Woodhouse Primary School's

WRITTEN CALCULATION POLICY

September 2022

Contents:

Rationale

This booklet has been written to ensure that clear, coherent methods of calculation are used that have a clear progression as children move through school. It shows the agreed written calculations and methods that are taught at Woodhouse Primary School and that children are also encouraged to use when completing calculations as part of their homework.

Each operation has its own section, starting with addition and subtraction and moving through to multiplication and division. The practical methods used in Reception are shown first followed by the different methods introduced across Key Stage 1 and Key Stage 2 broken down by year group.

Although the year group in which new methods are introduced has been identified, staff will choose the strategy most suited to the groups of children in their cohort. They should use the agreed methods from year groups below or above their own to aid understanding or extend able learners.

The strategies shown in this policy are mostly abstract in nature but within each year group, concrete equipment and pictorial representations will be used to develop children's understanding of the methods they are learning and to support children who are not yet ready to confidently use formal abstract methods of calculation.

Concrete: using manipulatives, objects or tools that the child can handle

Pictorial: using drawings, diagrams or jottings as a method to reach an answer (including bar models) by creating a physical representation of their mental image

Abstract: using numbers and symbols to represent calculations

Alongside this calculation policy, there are a set of videos that can be found on the school website. The videos give a step by step breakdown of each written method and are accompanied by questions and answers to allow practise of these strategies from home.

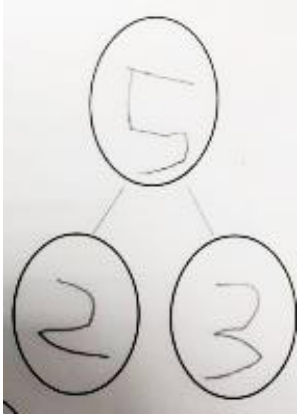
Note: The terms "ones" and "ones" are used interchangeably in both this policy and the tutorial videos.

Addition

Reception:

Counting all

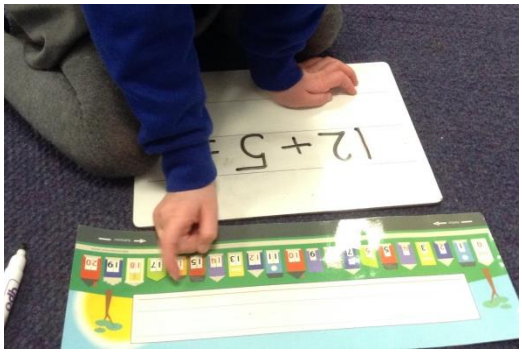
This begins by collecting two amounts and counting all the items to make a total and is introduced using two groups represented in a variety of ways including real life contexts (e.g. two farm pens, two shopping trolleys, two fish bowls etc). Two numbers are chosen and then objects are counted out for each number into the groups. The children are then asked the question “how many are there altogether?” and all the objects are counted (see below).



The whole part-part model is one way that this can be represented (see above) and continues to be used throughout school to represent the process of combining two (or more) parts to make a whole.

Counting on using a number line

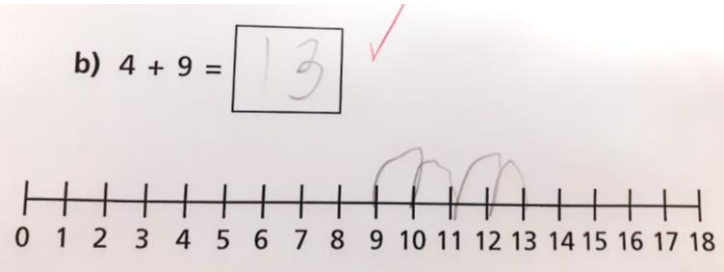
Once the counting all method has been mastered, children are taught the counting on method. This involves finding the biggest number in a calculation on a number line and counting on by tracking using their finger or by drawing jumps.

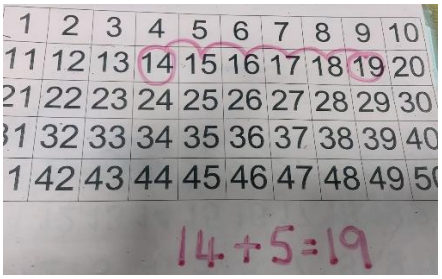


Year 1:

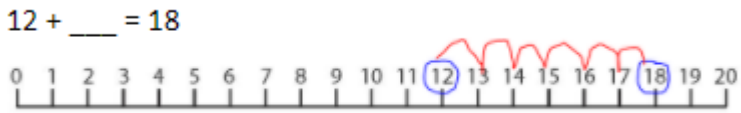
<u>Counting on using a number line or a hundred square:</u>

Building on the methods used in Reception, children use a number line or a hundred square to count on from the largest number, reordering the digits if necessary and working with progressively larger numbers





They are also introduced to calculations where the answer is at the beginning (e.g. ___ = 4 + 9) and missing number problems.



