Broom Barns Community Primary and Nursery School

September 2016

Calculation policy

Reviewed on: September 2016
Review by: September 2018

Contents

Rationale

The aim of this policy is to ensure all children leave Broom Barns 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 sets out the progression through written strategies for addition, subtraction, multiplication and division in line with curriculum (September 2014.) Through the policy, we aim to link key manipulatives and representations in order that the children can be vertically accelerated through each strand of calculation. We know that school wide policies, such as this, can ensure consistency of approach, enabling children to progress stage by stage through models and representations they recognise from previous teaching, allowing for deeper conceptual understanding and fluency.

As children move at the pace appropriate to them, teachers will be presenting strategies and equipment appropriate to children's level of understanding. However, we would expect the majority of each class to be working at age-appropriate levels as set out in the National Curriculum 2014 and in line with school policy.

Children who 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.

The importance of mental mathematics

While this policy focuses on written calculations in mathematics, we recognise the importance of the mental strategies and known facts that form the basis of all calculations. The following checklists outline the key skills and number facts that children are expected to develop throughout the school.

To add and subtract successfully, children should be able to:
· Recall all addition pairs to 9 + 9 and number bonds to 10
· Recognise addition and subtraction as inverse operations
· Add mentally a series of one digit numbers (e.g. 5 + 8 + 4)
· Add and subtract multiples of 10 or 100 using the related addition fact and their knowledge of place value (e.g. 600 + 700, 160 — 70)
· Partition 2 and 3 digit numbers into multiples of 100, 10 and 1 in different ways (e.g. partition 74 into 70 + 4 or 60 + 14)
· Use estimation by rounding to check answers are reasonable

To multiply and divide successfully, children should be able to:
· Add and subtract accurately and efficiently
· Recall multiplication facts to 12 x 12 = 144 and division facts to 144 ÷ 12 = 12
· Use multiplication and division facts to estimate how many times one number divides into another etc.

· Know the outcome of multiplying by 0 and by 1 and of dividing by 1.
· Understand the effect of multiplying and dividing whole numbers by 10, 100 and later 1000
· Recognise factor pairs of numbers (e.g. that 15 = 3 x 5, or that 40 = 10 x 4) and increasingly able to recognise common factors
· Derive other results from multiplication and division facts and multiplication and division by 10 or 100 (and later 1000)
· Notice and recall with increasing fluency inverse facts
· Partition numbers into 100s, 10s and 1s or multiple groupings
· Understand how the principles of commutative, associative and distributive laws apply or do not apply to multiplication and division
· Understand the effects of scaling by whole numbers and decimal numbers or fractions
· Understand correspondence where n objects are related to m objects
· Investigate and learn rules for divisibility

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 the teachers' 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.

Addition and subtraction:	**Multiplication and division:**
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…?	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
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	double, halve, share, share equal 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

PROGRESSION THROUGH CALCULATIONS FOR ADDITION

MENTAL CALCULATIONS

Mental recall of number bonds

6 + 4 = 10 □ + 3 = 10

25 + 75 = 100 19 + □ = 20

Use near doubles

6 + 7 = 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 (by counting on in tens and then in ones)

460 - 300 = 160 (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 =.

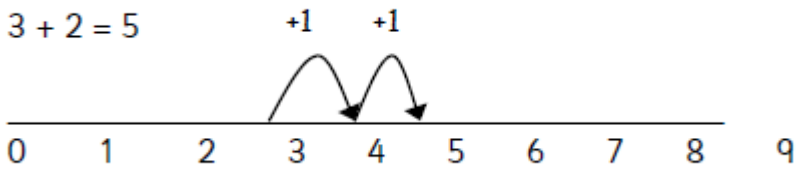
This is reinforced by opportunities provided in the outdoor area for the children to use addition e.g. adding together groups of building blocks, twigs etc.
Children build on their previous knowledge of 'more' by learning that adding two groups of objects together gives them a larger number (more objects).

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 number line 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 number line counting on in ones.

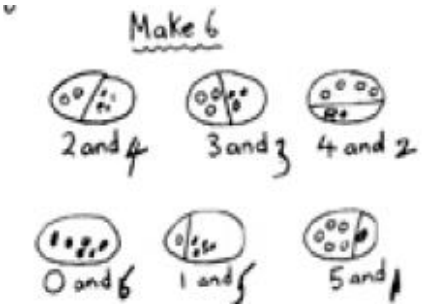


Children are taught all number objectives within the 40-60 month age band. Children are then given opportunities to transfer adult taught skills during independent play. This is supported by the three characteristics of effective learning: playing and exploring, active learning, creating and thinking critically

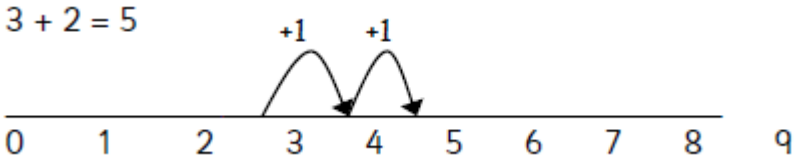
Year 1

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.

