



Weston Park Primary School Calculations Policy

The progression of skills for the four operations

Policy Outline:

This policy outlines both the informal and formal written methods taught at Weston Park from Year 1 through to Year 6. It has been written in line with the National Curriculum 2014 and should be read alongside the Weston Park Primary School Mathematics Policy and the progression of skills document. The attached appendix provides a visual progression of calculation skills across the school. The aim of this document is to support teachers in enabling children to reach the most efficient formal written method, in line with the National Curriculum.

This policy outlines the expectation for pupils at the end of each year group in order for them to be mathematically fluent in each operation. Teachers will use AfL and their discretion to return to earlier methods to consolidate learning or address any misconceptions to support the needs of individual pupils. Pupils will be expected to show that they can use the appropriate written strategies correctly in all maths learning, including arithmetic practice at the start of the lesson.

Formal written methods are usually only applied correctly when taught conceptually; enabling children to understand the processes they are going through. Therefore, alongside the teaching of both expanded and formal written methods should be opportunities for the use of concrete apparatus such as place value counters and dienes. Children should also be given the opportunity to represent pictorially the process of the formal written method if this aids a pupil's conceptual understanding. This deeper level of understanding behind the formal written method will be instrumental in helping the children reason effectively.

While the skill of addition might be taught separately to the skill of subtraction, and the same for multiplication and division, it is important for the children to see the mathematical link between these pairs of operations and teaching must therefore allow for this.

Addition

Year 1

Drawing and jottings

$2+3=$



$4 + 9 = 13$

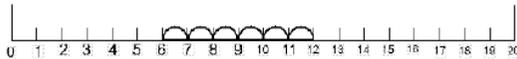


$5 + 4 = 9$

'Put your finger on number 5 and count on 4'

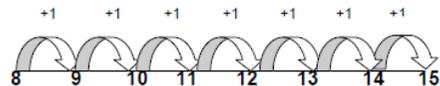
Then progress onto a structured number line.

$6 + 6 = 12$



'Put your finger on number six and count on six.'

$8 + 7 = 15$ 'Put your finger on number eight and count on seven.'



These are ways of completing addition in a written process. Year 1 will be focused on developing a bank a number bonds and using mental strategies such as bridging to add.

Year 2

Concrete and Pictorial representations

$$9 + 3 = 12.$$



Two digit and ones:

$$22 + 5 = 27$$

Children should be taught to count on in their heads or use their skill of bridging to make the method more efficient.

$$22 + 5 = 27$$

Two digit add tens:

$$22 + 30 = 52$$

Use in conjunction with a 100 square to show jumps of tens

Children should be taught to notice that if they are adding on tens, the tens number changes and ones number stays the same.

$$22 + 30 = 52$$

2 digit add 2 digit:

$$35 + 44 = 79$$

Children are taught to count the tens and then count the ones.

$$35 + 44 = 79$$

This works for bridging over the tens:

$$56 + 35 = 91$$

$$56 + 35 = 91$$

Partitioning:

Partitioning method to add two two-digit numbers.

$$43 + 25 = 68$$

$$40 + 20 = 60$$

$$3 + 5 = 8$$

$$60 + 8 = 68$$

'Partition the numbers into tens and ones

Add the tens together and then add the ones together.

Recombine to give the answer'.

Partition bridging the tens:

$$48 + 36 = 40 + 8 + 30 + 6$$

$$40 + 30 = 70$$

$$8 + 6 = 14$$

$$70 + 14 = 84$$

These are ways of completing addition in a written process.

Year 2 will continue to focus on using the bank of number bonds and a range of mental strategies such as bridging to add.

Year 2 will start preparing children for the formal written method if they feel the child has a secure enough place value knowledge and is developmentally ready for it.

Year 3

Teachers will use the formal written method to teach the children how to add 3 digit numbers together.

$$\begin{array}{r} 243 \\ +368 \\ \hline 611 \\ \hline 1 \quad 1 \end{array}$$

Year 4

Teachers will use the formal written method (as shown in Year 3) to teach the children how to add 4 digit numbers together.

Year 5

Teachers will use the formal written method (as shown in Year 3) to teach the children how to add multi digit numbers together.

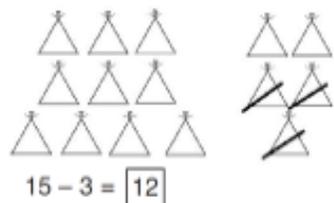
Year 6:

Teachers will use the formal written method (as shown in Year 3) to teach the children how to add multi digit numbers together.