Year 2:

<u>Counting on</u>

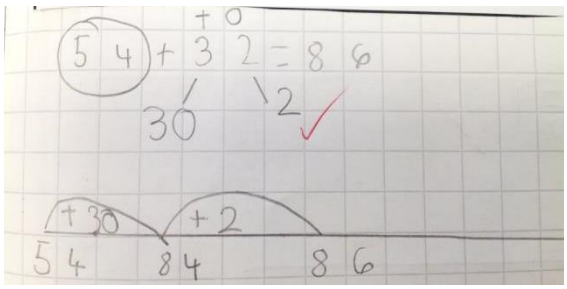
Children are encouraged to put one number in their head and count on in tens or ones using their fingers to keep track of how many tens or ones they have added.

e.g. to answer 37 + 40 = 77, put 37 in your head and count on in tens 4 times

37, 47, 57, 67, 77

<u>Using a blank number line:</u>

Add the tens in one jump and then the ones in one jump. If children are not yet confident adding multiples of 10, they can add the multiple of 10 in separate jumps (e.g. three +10 jumps when adding 30).

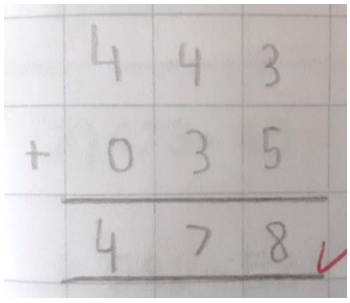


Year 3:

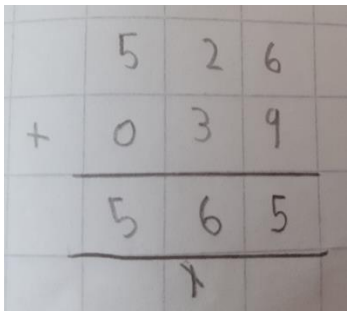
<u>Using the standard written method of column addition:</u>

Children will be taught how to use the standard written method of column addition to add numbers of up to 3 digits.

At first, these calculations will not require any regrouping (crossing over a boundary between ones and tens or tens and hundreds).



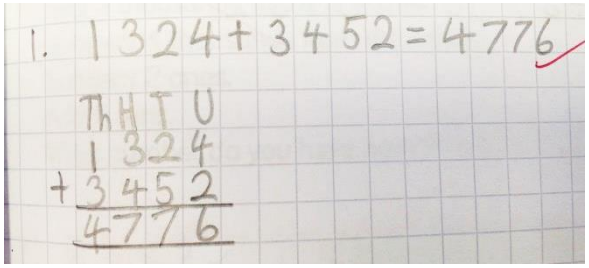
Once children can confidently use column addition to add numbers without regrouping, they are taught how to exchange across place value columns by putting the exchanged digit underneath the bottom line in the correct column. Teachers will always model exchanging below the line.

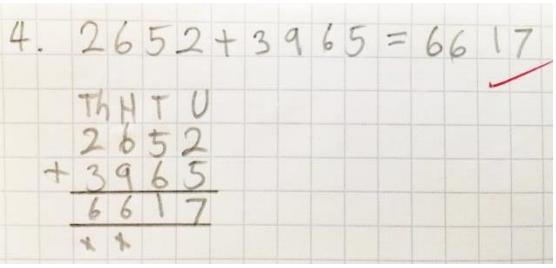


Year 4:

<u>Using the standard written method of column addition:</u>

Children in Year 4 and beyond will continue to use column addition as the most efficient method to add two numbers of 2 or more digits and will extend their knowledge and skills by adding progressively larger and more complex numbers as they move through Key Stage 2. In Year 4, children will add numbers of 4 digits:





Although the columns are labelled with hundreds (H), tens (T) and ones (U) in some of these examples, it is not necessary for the children to record these on their work once they are confident.

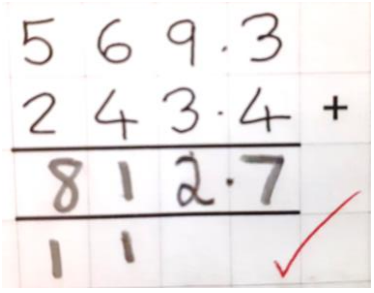
Year 5:

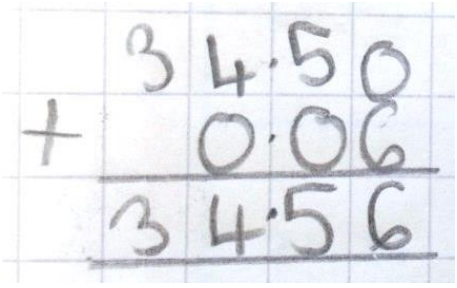
<u>Using the standard written method of column addition:</u>

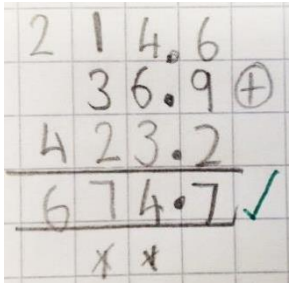
In Year 5, children will also use this method to add:

- numbers of 5 or more digits
- decimal numbers (up to 2 decimal places)
- more than 2 numbers

When adding decimals, children are encouraged to record place holders (zero) after the decimal point to avoid any confusion.







Year 6:

By Year 6, children will know when to use the standard algorithm of column addition and do so confidently and at appropriate times.