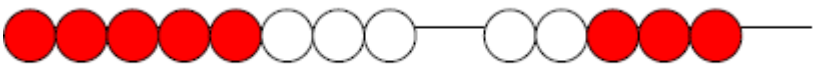
They should be encouraged to add through practical activities in meaningful contexts including using the outdoor area, as well as counting on using fingers.



They use number lines and **practical resources** to support calculation e.g. cubes, Numicon, Dienes, counters, beads etc.
Teachers demonstrate the use of the number line counting on in ones.

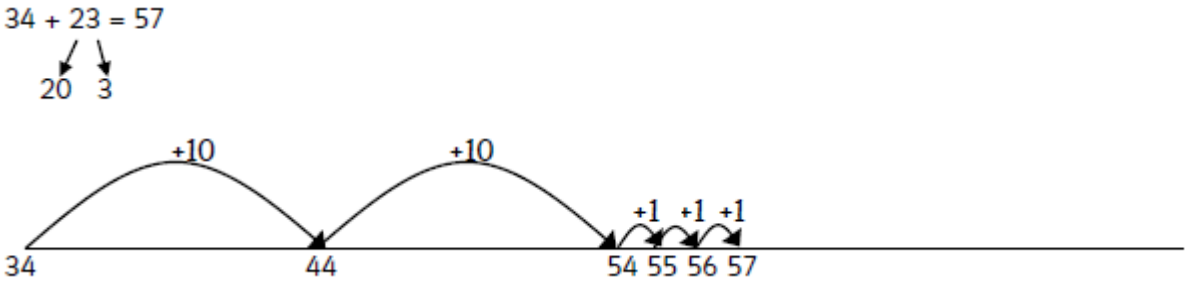


Bridging: Bead strings or Dienes can be used to illustrate addition including bridging through ten by counting on 2 then counting on 3.

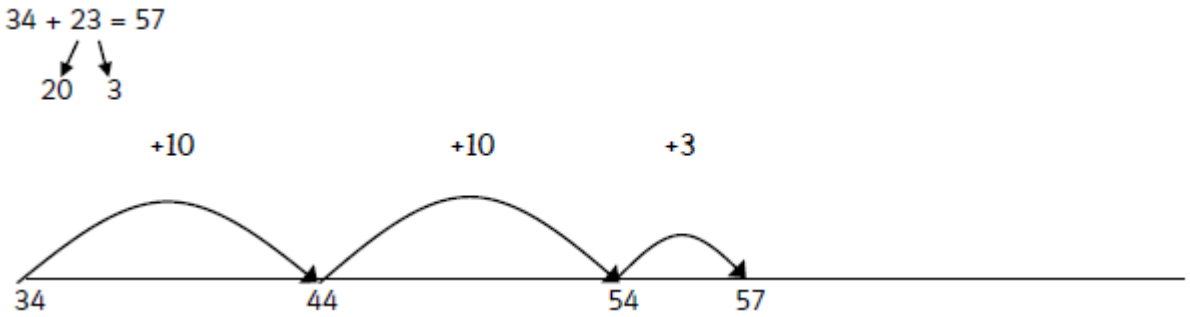


Year 2

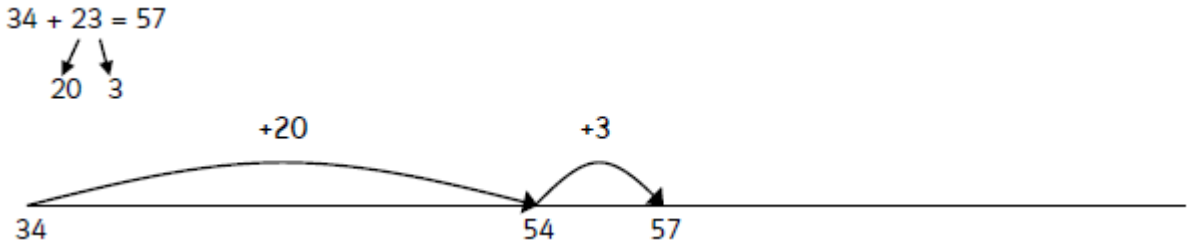
Children will begin to use 'empty number lines' themselves. Firstly partitioning the smaller number and then counting on from the larger number.
First counting on in tens and then ones.



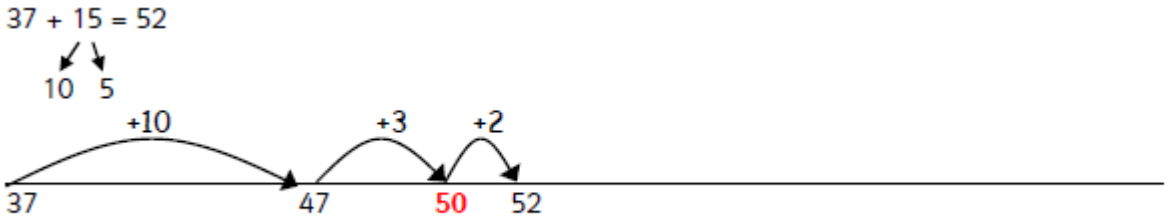
Then helping children to become more efficient by adding the units in one jump (by using the known fact 4 + 3 = 7)



Followed by adding the tens in one group and adding the ones in one jump.



