Calculation Policy: Guidance
An Overview of the Calculations

St Hugh of Lincoln
R.C Primary School

St Hugh of Lincoln have adopted the White Rose Scheme. Teachers have reviewed the White Rose Calculation Policy and have slightly altered layout in some of the calculations.

For more detail regarding Mathematical Models and Representations please see the White Rose Calculation Policy.

Teachers will use Mathematical Models and Representations to support understanding.
In KS1, concrete and pictorial are used to help develop firm foundations in children's mathematical understanding before moving on to abstract methods. In KS2 children, teachers can use concrete and pictorial resources alongside abstract methods (written) to support learning and understanding.

Updated: July 2021

Concrete representation – a pupil is first introduced to a concept/skill by acting it out with real objects. This is a 'hands on' component using real objects and a foundation for conceptual understanding.

Pictorial representation – a pupil can relate to representations that present a concept/skill in a picture or a diagram

Abstract representation – a pupil is now capable of representing problems by using mathematical notation, for example 12 x 3 = 36

Mathematics Mastery

At the centre of the mastery approach to the teaching of mathematics is the belief that all children have the potential to achieve. They should deepen their conceptional understanding by tackling challenging and varied problems. Similarly, with calculation strategies, children must not simply learn rote procedures but demonstrate a clear understanding of these procedures through the use of concrete and pictorial representations.

For each of the four rules of number, different concrete and pictorial representations/models are highlighted in red. The policy does not recommend one set of resources over another, rather that a variety of resources are used.

Addition

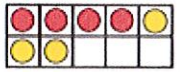
Key Language

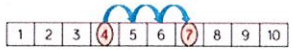
sum
total
parts
wholes
plus
add
altogether
more
equal

Year 1

Add two 1-digit numbers to 10

Using numicon/cubes
Tens frames
Number tracks



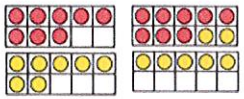


4 + 3 = 7

Add 1- and 2-digit numbers to 20

Using Part Whole Model
Numicon/cubes
Tens frames
Number tracks/Number lines (labelled)

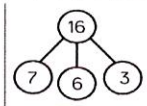
8 + 7 = 15



Year 2

Add three 1-digit numbers
Using numicon/cubes
Tens frames
Part Whole Model

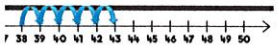
7 + 6 + 3 = 16



Add 1-digit and 2-digit numbers to 100.

Counting on from larger number.
Using number tracks and number lines

38 + 5 = 43



Add two 2-digit numbers to 100
Blank number line

Partitioning

37 + 26 = 63
30 + 20 = 50
7 + 6 = 13
50 + 13 = 63

Year 3

Add two 2- digit numbers to 100
(See Yr. 2 methods)

Year 2 do not need to learn formal methods for addition, but pupils could begin to think about the two quantities arranged in columns under place value headings of tens and ones. (Using counters or drawing dots)

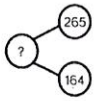
Formal Method
Expanded Method

T O
30 + 8
20 + 3
+ 10
60 + 1 = 61

Column Addition

38
23
+ 1
61

Add numbers with up to 3-digits
Part Whole
Bar Model
Place Value Counters

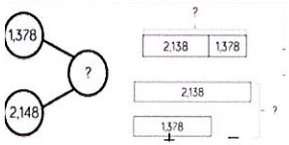


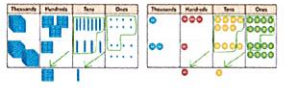
265
164
+1
429

Year 4

Add numbers with up to 4 digits

Place Value Counters
Part Whole Model
Bar Model





Formal Method
Column Addition

1378
2148
+ 11
3526

Year 5/6

Add numbers with more than 4-digits

Place Value Counters
Part Whole Model
Bar Model

At this stage children are encouraged to work in the abstract, using the column method to add larger numbers efficiently.

104325
61731
+ 1
166056

Add with up to 3 decimal places

3.65
2.41
+1
6.06

Children have experience of adding decimals with a variety of decimal places.

Subtraction

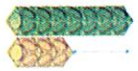
Key Language

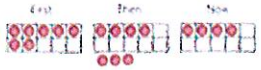
take away
less than
the difference
subtract
minus
fewer
decrease

Year 1

Subtract two 1-digit numbers to 10

Using numicon/cubes
Tens frames
Number tracks
Part Whole Models

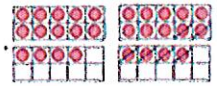




7 -3 = 4

Subtract 1- and 2-digit numbers to 20

Using numicon/cubes
Tens frames
Number tracks/number lines



14 – 6 = 8

Year 2

Subtract 1- and 2-digit numbers to 20

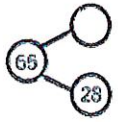
Using numicon/cubes
Tens frames
Number tracks/number lines
(See Year 1)