Subtraction

Reception:

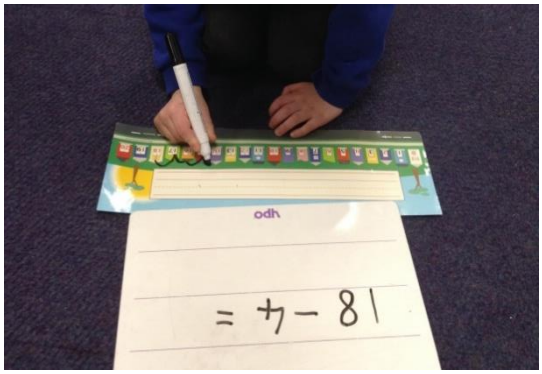
Taking away:

In Reception, subtraction is often known as “take away”. Children start with a group of objects and choose a number to take away. The amount of objects is then removed and the children count how many are left. It is important for children to understand that the amount left will be less than the amount they started with.

e.g. 3-1=2 is represented by three penguins standing on an iceberg and one jumping into the water

Counting back on a number line:

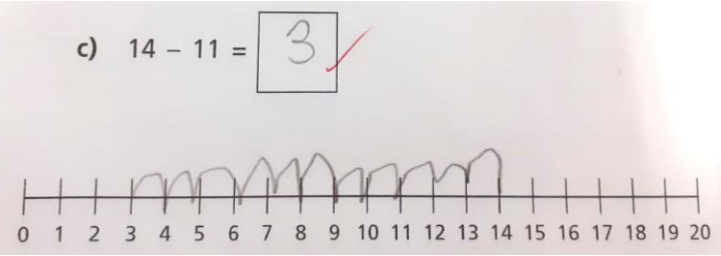
Children use a number line to take away by counting back from a number. They begin by putting their finger on the number they are starting with. Then they jump their finger down the number line counting how many they are taking away. Whichever number they stop on is the answer. If it helps children, they can draw jumps instead of tracking with their finger.

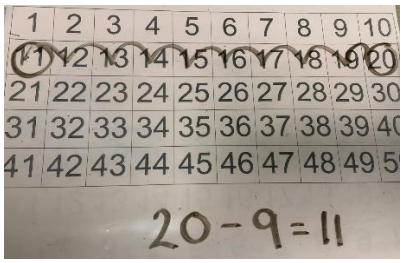


Year 1:

<u>Counting back using a number line or a hundred square:</u>

Building on the methods used in Reception, children use a number line or a hundred square to count back from the largest number and work with progressively larger numbers.





They are also introduced to calculations where the answer is at the beginning (e.g. ___ = 14 - 11) and missing number problems (e.g. 19 - ? = 13).

Year 2:

<u>Counting back:</u>

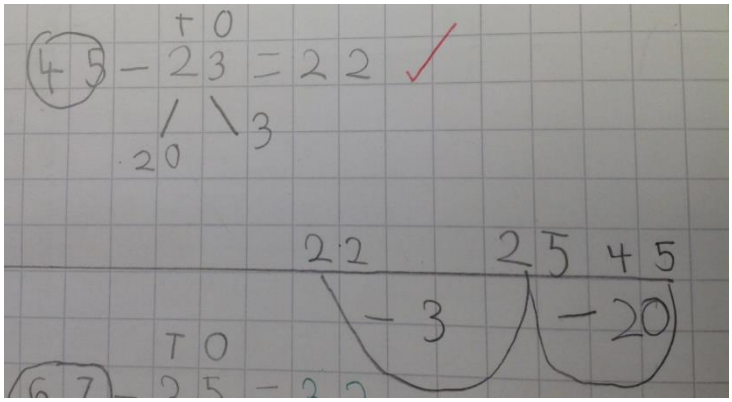
Children are encouraged to put the largest number in their head and count back in tens or ones using their fingers to keep track of how many tens or ones they have subtract.

e.g. to answer 85 - 30 = 55, put 85 in your head and count back in tens 3 times

85, 75, 65, 55

<u>Using a blank number line:</u>

Subtract the tens in one jump and then the ones in one jump. If children are not yet confident subtracting multiples of 10, they can subtract the multiple of 10 in separate jumps (e.g. two -10 jumps when subtracting 20).

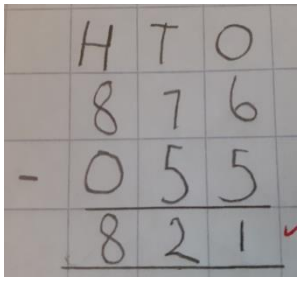


Year 3:

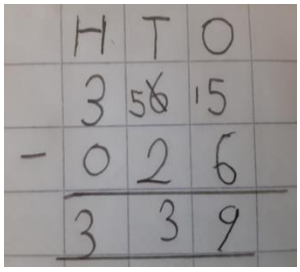
<u>Using the standard written method of column subtraction:</u>

Children will be taught how to use the standard written method of column subtraction to subtract numbers of up to 3 digits. When using the formal method of subtraction, children need to write the calculation accurately with the correct values in the correct columns.

At first, these calculations will not require any regrouping (crossing over a boundary between ones and tens or tens and hundreds).



Once children can confidently use column subtraction to subtract numbers without regrouping, they are taught how to exchange across place value columns (see example below). The children always exchange from the top number in the subtraction calculation. Exchanging is done when there are not enough ones or tens in the top number to subtract the bottom number.