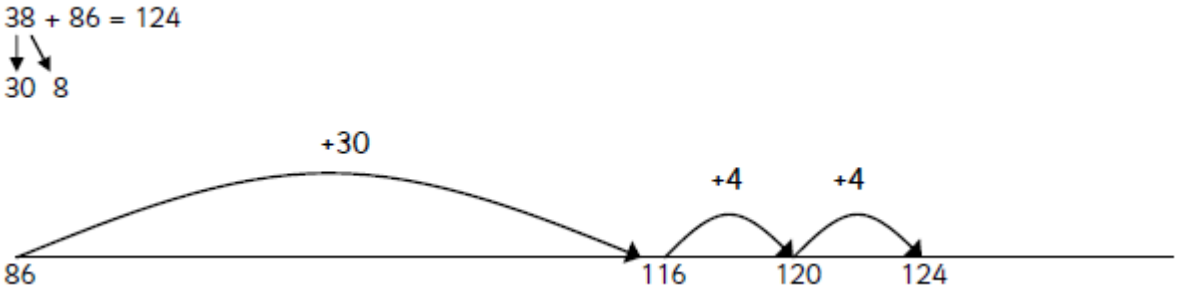
Bridging
Bridging through the next ten can help children become more efficient.


37 + 15 = 52
10 5
+10
+3
+2
37
47
50
52

Year 3

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

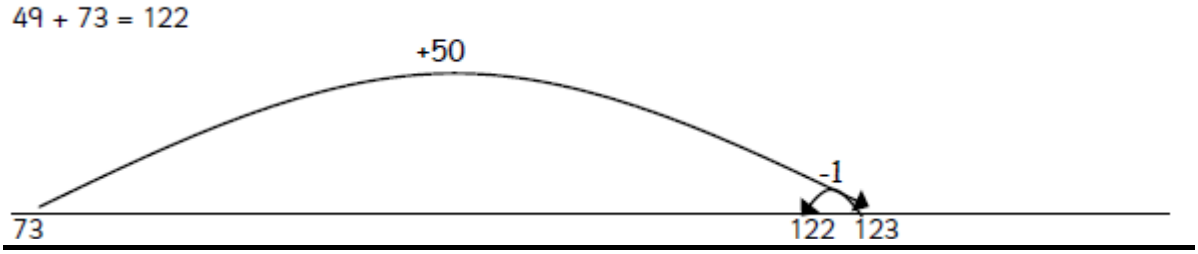
Count on from the largest number irrespective of the order of the calculation.



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)



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

```
  67
+ 24
  11   (7 + 4)
  80   (60 +20)
  91
```

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.

```
  625        783        367
+  48      +  42      +  85
  673        825        452
   1          1         1 1
```

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.

Year 5

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

```
  587
+ 475
 1062
  1 1
```

```
  3587
+  675
  4262
  1 1 1
```

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.

Year 6

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

```
   7648
+  1486
   9134
   111
```

```
   6584
+  5848
  12432
   111
```

```
     42
   6432
    786
      3
+ 4681
  11944
   121
```

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 - □□= 11

20 - 17 = 3 10 - □□= 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 (by counting on/back in tens and then in ones)

460 - 300 = 160 (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 monkeys 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.

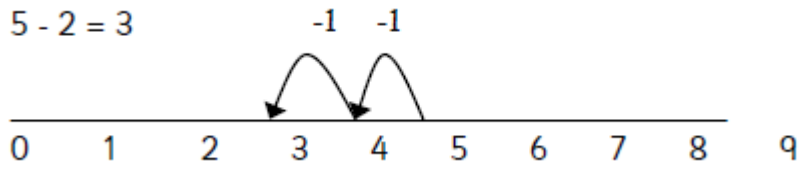
Children are then introduced to the concept of subtraction through practical games and activities. Children act out subtractions to physically subtract a number of objects from a group. Children use arm gestures to represent the signs - and =.
This is reinforced by opportunities provided in the outdoor 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 number line 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 number line counting back in ones.



Children are taught all number objectives within the 40-60 month age band (including ELG) from the Development 6Matters 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

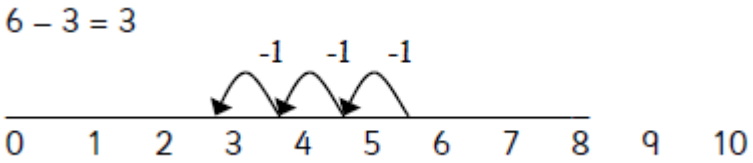
Year 1

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 subtract through practical activities in meaningful contexts including the outdoor area, as well as counting on using fingers.