Subtraction

Year 1
In Year 1 children will be taught how to subtract and find the difference through pictorial and concrete representations and on a number line.

CPA:



This method would come after the concrete understanding of taking away 3 objects from a set of 15 objects and having to count the remaining to find the answer.

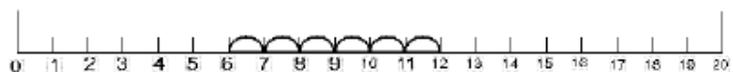
Children will then use a number line to count back from the largest number



Put your finger on number 9 and count back 5'

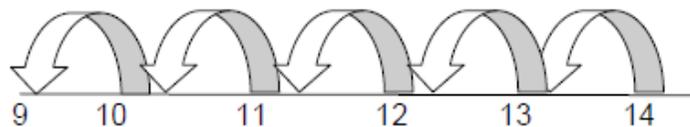
$$9 - 5 = 4$$

$$12 - 6 = 6$$



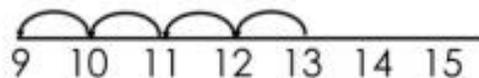
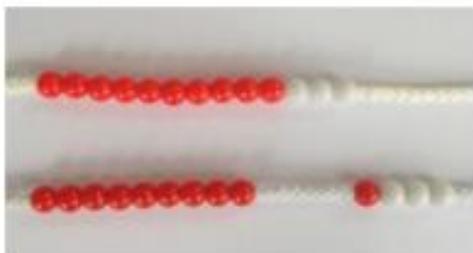
'Put your finger on number twelve and count back six.'

$$14 - 5 = 9$$



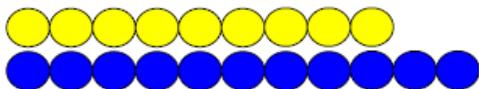
'Put your finger on number 14 and count back five.'

Bead strings can match and show practically what happens on a number line and helpful when using bridging to subtract.



$$13 - 4 = 9$$

Finding the Difference



$$11 - 9 = 2$$

The difference between nine and eleven is two.

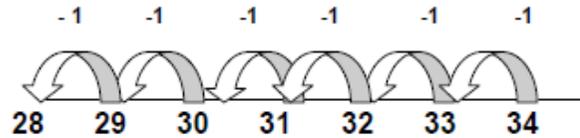
When the teacher feels certain children are ready they will be shown how to find the difference between 2 numbers by counting up a number line. This will then be compared to subtraction for the children to see the relationship.

These are ways of completing subtraction in a written process. Year 1 will be focused on developing a bank of number bonds and using mental strategies such as bridging to subtract.

Year 2

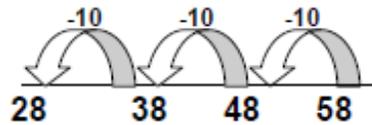
Counting back using an empty number line within 100, in ones...

$$34 - 6 = 28$$



...and in tens:

$$58 - 30 = 28$$



Use in conjunction with a 100 square to show jumps of tens.

Subtraction, using partitioning, on an empty number line. Children will be taught to partition the second number into tens and ones and use the above strategy to first take away the tens and then take away the ones. If children are confident, use more efficient jumps. When children are secure with the pictorial representation of the numberline it will be removed and the expanded written method will be taught:

$$57 - 23 =$$

$$57 - 20 = 37$$

$$37 - 3 = 34$$

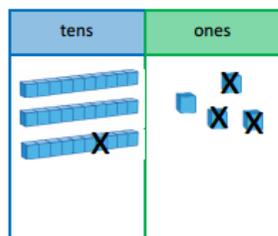
$$43 - 18 =$$

$$43 - 10 = 33$$

$$33 - 8 = 25$$

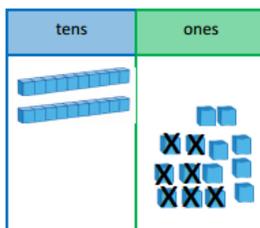
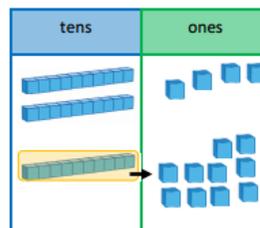
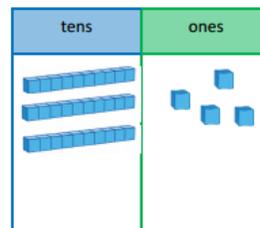
Children will also be taught subtraction by using dienes and exchanging getting the children ready for the formal written method in Year 3.

$$34 - 13 = 21$$



21

$$34 - 17 = 27$$



27

Counting on to find the difference.