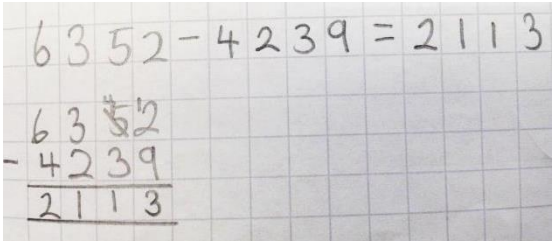


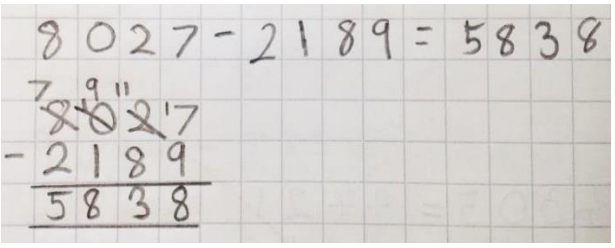
Year 4:

<u>Using the standard written method of column subtraction:</u>

Children in Year 4 and beyond will continue to use column subtraction as the most efficient method to subtract two numbers of 3 or more digits and will extend their knowledge and skills by adding progressively larger and more complex numbers as they move through Key Stage 2. Common errors occur when the calculation has a lot of zero digits e.g. 6005 – 3567.

In Year 4, children will subtract numbers of 4 digits:





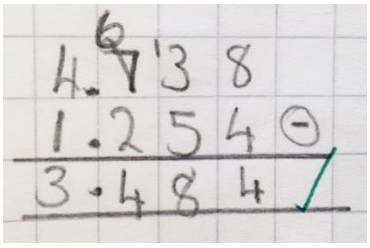
Although the columns are labelled with hundreds (H), tens (T) and ones (O) in some of these examples, it is not necessary for the children to record these on their work once they can subtract confidently.

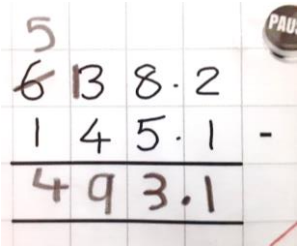
Year 5:

In Year 5, children will subtract:

- numbers of 5 or more digits
- decimal numbers to 2 decimal places

When subtracting decimals, children are taught to line up the decimal point.





Year 6:

By Year 6, children will know when to use the standard algorithm of column subtraction and do so confidently and at appropriate times.

Multiplication

Reception:

In Reception, multiplication is not taught formally. However, the first steps of this operation are introduced to the children by rote counting in twos, fives and tens. Children will use visual prompts to help them such as pairs of socks or fingers on a hand. They also use a hundred square to identify numbers that they would say when they count in twos, fives and tens.

<u>Doubles:</u>

Children are taught to recognise that a double requires two equal groups with the same amount in each group. They learn to double numbers by placing the same amount of objects into 2 groups and adding the amounts together. They also recognise doubles on dominoes and in other real life contexts.

Year 1 and 2:

The formal teaching of multiplication begins in Year 1.

<u>Counting in 2s, 5s and 10s:</u>

Children learn to count carefully in 2s, 5s and 10s both forwards and backwards. They use a hundred square to see patterns of numbers.

e.g. knowing that all multiples of 2 are even so have 0, 2, 4, 6 or 8 ones; recognising that all multiples of 10 have zero ones; seeing that multiples of 5 always have 0 or 5 ones.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Counting in 2s

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Counting in 5s

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

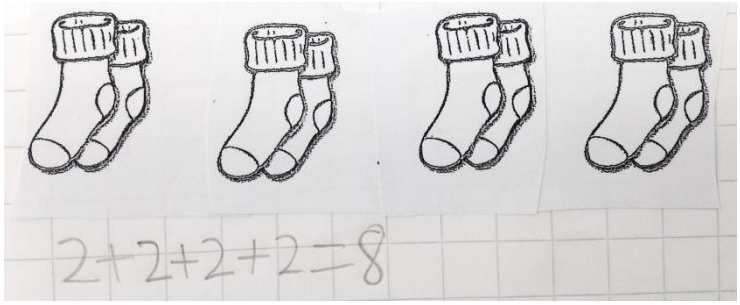
Counting in 10s

Children will also learn to count in 3s in Year 2.

Repeated addition:

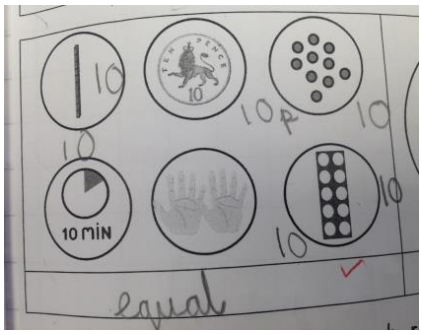
Once they are confident counting in 2s, 5s and 10s they will learn to add the same number several times to find an answer. This is called *repeated addition.*

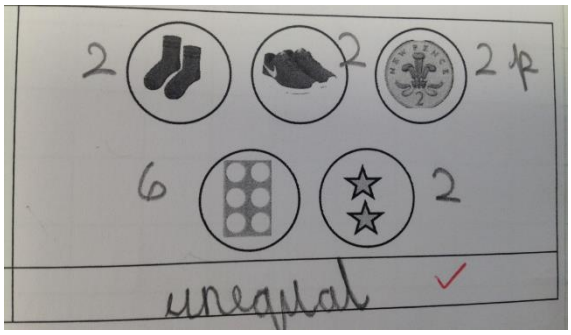
e.g. 2 + 2 + 2 + 2 = 8 *or* 10 + 10 + 10 + 10 + 10 = 50



Recognising equal groups:

In order to understand multiplication, it is important that children first understand the concept of equal and unequal groups. They must learn that it is the quantity, not the arrangement of the items in the group that makes them equal.