14 – 6 = 8

Subtract 1- and 2-digit numbers to 100

Blank number line to count on and find the difference

65 – 28 = 37



65 -20 = 45
45 – 8 = 37

Year 2 do not need to learn formal methods for subtraction, but pupils could begin to think about the two quantities arranged in columns under place value headings of tens and ones. (Using counters or drawing dots)

Year 3

Subtract numbers with up to 3-digits

Part whole model
Bar model
Place Value Counters

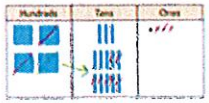
Formal Method
Expanded Column

	T	O
50		1
	60	5
-	20	8
	30	+ 7

Column Subtraction

65 – 28 = 37

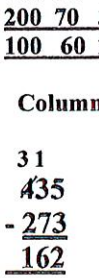
435 – 273 = 262



Expanded Column

H	T	O
300	1	
400	30	5
200	70	3
100	60	2

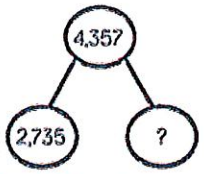
Column Subtraction



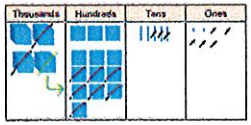
Year 4

Subtract numbers with up to 4- digits

Part Whole Model
Bar model

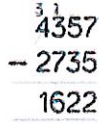


Place Value Counters used alongside a place value grid



4,357 – 2,735 = 1,622

Formal Method
Column Subtraction



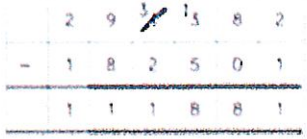
Year 5/6

Subtract numbers with more than 4-digits

Part Whole Model
Bar Model

Place Value Counters used alongside a grid

294,382 – 182,501= 111,881



Subtract with up to 3 decimal places

5.43 – 2.7 = 2.73

Formal Method
Column Subtraction

Multiplication

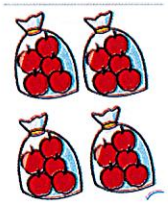
Key Language

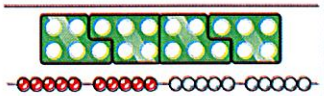
double times multiplied by the product of groups of lots of equal groups

Year 1

Solve 1-step problems using multiplication

Numicon
Counters
Tens frames
Bead Strings
Number line
Real Life Objects





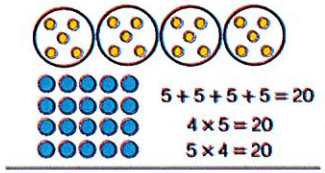
Year 1 not expected to record multiplication formally

Year 1 use concrete and pictorial representations to solve problems

Year 2

Solve 1-step problems using multiplication

Numicon
Counters
Tens frames
Bead Strings
Number line



Repeated grouping/repeated addition

5 + 5 + 5 + 5= 20

Year 2 are introduced to the multiplication symbol

4 x 5 = 20

5 x 4 = 20

Use arrays to illustrate commutatively

Year 3

Multiply 2-digit numbers by 1 digit

Partition to multiply using Numicon/base 10

Grid Method

X	10	5
4	40	20

15 x 4=60
10 x 4=40
5 x 4=20

Formal Method
Expanded Column

```
 H  T  0
    3  4
X       5
    2  0  (5x4)
1   5  0  (5x30)
1   7  0
```

Place value counters could be used to support understanding

Year 4

Formal Method
Short Multiplication Method

```
H T 0
  3 4
X   5
1 7 0
1 2
```

Multiply 3-digit numbers by 1-digit numbers

Base 10/place value counters could be used to support the understanding of the written method

```
H T 0
2 4 5
x     4
9 8 0
1 2
```

Year 5

Multiply 4 -digit numbers by 1-digit numbers

Place Value Counters could be used to continue to support understanding
Encourage use of multiplication grids if children are struggling with times tables.

1,826 x 3 = 5,478

```
TH H T 0
 1 8 2 6
X        3
5 4 7 8
2    1
```

Multiply 2-digit numbers by 2- digit numbers

Area Model – Base 10
Grid Method before moving on to the formal written multiplication

X	20	2
30	600	60
1	20	2

```
 H T O
    2 2
 X  3 1
    2 2
 6  6 0
 6  8 2
```

Year 5

Multiply 3-digit numbers by 2-digit numbers

Area Model using base ten/place value counters

X	200	30	4
30	6,000	900	120
2	400	60	8

Formal Method

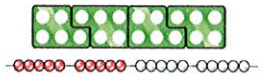
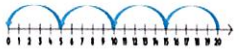
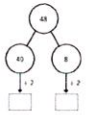
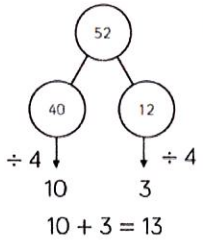
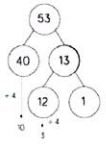
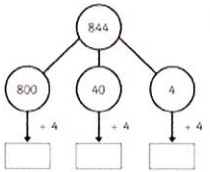
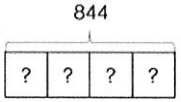
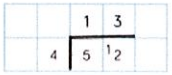
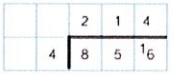
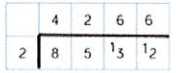
```
 TH H T O
     2 3 4
  X    3 2
 ---------
     4 6 8
   1 7 1 0 2 0
 ---------
   7 4 8 8
```

