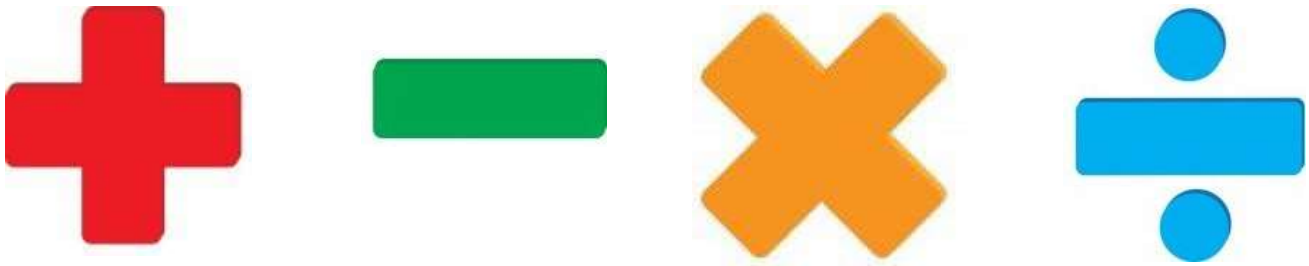
Harby C of E Primary School

Written calculation policy



Introduction

The purpose of this booklet is to outline the steps of progress for written calculation methods in the four operations (+ - x ÷). It has been written to ensure consistency and progression throughout the school and reflects a whole school agreement on the new 2014 Primary Curriculum.

Although the focus of the booklet is on written methods it is important to remember that the ability to calculate mentally is of equal importance. Mental calculations will help written recording.

It is important that children do not stop jottings and mental methods once written methods are introduced. Children should always be encouraged to look at a calculation and decide the best method to choose to help them find the answer – pictures, mental calculations with or without jotting, written methods or a calculator (if applicable).

They could ask themselves the following questions:

- *Can I do this in my head?*
- *Can I do this in my head using a picture or a jotting?*
- *Do I need to use my written method?*
- *Do I need a calculator?*

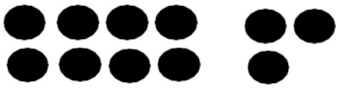
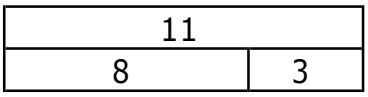
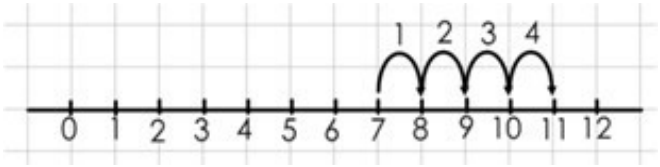
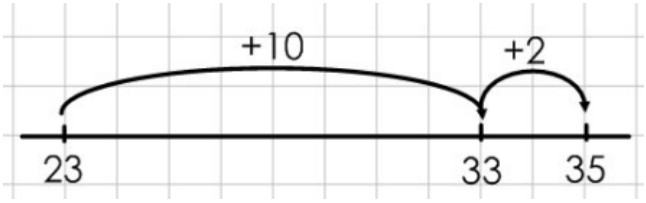
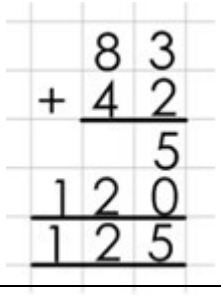
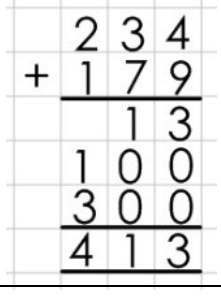
Children will have frequent opportunities to use and apply these methods to solve a variety of real life mathematical problems (e.g. money, measures, data handling etc.)

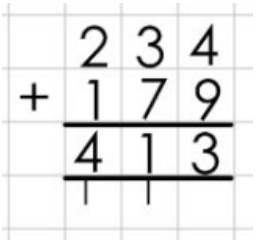
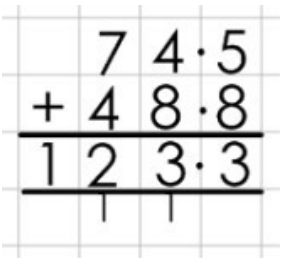
A good understanding of place value and the number system is essential for children to carry out calculations efficiently and accurately. Therefore, the methods for calculation are supported by lots of models, images and practical apparatus to reinforce understanding. Children are encouraged to talk about what they are doing before they record any calculation.

It is very important that children have a good understanding of the mathematics involved and not just a mechanical method for finding an answer.