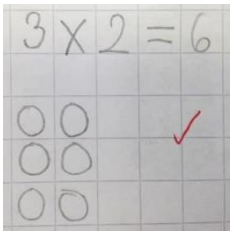


Introduction of the x sign:

The next step is to introduce the multiplication sign (x) and explain its significance as meaning *equal groups of*. They are introduced to the word *times* and *multiply by*. The children then learnt the link between repeated addition and multiplication by rewriting 2 + 2 + 2 + 2 = 8 as 4 x 2 = 8 because there are 4 equal groups of 2. Children are taught that this is a much more efficient way of completing and recording a calculation.

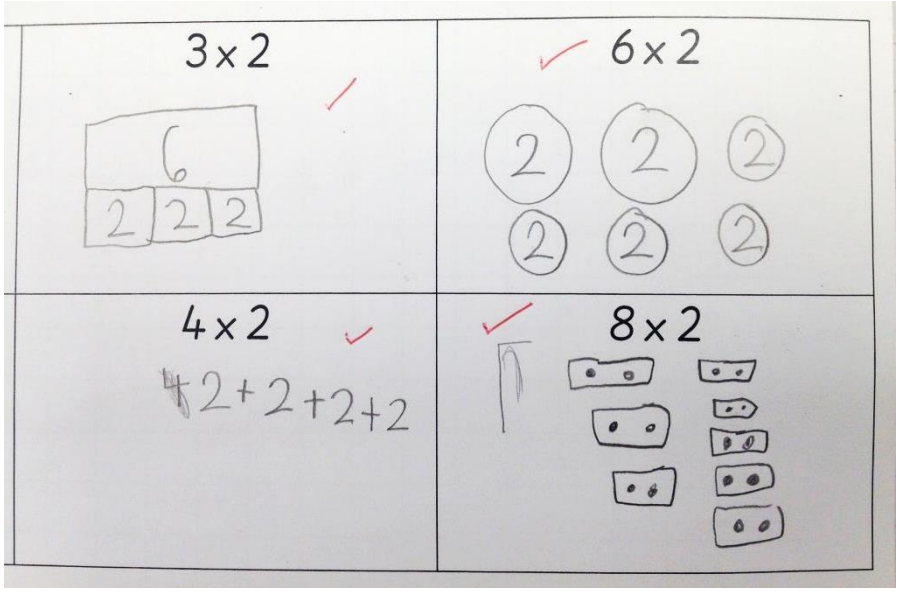
Arrays:

At the same time, arrays are introduced to the children as a visual representation of multiplication. Arrays are **not** to be used as a method for calculation but it is important that children can represent multiplication in this way.



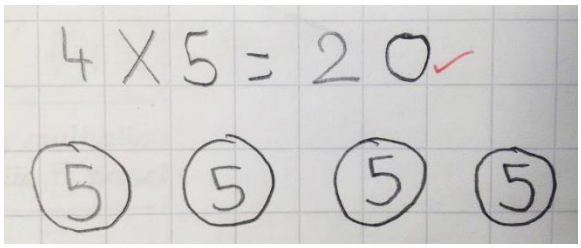
Different representations:

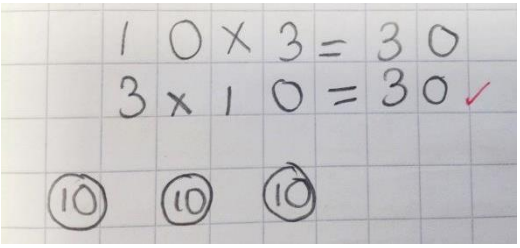
Once children understand that groups must be equal when multiplying, they can begin to represent groups in different ways using bar models, Numicon, bead strings, coins and other representations. The sentence *"there are __ groups with __ in each group"* is used to describe the representations.



Multiplying by 2, 5 and 10:

As the children become confident in their understanding of the operation of multiplication, they are taught to use informal jottings to help them complete multiplication calculations.





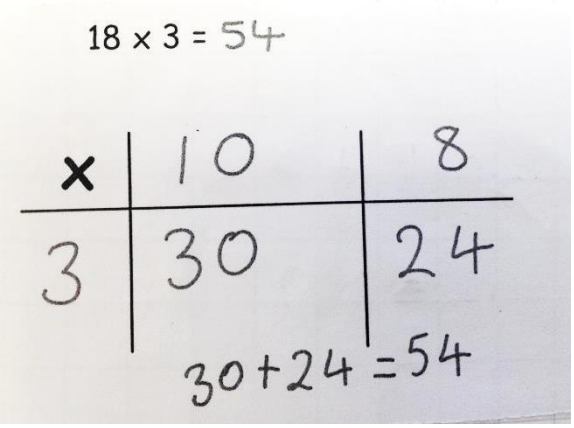
By the end of Year 2, children should have instant recall of their 2, 5 and 10 times tables or have strategies which allow efficient methods such as counting in 2s, 5s or 10s on their fingers to enable them to have fast recall.

Year 3:

Grid method:

In Year 3, children learn how to multiply a 2 digit number by 2, 5, 3, 4, 6 or 8 for example 37 x 3 using the grid method. Children are encouraged to partition the two digit number into tens and ones and multiply each

part by the single digit number in turn. The answer is then found by adding the answers to both parts together.



