for the children to halve and share out objects such as building blocks, twigs etc.



Children build on their previous knowledge of 'subtraction' by learning that halving and sharing is when you divide an amount into equal groups.

Adults model halving, sharing and initial division vocabulary supported by age appropriate definition. An example of this is "one for you, one for me...! How many have you got? (Adults to model counting to check) Yay! We have got the same. You have got 3 cakes and I have got 3 cakes".

Adults support children in recording their halving and sharing activities in the written form on whiteboards and in their maths books.

***Children are then given opportunities to transfer adult taught skills during independent play. This is supported by the three characteristics of effective learning: playing and exploring, active learning, creating and thinking critically.***

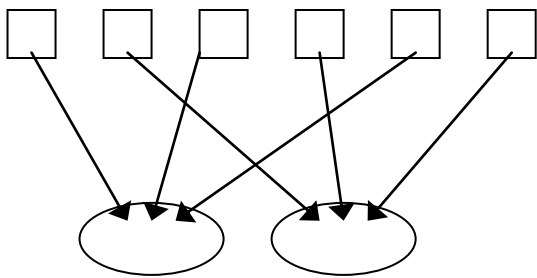
## Years 1 and 2

Children will continue to understand equal groups and share **practical items** out in play and problem solving. They will count in 2s, 10s and 5s.

Following this, children will develop their understanding of division and use jottings to support calculation.

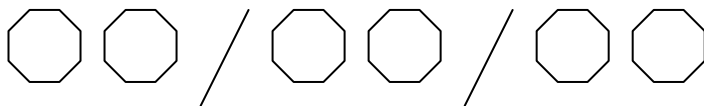
### **Sharing equally:**

6 sweets shared between 2 people, how many do they each get?



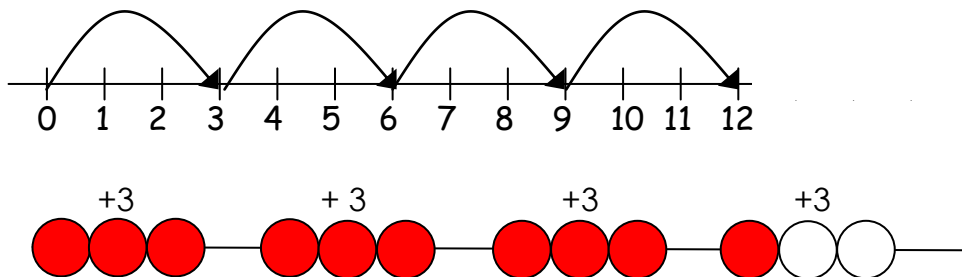
### **Grouping or repeated addition:**

There are 6 sweets, how many people can have 2 sweets each?



### **Repeated addition using a number line or bead bar:**

$$12 \div 3 = 4$$



The bead bar will help children with interpreting division calculations such as  $10 \div 5$  as 'how many 5s make 10?'

## Halving:

Children should begin to understand the term halving and be able to halve amounts of objects and up to 2 digit numbers by using number lines, objects and partitioning if ready.

$$\begin{array}{l} 12 \div 2 = 11 \\ \downarrow \searrow \\ 10 + 1 \end{array}$$

## Year 3

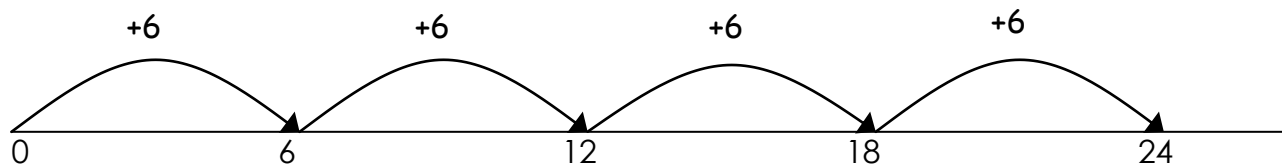
Ensure that the emphasis in Year 3 is on grouping rather than sharing.

Children will continue to use the following methods to divide 2 digit by 1 digit numbers:

### Repeated addition using a number line:

Children will begin to use an empty number line to support their calculation.

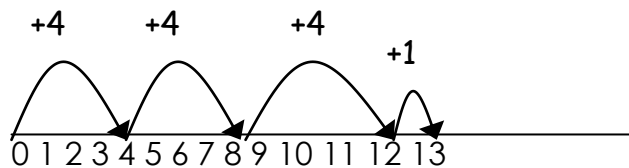
$$24 \div 4 = 6$$



### Remainders:

Children should also move onto calculations involving remainders.

$$13 \div 4 = 3 \text{ r}1$$



### Inverse Operations:

Using symbols to stand for unknown numbers to complete equations using inverse operations.

$$\square \div 2 = 4 \qquad 20 \div \triangle = 4 \qquad \square \div \triangle = 4$$

A number line or bead bar will be used to support these calculations.

### Halving by partitioning:

Children should be able to halve amounts using partitioning and objects if necessary.

$$\begin{array}{l} 22 \div 2 = 11 \\ \swarrow \quad \searrow \\ 20 + 2 \\ \downarrow \quad \downarrow \\ 10 + 1 = 11 \end{array}$$

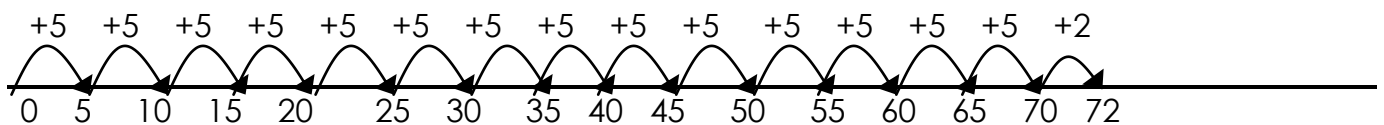
## Year 4

Children will use various methods to divide multi-digit numbers by a 1 digit number, including remainders.