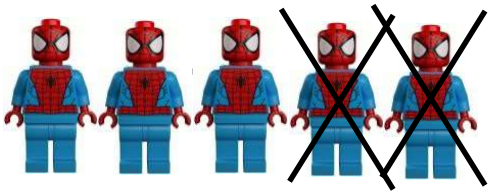
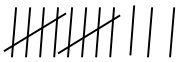
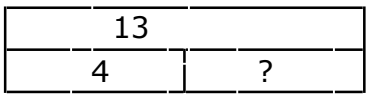
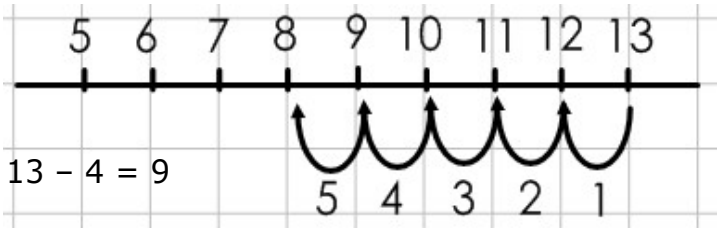
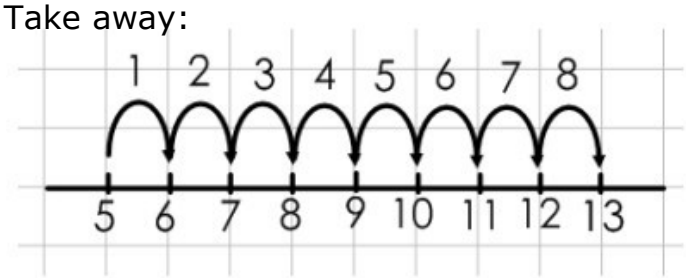
Ultimately the aim of this policy is to ensure all children have, at their personal level, a reliable method for solving questions on each of the four operations which they understand and can explain.

ADDITION

Step 1	 2 cars and 2 cars make… How many cars do I have? 1, 2, 3, 4. Concrete links with objects.	**Objects** Children use objects to help them count. Use language of addition.
Step 2	4 + 2 = 6 	**Pictures or objects** Children use pictures or objects to help them count, and add what they need to.
Step 3	8 + 3 = 11  8 + 3 = 11 	**Tallies or dots** Children use tallies or dots to help them be more efficient and add what they need to.
Step 4	8 + 3 = 11 	**Bars** Children use bars to represent addition.
Step 5	7 + 4 = 11 	**Addition number line (jumping in 1s)** Children 'jump' in 1s on a number line from one number.
Step 6	23 + 12 = 35 	**Addition number line (jumping in 10s and 1s)** Children 'jump' in 10s and 1s from one number to help them be more efficient.
Step 7	83 + 42 = 125  234 + 179 = 413 	**Expanded column method** Children add the numbers together starting from the right hand side (smallest place value column), writing the answers to each column added separately.

Step 8	234 + 179 = 413  	74.5 + 48.8 =  	**Column method** Children add the numbers together starting from the right hand side (smallest place value column), writing the answers to each column on a single line, and 'carrying' if needed.

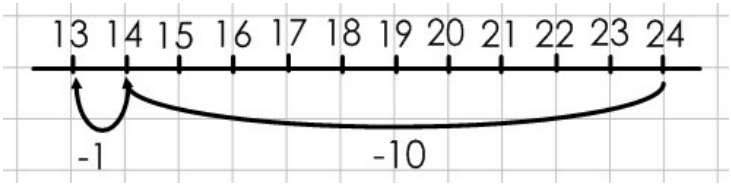
SUBTRACTION (1)

Step 1	 4 cars take away 2 cars.	**Objects** Children use objects to help them count. Use language of subtraction.
Step 2	5 – 2 = 3 	**Pictures or objects** Children use pictures or objects to help them, and take away what they need to.
Step 3	13 – 4 = 9   13 – 4 =  **Bars** Children use bars to represent subtraction.	**Tallies or dots** Children use tallies or dots to help them be more efficient, and take away what they need to.
Step 4		**Subtraction number lines** **(jumping in 1s)**
Step 5	13 – 5 = 8 Take away:  13 – 5 = 8 Difference between:	**Take away:** Children take away a number by 'jumping' back in 1s on a number line. **Difference between:** Children 'jump' forwards in 1s from the smallest to the largest number. The language for each is very specific – take away or difference between the two numbers.