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

Teachers demonstrate the use of the number line counting back in ones.



The number line 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.

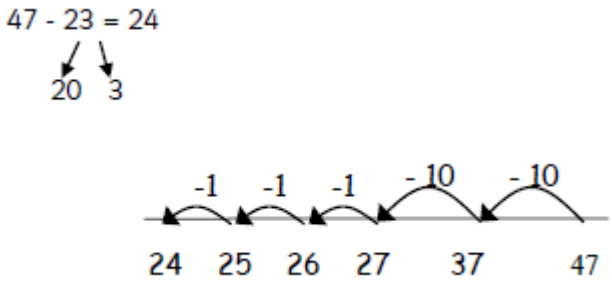
Bridging:
Bead strings or Dienes can be used to illustrate subtraction, including bridging through ten by counting back 3 then counting back 2.

Year 2

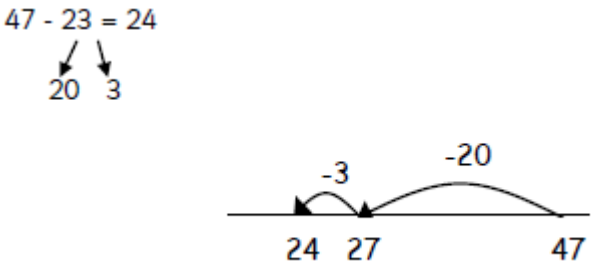
Children will begin to use empty number lines to support calculations.

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

First counting back in tens and ones.

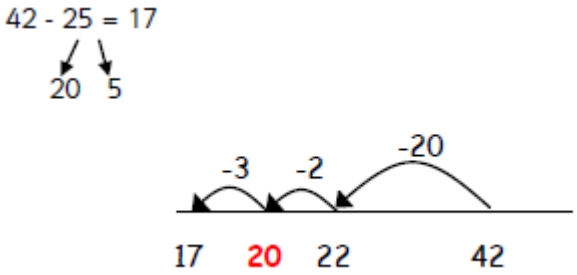


If ready, followed by subtracting the tens in one jump and the units in one jump.



Bridging:

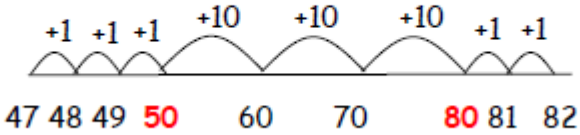
Bridging through ten can help children become more efficient.



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:

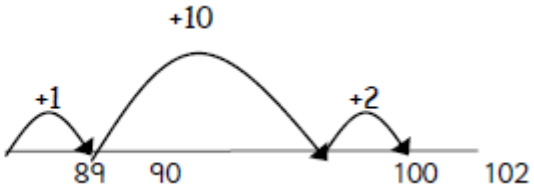
- ✓ Subtracting the units in one jump;
- ✓ Subtracting the tens in one jump and the units in one jump;
- ✓ Bridging through ten.
- ✓ Practising finding change

Year 3

Number lines: 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:

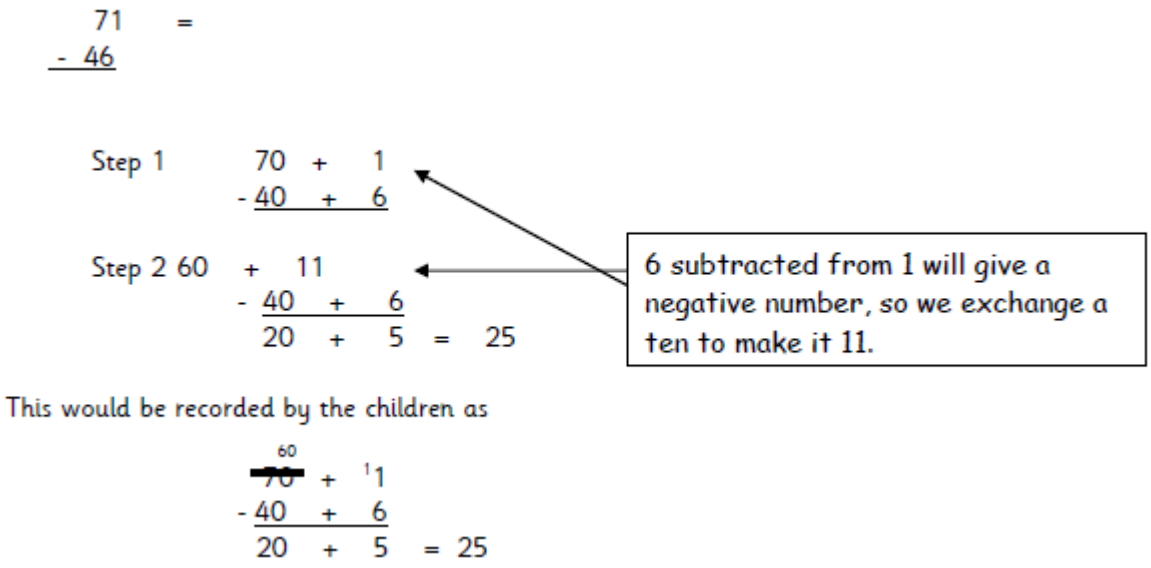
This process should be demonstrated using practical resources such as arrow cards to show the partitioning and Dienes materials to show the decomposition of the number.
NOTE: When solving the calculation 89 – 57, children should know that 57 **does NOT EXIST AS AN AMOUNT** it is what you are subtracting from the other number.