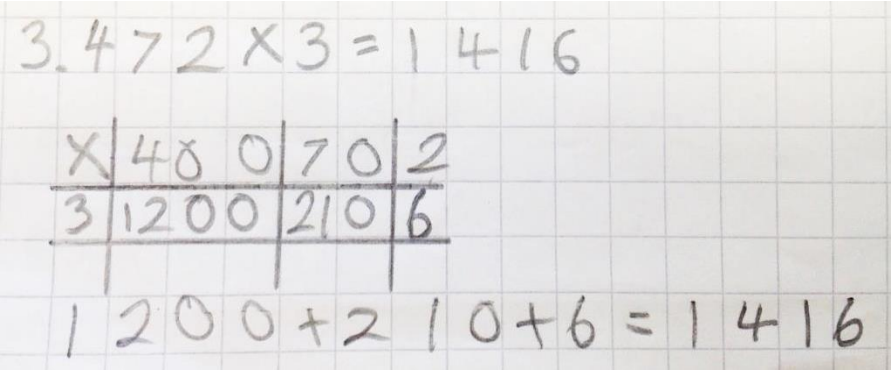
<u>Multiplying by 3, 4, 6 and 8:</u>

By the end of Year 3, children should aim to have instant recall of their 2, 5,10, 3, 4, 6 and 8 multiplication facts.

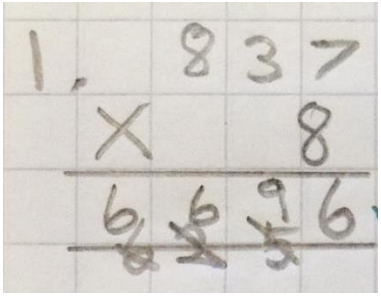
Year 4:

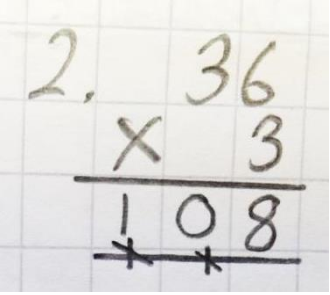
<u>Grid method:</u>

Children begin by recapping the grid method and consolidating their understanding of it by using it to multiply a 3 digit number by a 1 digit number.



As the children become increasingly confident using the grid method, they learn how to use column multiplication to multiply a 2 or 3 digit number by a 1 digit number.





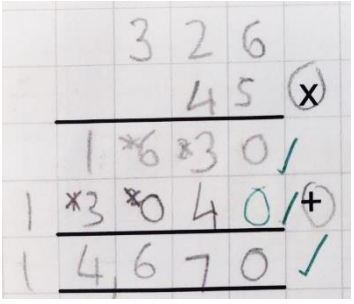
Multiplying by all numbers to 12:

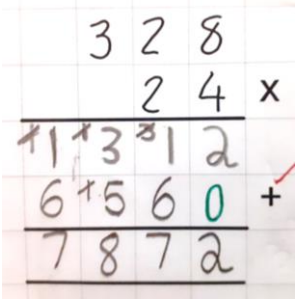
By the end of Year 4, children should have instant recall of times tables facts up to 12 x 12. Children's instant recall of multiplication facts up to 12 x 12 is tested in a Multiplication Tables Check towards the end of Year 4.

Year 5:

Long multiplication:

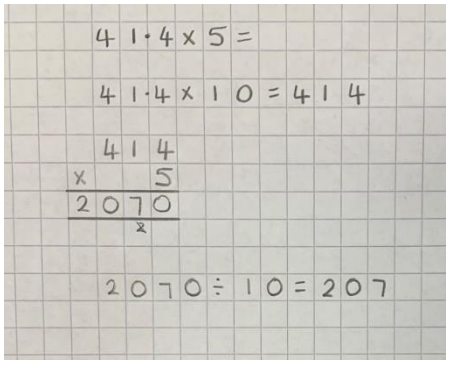
Children move on to using long multiplication to multiply a 3/4 digit number by a 2 digit number. The children begin by multiplying the 3 digit number by the ones (e.g. 326 x 5). They then multiply the 3 digit number by the tens (326 x 40) remembering to put a place holder zero in first to recognise the fact that they are multiplying by tens not ones. To find the final answer, they total the answers to the two previous calculations using column addition.

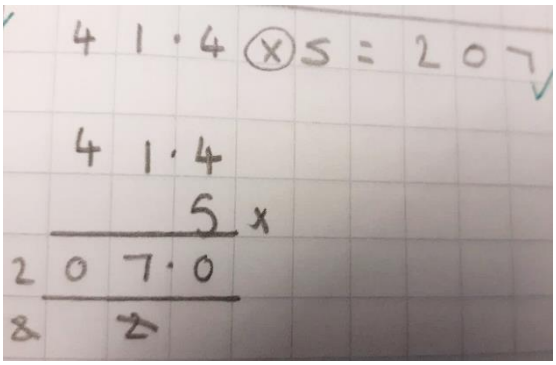




Year 6:

When introducing multiplying an integer (*a whole number*) by a decimal, children are encouraged to multiply the decimal by 10,100 or 1000 to convert it into an integer then complete the written calculation (see example 1 below). Using the answer, they then divide the integer by 10,100 or 1000 using a place value chart if needed. Once more confident, the written calculation is completed with the decimal point in place in both the question and the answer (see example 2 below).





Example 2

Division

Reception:

In Reception, division is not taught formally.