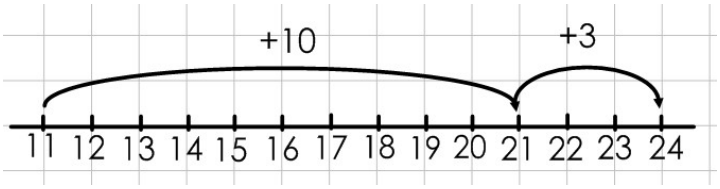
SUBTRACTION (2)

Step 6

24 – 11 = 13
Take away:



24 – 11 = 13
Difference between:



Subtraction number lines (jumping in 10s and 1s)

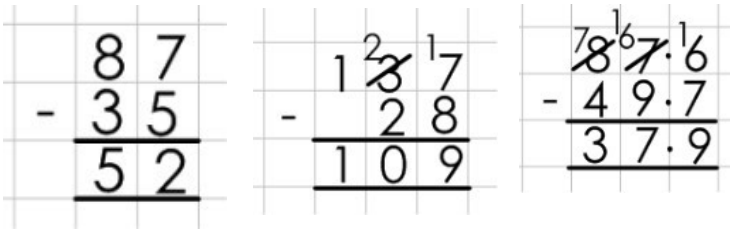
Take away: Children take away a number by 'jumping' back in 10s and 1s on a number line.

Difference between: Children 'jump' forwards in 10s and 1s from the smallest to the largest number.

The language for each is very specific – take away or difference between the two numbers.

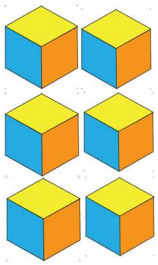
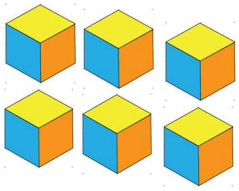
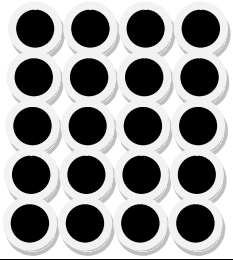
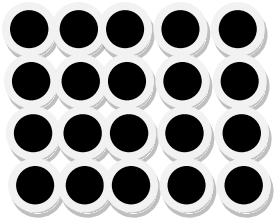
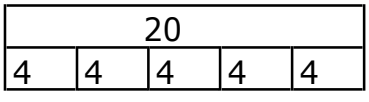
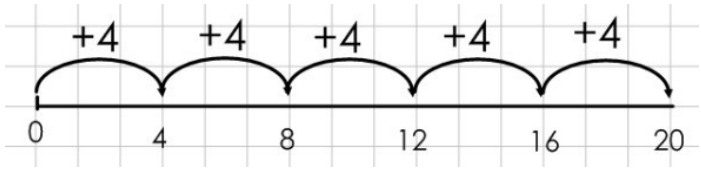
Step 7

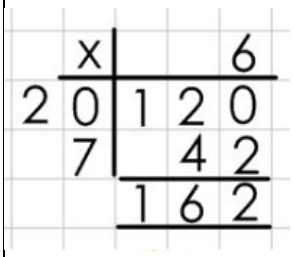
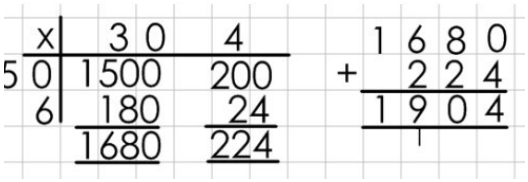
87 – 35 = 52 137 – 28 = 119 87.6 – 49.7 = 37.9



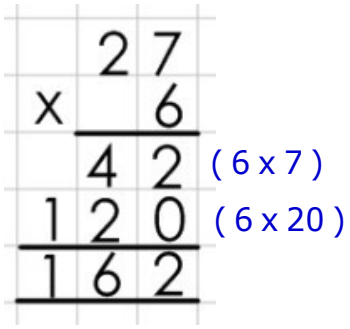
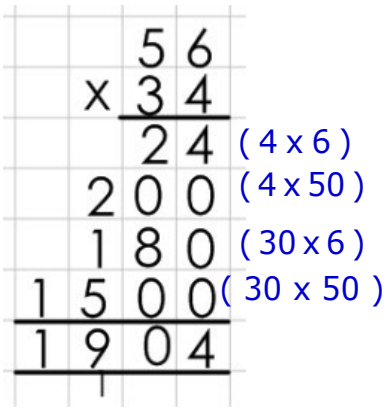
Column method
Children take the bottom digits away from the digits above it, starting from the right hand side (smallest place value column), and 'borrowing' from the larger column to the left if needed.