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

$$\begin{array}{rcl} 89 & = & 80 + 9 \\ -\,57 & & -\,50 + 7 \\ & & 30 + 2 = 32 \end{array}$$

Exchanging:

From this the children will begin to exchange



This would be recorded by the children as

Year 4

Number lines 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:

754
_ 86 =
———————

Step 1 700 + 50 + 4
_ 80 + 6

Step 2
700 + 40 + 14 *(adjust from T to U)*
- 80 + 6

Step 3
600 + 140 + 14 *(adjust from H to T)*
- 80 + 6
600 + 60 + 8 = 668

This would be recorded by the children as

600 140
~~700~~ + ~~50~~ + 14
- 80 + 6
600 + 60 + 8 = 668

Decomposition:

Using this method, children should:

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

754 – 86 = 668

6 14 1
~~7~~ ~~5~~ 4
- 8 6
6 6 8

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).

£8.95	=		8	+	0.9	+	0.05		leading to
-£4.38		-	4	+	0.3	+	0.08		
	=		8	+	0.8	+	0.15	*(adjust from T to U)*	
		-	4	+	0.3	+	0.08		
			4	+	0.5	+	0.07		

8 1
8.95
- 4.38
4.57

= £4.57

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.

```
 0 17 1
 1283
-956
 327
```

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

```
  2 17 1
  1308.3
-  295.6
  1012.7
```

PROGRESSION THROUGH CALCULATIONS FOR MULTIPLICATION

MENTAL CALCULATIONS

Doubling and halving
Applying the knowledge of doubles and halves to known facts.
E.g. 8 x 4 is double 4 x 4
Using multiplication facts
Tables should be taught every day from Y1 onwards.

Year 1	1 times table 2 times table 10 times table	**Year 2**	3 times table 4 times table 5 times table
Year 3	6 times table 7 times table 8 times table 9 times table	**Year 4, 5 & 6**	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 x 7 = 21, what else do I know?
30 x 7 = 210, 300 x 7 = 2100, 3000 x 7 = 21 000, 0.3 x 7 = 2.1 etc
□ x 7 = 21 300 x □ = 2100 □ x □ = 2.1

Use closely related facts already known
13 x 11 = (13 x 10) + (13 x 1)
= 130 + 13
= 143

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
23 x 4 = (20 x 4) + (3 x 4)
= 80 + 12
= 102

Use of factors
8 x 12 = 8 x 4 x 3

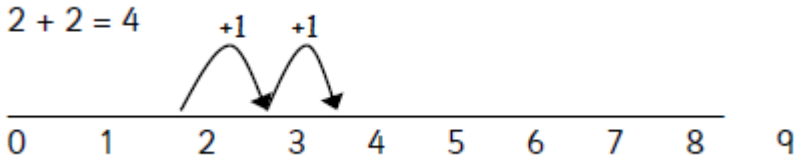
MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.
CHILDREN SHOULD BE ENCOURAGED TO CONSIDER IF A MENTAL CALCULATION WOULD BE APPROPRIATE BEFORE USING WRITTEN METHODS.

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 number line counting on in ones to find the answer to their doubles problem / question.

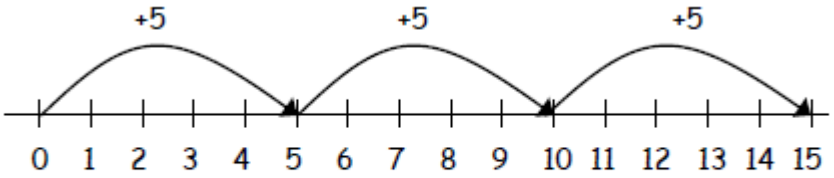


Children are then given opportunities to transfer adult taught skills during independent play. This is supported by the three characteristics of effective learning: playing and exploring, active learning, creating and thinking critically.