<u>Halving:</u>

However, the first steps of this operation are introduced to the children by sharing objects between two groups or people and finding half. The language of “one for you and one for me” is used. They are taught to recognise that half means splitting into two equal groups with the same amount in each group. They learn to halve numbers by sharing a number of objects between 2 groups and counting how many are in each group to find their answer.

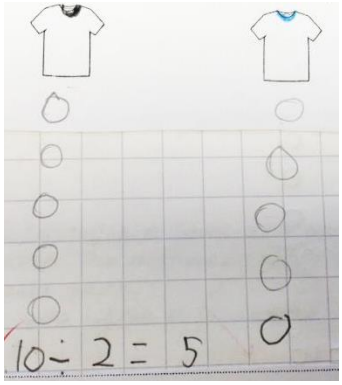
e.g. half of 8 = 4 using sweets and plates to share equally

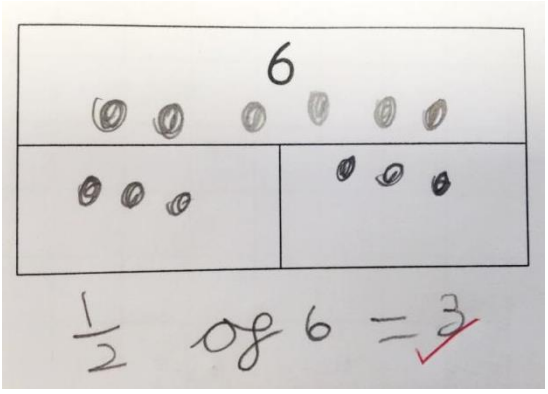
Year 1:

The formal teaching of division begins in Year 1.

<u>Dividing by sharing (halving):</u>

Children may need to share objects physically but in Year 1, halving is mainly taught using informal jottings that progress eventually to a bar model. The link is made between halving and dividing by 2. Children put the whole number in the top bar of the model then share the number between two parts. They find the answer by counting how many are in each part.

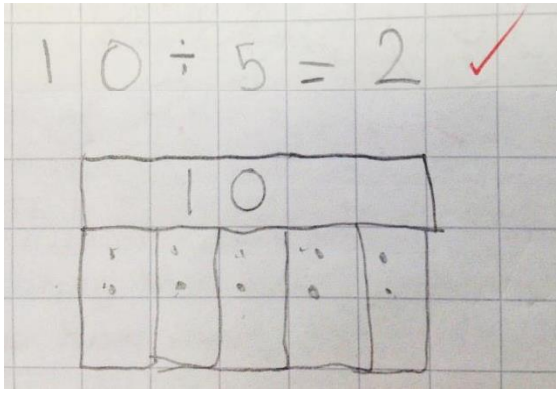




Year 2:

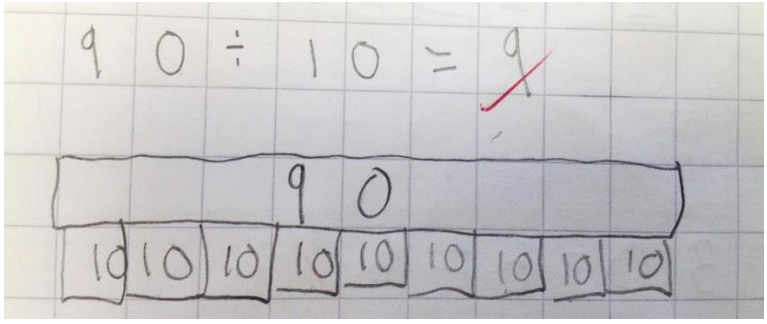
Dividing by sharing:

In Year 2, division is introduced as sharing using a bar model. Children put the whole number in the top bar of the model then draw the number of parts that they need to share between which may either be 2, 5 or 10. They then share the number between two parts by drawing dots in each part in turn. They find the answer by counting how many are in each part.



Dividing by grouping:

When answering the question 6 ÷ 2 = 3, they will ask themselves the question “how many 2s are in 6?” They will then count in groups of 2 on a bar model until they reach 6.

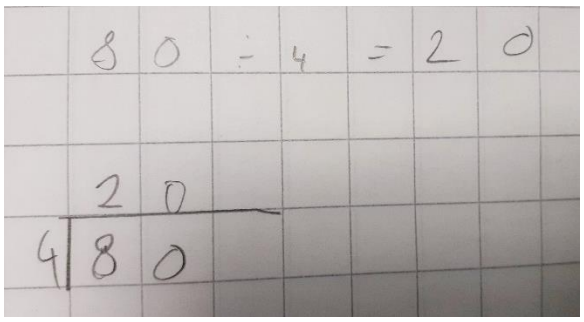


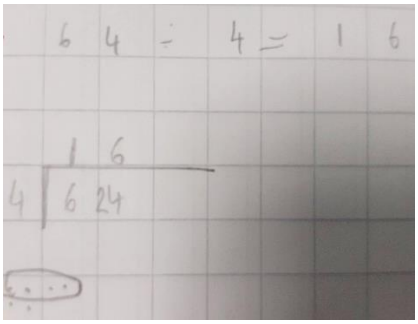
As the children become more confident, they use their fingers to count in groups of 2, 5 or 10.

Year 3:

Short division (bus stop method) without remainders:

In Year 3, children are introduced for the first time to the short division method (bus stop) to divide a two digit number by a one digit number. If it helps them to draw dots and group them to see how many will be exchanged to the next place value column this is encouraged (see second example overleaf).