MULTIPLICATION (1)

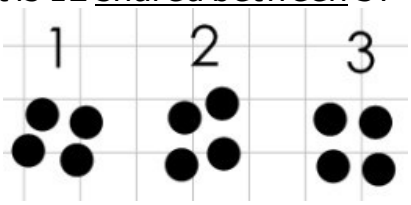
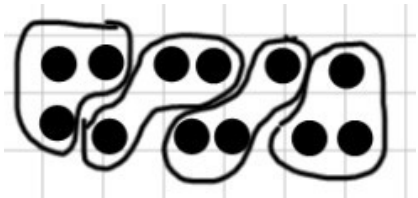
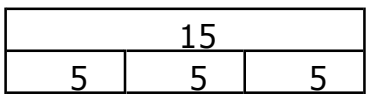
Step 1	 2 bears in each row. 5 pairs of bears.	**Objects** Children use objects to help them count. Use language of multiplication.
Step 2	2 x 3 = 6 2 cubes, 3 times is 6  3 x 2 = 6 3 cubes, 2 times is 6 	**Pictures or objects** Children use pictures or objects to help them count.
Step 3	4 x 5 = 20 4 dots, repeated 5 times times  5 x 4 = 20 5 dots, repeated 4 	**'Arrays' using dots** Children use dots to help them become more efficient, arranging the dots into rectangles (or 'arrays') according to the numbers.
Step 4	4 x 5 = 20 	**Bars** Children use bars to represent multiplication.
Step 5	4 x 5 = 20  Repeatedly add 4 (in this case, 5 times)	**Repeated addition** Children use a number line to repeatedly 'jump' forward the number of times needed.

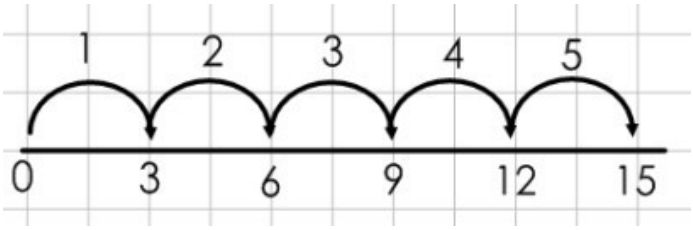
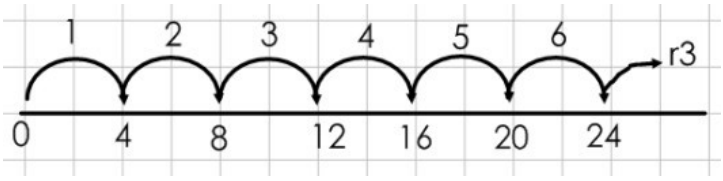
Step 6	27 x 6 = 162 34 x 56 = 1904   	**Grid method** Children 'partition' the numbers into units, tens, hundreds etc. and arrange outside a grid. Each number within the grid is made by multiplying the numbers in the same row and column. The answers are then added together to give the answer.

MULTIPLICATION (2)

Step 6	27 x 6 = 162 	56 x 34 = 1904 	**Column method** The digit(s) at the bottom are multiplied by each digit from the top number in turn, with each answer written on a new line below. Each of those answers is then added together to give the answer to the question.

DIVISION (1)

Step 1	Counting and sharing objects.  You have two and I have two	**Objects** Children use objects to help them count. Use language of division.
Step 2 Sharing	6 ÷ 2 = 3 What is 6 shared between 2? = 3  12 ÷ 3 = 4 What is 12 shared between 3? = 4  	**Pictures or objects** then **Tallies or dots** Division as 'sharing' *(What is 18 shared between 3?)* This involves children 'sharing' objects or numbers between 2, 3, 4 etc.
Step 3 Grouping	6 ÷ 2 = 3 How many groups of 2 are in 6? = 3 groups *1 group* *1 group* *1 group*  12 ÷ 3 = 4 How many groups of 3 are in 12? = 4 groups 	**Pictures or objects** then **Tallies or dots** Division as 'grouping' *(How many groups of 3 are there in 18?)* This involves children 'grouping'/ sorting objects or numbers into groups of 2s, 3s, 4s etc.
Step 4	15 ÷ 3 = 5  	**Bars** Children use bars to represent division.

Step 5	15 ÷ 3 = 5 Count in 3s until reaching 18.  27 ÷ 4 = 6 r 3 For 'remainders', count in 4s until just before 27, as you can't land directly on 27. What is left over is the 'remainder'.  	**Division number line in jumps of the divisor** Children count in 'jumps' of the 'divisor' (the number they are dividing by) and count the number of jumps they made to get to the 'dividend' (the number being divided). This links division with multiplication (counting in the times table of the divisor, called 'repeated addition').