Children will be taught to find the difference by counting on using a number line or mental methods to build on understanding from year 1.

This will be taught alongside subtraction so the children see the relationship between the two processes. In Year 2 we would discuss with the children based on the numbers involved in the calculation which method is the most efficient.

These are ways of completing subtraction in a written process. Year 2 will continue to focus on using the bank of number bonds and a range of mental strategies such as bridging to subtract.

Year 3

Children will be taught the formal written method for subtraction alongside the concrete and pictorial representations of dienes and place value counters. Where appropriate, children should also be shown the expanded written method to help place value understanding.

$942 - 214$	<i>Compact Method</i>
<i>Expanded method</i>	
$\begin{array}{r} 900 \quad \overset{30}{\cancel{40}} \quad \overset{12}{\cancel{2}} \\ - 200 \quad 10 \quad 4 \\ \hline 700 \quad 20 \quad 8 \end{array}$	$\begin{array}{r} \overset{3}{\cancel{9}} \overset{12}{\cancel{4}} \\ - 214 \\ \hline 728 \end{array}$

Year 4

Teachers will use the formal written method (as shown in Year 3) to teach the children how to subtract 4 digit numbers.

Year 5

Teachers will use the formal written method (as shown in Year 3) to teach the children how to subtract 5 digit numbers.

Year 6

Teachers will use the formal written method (as shown in Year 3) to teach the children how to subtract multi digit numbers.

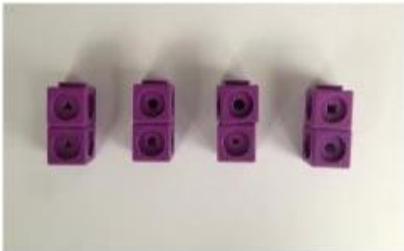
Multiplication

Year 1

Use of visual models to support counting in 2, 5, 10. Ensure children begin to see the patterns of counting in 2, 5, 10.

Children do not need to record number sentences using the symbols. Develop the vocabulary by encouraging children to explain what they are doing using the language groups of and lots of.

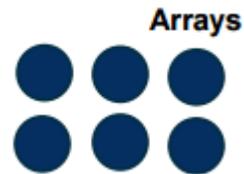
Children use this knowledge to solve problems supported by the teacher.



4 lots of 2



4 lots of 5



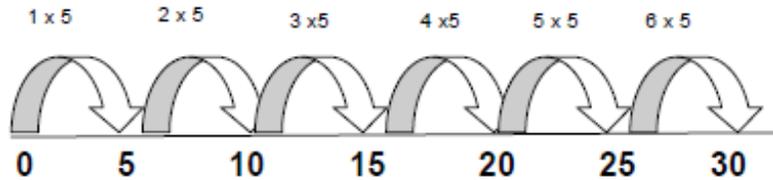
Arrays

3 groups of 2

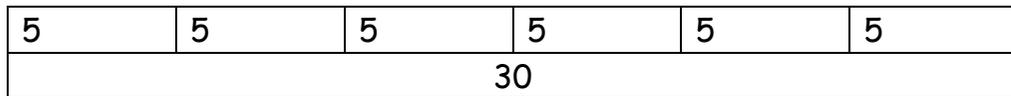
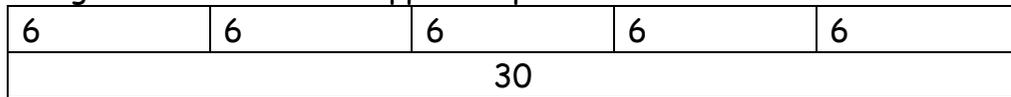
Year 2

Using repeated addition

$$6 \times 5 = 30$$



Using the bar model to support repeated addition



Using arrays to support multiplication

$$6 \times 5 = 30$$



Underpinning this is the understanding that children should be using their mental strategies and learnt timetables, if the calculation allows this.

Year 3

Continue to use number lines and arrays to support multiplication, as appropriate from year 2.

Grid method based on an array.

×	10	2
3		

×	10	2
3	30	6

$$3 \times 12 = 36$$

$$13 \times 8 =$$

'Partition 13 into 10 + 3 then multiply each number by 8. Add the partial products (80 and 24) together.'