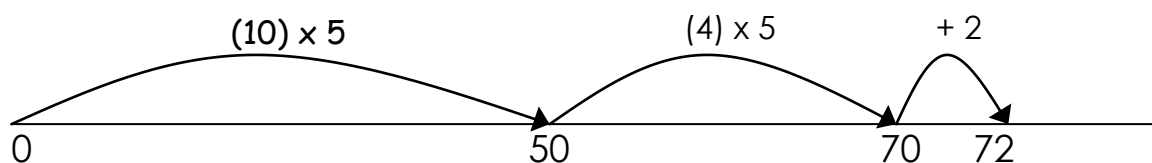
### Repeated Addition:

Children will develop their use of repeated addition to be able to add multiples of the divisor. Initially, these should be multiples of 10s, 5s, 2s and 1s - numbers with which the children are more familiar.

$$72 \div 5 = 14 \text{ r}2$$



Moving onto:



Halving by partitioning:

$$\begin{array}{l} 22 \div 2 = \\ \swarrow \quad \searrow \\ 20 + 2 \\ \downarrow \quad \downarrow \\ 10 + 2 = 12 \end{array}$$

Then, **when ready**, children move onto the short method of division:

**Short division:**

$$TU \div U$$

$$72 \div 5$$

$$\begin{array}{r} 14 \text{ r}2 \\ 5 \overline{) 72} \end{array}$$

### Short division HTU $\div$ U

$$196 \div 6$$

$$\begin{array}{r} 032 \text{ r}4 \\ 6 \overline{)1916} \end{array}$$

Answer: 32 remainder 4 or 32 r 4

Any remainders should be shown as integers, i.e. 14 remainder 2 or 14 r 2.

Children need to be able to decide what to do after division and round up or down according to the context of the question.

E.g. I have 196p. Sweets are 6p each. How many can I buy?

Answer: 32

The remaining 4p is not enough to buy another sweet so it is rounded down.

Apples are packed into boxes of 6. There are 196 apples. How many boxes are needed?

Answer: 33

The remaining 4 apples still need to be placed into a box so it is rounded up.

## Year 5

Children will continue to use written methods to solve short division with numbers up to 4 digits by a one digit number ( $TU \div U$ ,  $HTU \div U$  and  $ThHTU \div U$ ).

**Short division:**

**TU  $\div$  U**

$$72 \div 5$$

$$\begin{array}{r} 14 \text{ r}2 \\ 5 \overline{) 72} \end{array}$$

**Short division**

**HTU  $\div$  U**

$$196 \div 6$$

$$\begin{array}{r} 32 \text{ r}4 \\ 6 \overline{) 196} \end{array}$$

Answer: 32 remainder 4 or 32 r 4

Any remainders should be shown as integers, i.e. 14 remainder 2 or 14 r 2.

Children need to be able to decide what to do after division and round up or down according to the context of the question.

E.g. I have 196p. Sweets are 6p each. How many can I buy?

Answer: 32

The remaining 4p is not enough to buy another sweet so it is rounded down.

Apples are packed into boxes of 6. There are 196 apples. How many boxes are needed?

Answer: 33

The remaining 4 apples still need to be placed into a box so it is rounded up.

Children will begin to express remainders as fractions.

$$\text{I.e. } 98 \div 4 = 24 \frac{1}{2}$$

**Halving by partitioning:**

$$\begin{array}{c} 22 \div 2 = 11 \\ \swarrow \quad \searrow \\ 20 + 2 \\ \downarrow \quad \downarrow \end{array}$$



$$10 + 1 = 11$$

## Year 6

Children will continue to use written methods to solve short division with numbers up to 4 digits by a one and when ready two digit number ( $TU \div U$ ,  $HTU \div U$ ,  $ThHTU \div U$  and  $ThHTU \div TU$ ).

They will also continue to decide what to do after division and round up or down according to the context of the question (see Year 5 division pages for examples).

This will include remainders being shown as fractions, i.e. if the children were dividing 32 by 10, the answer could be shown as  $3 \frac{2}{10}$ , which could then be written as  $3 \frac{1}{5}$  in it's lowest terms.

### Short division

#### HTU $\div$ U

$$196 \div 6$$

$$\begin{array}{r} 032 \text{ r}4 \\ 6 \overline{)1916} \end{array}$$

Answer: 32 remainder 4 or 32 r 4

#### Long division:

Children will use the written method of long division to divide numbers with up to 4 digits by a two digit whole number ( $HTU \div TU$  and  $ThHTU \div TU$ ), including remainders.

#### HTU $\div$ TU

$$972 \div 36 =$$

$$\begin{array}{r} 27 \\ 36 \overline{)972} \\ \underline{-720} \quad (20) \times 36 \\ 252 \\ \underline{-252} \quad (7) \times 36 \\ 0 \end{array}$$

Answer: 27

Children will continue to decide what to do after division and round up or down according to the context of the question.

## Dividing Decimals:

Children should be introduced to the division of decimal numbers by 1 digit numbers.

This can be done by:

E.g.  $3.6 \div 6 = 0.6$

1. Adjusting (multiplying) the dividend by 10:  $3.6 \times 10 = 36$
2. Divide the answer by the divisor:  $36 \div 6 = 6$
3. Use the inverse of step 1:  $6 \div 10 = 0.6$