DIVISION (2)

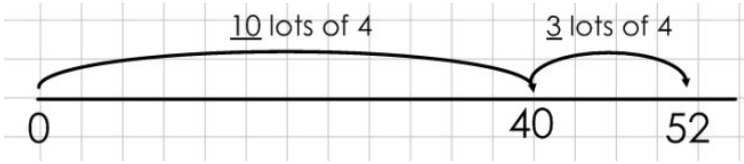
Dividend **Divisor**

15 ÷ 3

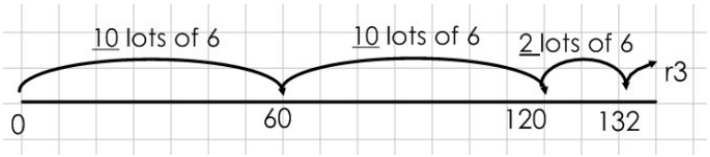
Step 6

52 ÷ 4 = 13

The lots of the divisor are 10 in the first jump (because 10 lots of 4 is 40) and 3 in the second jump (because 3 lots of 4 is 12), so the answer is 13.



135 ÷ 6 = 22 r 3



Division number line in larger jumps of the divisor

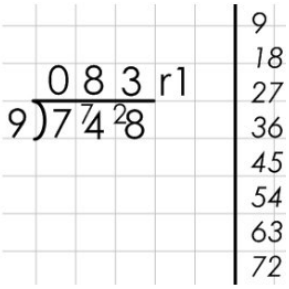
Children 'jump' much larger steps forwards towards the 'dividend' in large multiples of the 'divisor'.

This is more efficient when dividing large numbers, and the children don't have to write every multiple on their number line up to the dividend.

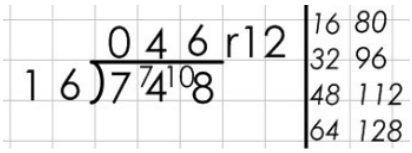
To find the answer, the lots of the divisor are added together

Step 7

748 ÷ 9 = 83 r 1



748 ÷ 16 = 46 r 12



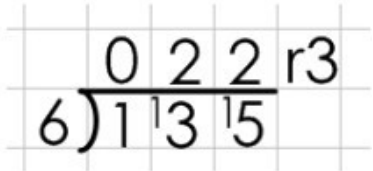
Children (if they need to) write out the multiples of the divisor that they need on the side, to help with how many times the divisor goes into each digit.

Bus stop method 1

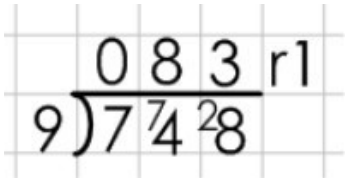
The dividend is under the 'bus stop', with the divisor outside to the left. The chidren see how many times the divisor 'goes into' each digit of the dividend, starting from the left. The number of times is written above and the left over number is written by the next digit of the dividend.

Step 8

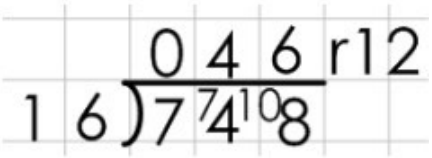
135 ÷ 6 = 22 r 3



748 ÷ 9 = 83 r 1



748 ÷ 16 = 46 r 12



Bus stop method 2

As above, but the children don't write the multiples of the divisor in their margin. This means they are more efficient.

Remainders are the amount of the dividend that is 'left over'.

DIVISION (3)

Dividend **Divisor**

15 ÷ 3

Step 8a *Extension1*	748 ÷ 16 = $16\overline{)748}$ = 046 remainder 12 = $\frac{12}{16} = \frac{3}{4}$ The remainder above is simplified to ¾.	**Bus stop method 2** As before, but any remainders are written as <u>fractions</u> instead of writing r. If there are any remainders, the children write them as a fraction of the divisor. They can then 'simplify' the fraction if possible.
Step 8b *Extension2*	748 ÷ 9 = $9\overline{)748.00}$ = 83.11 748 ÷ 16 = $16\overline{)748.0}$ = 46.75	**Bus stop method 2** As above, but any remainders are written as <u>decimals</u> instead of fractions or writing r__. If there are any remainders, the children carry them to a '0' digit to the right of the dividend (beyond a decimal point that they draw for remainders), repeating as necessary – e.g. to 2 decimal places.