Years 1 and 2

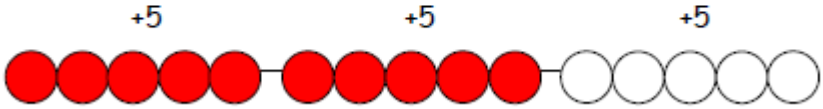
As with Nursery and Reception, children will experience equal groups of objects and will count in 2s, 10s and 5s.
They will work on practical problem solving activities using practical resources, involving equal sets or groups.
Following this, children will develop their understanding of multiplication and use jottings to support calculation:

Repeated addition:
3 times 5 is 5 + 5 + 5 = 15 or 3 lots of 5 or 5 x 3
Repeated addition can be shown easily on a number line:
5 x 3 = 5 + 5 + 5

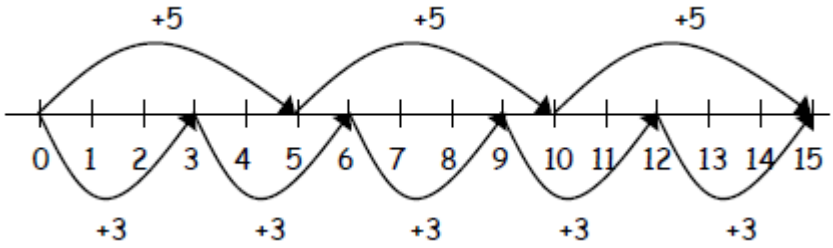


and on a bead bar:

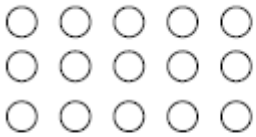
5 x 3 = 5 + 5 + 5



Commutatively:
Children should know that 3 x 5 has the same answer as 5 x 3. This can also be shown on the number line.



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.



5 x 3 = 15

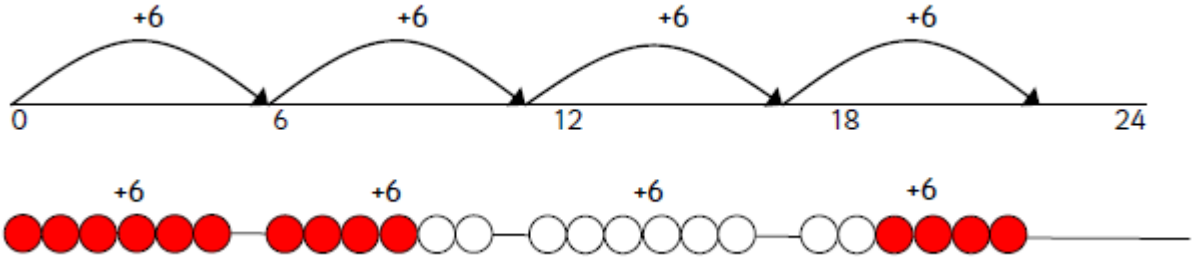
3 x 5 = 15

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.
1 2 x 2 = 24
20 + 4

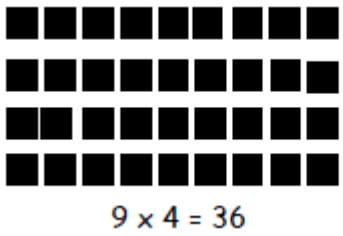
Year 3

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 x 4
72 times 3 is 72 + 72 + 72 or 72 lots of 3 or 72 x 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.



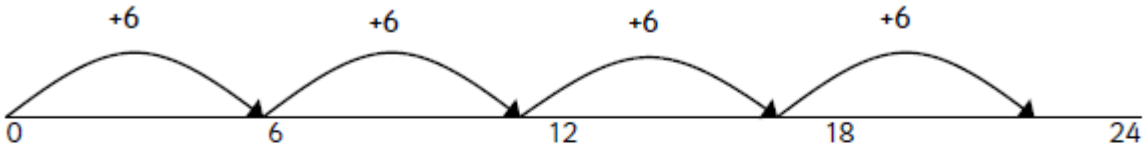
9 x 4 = 36

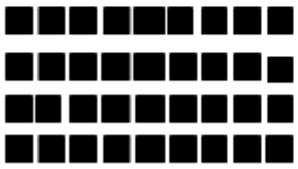
Partitioning:
Children should multiply amount using partitioning, with objects if necessary.
38 x 5 = (30 x 5) + (8 x 5)
= 150 + 40
= 190
This method can also be applied to doubling

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

Year 4

Arrays and Number lines:
Children will continue to use arrays and number lines where appropriate, leading into the grid method of multiplication.





9 x 4 = 36

9 x 4 = 36

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 x 8 =

Children will:

1. Approximate first (23 x 8 is approximately 25 x 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 x 8 = 184
↓ ↘
20 3

x	20	3
8	160	24

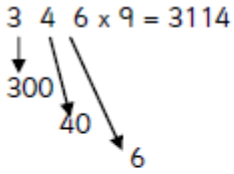
$$\begin{array}{r} 160 \\ +\ 24 \\ \hline 184 \end{array}$$

HTU x U

346 x 9 =

Children will:

1. Approximate first (346 x 9 is approximately 346 x 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.



x	300	40	6
9	2700	360	54

2700
+ 360
+ 54
3114
1 1

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

23
X 8
24 (3X8) (make notes)
160(20X8)
184

leading to

184

23
x 8
2

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

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.