X	10	3
8	80	24

$$80 + 24 = 104$$

Expanded written method

$$13 \times 8 = 104$$

$$\begin{array}{r} 10 + 3 \\ \times 8 \\ \hline 24 \quad (3 \times 8) \\ + 80 \quad (10 \times 8) \\ \hline 104 \end{array}$$

$$\begin{array}{r} 13 \\ \times 8 \\ \hline 24 \quad (3 \times 8) \\ + 80 \quad (10 \times 8) \\ \hline 104 \end{array}$$

Then... 104

Model the same calculation using the grid method, if necessary, to ensure understanding.

Some children, when ready should be introduced to formal short multiplication to ready them for year 4.

$$\begin{array}{r} 13 \\ \times 8 \\ \hline 104 \\ \hline \end{array}$$

Ensure that the digit 'carried over' is written under the line in the correct column.

Continue to develop the formal written method of multiplication using teen- numbers multiplied by a one-digit number.

Underpinning all of these methods should be sound understanding and recall of statutory multiplications. If there is quicker mental method for certain calculations, children should be taught to spot these.

Year 4

Expanded short multiplication (two-digit number by a one-digit number):

$$26 \times 4 = 144$$

$$\begin{array}{r} 30 + 6 \\ \times 4 \\ \hline 24 \quad (4 \times 6 = 24) \\ + 120 \quad (4 \times 30 = 120) \\ \hline 144 \end{array}$$

Refine the recording in preparation for formal short multiplication:

$$\begin{array}{r} 36 \\ \times 4 \\ \hline + 24 \quad (4 \times 6) \\ \underline{120} \quad (4 \times 30) \\ \hline 144 \end{array}$$

Short multiplication (formal method) of a two-digit number multiplied by a one- digit number:

$$\begin{array}{r} 36 \\ \times 4 \\ \hline 144 \\ \hline \end{array}$$

Ensure that the digit 'carried over' is written under the line in the correct column.

If children are confident, continue to develop short multiplication with three- digit numbers multiplied by a one-digit number.

342×7 becomes

$$\begin{array}{r} 342 \\ \times \quad 7 \\ \hline 2394 \\ 2 \end{array}$$

Answer: 2394

Underpinning all of these methods should be sound understanding and recall of statutory multiplications. If there is quicker mental method for certain calculations, children should be taught to spot these.

Year 5

Multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers

Expanded long multiplication (two-digit numbers multiplied by a teen- number):

$23 \times 13 = 299$

$$\begin{array}{r} 23 \\ \times 13 \\ \hline 9 \quad (3 \times 3) \\ 60 \quad (3 \times 20) \\ + 30 \quad (10 \times 3) \\ \hline 200 \quad (10 \times 20) \\ \hline 299 \end{array}$$

$$\begin{array}{r} 56 \\ \times 27 \\ \hline 42 \quad (7 \times 6) \\ 350 \quad (7 \times 50) \\ + 120 \quad (20 \times 6) \\ \hline 1000 \quad (20 \times 50) \\ \hline 1512 \\ 1 \end{array}$$

Compact long multiplication (formal method):

$$23 \times 13 = 299$$

$$\begin{array}{r} 23 \\ \times 13 \\ \hline + 69 \quad (3 \times 23) \\ \hline 230 \quad (10 \times 23) \\ \hline 299 \end{array}$$

$$\begin{array}{r} 1 \quad 2 \quad 4 \\ \times \quad 2 \quad 6 \\ \hline \overset{-}{7} \quad \overset{4}{4} \quad 4 \\ \overset{-}{1} \quad \overset{2}{8} \quad 0 \\ \hline 3 \quad 2 \quad 2 \quad 4 \\ \hline 1 \quad 1 \end{array}$$

Year 6

Children in year 6 will continue to use the formal written method of long multiplication with multi digit numbers and will start to use it to multiply decimal numbers

$$\begin{array}{r} 2.7 \\ \times \quad 3 \\ \hline 8.1 \\ \hline 2 \end{array}$$

$$\begin{array}{r} 6.12 \\ \times \quad 4 \\ \hline 24.48 \\ \hline \end{array}$$

Division

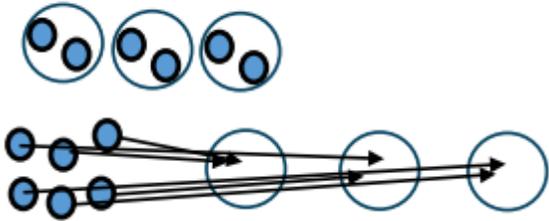
Year 1:

Children will solve practical problems using sharing and grouping and their knowledge of counting in 2's 5's and 10's.

Like multiplication, children are not expected to form calculations using the symbols at this stage.