Year 5/6

Multiply 4-digit numbers by 2-digit numbers

```
 TTh Th H T O
       2  7  3  9
  X              2  8
 ---------------------
    22 51 3 9 71  2
     15  4  17  8  0
 ---------------------
     7  6  6  9  2
     1
```

Children struggling with times tables, provide multiplication grids to support when they are focusing on the use of the method.

	Year 1/2	Year 1/2	Year 3/4	Year 4	Year 4/5	Year 5
Division ***Key Language*** ***share*** ***group*** ***divide*** ***divided*** ***by*** ***half***	**Solve 1 step problems using multiplication (sharing)** Children solve problems by sharing amounts into equal groups Real life objects Arrays Bar Model Counters   In Year 1, children are not expected to record division formally. In Year 2, children are introduced to the division symbol **20 ÷ 5 = 4**	**Solve 1 step problems using division (grouping)** Real life objects Numicon Bead Strings Number lines Arrays Counters  Children count in multiples, links to repeated subtraction on a number line.  **Divide 2 digits by 1 digit (sharing with no exchange)** Place Value Counters Part Whole Model 	**Divide 2 digits by 1 digit (sharing with exchange)** Base 10 Bar Model Place Value Counters Part –whole model  10 + 3 = 13 **52 ÷ 4 = 13** 52 ÷4 =13 40 ÷ 4 =10 12 ÷ 4 = 3 **Divide 2 digits by 1 digit (Sharing with remainders)** **53 ÷4 =13r1** 	**Divide 3 digits by 1 digit (sharing)** Place Value Counters Bar Model Part –Whole Model Partitioning  **844 ÷ 4 = 211**  	**Divide 2 digits by 1 digit (grouping)** Place Value Counters **Formal Method** Short division method 	**Divide 3 digits by 1 digit (grouping)** Place Value /Plain Counters **Formal Method** Short division method  **Divide 4 digits by 1 digit (grouping)** Place Value/Plain Counters  Children to be encouraged to move away from the concrete and the pictorial when dividing numbers with multiple exchanges.

Year 6

Divide multi digits by 2 digits (Short Division)

Use of concrete and pictorial representations become less effective

Children can write out multiples to support their calculations

		0	3	6
	12	4	$^{4}3$	$^{7}2$

$432 \div 12 = 36$

$7{,}335 \div 15 = 489$

	0	4	8	9
15	7	$^{7}3$	$^{13}3$	$^{13}5$

15	30	45	60	75	90	105	120	135	150

Year 6

Divide multi digits by 2 digits (Long Division)

		0	3	6	
1	2	4	3	2	
	−	3	6	0	(×30)
			7	2	
	−		7	2	(×6)
				0	

$12 \times 1 = 12$
$12 \times 2 = 24$
$12 \times 3 = 36$
$12 \times 4 = 48$
$12 \times 5 = 60$
$12 \times 6 = 72$
$12 \times 7 = 84$
$12 \times 8 = 96$
$12 \times 7 = 108$
$12 \times 10 = 120$

$432 \div 12 = 36$

$7{,}335 \div 15 = 489$

	0	4	8	9	
15	7	3	3	5	
−	6	0	0	0	(×400)
	1	3	3	5	
−	1	2	0	0	(×80)
		1	3	5	
−		1	3	5	(×9)
				0	

$1 \times 15 = 15$
$2 \times 15 = 30$
$3 \times 15 = 45$
$4 \times 15 = 60$
$5 \times 15 = 75$
$10 \times 15 = 150$

Glossary

Addend - A number to be added to another.

Aggregation - combining two or more quantities or measures to find a total.

Augmentation - increasing a quantity or measure by another quantity.

Commutative – numbers can be added in any order.

Complement – in addition, a number and its complement make a total e.g. 300 is the complement to 700 to make 1,000

Difference – the numerical difference between two numbers is found by comparing the quantity in each group.

Exchange – Change a number or expression for another of an equal value.

Minuend – A quantity or number from which another is subtracted.

Partitioning – Splitting a number into its component parts.

Reduction – Subtraction as take away.

Subitise – Instantly recognise the number of objects in a small group without needing to count.

Subtrahend - A number to be subtracted from another.

Sum - The result of an addition.

Total – The aggregate or the sum found by addition.