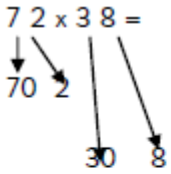
Grid method:

TU x TU

72 x 38

Children will:

1. Approximate first (72 x 38 is approximately 70 x 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.



x	70	2
30	2100	60
8	560	16

```
  2100
+  560
+   60
+   16
 2736
  1
```

ThHTU x U

4346 x 8

Children will:

1. Approximate first (4346 x 8 is approximately 4346 x 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.

4 3 4 6 x 8 =

4000 300 40 6

x	4000	300	40	6
8	32000	2400	320	48

32000
+ 2400
+ 320
+ 48
34768

HTU x TU

372 x 24
Children will:

1. Approximate first (372 x 24 is approximately 400 x 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.

37 2 x 2 4 =

300 70 20 2 4

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

6000
+ 1400
+ 1200
+ 280
+ 40
+ 8
8928

Short Multiplication:
TU x U

23
X 8
24 (3X8) (make notes)
160 (20X8)
184

leading to 184

23
x 8
2

HTU x TU

233
X 32
466
6990
7456
1 1

Scaling:

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

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 x U and TU.t x U)**.

Children will:

1. Approximate first (4.9 x 3 is approximately 5 x 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 x 3 =

4 0.9

x	4	0.9
3	12	2.7

12.0
+ 2.7
14.7

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 x U)**.

4.92 x 3

Children will:

1. Approximate first (4.92 x 3 is approximately 5 x 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 2 x 3 =

4
0.9
0.02

x	4	0.9	0.02
3	12	2.7	0.06

12.00
+ 2.70
+ 0.06
14.76

Scaling:

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

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.

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.

Year 1 1 times table 2 times table 10 times table	**Year 2** 3 times table 4 times table 5 times table
Year 3 6 times table 7 times table 8 times table 9 times table	**Year 4, 5 & 6** Derive and recall all multiplication facts up to 12 x 12

Children should be able to utilise their tables knowledge to derive other facts.
E.g. If I know 3 x 7 = 21, what else do I know?

30 x 7 = 210, 300 x 7 = 2100, 3000 x 7 = 21 000, 0.3 x 7 = 2.1 etc

□ ÷ 2 = 4 80 ÷ □ = 40 □ ÷ □ = 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

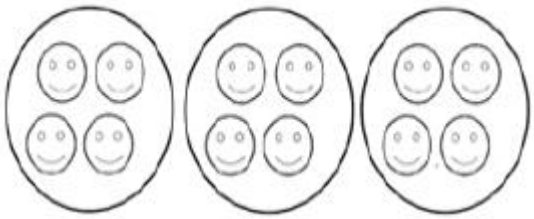
72 ÷ 18 → 72 ÷ **6** = 12 → 12 ÷ **3** = 4 → 72÷18=4
(6 and 3 are factors of 18)

Use related facts
Given that 1.4 x 1.1 = 1.54
What is 1.54 ÷ 1.4, or 1.54 ÷ 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.

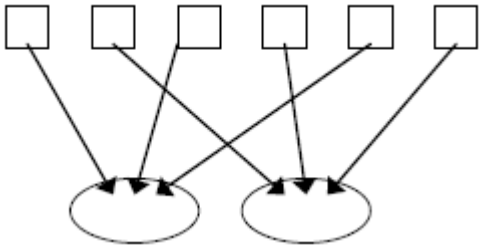


Children build on their previous knowledge of 'subtraction' by learning that halving and sharing is when you divide an amount into equal groups.
Adults model halving, sharing and initial division vocabulary supported by age appropriate definition. An example of this is "one for you, one for me…! How 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.

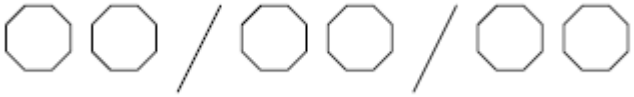
Years 1 and 2

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.

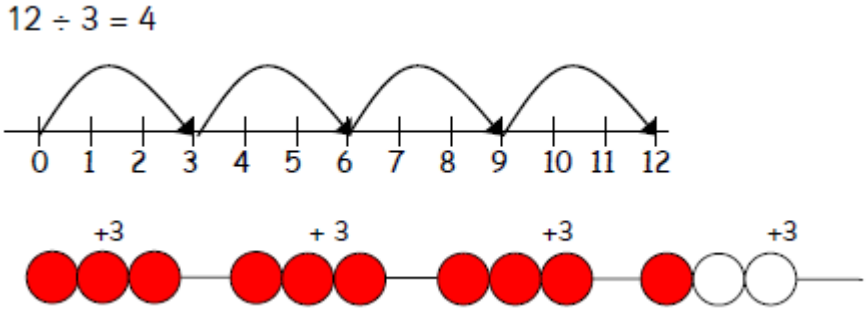
Sharing equally:
6 sweets shared between 2 people, how many do they each get?



Grouped or repeated addition:
There are 6 sweets, how many people can have 2 sweets each?