Children should solve both grouping and sharing problems but not necessarily be introduced to the difference unless the teacher feels certain children are ready.

Grouping and sharing



Sam has 10 sweets and wants to share them with his friend:



Carla has 6 wheels and wants to make bikes. How many bikes can she make?

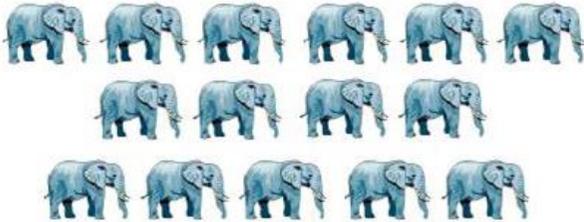
Children can record this pictorial as jotting.

Year 2:

Division grouping:

Put the elephants into **groups of 5**.

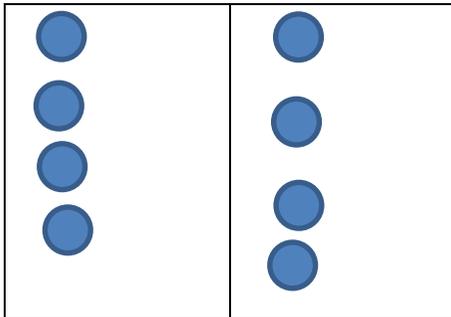
How many groups can you make?



$$15 \div 5 = \underline{\quad}$$

Division using sharing:

$$8 \div 2 =$$



Children should be able to see division as grouping and sharing. Some children will be able to read a problem and know if it asking for them to group or share.

Underpinning these written calculations should be sound understanding and recall of known timetables. Children should use their times table to recall division facts if this is a more efficient process to get to the answer.

Year 3

Children continue to use Year 2 methods to solve problems but with statutory timetables.

To access formal division children need to move towards more of a grouping understanding of division.

"How many groups of 4 can you make out of 12" is the verbal understanding before "How many 4's in 12"

Formal division

Use multiplication/division facts that the children know:

$$24 \div 3 = 8$$

This can also be recorded as...

$$\begin{array}{r} 8 \\ 3 \overline{) 24} \end{array}$$

'Twenty four divided by three equals eight.' 'How many threes are there in twenty four?'

Underpinning these written calculations should be sound understanding and recall of known timetables. Children should use their times table to recall division facts if this is a more efficient process to get to the answer.

Year 4

Formal short division

$$\begin{array}{r} 14 \\ 7 \overline{) 928} \end{array}$$

If children are confident develop further, by dividing three-digit numbers by a one-digit number using the formal method of short division with whole number answers (no remainders).

$$\begin{array}{r} 123 \\ 5 \overline{) 615} \end{array}$$

Underpinning these written calculations should be sound understanding and recall of known timetables. Children should use their times table to recall division facts if this is a more efficient process to get to the answer.

Year 5

Divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context. Continue to practise the formal written method of short division with whole number answers as in Year 4 and start to introduce remainders:

$$432 \div 5 = 86 \text{ r}2$$

$$\begin{array}{r} 86 \text{ r}2 \\ 5 \overline{) 432} \end{array}$$

Underpinning these written calculations should be sound understanding and recall of known timetables. Children should use their times table to recall division facts if this is a more efficient process to get to the answer.

Year 6

Continue to practise the formal method of short division, with and without remainders, using the language of place value to ensure understanding (see Y5 guidance).

$$11 \overline{) 4956} \quad 45 \text{ r } 1$$

$$496 \div 11 = 45 \text{ r } 1$$

Dividing by a two-digit number using a formal method of long division:

$$\begin{array}{r} 0212 \\ 12 \overline{) 2544} \\ \underline{24} \\ 14 \\ \underline{12} \\ 24 \\ \underline{24} \\ 0 \end{array}$$

The remainder can also be expressed as a fraction, (the remainder divided by the divisor) $\frac{1}{11}$ and teach how to find the remainder as a fraction.

$$\begin{array}{r} 045 \text{ r } 1 \\ 11 \overline{) 496} \\ \underline{-44} \text{ (x4)} \\ 056 \\ \underline{-55} \text{ (x5)} \\ 01 \end{array}$$

$$\begin{array}{r} 045.09 \\ 11 \overline{) 496.00} \\ \underline{-44} \\ 056 \\ \underline{-55} \\ 0100 \\ \underline{-99} \\ 1 \end{array}$$

$$45 \text{ r } 1 \text{ or } 45 \frac{1}{11} \text{ or } 45.09$$

Children will need to be taught to select the most effective method for each calculation / problem they meet.