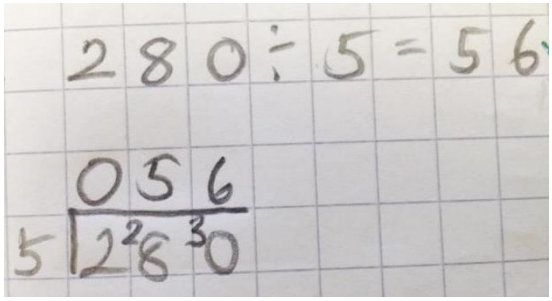
Dividing by 3, 4, 6 and 8:

By the end of Year 3, children should aim to have instant recall of their 2, 5,10, 3, 4, 6 and 8 division facts.

Year 4:

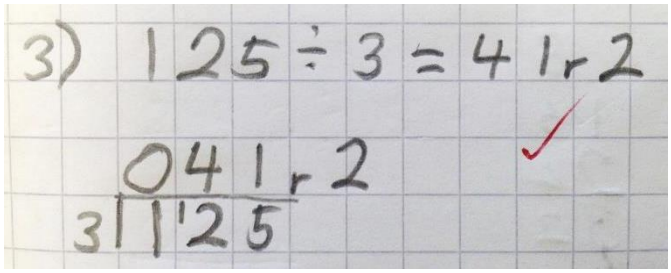
Short division (bus stop method) without remainders:

Children build on their understanding of the bus stop method taught in Year 3 to divide a three digit number by a one digit number.



Short division (bus stop method) with remainders:

This formal written method for division is then used to introduce children to the concept of remainders when a number does not divide equally by the divisor (the number being divided by). At this point, remainders are expressed using the small *r* followed by the remainder. Children do not learn to express a remainder as a decimal until Year 5.



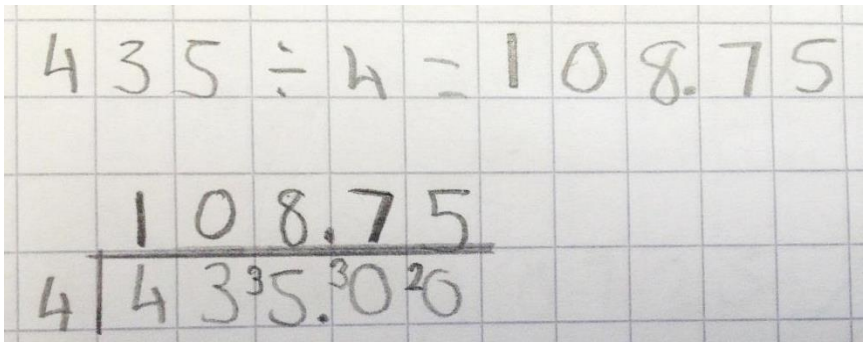
Dividing by all numbers to 12:

By the end of Year 4, children should have instant recall of all related division facts up to 12 x 12.

Year 5:

<u>Short division (bus stop method) with remainders as decimals:</u>

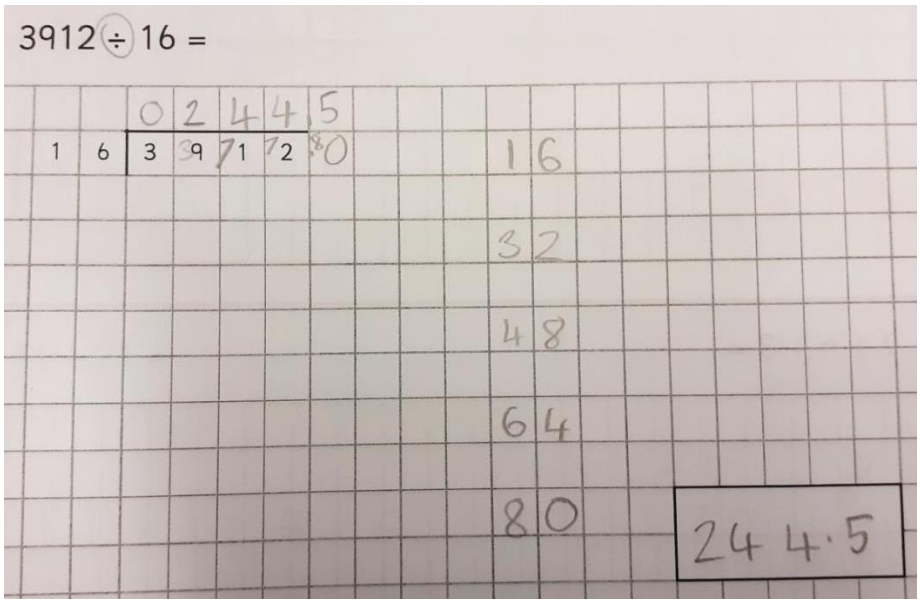
Building on their understanding of short division from Year 4, children learn to express the remainder as a decimal to a maximum of 2 decimal places.



Year 6:

<u>Short division (bus stop method)</u>

Bus stop continues to be the method used for division as children move into Year 6 and begin to divide a 4 digit or more number by a 2 digit number (e.g. 3764 ÷ 16). To complete 2 digit division, the children are encouraged to write down a list of the 2 digit multiples and use this to help them to complete the calculation using the normal bus stop method.



To further refine their use of this method, children can complete an estimation of how many times the 2 digit number goes into the dividend (the number being divided). This should be done using a column multiplication.