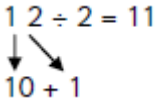
Repeated addition using a number line or bead bar:



0 1 2 3 4 5 6 7 8 9 10 11 12
The bead bar will help children with interpreting division calculations such as 10 ÷ 5 as 'how many 5s make 10?' 40

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.

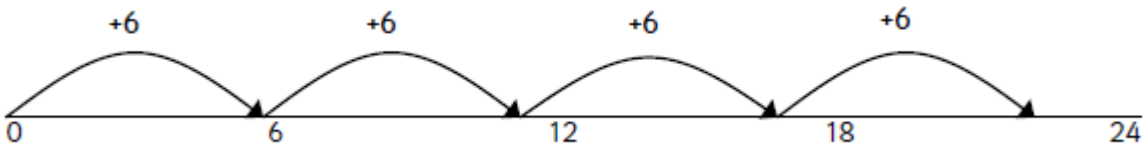


Year 3

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:

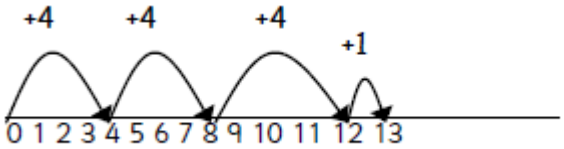
Repeated addition using a number line:

Children will begin to use an empty number line to support their calculation.
24 ÷ 4 = 6



Remainders:

Children should also move onto calculations involving remainders.
13 ÷ 4 = 3 r1

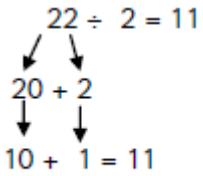


Inverse Operations:

Using symbols to stand for unknown numbers to complete equations using inverse operations.
□ ÷ 2 = 4 20 ÷ □ = 4 □ ÷ □ = 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 is necessary.



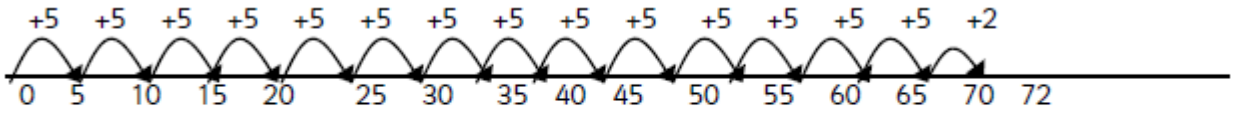
Year 4

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

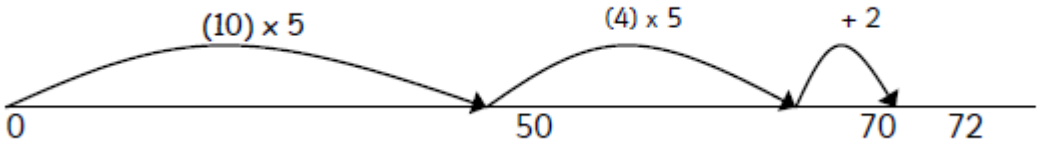
Repeated Addition:

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.

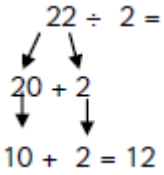
72 ÷ 5 = 14 r2



Moving onto:



Halving and partitioning:



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

Short division:

TU ÷ U

72 ÷ 5

$$5\overline{)\,7^{2}2}\quad 14\ r2$$

Short division HTU ÷ U

196 ÷ 6

$$6\overline{)\,{}^{0}19^{1}6}\quad 32\ r4$$

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.

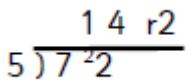
Year 5

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

Short division:

TU ÷ U

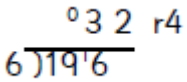
72 ÷ 5



Short division

HTU ÷ U

196 ÷ 6



Answer: 32 remainder 4 or 32 r 4

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

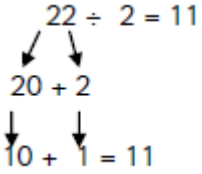
Children need to be able to decide what to do after division and round up or down according to the context of the question.

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.
I.e. 98 ÷ 4 = 24 ½.

Halving by partitioning:



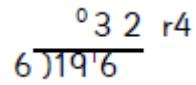
Year 6

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 ÷ U, HTU ÷ U, ThHTU ÷ U and ThHTU ÷ 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 2/10, which could then be written as 3 1/5 in its lowest terms.

Short division

HTU ÷ U

196 ÷ 6



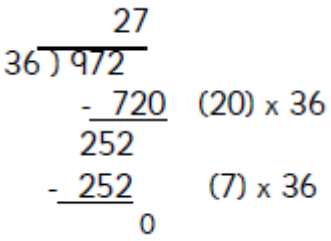
Answer: 32 remainder 4 or 32 r 4

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 ÷ TU and ThHTU ÷ TU), including remainders.

HTU ÷ TU

972 ÷ 36 =



Answer 27

Children will continue to decide what to do after division and round up or down according to the context of the question. 46

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 ÷ 6 = 0.6

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